HANDBOOK OF BIOLOGICAL DYES AND STAINS

SYNTHESIS AND INDUSTRIAL APPLICATIONS

R. W. SABNIS
Pfizer Inc.
Madison, NJ

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Dedicated to
My Father
Late Mr. Wasudeo S. Sabnis
&
My Mother
Late Mrs. Suhasini W. Sabnis

Contents

Preface

Color has been a fascination for individuals for a long time. The book is intended as a reference guide for dyes used in biology, chemistry, histology, cytology, medicine, microscopy, and all color- and medical-related allied fields.

Even though the use of biological dyes is widespread, it is growing rapidly, and has exploded in the last decade, there is no book available in the market directly on these dyes that provides information, such as CAS registry numbers, safety/toxicity data, and various applications, in one source. Hence, there was a need to publish a book that provided an immediate incentive for compiling the notes to update the scientific community with the wealth of information on biological dyes and stains. The dyestuff literature, particularly on biological dyes and stains, is largely in patents. This book, as a reference handbook, provides systematic and up-to-date library of information on 200 + biological dyes and stains. The book is compiled as a resource guide for biologists, chemists, histologists, cytologists, medical professionals, and nonchemists in industry as well as in university.

Biological dyes and stains are arranged alphabetically by the most commonly used name. Again, the choice of primary name is somewhat arbitrary, but an effort has been made to strike a balance between names that are easily recognizable and names that are chemically informative. The detailed information on each biological dye or stain is covered in the following order: CAS registry number, chemical structure, CA index name, other names, Merck index number (Merck Index 14th Edition, 2006), chemical/dye class, molecular formula, molecular weight, physical form, solubility, melting point, boiling point, pH range, color change at pH, pK_a, absorption (λ_{max}), emission (λ_{max}), synthesis, staining applications, biological applications, industrial applications, safety/toxicity, certification/approval, and references. Where there are discrepancies between different values, the author has used his judgment on selecting the most likely value.

Numerous recent references have been provided on various synthetic methods, staining applications, biological applications, industrial applications, and safety/toxicity data. Space and format limitations prevent giving all the references for each dye. This is the first ever book that provides safety/toxicity data with reference to acute toxicity, aquatic toxicity, carcinogenicity, cytotoxicity, chronic toxicity, ecotoxicity, genotoxicity, hematotoxicity, hepatotoxicity, immunotoxicity, microbial toxicity, mutagenicity, nephrotoxicity, neurotoxicity, nucleic acid damage, oral toxicity, phototoxicity, phytotoxicity, skin toxicity, reproductive toxicity, and so on. The book also provides Biological Stain Commission (BSC)-certified dyes and Food & Drug Administration (FDA)-approved dyes.

Several appendixes have been provided at the end of the book for scientists to conveniently and easily find a dye as per their need. These appendixes include CAS registry numbers, BSC-certified dyes, FDA-approved dyes, metal indicators, nucleic acid stains, organelle probes, and pH indicators.

Omissions as well as errors of fact and interpretation are inevitable in dealing with so vast a subject as biological dyes. I shall be glad to have my attention drawn to errors and to incorporate suggestions for improvement when a revision becomes possible.

I express my profound respect and appreciation to my guru/mentor/advisor, Prof. D. W. Rangnekar, who brought me to this wonderful world of color science in the Dyestuff Technology Department of Mumbai University Institute of Chemical Technology (MUICT), where I laid the foundation stone for my research career in dye chemistry.

It is my pleasure to make grateful acknowledgement to Dr. Alan Fanta, Dr. Ganapati Shankarling, and Dr. Jeffrey Talkington for their extremely useful discussions, encouragement, and inspiration.

Words are inadequate to express my sincere appreciation for my wife Madhuri and daughter Anika. It would not have been possible to write this book without their encouragement and patience. It is a great pleasure to express my gratitude to John Wiley & Sons, Inc. for giving me an opportunity to write this book.

R. W. Sabnis

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About the Author

Ram W. Sabnis is currently a patent agent at Pfizer Inc. in Madison, NJ. His interests include dyes, pigments, organic chemistry, heterocycles, polymers, synthesis, formulations, coatings, biotechnology, medicinal chemistry, medical devices, and patents. Presently, he focuses on drafting and prosecuting U.S. and international patents. He is a registered patent agent with U.S. Patent & Trademark Office (USPTO) and is also the inventor of more than 50 U.S. and international patents (issued/published). Before entering the legal (patents) field, he was a research chemist for Ascadia, General Electric, Brewer Science, U.S. Textiles, and Invitrogen in the United States. He had also worked as a patent agent at Squire, Sanders & Dempsey L.L.P. in San Francisco, CA.

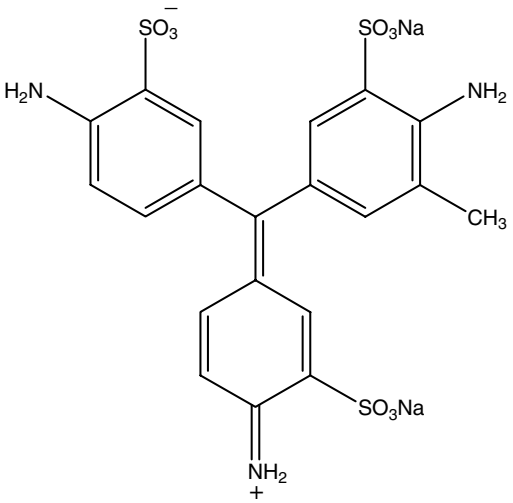
Dr. Sabnis was born and raised in Mumbai, India. He received his M.Sc. in Organic Chemistry from University of Mumbai and Ph.D. in Organic Chemistry (Dyes) from University Institute of Chemical Technology (UICT), University of Mumbai, India. He received FAIC from American Institute of Chemists, USA. He was awarded CCol FSDC (Chartered Colourists, Fellow of Society of Dyers & Colourists), Society of Dyers & Colourists, UK.

Dr. Sabnis is one of the world's foremost experts in dyes, inventing world's first colored bubbles (nonstaining) and color changing dye system with many applications. He has more than 25 years of industrial and academic research experience in dye chemistry, particularly, dyes for biomedical (fluorescent probes), personal care products, health/beauty products, displays, inks, paints, plastics, textiles, and toys. He has over 150 publications that include books, book chapters, encyclopedia chapters, patents, reviews, papers, and symposium presentations. Dr. Sabnis is the recipient of Perkin Innovation Award by Society of Dyers & Colourists (SDC), UK; Grand Innovation Award by Popular Science, USA; Six Sigma Green Belt & Competitive Spirit Award by GE, USA; and Best Doctoral Thesis Award by University of Mumbai, India. He will continue to focus his activities on fascinating dye chemistry as well as demanding intellectual property in the years to come.

ACID FUCHSIN

CAS Registry Number 3244-88-0

Chemical Structure



CA Index Name Benzenesulfonic acid, 2-amino-5-[(4-amino-3-sulfophenyl)(4-imino-3-sulfo-2,5-cyclohexadien-1-ylidene)methyl]-3-methyl-, sodium salt

Other Names Benzenesulfonic acid, 2-amino-5-[(4-amino-3-sulfophenyl)(4-imino-3-sulfo-2,5-cyclohexadien-1-ylidene)methyl]-3-methyl-, disodium salt; C.I. Acid Violet 19; C.I. Acid Violet 19, disodium salt; Rubine S; Acid Fuchsine; Acid Fuchsine FB; Acid Fuchsine N; Acid Fuchsine O; Acid Fuchsine S; Acid Leather Magenta A; Acid Magenta; Acid Magenta O; Acid Violet 19; Acid fuchsin sodium salt; Acid rosein; Acid rubin; Acidal Fuchsine; Acidal Magenta; Albion Acid Magenta; Andradeindicator; C.I. 42685; Fuchine Acid Photo Grade; Fuchsin S; Fuchsin acid; Fuchsine acid; Kiton Magenta A; Triacid Magenta; *p*-Fuchsine acid

Merck Index Number 107

Chemical/Dye Class Triphenylmethane

Molecular Formula $C_{20}H_{17}N_3Na_2O_9S_3$

Molecular Weight 585.54

Physical Form Olive to dark olive-green crystals or powder

Solubility Very soluble in water; slightly soluble to insoluble in ethanol; insoluble in xylene

Melting Point >250 °C

pH Range 12.0–14.0

Color Change at pH Red (12.0) to colorless (14.0)

Absorption (λ_{max}) 546 nm

Emission (λ_{max}) 630 nm

Synthesis Synthetic methods[1–3]

Staining Applications Antigen;[4] bacteria;[5] collagen;[6] fungi;[7] fats;[8] neurons;[9,10] paraffin sections;[11] proteins;[8] starch;[8] processed food;[12] tumor cells;[1,13] decayed teeth;[14] lips;[1,15,16] hairs[1,17]

Biological Applications Detecting enzyme activity,[18] proteins,[19] tumor cells[1,13]

Industrial Applications Color filter;[1,20] recording material;[1,21] photographic film;[22] inks;[1,23] highlighters;[1,24] paints;[1,23] explosives;[1,25] corrosion inhibitors;[1,26] leathers;[27] textiles[1,28]

Safety/Toxicity Acute oral toxicity;[1,29] genotoxicity;[1,30] neurotoxicity[1,31,32]

Certification/Approval Certified by Biological Stain Commission (BSC)

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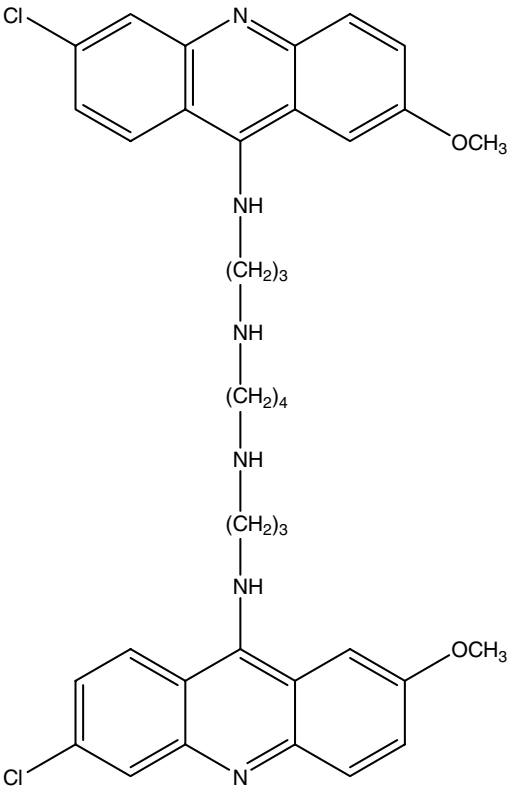
ACRIDINE HOMODIMER

CAS Registry Number 57576-49-5

Chemical Structure



CA Index Name 1,4-Butanediamine, *N*,*N*′-bis[3-[(6-chloro-2-methoxy-9-acridinyl)amino]propyl]-

Other Names Acridine homodimer; NSC 219743

Merck Index Number Not listed

Chemical/Dye Class Acridine

Molecular Formula $C_{38}H_{42}Cl_2N_6O_2$

Molecular Weight 685.69

Physical Form Orange-brown powder

Solubility Soluble in *N*,*N*-dimethylformamide, dimethyl sulfoxide

Melting Point 169–170 °C

Boiling Point (Calcd.) 885.4 ± 65.0 °C, pressure: 760 Torr

pK_a (Calcd.) 10.63 ± 0.19, most basic, temperature: 25 °C

Absorption (λ_{max}) 431 nm

Emission (λ_{max}) 498 nm

Synthesis Synthetic methods[1–4]

Staining Applications Nucleic acids;[3–8] chromosomes[9]

Biological Applications Diagnosis of tissue necrosis;[10] treating malformed proteins causing neurodegenerative disease[11]

Industrial Applications Not reported

Safety/Toxicity Neurotoxicity[11]

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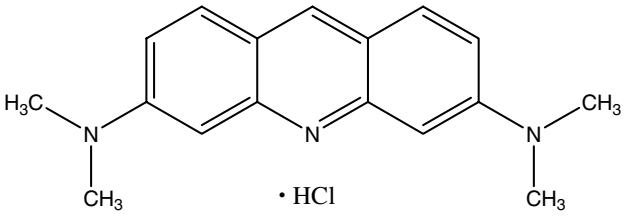
ACRIDINE ORANGE

CAS Registry Number 65-61-2

Chemical Structure



CA Index Name 3,6-Acridinediamine, *N*3,*N*3,*N*6,*N*6-tetramethyl-, hydrochloride (1 : 1)

Other Names 3,6-Acridinediamine, *N*,*N*,*N*′,*N*′-tetramethyl-, monohydrochloride; Acridine Orange R; Acridine, 3,6-bis(dimethylamino)-, hydrochloride; Acridine, 3,6-bis(dimethylamino)-, monohydrochloride; 3,6-Bis (dimethylamino)acridine hydrochloride; Acridine Orange; Acridine Orange N; Acridine Orange NO; Acridine Orange NS; Basic Orange 14; Basic Orange 3RN; C.I. 46005; C.I. Basic Orange 14; Euchrysine 3R; Rhoduline Orange NO; Sumitomo Acridine Orange NO; Sumitomo Acridine Orange RK conc

Merck Index Number Not listed

Chemical/Dye Class Acridine

Molecular Formula $C_{17}H_{20}ClN_3$

Molecular Weight 301.81

Physical Form Burnt orange to brick-red powder

Solubility Soluble in water, ethanol, dimethyl sulfoxide

Melting Point 284–287 °C

pK_a −3.2, 10.5

Absorption (λ_{max}) 500 nm

Emission (λ_{max}) 526 nm

Synthesis Synthetic methods[1–8]

Staining Applications Lysosomes;[9] Golgi apparatus;[9] acidic compartments;[9] secretory granules (SGs);[10] synaptic-like microvesicles (SLMVs);[10] liposomes;[10] acidic organelle membranes;[10] bacteria;[11] bacterial endospores;[12] apoptotic cells;[13] blood smears;[14] nucleic acids;[15–17] cells;[18] malignant musculoskeletal tumors;[19] micronucleus;[20] microorganisms;[21,22] nuclei;[23] peptides;[24] proteins;[24] antibodies;[24] parasites;[25] sperms[26]

Biological Applications Detecting cancer cells,[27,28] spores,[28] human papilloma virus (HPV),[29] stress biomarkers;[30] treating amyloid associated diseases,[31] lupus,[32] pathogen infections;[33] apoptosis assays;[34] cytotoxicity assays[35]

Industrial Applications Thin films;[36] wiring boards[37]

Safety/Toxicity Carcinogenicity;[38,39] cytotoxicity;[40] DNA damage;[41] embryotoxicity;[42] genotoxicity;[43,44] mutagenicity;[45,46] phototoxicity[47]

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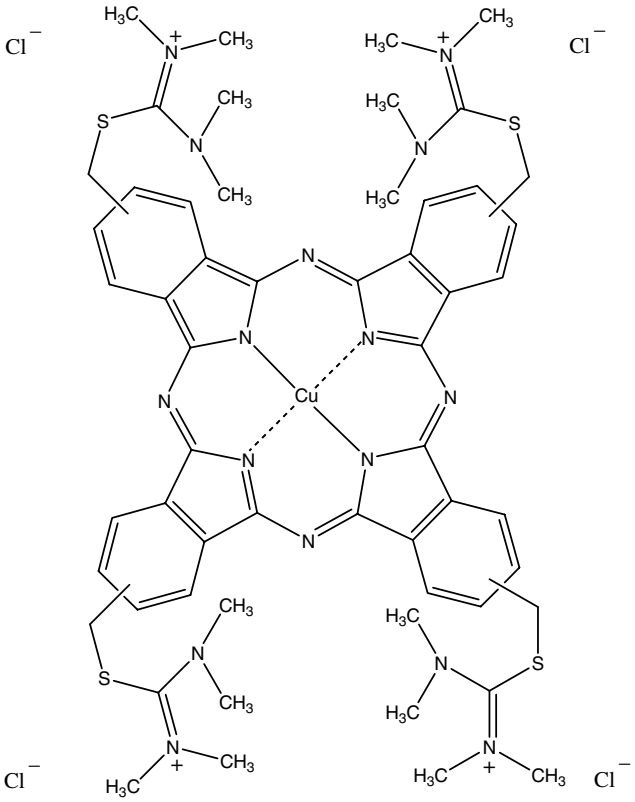
ALCIAN BLUE 8GX

CAS Registry Number 33864-99-2

Chemical Structure



CA Index Name Copper(4 +), [[*N*,*N*′,*N*″,*N*‴-[(29*H*,31*H*-phthalocyanine-*C*,*C*,*C*,*C*-tetrayl-κ*N*29,κ*N*30,κ*N*31,κ*N*32)tetrakis[methylenethio[(dimethylamino)methylidyne]]]tetrakis[*N*-methylmethanaminiumato]](2-)]-, chloride (1 : 4)

Other Names Alcian Blue; Alcian Blue 8G; Alcian Blue 8GN; Alcian Blue 8GS; Alcian Blue 8GX; C.I. 74240; C.I. Ingrain Blue 1; Chloromethylated copper phthalocyanine-thiourea reaction products; Copper (4 +), [[*N*,*N*′,*N*″,*N*‴-[(29*H*,31*H*-phthalocyaninetetrayl-κ*N*29,κ*N*30,κ*N*31,κ*N*32)tetrakis[methylenethio[(dimethylamino)methylidyne]]]tetrakis[*N*-methylmethanaminiumato]](2-)]-, tetrachloride; Copper(4 +), [[*N*,*N*′,*N*″,*N*‴-[29*H*,31*H*-phthalocyaninetetrayltetrakis[methylenethio[(dimethylamino)methylidyne]]]tetrakis[*N*-methylmethanaminiumato]](2-)-*N*29,*N*30,*N*31,*N*32]-, tetrachloride; Methanaminium, *N*,*N*′,*N*″,*N*‴-[29*H*,31*H*-phthalocyaninetetrayltetrakis[methylenethio[(dimethylamino)methylidyne]]]tetrakis[*N*-methyl-, copper complex

Merck Index Number 218

Chemical/Dye Class Copper phthalocyanine

Molecular Formula $C_{56}H_{68}Cl_4CuN_{16}S_4$

Molecular Weight 1298.93

Physical Form Dark blue-violet powder

Solubility Soluble in water, ethanol

Melting Point 148 °C

Absorption (λ_{max}) 615 nm

Synthesis Synthetic methods[1–6]

Staining Applications Bonghan threads inside lymphatic vessels;[7] chromatin;[8,9] glycoproteins;[10] glycosaminoglycans;[11] lung goblet cells;[12] neurons;[13] nuclear basic proteins;[14] surface coat of cells;[15] urine sediments;[16]

Biological Applications Glycoconjugates assay;[2] hyaluronic acid assay;[17] hybridization assay;[18] cell agglutionation;[19,20] detecting humic acid,[21,22] detecting pancreatic β-granules;[23] locomotion of amoeba,[24] quantitative determination of glycosaminoglycans,[25,26]

Industrial Applications Inks;[4] leather products;[27] textiles[28]

Safety/Toxicity No data available

Certification/Approval Certified by Biological Stain Commission (BSC)

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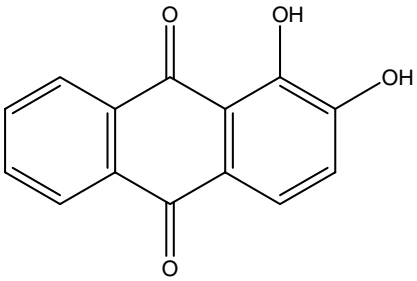
ALIZARIN

CAS Registry Number 72-48-0

Chemical Structure



CA Index Name 9,10-Anthracenedione, 1,2-dihydroxy-

Other Names Alizarin B; Anthraquinone, 1,2-dihydroxy-; 1,2-Anthraquinonediol; 1,2-Dihydroxy-9,10-anthracenedione; 1,2-Dihydroxy-9,10-anthraquinone; 1,2-Dihydroxyanthraquinone; 1,2-Dihydroxyanthrachinone; Acid Metachrome Red B; Acid Mordant Red B; Alizarin; Alizarin Red; Alizarina; Alizarine; Alizarine 3B; Alizarine B; Alizarine Indicator; Alizarine L Paste; Alizarine Lake Red 2P; Alizarine Lake Red 3P; Alizarine Lake Red IPX; Alizarine NAC; Alizarine Paste 20 percent Bluish; Alizarine Red; Alizarine Red B; Alizarine Red B2; Alizarine Red IP; Alizarine Red IPP; Alizarine Red L; C Ext. Red 62; C.I. 58000; C.I. Mordant Red 11; Certiqual Alizarine; C.I. Pigment Red 83; D And C Orange Number 15; Deep Crimson Madder 10821; Eljon Madder; Mitsui Alizarine B; Mordant Red 11; NSC 7212; Sanyo Carmine L2B; Turkey Red

Merck Index Number 251

Chemical/Dye Class Anthraquinone

Molecular Formula $C_{14}H_8O_4$

Molecular Weight 240.21

Physical Form Orange needles or powder

Solubility Virtually insoluble in water; moderately soluble in ethanol; soluble in benzene, toluene, xylene, pyridine, acetic acid; freely soluble in hot methanol, ether

Melting Point 290 °C

Boiling Point 430 °C

pH Range 5.5–6.8; 10.1–12.1

Color Change at pH Yellow (5.5) to red (6.8); red (10.1) to purple (12.1)

pK_a 6.77

Absorption (λ_{max}) 567 nm, 609 nm

Synthesis Synthetic methods[1–16]

Staining Applications Bacteria;[17] human adipose-derived stem cells;[18] multipotent adult progenitor cells;[19] parasite;[5] lips;[1,20] skin;[1,20,21] hairs;[1,22,23] keratin fibers[24]

Biological Applications Detecting microorganisms;[25] treating dermatological conditions[26]

Industrial Applications Solar cells;[27,28] plasma display panel;[1,29] antireflective coatings;[1,30] chemical mechanical polishing;[1,31] optical recording materials;[32] inks;[33,34] paints;[1,34,35] adhesives;[34] thermoplastics;[1,36] detergents;[1,37] textiles;[1,38,39] wood[1,40]

Safety/Toxicity Acute oral toxicity;[1,41] carcinogenicity;[1,42] clastogenicity;[43] environmental toxicity;[1,44] estrogenicity;[1,45] genotoxicity;[1,46,47] hypersensitivity;[1,48] mutagenicity;[1,49,50] photoinduced toxicity[1,51]

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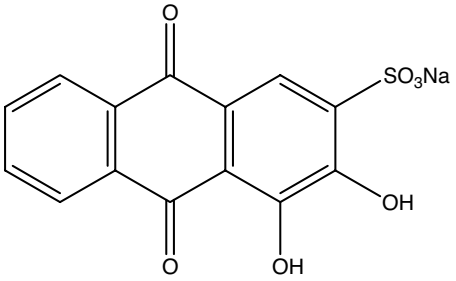
ALIZARIN RED S

CAS Registry Number 130-22-3

Chemical Structure



CA Index Name 2-Anthracenesulfonic acid, 9,10-dihydro-3,4-dihydroxy-9,10-dioxo-, monosodium salt

Other Names 2-Anthraquinonesulfonic acid, 3,4-dihydroxy-, sodium salt; Acid Mordant Red SW; Acid Red Alizarine; Ahcoquinone Red S; Alizarin Carmine; Alizarin Red S; Alizarin S; Alizarine Carmine; Alizarine Carmine Indicator; Alizarine Red A; Alizarine Red AS; Alizarine Red Indicator; Alizarine Red S; Alizarine Red S sodium salt; Alizarine Red SW; Alizarine Red SZ; Alizarine Red W; Alizarine Red WA; Alizarine Red WS; Alizarine Red for Wool; Alizarine S; Alizarine S Extra Conc. A Export; Alizarine S Extra Pure A; Alizarinsulfonate; C.I. 58005; C.I. Mordant Red 3; Calcochrome Alizarine Red SC; Carnelio Rubine Lake; Chrome Red Alizarine; Diamond Red W; Ext D and C Red No. 7; Fenakrom Red W; Mitsui Alizarine Red S; Mordant Red 3; Oxanal Fast Red SW; Sodium 3,4-dihydroxyanthraquinone-2-sulfonate; Sodium alizarin-3-sulfonate; Sodium alizarinesulfonate; Sodium alizarinsulfonate

Merck Index Number 8573

Chemical/Dye Class Anthraquinone

Molecular Formula $C_{14}H_7NaO_7S$

Molecular Weight 342.26

Physical Form Orange-yellow powder

Solubility Freely soluble in water; soluble in ethanol; insoluble in ether

Melting Point 287–289 °C

pH Range 3.5–6.5; 9.4–12.0

Color Change at pH Yellow (3.5) to red (6.5); orange (9.4) to violet (12.0)

pK_a 4.5, 11

Absorption (λ_{max}) 556 nm, 596 nm, 423 nm, 546 nm

Synthesis Synthetic methods[1–6]

Staining Applications Bacteria;[7] bones;[8,9] cartilage;[8] dental plaques;[10] fetal skeletons;[11] fish;[12] myocardium;[13] protein particles;[14] calcified tissues;[15] hairs;[1,16] keratin fibers[17,18]

Biological Applications Detecting *Candida*,[19] lactic acid bacteria,[7] microorganisms;[20] treating gastropathy,[21] viral diseases[22]

Industrial Applications Chemical mechanical polishing;[1,23] inks;[24] adhesives;[25] ozone sensor;[26] chemical warfare agent;[27] detergents;[28] coloring fabrics[1,29]

Safety/Toxicity Carcinogenicity;[1,30] cytotoxicity;[1,31] genotoxicity;[1,31] fish toxicity;[1,32] environmental pollutants;[1,33] viral toxicity[31]

Certification/Approval Certified by Biological Stain Commission (BSC)

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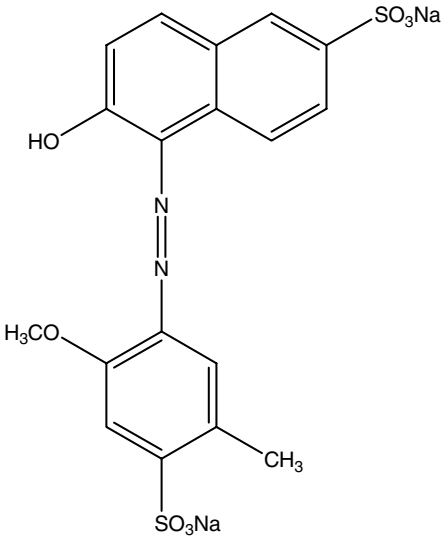
ALLURA RED

CAS Registry Number 25956-17-6

Chemical Structure



CA Index Name 2-Naphthalenesulfonic acid, 6-hydroxy-5-[2-(2-methoxy-5-methyl-4-sulfophenyl)diazenyl]-, sodium salt (1 : 2)

Other Names 2-Naphthalenesulfonic acid, 6-hydroxy-5-[(2-methoxy-5-methyl-4-sulfophenyl)azo]-, disodium salt; 2-Naphthalenesulfonic acid, 6-hydroxy-5-[(6-methoxy-4-sulfo-*m*-tolyl)azo]-, disodium salt; Allura Red 40; Allura Red AC; Allura red; C.I. 16035; C.I. Food Red 17; E 129; FD and C Red No. 40; FD&C Red No. 40; FDC Red 40; FDC Red 40 dye; Food Red 17; Food Red No. 17; Food Red No. 40; Japan Food Red No. 40; Japan Red 40; Red 40; Red No. 40

Merck Index Number 284

Chemical/Dye Class Azo

Molecular Formula $C_{18}H_{14}N_2Na_2O_8S_2$

Molecular Weight 496.42

Physical Form Dark red powder

Solubility Soluble in water, ethanol

Melting Point >300 °C

Absorption (λ_{max}) 504 nm

Synthesis Synthetic methods[1–6]

Staining Applications Alcohol;[7] beverage;[8,9] drinks;[7,10,11] syrup;[9] candies;[11] cotton candy;[12] baked food;[13] frozen food;[14] aerated fruits;[15] seafood;[16] sweetener;[17] capsules;[18] pharmaceutical dosage;[19] tablets;[20] toothpaste;[21] suncreeen;[22] dental bleaching gel;[23] eyebrows;[24] lips;[25–27] skin;[26,27] body surfaces;[27] tattoos;[28] hairs;[29] keratin fibers;[29,30] cocoa bath;[31] waters[32]

Biological Applications Antifungal formulation;[33] treating bone metabolic diseases,[34] coughing,[35] sneezing,[35] rhinorrhea,[35] nasal obstruction,[35] periodontal disease,[36] rhinitis[37]

Industrial Applications Antireflective coatings;[38] inks;[39] detergents;[40] colored bubbles;[41] fabric softeners;[42] textiles;[43] entertainment products;[44] toys[45]

Safety/Toxicity Carcinogenicity;[46,47] chromosomal aberration;[48] developmental toxicity;[49] DNA damage;[50] genotoxicity;[51] hyperactive behavior in children;[52] mutagenicity;[53–55] neurotoxicity;[56] psychotoxicity,[49] reproductive toxicity[56]

Certification/Approval Approved by Food & Drugs Administration (FDA)

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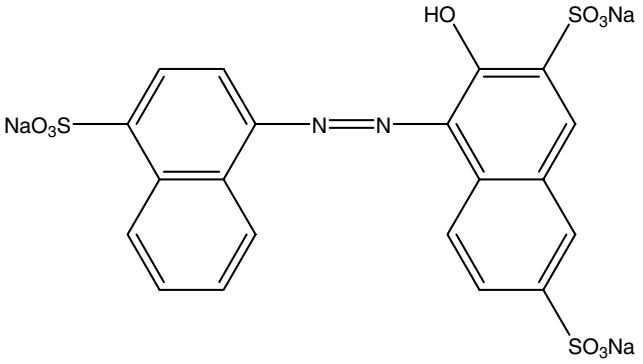
AMARANTH

CAS Registry Number 915-67-3

Chemical Structure



CA Index Name 2,7-Naphthalenedisulfonic acid, 3-hydroxy-4-[2-(4-sulfo-1-naphthalenyl)diazenyl]-, sodium salt (1 : 3)

Other Names 2,7-Naphthalenedisulfonic acid, 3-hydroxy-4-[(4-sulfo-1-naphthalenyl)azo]-, trisodium salt; Bordeaux S; C.I. Acid Red 27; C.I. Acid Red 27, trisodium salt; 1-(4-Sulfo-1-naphthylazo)-2-naphthol-3,6-disulfonic acid trisodium salt; 1302 Red; 1508 Red; 2-Hydroxy-1,1′-azonaphthalene-3,6,4′-trisulfonic acid trisodium salt; Acid Amaranth; Acid Amaranth I; Acid Amaranth J; Acid Amaranth N; Acid Leather Red I 2BW; Acid Leather Rubine S; Acid Red 27; Aizen Amaranth; Amacid Amaranth; Amaranth; Amaranth (dye); Amaranth 307018; Amaranth 36010; Amaranth 85; Amaranth A; Amaranth B; Amaranth BPC; Amaranth Extra; Amaranth Lake; Amaranth R; Amaranth S; Amaranth S Specially Pure; Amaranth USP; Amaranth WD; Amaranth red; Amaranthe; Azo Red R; Azo Rubine S-FQ; Azo Rubine SF; Azo Ruby S; Azorubin S; Basovit Red 470E; Bordeaux S Extra Conc. A Export; Bordeaux S Extra Pure A; Borunil Red A-B; C.I. 16185; C.I. Food Red 9; Canacert Amaranth; Certicol Amaranth S; Cogilor Red 318.11; Cranberry Red; D & C Red 2; D and C Red No. 2; D&C Red No. 2; Daishiki Amaranth; Dolkwal Amaranth; Dye Red Raspberry; E 123; Edicol Amaranth; Edicol Supra Amaranth A; Edicol Supra Amaranth AS; Euorcert Allura 311801; Eurocert Amaranth; FD and C Red No. 2; FD&C Red 2; Fast Red; Food Red 2; Food Red 9; Food Red No. 2; Fruit Red A Geigy; HD Amaranth B; HD Amaranth Supra; Hexacert Red No. 2; Hexacol Amaranth B Extra; Hidacid Amaranth; Hidacid Amaranth 21-6008; Hispacid Red AM; Japan Food Red No. 2; Japan Red 2; Japan Red No. 2; Java Amaranth; KCA Foodcol Amaranth A; Kayaku Amaranth; Kayaku Food Colour Red No. 2; Kiton Rubine S; L Red 3; L Red Z 3050; Lissamine Amaranth AC; Maple Amaranth; Naphthol Red LZS; Naphthol Red S; Naphthol Red S Conc. Specially Pure; Naphthol Red S Specially Pure; Naphthol Red SI; Necol Amaranth; Neklacid Red A; PuriColor Red ARE 27; Rakuto Amaranth; Red No. 2; Red dye no. 2; Ritacid Red G; Rouge Solid E; S-Azo Rubine; San-ei Amaranth; Sandal Amaranth I; Shikiso Amaranth; Solar Red O; Takaoka Amaranth; Tertracid Red A; Toyo Amaranth; Triacid Amaranth A; Trisodium salt of 1-(4-sulfo-1-naphthylazo)-2-naphthol-3,6-disulfonic acid; Usacert Red No. 2; Victoria Rubine O; Victory Scarlet; Water Red 176574; Whortleberry Red; Wool Bordeaux 6RK; Wool Red 40F

Merck Index Number 375

Chemical/Dye Class Azo

Molecular Formula $C_{20}H_{11}N_2Na_3O_{10}S_3$

Molecular Weight 604.47

Physical Form Dark reddish-brown powder

Solubility Soluble in water; slightly soluble in ethanol

Melting Point >300 °C

Absorption (λ_{max}) 520 nm

Synthesis Synthetic methods[1–13]

Staining Applications Candies;[14,15] cereals;[14] chewing gums;[14] chocolate confetti;[14] snacks;[14] drinks;[15] microorganisms;[16] oral liquids;[17] soft drinks;[18] sweetener;[19] drugs;[20] dietary supplements;[20] tablets;[20] granules;[20] drug crystals;[20] pellets;[20] capsules;[20] skin;[21] hairs;[22,23] keratin fibers[24,25]

Biological Applications Detecting membrane-potential change;[26] treating acquired resistance to GABAergic (ARG) agents[27]

Industrial Applications Color filters;[28] inks;[29,30] thermoplastics;[31] laundry detergent;[32] textiles[33,34]

Safety/Toxicity Acute toxicity;[35] carcinogenicity;[36] cytotoxicity;[37] DNA damage;[38] embryotoxicity;[39] genotoxicity;[40–42] hepatotoxicity;[43] mutagenicity;[44–48] neurotoxicity;[49] teratogenicity[50,51]

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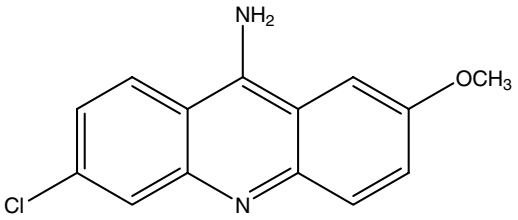
9-AMINO-6-CHLORO-2-METHOXYACRIDINE (ACMA)

CAS Registry Number 3548-09-2

Chemical Structure



CA Index Name 9-Acridinamine, 6-chloro-2-methoxy-

Other Names Acridine, 9-amino-6-chloro-2-methoxy-; 2-Methoxy-6-chloro-9-aminoacridine; 3-Chloro-7-methoxy-9-aminoacridine; 6-Chloro-9-amino-2-methoxyacridine; 9-Amino-3-chloro-7-methoxyacridine; 9-Amino-6-chloro-2-methoxyacridine; G 185; NSC 15300

Merck Index Number Not listed

Chemical/Dye Class Acridine

Molecular Formula $C_{14}H_{11}ClN_2O$

Molecular Weight 258.70

Physical Form Yellow crystals

Solubility Soluble in methanol, *N*,*N*-dimethylformamide, dimethylsulfoxide

Melting Point 272–274 °C

Boiling Point (Calcd.) 475.1 ± 35.0 °C, pressure: 760 Torr

pK_a 8.6

Absorption (λ_{max}) 412 nm

Emission (λ_{max}) 471 nm

Synthesis Synthetic methods[1–10]

Staining Applications Nucleic acids;[11–15] cells;[16] chromosomes;[17] microorganisms[18]

Biological Applications Antimalarial;[19,20] bactericidal;[21,22] detection of cancer cells,[23] nucleic acids;[11–15] treating malformed proteins causing neurodegenerative disease[24]

Industrial Applications Not reported

Safety/Toxicity Genotoxicity;[25] mutagenicity[26,27]

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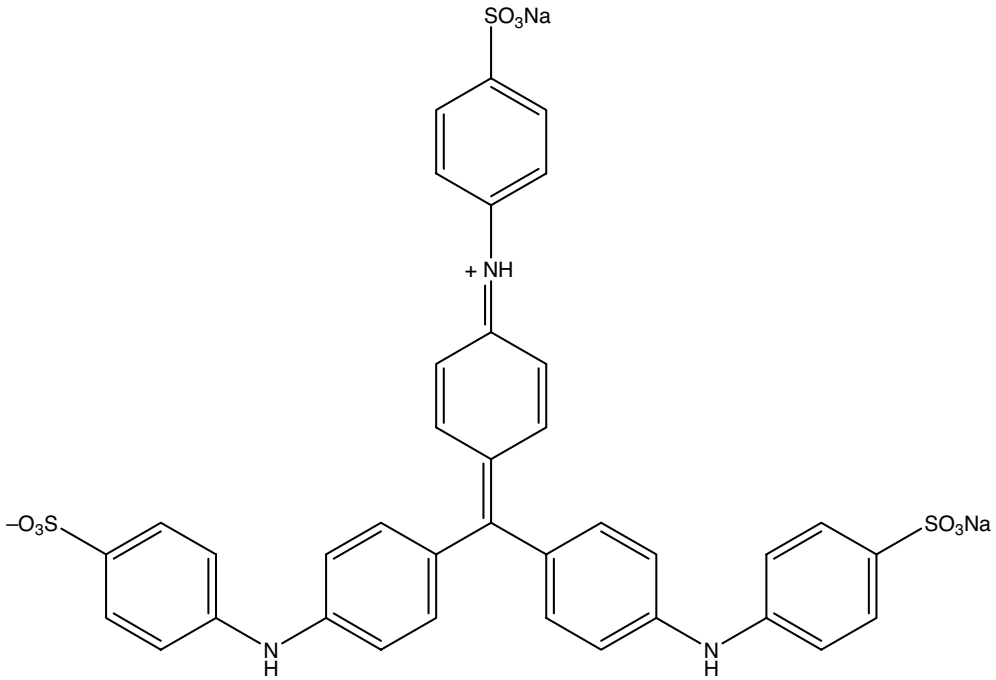
ANILINE BLUE (METHYL BLUE)

CAS Registry Number 28983-56-4

Chemical Structure



Merck Index Number 6028

Chemical/Dye Class Triphenylmethane

Molecular Formula $C_{37}H_{27}N_3Na_2O_9S_3$

Molecular Weight 799.80

CA Index Name Benzenesulfonic acid, [[4-[bis[4-[(sulfophenyl)amino]phenyl]methylene]-2,5-cyclohexadien-1-ylidene]amino]-, sodium salt (1 : 2)

Other Names Benzenesulfonic acid, [[4-[bis[4-[(sulfophenyl)amino]phenyl]methylene]-2,5-cyclohexadien-1- ylidene]amino]-, disodium salt; C.I. Acid Blue 93; C.I. Acid Blue 93, disodium salt; Methyl blue; Acid Blue 93; Acid Blue FG; Acid Ink Blue G; Acid Leather Blue HER; Aniline Blue; Aniline Blue water soluble; Brilliant Lake Blue G; C.I. 42780; Conacid Blue NC; Cotton blue; Dycosacid Ink Blue G; Helvetia Blue; Helvetia Blue I; Helvetia Blue Pure I; Ink Blue; Ink Blue BA; Ink Blue BJT; Ink Blue BJTBN 80; Ink Blue BJTBNA 80; Ink Blue BJTN; Ink Blue G; Ink Blue M; Ink Blue N; Ink Blue Special; Ink Blue WGS; Ink Blue WRS; Methyl blue (biological stain); Orient Soluble Blue OBB; Orient Soluble Blue OBC; Orient Soluble Blue OBX; Poirriers Blue; Pure Soluble Blue I; Silk Blue H; Sky Blue G; Solar Soluble Blue BN; Soluble Blue; Soluble Blue 8B; Soluble Blue OBB; Soluble Blue OBX; Special Soluble Blue HT; Vicoacid Ink Blue; Water Blue; Water Blue 6B; Water Blue B; Water Blue I Old Type 1240a; Water Blue IN

Physical Form Dark blue or dark brown powder

Solubility Soluble in water, ethanol; insoluble in xylene

Melting Point >250 °C

Absorption (λ_{max}) 600 nm

Synthesis Synthetic methods[1–9]

Staining Applications Cartilage;[10] chitin;[11] hyaline droplets;[12] louse eggs;[13] mitochondria;[14] proteins;[15] sphagnum moss;[16] urine sediment;[17]

Biological Applications Assay for nucleic acids,[18] protein determination,[19] identification of *Candida albicans*;[20] method for counting leukocytes,[21] controlled drug release;[22] radiotherapy;[23] treating apolipoprotein E-related diseases;[24] oral care products[25]

Industrial Applications Color filter;[26,27] magnetic toners;[28] inks;[29] highlighters;[30] colored pencils;[31] packaging materials;[32] paints;[33] textiles;[34] asbestos content measurement;[35] paper products[36]

Safety/Toxicity Mutagenicity[37]

Certification/Approval Certified by Biological Stain Commission (BSC)

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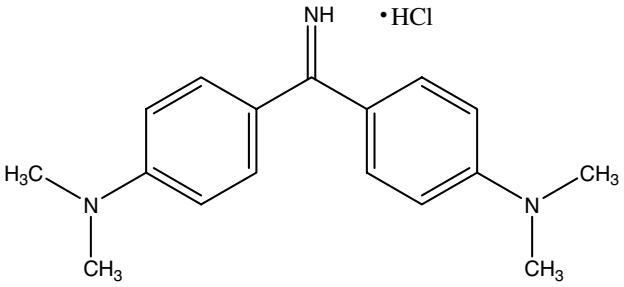
AURAMINE O

CAS Registry Number 2465-27-2

Chemical Structure



CA Index Name Benzenamine, 4,4′-carbonimidoylbis [*N*,*N*-dimethyl-, hydrochloride (1 : 1)

Other Names Benzenamine, 4,4′-carbonimidoylbis[*N*, *N*-dimethyl-, monohydrochloride; C.I. Basic Yellow 2; C.I. Basic Yellow 2, monohydrochloride; ADC Auramine O; Aizen Auramine; Aizen Auramine OH; Aizen Auramine OW 100; Aizen Auramine conc. SFA; Arazine Yellow; Auramin; Auramine; Auramine 0-100; Auramine A1; Auramine Extra; Auramine Extra 0-100; Auramine Extra 0-125; Auramine Extra Conc. A; Auramine FA; Auramine FWA; Auramine II; Auramine Lake Yellow O; Auramine N; Auramine O; Auramine O Extra Conc. A Export; Auramine ON; Auramine OO; Auramine OOO; Auramine OS; Auramine Pure; Auramine SP; Auramine Yellow; Auramine chloride; Auramine hydrochloride; Basic Flavine Yellow O; Basic Light Yellow; Basic Light Yellow O; Basic Yellow 2; Basonyl Yellow 120; C.I. 41000; Calcozine Yellow OX; Flexo Yellow 110; Mitsui Auramine O

Merck Index Number Not listed

Chemical/Dye Class Diphenylmethane

Molecular Formula $C_{17}H_{22}ClN_3$

Molecular Weight 303.84

Physical Form Yellow powder

Solubility Soluble in water, ethanol; very slightly soluble in xylene

Melting Point >250 °C (decompose)

pK_a 9.8, 10.7

Absorption (λ_{max}) 370 nm, 432 nm

Emission (λ_{max}) 550 nm

Synthesis Synthetic method[1–18]

Staining Applications Acid fast bacilli;[19] cells;[20,21] nuclei;[22] smear;[23] sputum;[24] hairs[25]

Biological Applications Detecting bacteria;[26,27] treatment of cancers,[28] cardiovascular disease,[29] diabetes-associated pain,[30] mechanical allodynia,[31] metabolic syndrome,[32] protozoan infections in fish;[33] targeted drug delivery;[34] as fungal inhibitors[35]

Industrial Applications Color filter;[36] plasma displays;[37] semiconductor devices;[38] inks;[39] highlighters;[40] image-recording materials;[41] printing plates;[42] toners;[43] adhesives;[44] fuels;[45] pesticides;[46] textiles;[47,48] wood[49]

Safety/Toxicity Acute oral toxicity;[50] carcinogenicity;[51–53] cytotoxicity;[54] DNA damage;[55] genotoxicity;[56,57] mutagenicity[58,59]

Certification/Approval Certified by Biological Stain Commission (BSC)

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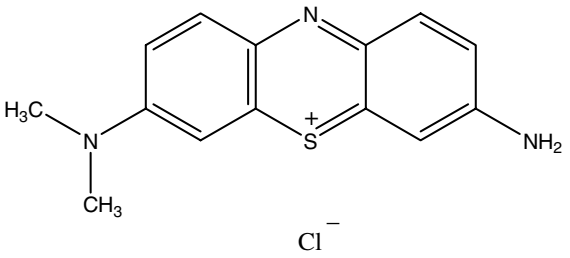
AZURE A

CAS Registry Number 531-53-3

Chemical Structure



CA Index Name Phenothiazin-5-ium, 3-amino-7-(dimethylamino)-, chloride (1 : 1)

Other Names Azure A; Phenothiazin-5-ium, 3-amino-7-(dimethylamino), chloride; 3-Amino-7-(dimethylamino)phenazathionium chloride; 5-Chloro-3-dimethylamino-7-amino-5*H*-phenothiazine; Azur A; Azurea dye; C.I. 52005; *N*,*N*-Dimethylthionine

Merck Index Number 927

Chemical/Dye Class Phenothiazine

Molecular Formula $C_{14}H_{14}ClN_3S$

Molecular Weight 291.80

Physical Form Dark green powder or crystals

Solubility Soluble in water, methanol, glycerol; sparingly soluble in ethanol

Melting Point 290 °C (decompose)

Absorption (λ_{max}) 620–634 nm

Synthesis Synthetic method[1–9]

Staining Applications Bacteria;[10] fungi;[10] blood products;[11,12] cells;[13] nucleic acids;[14–16] proteins;[16] viruses;[16] nuclei;[17] plant virus inclusions;[18] tissues;[19] hairs;[20] keratin fibers;[21] malaria-infected cells[22]

Biological Applications Antimalarial;[22,23] medical devices;[24] diagnosis of amyloid accumulation related diseases;[25] reducing the extent of cardiac arrhythmias;[26] treating angiogenic diseases,[27] avian influenza virus,[28] oral cavity infection,[29] neurodegenerative diseases,[30] pathological tau–tau association in Alzheimer disease,[31,32] protozoan infections,[33] viral diseases[34]

Industrial Applications Electrochromic devices;[35] optical sensors;[36] photovoltaic cells;[37] solar cells[37]

Safety/Toxicity Phototoxicity[38]

Certification/Approval Certified by Biological Stain Commission (BSC)

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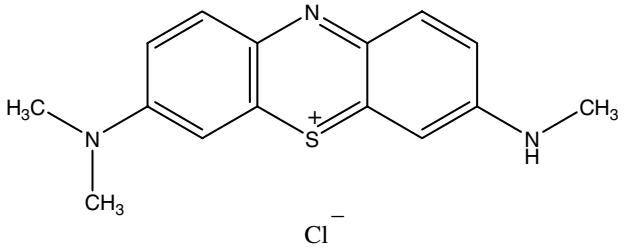
AZURE B

CAS Registry Number 531-55-5

Chemical Structure



CA Index Name Phenothiazin-5-ium, 3-(dimethylamino)-7-(methylamino)-, chloride (1 : 1)

Other Names Azure B; Phenothiazin-5-ium, 3-(dimethylamino)-7-(methylamino)-, chloride; Trimethylthionine; 3-Methylamino-7-dimethylaminophenazathionium chloride; Azur I; Azure I; C.I. 52010; Methylene Azure; Trimethylthionine chloride

Merck Index Number 928

Chemical/Dye Class Phenothiazine

Molecular Formula $C_{15}H_{16}ClN_3S$

Molecular Weight 305.83

Physical Form Dark green powder or crystals

Solubility Soluble in water; sparingly soluble in ethanol

Melting Point 205–210 °C (decompose)

Absorption (λ_{max}) 648–655 nm

Synthesis Synthetic method[1–14]

Staining Applications Blood products;[15–17] cells;[18] epithelial tissues;[19] nucleic acids;[20–24] proteins;[23,24] viruses;[23] nuclei;[25] nucleolus;[26] lignins;[27] melanin;[28,29] reticulocytes;[30] keratin fibers;[31] malaria-infected cells[32]

Biological Applications Antimalarial;[32,33] biofuel cell;[34] medical devices;[35] diagnosis of amyloid accumulation related diseases,[36] diabetes,[37] malignant melanoma;[28,29] detecting oral cancer,[38] cells,[18] nucleic acids;[20–24] treating avian influenza virus,[39] nail infection,[40] oral cavity infection,[41,42] neurodegenerative diseases,[43] pathological tau–tau association in Alzheimer disease,[44,45] protozoan infections,[46] viral diseases[47]

Industrial Applications Inks;[48] electrochromic devices;[49] solar energy[50]

Safety/Toxicity Carcinogenicity;[51] phototoxicity[52,53]

Certification/Approval Certified by Biological Stain Commission (BSC)

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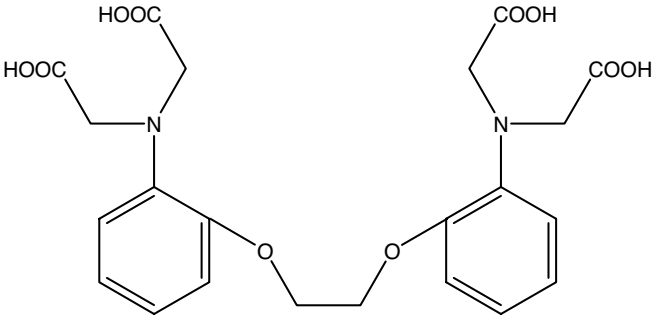
BAPTA

CAS Registry Number 85233-19-8

Chemical Structure



CA Index Name Glycine, *N*,*N*′-[1,2-ethanediylbis(oxy-2,1-phenylene)]bis[*N*-(carboxymethyl)-

Other Names 1,2-Bis(2-aminophenoxy)ethane-*N*,*N*,*N*′,*N*′-tetraacetic acid; 1,2-Bis(*o*-aminophenoxy)ethane-*N*,*N*,*N*′,*N*′-tetraacetic acid; Ethylenedioxybis(*o*-phenylenenitrilo)tetraacetic acid; 2,2′-(Ethylenedioxy)dianiline-*N*,*N*,*N*′,*N*′-tetraacetic acid; BAPTA

Merck Index Number 957

Chemical/Dye Class Aromatic

Molecular Formula $C_{22}H_{24}N_2O_{10}$

Molecular Weight 476.43

Physical Form Beige powder

Solubility Soluble in dimethyl sulfoxide

Melting Point 149–159°C

Boiling Point (Calcd.) 766.6 ± 60.0°C, pressure: 760 Torr

pKa (Calcd.) 1.40 ± 0.10, most acidic, temperature: 25°C; 5.96 ± 0.38, most basic, temperature 25°C

Absorption (λ_{max}) 209 nm, 254 nm, 203 nm, 274 nm

Emission (λ_{max}) 363 nm

Synthesis Synthetic methods[1–3]

Staining Applications Calcium ions;[1–3,6–22] zinc ions;[23,24] bone;[4] proteins[5]

Biological Applications Calcium indicators;[1–3,6–22] zinc indicators;[23,24] treating acute cell death,[25] cerebral infarction,[25] myocardial infarction,[25] hepatonecrosis,[25] kidney ischemic necrosis,[25] necrotizing pancreatitis,[25] amyloidosis,[26] atherosclerosis,[26] diseases characterized by calcification and/or plaque formation,[27] osteoporosis,[28] Paget's disease,[28] heterotropic ossification,[28] hypercalcemia,[28] cancer,[29] inflammation,[29] diabetes mellitus,[30] epilepsy,[31] epithelial disorders,[32] glaucoma,[33] HIV-associated conditions,[34] respiratory disorders,[35] streptococcal infection,[36] viral diseases[37]

Industrial Applications Inks[38]

Safety/Toxicity Carcinogenicity;[39] cytotoxicity;[40] excitotoxicity;[41,42] hydrogen peroxide toxicity;[43] neurotoxicity[44–48]

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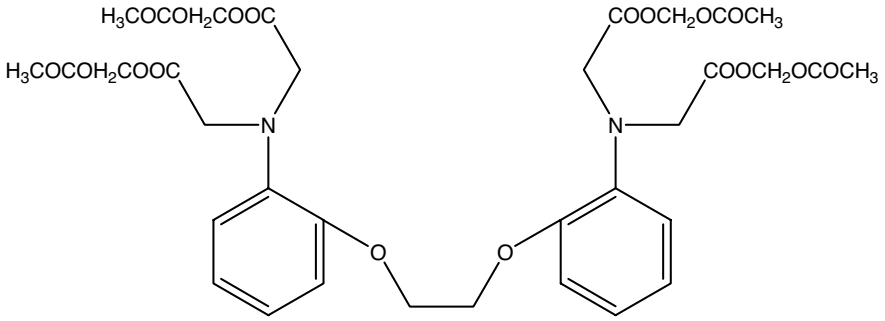
BAPTA AM

CAS Registry Number 126150-97-8

Chemical Structure



CA Index Name Glycine, *N*,*N*′-[1,2-ethanediylbis(oxy-2,1-phenylene)]bis[*N*-[2-[(acetyloxy)methoxy]-2-oxoethyl]-, 1,1′-bis[(acetyloxy)methyl] ester

Other Names 1,2-Bis(2-aminophenoxy)ethane-*N*,*N*,*N*′,*N*′-tetraacetic acid tetrakis(acetoxymethyl ester); Glycine, *N*,*N*′-[1,2-ethanediylbis(oxy-2,1-phenylene)]bis[*N*-[2-[(acetyloxy)methoxy]-2-oxoethyl]-, bis[(acetyloxy)methyl] ester; BAPTA-AM

Merck Index Number Not listed

Chemical/Dye Class Aromatic

Molecular Formula $C_{34}H_{40}N_2O_{18}$

Molecular Weight 764.68

Physical Form White powder

Solubility Soluble in chloroform, dimethyl sulfoxide

Melting Point >200°C

Boiling Point (Calcd.) 796.1 ± 60.0°C, pressure: 760 Torr

pK_a (Calcd.) 1.69 ± 0.50, most basic, temperature: 25°C

Absorption (λ_{max}) 287 nm

Synthesis Synthetic methods[1,2]

Staining Applications Calcium ions;[1–18] fungi;[19] motor neurons[20]

Biological Applications Calcium indicators;[1–18] treating cancer,[21] chronic bacterial infection,[22] glaucoma,[23] ocular hypertension,[23] HIV-associated conditions,[24] infectious diseases,[25] neurodegenerative disorders,[26] neurological conditions,[27] psychiatric conditions[27]

Industrial Applications Not reported

Safety/Toxicity Cytotoxicity;[28] excitotoxicity;[29] neurotoxicity;[20,30,31] renal toxicity[32]

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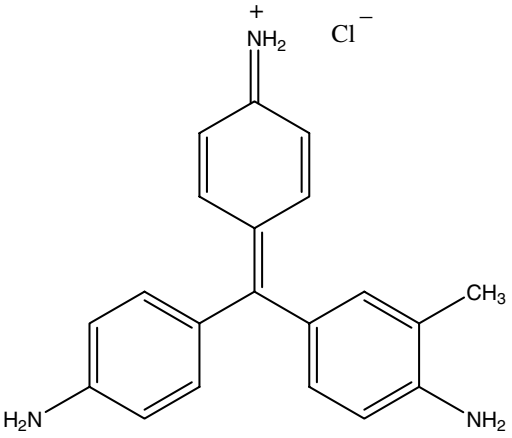
BASIC FUCHSIN

CAS Registry Number 632-99-5

Chemical Structure



CA Index Name Benzenamine, 4-[(4-aminophenyl)(4-imino-2,5-cyclohexadien-1-ylidene)methyl]-2-methyl-, hydrochloride (1:1)

Other Names Benzenamine, 4-[(4-aminophenyl)(4-imino-2,5-cyclohexadien-1-ylidene)methyl]-2-methyl-, monohydrochloride; C.I. Basic Violet 14, monohydrochloride; Rosaniline; 12418 Red; Aizen Magenta; Astra Fuchsine B; Basic Fuchsine; Basic Magenta; Basic Magenta E 200; Basic Violet 14; Basic fuchsin; C-WR Violet 8; C.I. 42510; C.I. Basic Violet 14; Calcozine Fuchsine HO; Calcozine Magenta RTN; Calcozine Magenta XX; Cerise B; Diabasic Magenta; Diamond Fuchsine; Fuchsin; Fuchsin basic; Fuchsine; Fuchsine A; Fuchsine CS; Fuchsine G; Fuchsine HO; Fuchsine N; Fuchsine RTN; Fuchsine SBP; Fuchsine Y; Lowacryl Violet 14; Magenta; Magenta DP; Magenta E; Magenta G; Magenta I; Magenta PN; Magenta Powder N; Magenta S; Magenta superfine; Orient Basic Magenta; RGB 20; RGN 10; RGN 10 (dye); Rosaniline chloride; Rosaniline hydrochloride; Rosanilinium chloride

Merck Index Number 5652

Chemical/Dye Class Triphenylmethane

Molecular Formula $C_{20}H_{20}ClN_3$

Molecular Weight 337.85

Physical Form Dark green crystals

Solubility Soluble in water, ethanol; insoluble in ether

Melting Point 200°C (decompose)

Absorption (λ_{max}) 543 nm

Synthesis Synthetic method[1–7]

Staining Applications Bacteria;[8,9] cells;[10] cytoplasm;[11] nuclei;[11] collagen;[11] mucus;[11] elastin;[11] fats;[11] lipids;[11] fish;[12] intestinal mucosa;[13] fruit juices;[14] fungi;[15] nucleic acids;[16] pathogens;[17] white blood cells;[18] nails;[19] skin;[20] lips;[20] hairs;[21–23] keratin fibers;[24] shampoos[25]

Biological Applications Detecting cancer;[26] treating Jock itch,[27] oral fungal infection,[28] piles;[29] periodontal disease[30]

Industrial Applications Inks;[31,32] highlighters;[33] textiles[34]

Safety/Toxicity Acute toxicity;[35] carcinogenicity;[36] genotoxicity;[37,38] mutagenicity[39]

Certification/Approval Certified by Biological Stain Commission (BSC)

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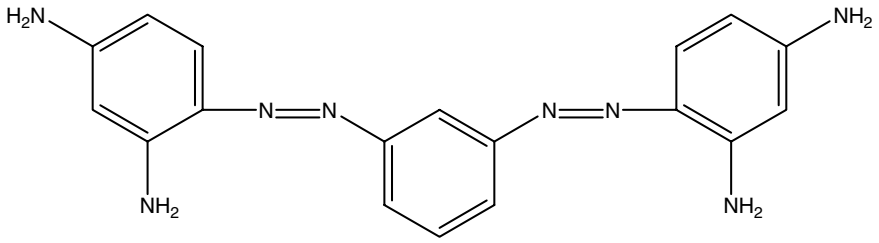
BISMARK BROWN Y

CAS Registry Number 10114-58-6

Chemical Structure



• 2HCl

Solubility Soluble in water, methyl cellosolve, ethylene glycol; slightly soluble in ethanol; insoluble in acetone, benzene, carbon tetrachloride, xylene

Melting Point >200°C

CA Index Name 1,3-Benzenediamine, 4,4′-[1,3-phenylenebis(2,1-diazenediyl)]bis-, hydrochloride (1:2)

Other Names 1,3-Benzenediamine, 4,4′-[1,3-phenylenebis(azo)]bis-, dihydrochloride; C.I. 21000; C.I. Basic Brown 1, dihydrochloride; Basic Brown G; Basic Brown GX; Basic Brown GXP; Excelsior Brown; Leather Brown; Manchester Brown; Phenylene Brown; Vesuvin; Vesuvine

Merck Index Number 1253

Chemical/Dye Class Azo

Molecular Formula $C_{18}H_{20}Cl_2N_8$

Molecular Weight 419.31

Physical Form Blackish-brown or red-brown powder

pK_a 5.0

Absorption (λ_{max}) 457 nm

Synthesis Synthetic methods[1–3]

Staining Applications Brain;[3] spinal cord;[3] sperm head;[4] tissue culture;[5] cytoplasmic vacuoles;[6] nucleic acids;[7] keratin fibers[8]

Biological Applications Differential inhibition of brain specific binding[9]

Industrial Applications Inks;[10] toners;[11] electrophotography;[12] paints;[13] wood[14]

Safety/Toxicity No data available

Certification/Approval Certified by Biological Stain Commission (BSC)

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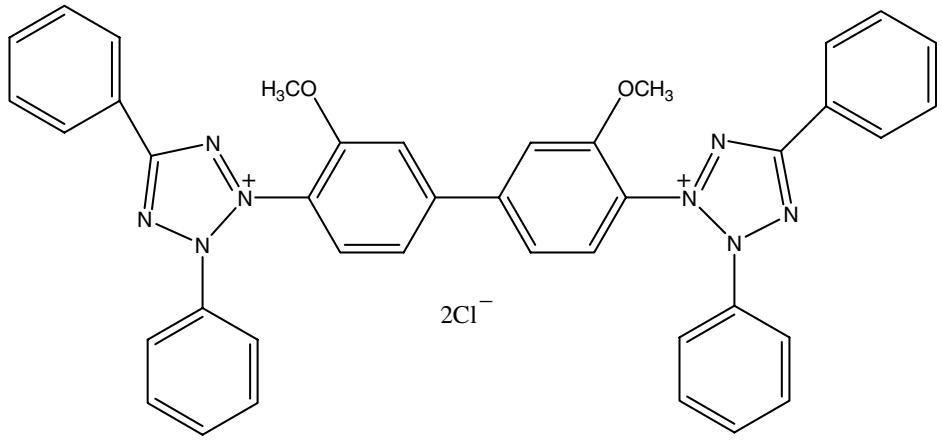
BLUE TETRAZOLIUM (BT)

CAS Registry Number 1871-22-3

Chemical Structure



CA Index Name 2*H*-Tetraolium, 2,2′-(3,3′-dimethoxy [1,1′-biphenyl]-4,4′-diyl)bis[3,5-diphenyl-, chloride (1:2)

Other Names 2*H*-Tetrazolium, 2,2′-(3,3′-dimethoxy [1,1′-biphenyl]-4,4′-diyl)bis[3,5-diphenyl-, dichloride; 2*H*-Tetrazolium,3,3′-(3,3′-dimethoxy-4,4′-biphenylylene) bis[2,5-diphenyl-, dichloride; 3,3′-(3,3′-Dimethoxy-4,4′-biphenylylene)bis[2,5-diphenyl-2*H*-tetrazolium chloride]; 2,2′,5,5′-Tetraphenyl-3,3′-(3,3′-dimethoxy-4,4′-diphenylene)ditetrazolium chloride; 2,2′-(*m*,*m*′-Dimethoxy-*p*,*p*′-biphenylene)bis(3,5-diphenyltetrazolium chloride); 3,3′-(3,3′-Dimethoxy-4,4′-biphenylene)bis[2,5-diphenyl-2*H*-tetrazolium chloride]; 3,3′-Dianisolebis[4,4′-(3,5-diphenyl)tetrazolium chloride]; BT; BT (dye); Blue tetrazolium; Blue tetrazolium chloride; Ditetrazolium chloride; NSC 27623; Tetrazolium blue; Tetrazolium blue chloride

Merck Index Number 9244

Chemical/Dye Class Tetrazolium salt

Molecular Formula $C_{40}H_{32}Cl_2N_8O_2$

Molecular Weight 727.64

Physical Form Lemon yellow crystals or powder

Solubility Soluble in water; freely soluble ethanol, methanol, chloroform; insoluble in acetone, ether, ethyl acetate

Melting Point 242–245°C (decompose)

Absorption (λ_{max}) 253 nm

Synthesis Synthetic methods[1–8]

Staining Applications Fungi;[9] motoneurons[10]

Biological Applications Cellular response evaluation assays;[11] microbial growth assays;[12,13] tannins assays;[14] anti-cancer agents;[15] diagnostic test strips;[16] detecting lactate dehydrogenase (LDH) isoenzymes,[17] gamma-hydroxybutyric acid (GHB);[18] measuring ATP,[19] number of soil microorganisms,[20] niacin;[21] treating cancer[22]

Industrial Applications Electrochromic displays;[23] recording materials;[24,25] toner;[26] photochromic devices;[27] thin-film sensor;[28] photographic materials[29]

Safety/Toxicity Cytotoxicity;[30–32] dental toxicity;[33,34] hepatotoxicity;[35] *in vitro* toxicity[36,37]

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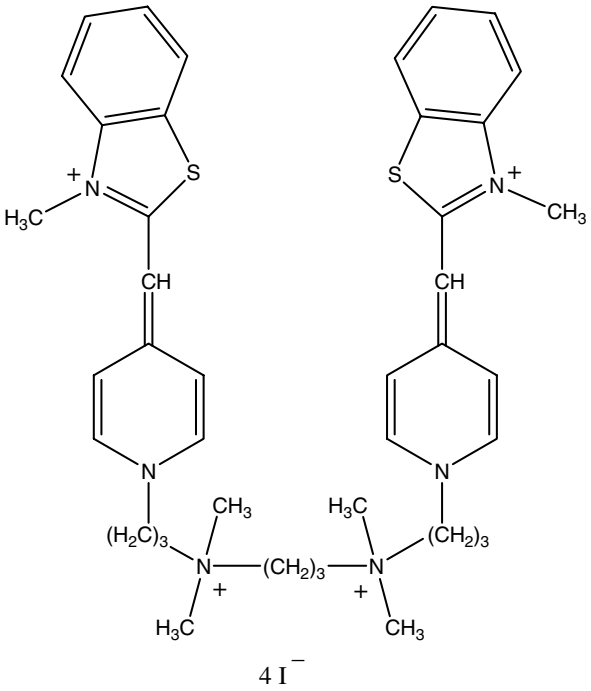
BOBO 1

CAS Registry Number 169454-13-1

Chemical Structure



CA Index Name Benzothiazolium, 2,2′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl-1(4*H*)-pyridinyl-4-ylidenemethylidyne]]bis[3-methyl-, iodide (1:4)

Other Names Benzothiazolium, 2,2′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl-1(4*H*)-pyridinyl-4-ylidenemethylidyne]]bis[3-methyl-, tetraiodide; BOBO 1; BOBO 1 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{41}H_{54}I_4N_6S_2$

Molecular Weight 1202.66

Physical Form Yellow-brown powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250°C

Absorption (λ_{max}) 462 nm

Emission (λ_{max}) 481 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[1–4] cells;[5,6] chromatin;[7] leukocytes;[15] nuclei;[15] micronuclei;[7] megakaryocyte;[8] microorganisms;[9] sperms;[10] hairs[11]

Biological Applications Nucleic acid hybridization;[12,13] detecting nucleic acids,[1–4] cells,[5,6] pathogens;[14] counting embryoblasts;[15] characterization of DNA/lipid complexes[16]

Industrial Applications Not reported

Safety/Toxicity No data available

REFERENCES

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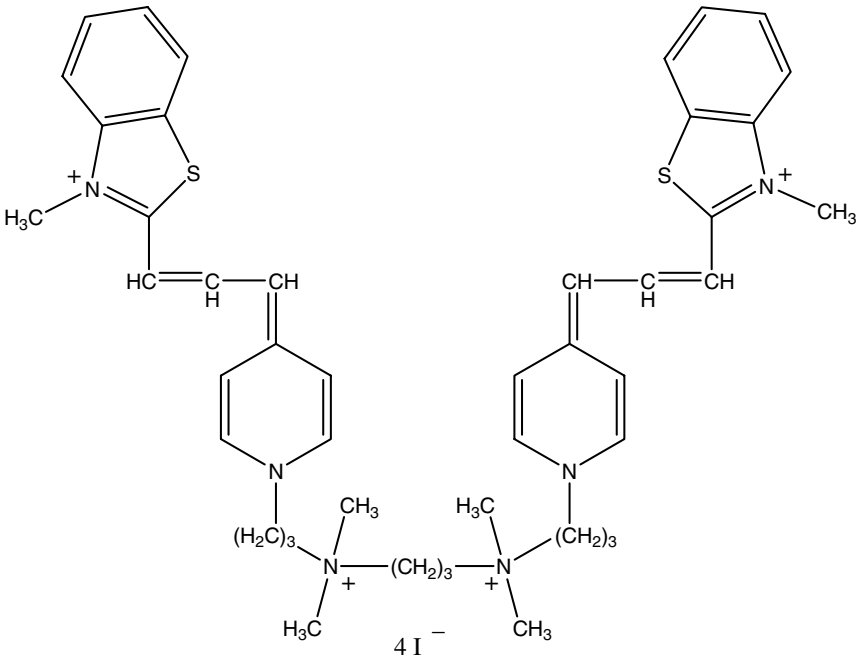
BOBO 3

CAS Registry Number 169454-17-5

Chemical Structure



Solubility Soluble in dimethyl sulfoxide

Melting Point >250°C

Absorption (λ_{max}) 570 nm

CA Index Name Benzothiazolium, 2,2′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl-1(4*H*)-pyridinyl-4-ylidene-1-propen-1-yl-3-ylidene]]bis[3-methyl-, iodide (1:4)

Other Names Benzothiazolium, 2,2′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl-1(4*H*)-pyridinyl-4-ylidene-1-propen-1-yl-3-ylidene]]bis[3-methyl, tetraiodide; BOBO 3, BIBO 3 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{45}H_{58}I_4N_6S_2$

Molecular Weight 1254.73

Physical Form Yellow-brown powder

Emission (λ_{max}) 602 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[1–5] bacteria;[6] cells;[7,8] leukocytes;[16] nuclei;[16] megakaryocytes;[9] sperms;[10] hairs[11]

Biological Applications Nucleic acid hybridization;[12] DNA fingerprinting;[13] DNA sequencing;[14] detecting nucleic acids,[1–5] cells,[7,8] pathogens;[15] counting embryoblasts[16]

Industrial Applications Not reported

Safety/Toxicity No data available

REFERENCES

1. Yue, S. T.; Haugland, R. P. Dimers of unsymmetrical cyanine dyes containing pyridinium moieties. U.S. Patent 5410030, 1995; *Chem. Abstr.* **1995**, *123*, 259753.
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dyes as a reporter to monitor denaturation. PCT Int. Appl. WO 2004038038, 2004; *Chem. Abstr.* **2004**, *140*, 386988.

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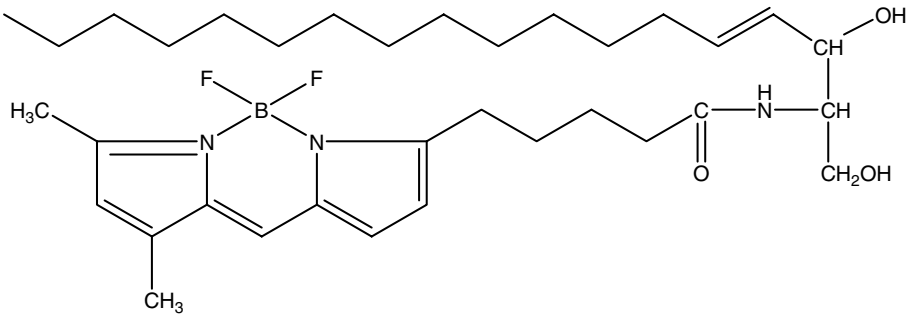
BODIPY FL C_5-CERAMIDE

CAS Registry Number 133867-53-5

Chemical Structure



Molecular Formula $C_{34}H_{54}BF_2N_3O_3$

Molecular Weight 601.63

Physical Form Solid

Solubility Soluble in chloroform, methanol, dimethyl sulfoxide

CA Index Name Boron, [5-[(3,5-dimethyl-2*H*-pyrrol-2-ylidene-κ*N*)methyl]-*N*-[(1*S*,2*R*,3*E*)-2-hydroxy-1-(hydroxymethyl)-3-heptadecen-1-yl]-1*H*-pyrrole-2-pentanamidato-κ*N*1]difluoro-, (T-4)-

Other Names Boron, [5-[(3,5-dimethyl-2*H*-pyrrol-2-ylidene)methyl]-*N*-[2-hydroxy-1-(hydroxymethyl)-3-heptadecenyl]-1*H*-pyrrole-2-pentanamidato-*N*1,*N*5]difluoro-, [T-4-[*R*-[*R**,*S**-(*E*)]]]-; Boron, [5-[(3,5-dimethyl-2*H*-pyrrol-2-ylidene-κ*N*)methyl]-*N*-[(1*S*,2*R*,3*E*)-2-hydroxy-1-(hydroxymethyl)-3-heptadecenyl]-1*H*-pyrrole-2-pentanamidato-κ*N*1]difluoro-, (T-4)-; 1*H*-Pyrrole-2-pentanamide, 5-[(3,5-dimethyl-2*H*-pyrrol-2-ylidene) methyl]-*N*-[2-hydroxy-1-(hydroxymethyl)-3-heptadecenyl]-, boron complex, [*R*-[*R**,*S**-(*E*)]]-; BODIPY FL-C_5-ceramide; C_5-DMB-ceramide

Merck Index Number Not listed

Chemical/Dye Class Organometallic, boron based

Melting Point >200°C

Absorption (λ_{max}) 505 nm

Emission (λ_{max}) 511 nm, 620 nm

Synthesis Synthetic method[1]

Staining Applications Golgi apparatus;[1–4] endoplasmic reticulum;[4] bacteria;[5] exosomes;[6] glycoproteins;[7] Madin–Darby canine kidney (MDCK) cells;[8] lipids;[9–12] lipid bilayers;[13] lipoproteins;[14] myelin;[15] sphingolipid;[16–19] transfer RNA[20]

Biological Applications Measuring activity of a hydrolase;[21] studying lipid traffic,[18] membrane traffic;[19] inositol phosphorylceramide synthase activity assay[22]

Industrial Applications Not reported

Safety/Toxicity No data available

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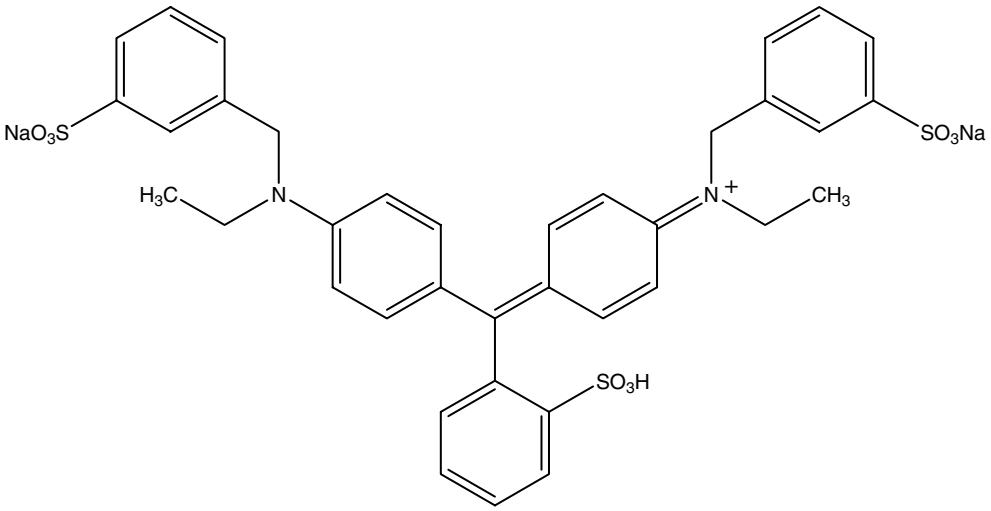
BRILLIANT BLUE FCF

CAS Registry Number 3844-45-9

Chemical Structure



Merck Index Number 1373

Chemical/Dye Class Triphenylmethane

Molecular Formula $C_{37}H_{34}N_2Na_2O_9S_3$

Molecular Weight 792.85

CA Index Name Benzenemethanaminium, *N*-ethyl-*N*-[4-[[4-[ethyl[(3-sulfophenyl)methyl]amino]phenyl](2-sulfophenyl)methylene]-2,5-cyclohexadien-1-ylidene]-3-sulfo-, inner salt, sodium salt (1:2)

Other Names Alphazurine FG; Benzenemethanaminium, *N*-ethyl-*N*-[4-[[4-[ethyl[(3-sulfophenyl)methyl]amino]phenyl](2-sulfophenyl)methylene]-2,5-cyclohexadien-1-ylidene]-3-sulfo-, hydroxide, inner salt, disodium salt; Benzenemethanaminium, *N*-ethyl-*N*-[4-[[4-[ethyl[(3-sulfophenyl)methyl]amino]phenyl](2-sulfophenyl)methylene]-2,5-cyclohexadien-1-ylidene]-3-sulfo-,inner salt, disodium salt; Brilliant Blue FCF; C.I. 42090; C.I. Acid Blue 9, disodium salt; Blue 1; Blue 1206; Blue FCF; Blue No. 1; Brilliant Blue E 133; Brilliant Blue FCF Supra; C.I. Food Blue 2; Canacert Brilliant Blue FCF; D and C Blue No. 1; D&C Blue No. 1; Disodium erioglaucine; Dolkwal Brilliant Blue; Duasyn Acid Blue AE 02; E 133; E 133 (dye); Erioglaucine; Erioglaucine disodium salt; FD and C Blue 1; FD and C Blue No. 1; FD&C Blue No. 1; FDC Blue 1; Food Blue 1; Food Blue 2; Food Blue Dye No. 1; Food Blue No. 1; Food Blue No. 2; Hexacol Brilliant Blue A; Japan Blue 1; Japan Blue No. 1; Japan Food Blue No. 1; Puricolor Blue ABL 9; Sicovit Brilliant Blue 85E133; Usacert Blue No. 1; Usacert FD and C Blue No. 1

Physical Form Reddish-violet or purple powder

Solubility Soluble in water, ethanol, methyl cellosolve

Melting Point 283°C (decompose)

Absorption (λ_{max}) 406 nm, 625 nm

Synthesis Synthetic methods[1–11]

Staining Applications Stain for endoscopy;[12] cells;[13] microorganisms;[14] alcohol;[15] bakery products;[16] beverages;[17,18] candies;[19] cotton candy;[20] canned food;[21] cucumbers;[21] drinks;[15,19] meat products;[22] sweeteners;[23] capsules;[24] tablets;[25] toothpastes;[26] eyelashes;[27] eye shadow;[28] skin;[29] hairs;[30] tattoos;[31] teeth[32]

Biological Applications Treating coughing,[33] sneezing,[33] rhinorrhea,[33] nasal obstruction,[33] rhinitis;[34] medical devices[35]

Industrial Applications Electrochromic display devices;[36] inks;[37,38] paints;[39] photographic materials;[40] detergents;[41] textiles;[42] wood;[43] entertainment products[44]

Safety/Toxicity Acute toxicity;[45] carcinogenicity;[46–48] environmental toxicity;[49] genotoxicity;[50,51] mutagenicity[52,53]

Certification/Approval Approved by Food & Drugs Administration (FDA)

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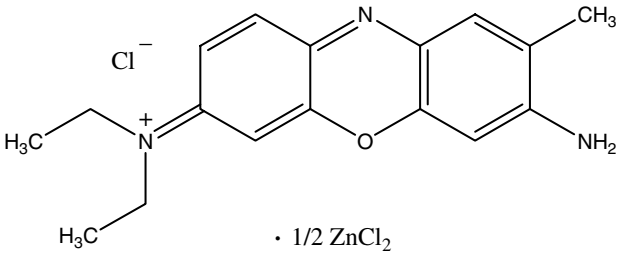
BRILLIANT CRESYL BLUE

CAS Registry Number 81029-05-2

Chemical Structure



CA Index Name Phenoxazin-5-ium, 3-amino-7-(diethylamino)-2-methyl-, chlorozincate (2:1)

Other Names 3-Amino-7-(diethylamino)-2-methylphenoxazin-5-ium chlorozincate; BCB; Brilliant Cresyl Blue; Brilliant Cresyl Blue ALD; Brilliant Cresyl Blue BB; Brilliant Blue C; C.I. 51010

Merck Index Number Not listed

Chemical/Dye Class Phenoxazine

Molecular Formula $C_{17}H_{20}ClN_3O \cdot 0.5\ ZnCl_2$

Molecular Weight 385.96

Physical Form Green crystalline powder

Solubility Soluble in water, ethanol

Melting Point 233–236°C

pK_a 6.0, 11.0

Absorption (λ_{max}) 622 nm

Synthesis Synthetic methods[1–3]

Staining Applications Brain tissue;[4] nuclei;[5] plant chromosomes;[6] reticulocytes;[7] platelets;[8] reticulated red cells[8]

Biological Applications Detection of biochemical molecules;[9] enzyme assay[9]

Industrial Applications Optical data storage[10]

Safety/Toxicity No data available

Certification/Approval Certified by Biological Stain Commission (BSC)

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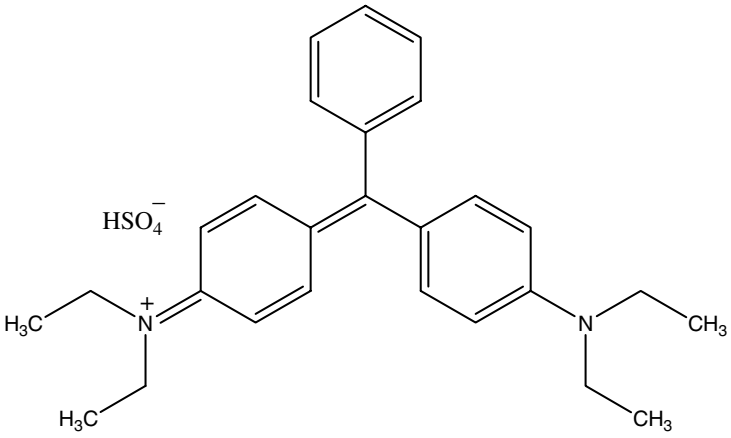
BRILLIANT GREEN

CAS Registry Number 633-03-4

Chemical Structure



Merck Index Number 1374

Chemical/Dye Class Triphenylmethane

Molecular Formula $C_{27}H_{34}N_2O_4S$

Molecular Weight 482.63

CA Index Name Ethanaminium, *N*-[4-[[4-(diethylamino)phenyl]phenylmethylene]-2,5-cyclohexadien-1-ylidene]-*N*-ethyl-, sulfate

Other Names ADC Brilliant Green crystals; Astradiamant Green GX; C.I. Basic Green 1; 12415 Green; ADC Brilliant Green Crystals; Aizen Diamond Green GH; Aizen Malachite Green GH; Astra Diamond Green GX; Astrazon Green D; Avon Green A 4379; Basic Bright Green; Basic Bright Green Sulfate; Basic Brilliant Green; Basic Green 1; Basic Green V; Brilliant Green; Brilliant Green B; Brilliant Green BP; Brilliant Green BP Crystals; Brilliant Green BPC; Brilliant Green Crystals; Brilliant Green Crystals H; Brilliant Green DSC; Brilliant Green G; Brilliant Green GX; Brilliant Green Lake; Brilliant Green P; Brilliant Green Special; Brilliant Green Sulfate; Brilliant Green WP Crystals; Brilliant Green Y; Brilliant Green YN; Brilliant Green YNS; Brilliant Lake Green Y; Brilliant green aseptic; C.I. 42040; Calcozine Brilliant Green G; Deorlene Green JJO; Diamond Green G; Diamond Green GH; *N*-[4-[[4-(Diethylamino)phenyl]phenylmethylene]-2,5-cyclohexadien-1-ylidene]-*N*-ethylethanaminium sulfate (1:1); Emerald Green; Ethyl green; Fast Green J; Fast Green JJO; Green EN; Hidaco Brilliant Green; Malachite Green G; Mitsui Brilliant Green GX; NSC 5011; Resplendency Green; Solid Green; Solid Green JO; Tertrophene Brilliant Green G; Tokyo Aniline Brilliant Green; Zelen brilantni; Zelen malachitova G; Zelen smaragdova; Zelen zasadita 1

Physical Form Glistering green to green-gold crystals

Solubility Soluble in water, ethanol

Melting Point 210°C (decompose)

pH Range 0.0–2.6

Color Change at pH Yellow (0.0) to green (2.6)

Absorption (λ_{max}) 625 nm, 428 nm

Synthesis Synthetic methods[1–12]

Staining Applications Bone cement;[13] cytoplasm;[14] horny layer cell;[15] large intestine;[14] nucleic acids;[16] skin;[15,17] stratum corneum cell;[18] tissues;[14] hairs[1,19,20]

Biological Applications Antimalarial agent;[1,21] detecting carious tissue;[1,22] treating anococcygeal pain syndrome;[23] wound dressing materials;[1,17,24] catheter;[25] mouthwash[26]

Industrial Applications Color filters;[1,27] black matrix;[1,27] liquid crystal displays;[1,27] photoresist;[1,28] conducting polymer films;[29] optical fiber pH sensor;[30] printed circuit boards;[31] inks;[1,32,33] textiles[34]

Safety/Toxicity Bacterial toxicity;[35] carcinogenicity;[1,36] fish toxicity;[1,37] microbial toxicity;[38] skin toxicity[39]

Certification/Approval Certified by Biological Stain Commission (BSC)

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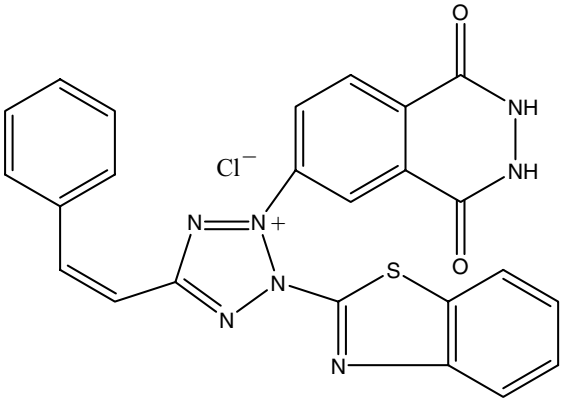
BSPT

CAS Registry Number 38116-89-1

Chemical Structure



CA Index Name 2*H*-Tetrazolium, 2-(2-benzothiazolyl)-3-(3,4-dihydro-1-hydroxy-4-oxo-6-phthalazinyl)-5-(2-phenylethenyl)-, chloride (1:1)

Other Names 2*H*-Tetrazolium, 2-(2-benzothiazolyl)-5-(2-phenylethenyl)-3-(1,2,3,4-tetrahydro-1,4-dioxo-6-phthalazinyl)-, chloride; 2-(2′-Benzothiazolyl)-5-styryl-3-(4′-phthalhydrazidyl)tetrazolium chloride; 2-(2-Benzothiazolyl)-3-(4-phthalhydrazidyl)-5-styryltetrazolium chloride; 2-(2-Benzothiazolyl)-5-styryl-3-(4-phthalhydrazidyl)tetrazolium chloride; BPST; BPST chloride; BSPT; BSPT (dye); Thiazolyl blue; Thiazolyl blue (Chinese)

Merck Index Number Not listed

Chemical/Dye Class Tetrazolium salt

Molecular Formula $C_{24}H_{16}ClN_7O_2S$

Molecular Weight 501.95

Physical Form Orange crystals or powder

Solubility Soluble in water, ethanol, *N*,*N*-dimethylformamide

Melting Point 254°C

Absorption (λ_{max}) 300 nm

Synthesis Synthetic methods[1–3]

Staining Applications Enzymes;[4–11] tissues[12,13]

Biological Applications Albumin assays;[14] detecting gamma-hydroxybutyric acid (GHB);[15] treating cancer,[16] cerebrovascular disorder,[17] brain degenerative disease,[17] demyelinating disease,[17] muscle degenerative disease[18]

Industrial Applications Not reported

Safety/Toxicity Skin toxicity[19]

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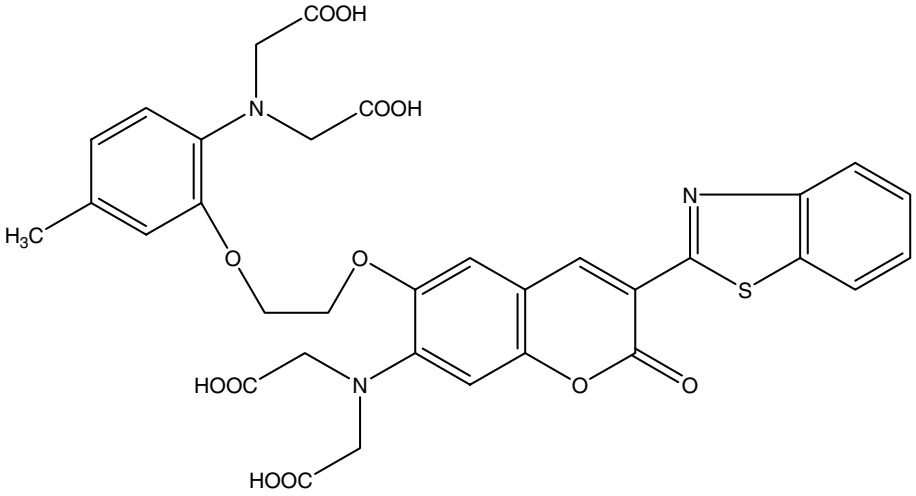
BTC

CAS Registry Number 154324-80-8

Chemical Structure



CA Index Name Glycine, *N*-[3-(2-benzothiazolyl)-6-[2-[2-[bis(carboxymethyl)amino]-5-methylphenoxy]ethoxy]-2-oxo-2*H*-1-benzopyran-7-yl]-*N*-(carboxymethyl)-

Other Names BTC

Merck Index Number Not listed

Chemical/Dye Class Benzothiazolylcoumarin

Molecular Formula $C_{33}H_{29}N_3O_{12}S$

Molecular Weight 691.66

Physical Form Solid

Solubility Soluble in dimethyl sulfoxide

Melting Point >250°C

Boiling Point (Calcd.) 1027.8 ± 75.0°C, pressure: 760 Torr

pK_a (Calcd.) 1.70 ± 0.10, most acidic, temperature: 25°C

6.17 ± 0.50, most basic, temperature: 25°C

Absorption (λ_{max}) 464 nm

Emission (λ_{max}) 533 nm

Synthesis Synthetic methods[1,2]

Staining Applications Calcium ions[1–10]

Biological Applications Calcium indicator;[1–10] identifying ion channels modulators[11]

Industrial Applications Not reported

Safety/Toxicity No data available

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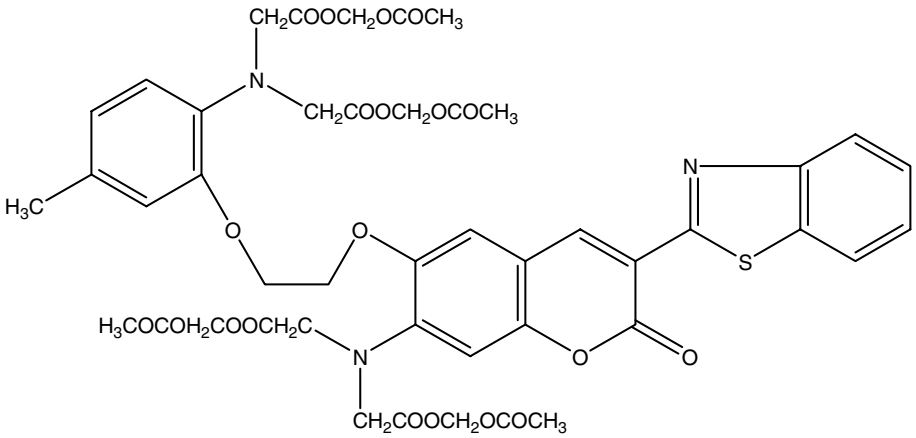
BTC AM

CAS Registry Number 176767-94-5

Chemical Structure



CA Index Name Glycine, *N*-[2-[(acetyloxy)methoxy]-2-oxoethyl]-*N*-[3-(2-benzothiazolyl)-6-[2-[2-[bis[2-[(acetyloxy)methoxy]-2-oxoethyl]amino]-5-methylphenoxy]ethoxy]-2-oxo-2*H*-1-benzopyran-7-yl]-, (acetyloxy)methyl ester

Other Names BTC acetoxymethyl ester, BTC AM

Merck Index Number Not listed

Chemical/Dye Class Benzothiazolylcoumarin

Molecular Formula $C_{45}H_{45}N_3O_{20}S$

Molecular Weight 979.91

Physical Form Solid

Solubility Soluble in methanol, dimethyl sulfoxide

Melting Point >250°C

Boiling Point (Calcd.) 992.9 ± 75.0°C, pressure: 760 Torr

pK_a (Calcd.) 1.91 ± 0.50, most basic, temperature: 25°C

Absorption (λ_{max}) 433 nm

Emission (λ_{max}) 504 nm

Synthesis Synthetic method[1]

Staining Applications Calcium ions;[1,3–11] leukocytes[2]

Biological Applications Calcium indicator;[1,3–11] detecting leukocytes tumor cells[2]

Industrial Applications Not reported

Safety/Toxicity No data available

REFERENCES

1. Katerinopoulos, H. E.; Iatridou, H.; Foukaraki, E.; Malekzadeh, M. N.; Kuhn, M. A.; Haugland, R. P. Benzazolylcoumarin-based ion indicators. U.S. Patent 5501980, 1996; *Chem. Abstr.* **1996**, *124*, 359466.
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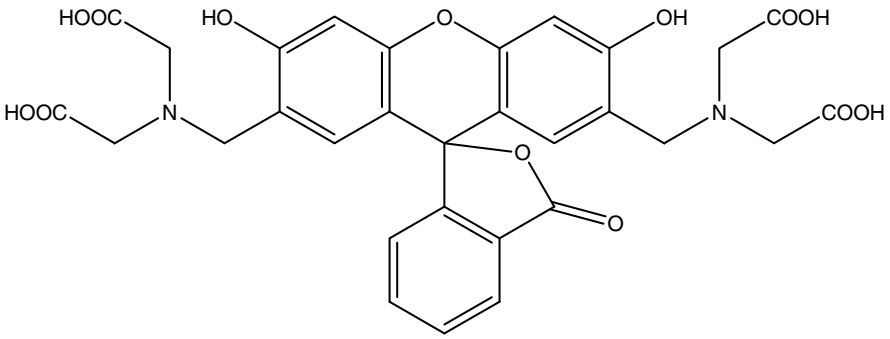
CALCEIN

CAS Registry Number 1461-15-0

Chemical Structure



CA Index Name Glycine, *N*,*N*′-[(3′,6′-dihydroxy-3-oxospiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthene]-2′,7′-diyl) bis(methylene)]bis[*N*-(carboxymethyl)-

Other Names Bis[*N*,*N*-bis(carboxymethyl)aminomethyl] fluorescein; Fluorescein, 2′,7′-bis[[bis(carboxymethyl) amino]methyl]-; Fluorescein-bis(methyliminodiacetic acid); Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthene], glycine derivative; 2,7-Bis[*N*,*N*-bis(carboxymethyl)aminomethylene]fluorescein; Acetic acid, [(3′,6′-dihydroxy-2′,7′-fluorandiyl)bis(methylenenitrilo)]tetra-; Calcein; Fluorescein complexon; Fluorexon; NSC 298193; Oftasceine

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{30}H_{26}N_2O_{13}$

Molecular Weight 622.53

Physical Form Yellow-orange to brown powder

Solubility Soluble in water, ethanol, *N*,*N*-dimethyl formamide, dimethyl sulfoxide

Melting Point 200°C

Boiling Point (Calcd.) 952.7 ± 65.0°C, pressure: 760 Torr

pH Range 6.0–7.2

Color Change at pH Weak green fluorescence (6.0) to strong green fluorescence (7.2)

pK_a 6.67

Absorption (λ_{max}) 494 nm

Emission (λ_{max}) 517 nm

Synthesis Synthetic methods[1–7]

Staining Applications Calcium ions;[8,9] fluoride ions;[10] iron ions;[11–13] mercury ions;[14] peptides;[2] proteins;[2] antibodies;[2] atherosclerotic plaque;[1,15] bone;[16,17] cells;[18–20] fish;[21] liposomes;[22,23] neurons;[8] skin;[24] tumor cells;[1,25] inflammations;[1] lymphokines;[1] hepatocytes[3,4]

Biological Applications Calcium indicator;[8,9] fluoride indicator;[10] iron indicator;[11–13] mercury indicator;[14] detecting nucleic acids,[1,26] proteins;[27] treating osteoporosis;[28] drug delivery systems[1,29]

Industrial Applications Chemical mechanical polishing;[1,30] coatings;[31] photoresists[32]

Safety/Toxicity Acute toxicity;[33] cytotoxicity;[1,34] mutagenicity;[35] neurotoxicity;[36] ophthalmotoxicity[37]

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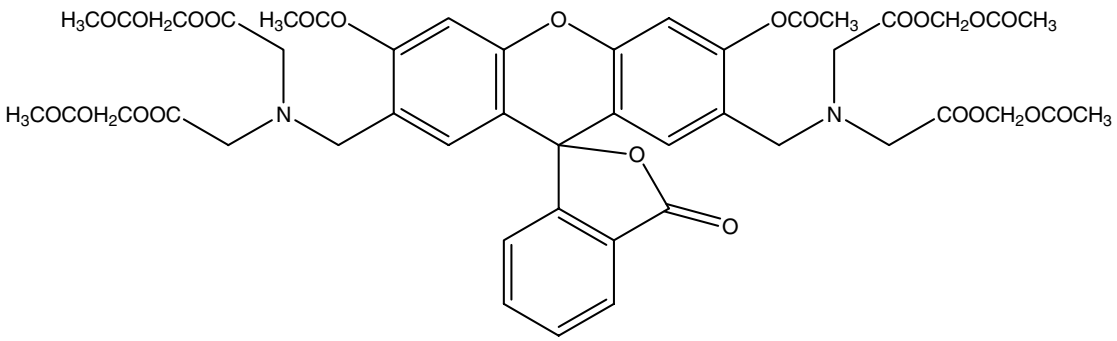
CALCEIN AM

CAS Registry Number 148504-34-1

Chemical Structure



CA Index Name Glycine, *N*,*N*′-[[3′,6′-bis(acetyloxy)-3-oxospiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthene]-2′,7′-diyl]bis(methylene)]bis[*N*-[2-[(acetyloxy)methoxy]-2-oxoethyl]-, 1,1′-bis[(acetyloxy)methyl] ester

Other Names Calcein *O*,*O*′-diacetate tetrakis(acetoxymethyl)ester; Glycine, *N*,*N*′-[[3′,6′-bis(acetyloxy)-3-oxospiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthene]-2′,7′-diyl] bis(methylene)]bis[*N*-[2-[(acetyloxy)methoxy]-2-oxoethyl]-, bis[(acetyloxy)methyl] ester; Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthene], glycine derivative; Calcein AM; Calcein acetoxymethyl ester; NSC 689290

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{46}H_{46}N_2O_{23}$

Molecular Weight 994.86

Physical Form Colorless powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250°C

Boiling Point (Calcd.) 982.7 ± 65.0°C, pressure: 760 Torr

pK_a (Calcd.) 2.66 ± 0.50, most basic, temperature: 25°C

Absorption (λ_{max}) < 300 nm

Synthesis Synthetic methods[1–4]

Staining Applications Calcium ions;[5–8] zinc ions;[9] bacteria;[10–12] fungi;[11] yeast;[12,13] cells;[14–21] cornea;[22,23] erythrocytes;[24] lymphocytes;[25] microorganisms;[26,27] neurons;[28,29] Schwann cells;[30] sperms;[31–33] tissues[34]

Biological Applications Calcium indicators;[5–8] zinc indicators;[9] cytotoxicity assays;[35–37] apoptosis assays;[38,39] viability assays;[3,4,9,13,14,16,21–24,28,32,33] labile iron pool assays;[40] chemotaxis probes;[41,42] cell adhesion probes;[25,43–46] mitochondrial probes;[46,47] P-glycoprotein probes;[48] multi-drug resistance probes;[49–51] treating atherosclerosis,[52] cancer;[53] ischemic disease[54]

Industrial Applications Not reported

Safety/Toxicity Carcinogenicity;[55] cytotoxicity;[56–61] fish toxicity;[62] nanoparticle toxicity;[63] neurotoxicity;[64–66] phototoxicity;[67] ophthalmotoxicity;[68,69] reproductive toxicity[46]

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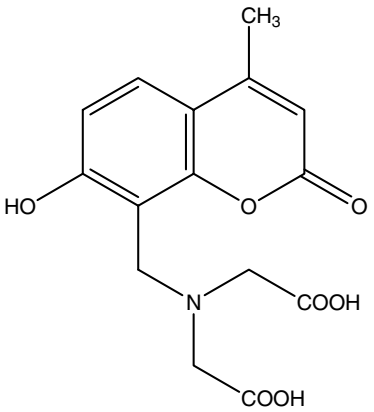
CALCEIN BLUE

CAS Registry Number 54375-47-2

Chemical Structure



CA Index Name Glycine, *N*-(carboxymethyl)-*N*-[(7-hydroxy-4-methyl-2-oxo-2*H*-1-benzopyran-8-yl)methyl]-

Other Names Calcein blue; 4-Methylumbelliferone-8-methyliminodiacetic acid

Merck Index Number Not listed

Chemical/Dye Class Coumarin

Molecular Formula $C_{15}H_{15}NO_7$

Molecular Weight 321.28

Physical Form White to pale yellow powder

Solubility Soluble in water, methanol, dimethyl sulfoxide

Melting Point >200°C

Boiling Point (calcd.) 636.2 ± 55.0°C, pressure: 760 Torr

pK_a (Calcd.) 1.74 ± 0.10, most acidic, temperature: 25°C

Absorption (λ_{max}) 360 nm

Emission (λ_{max}) 449 nm

Synthesis Synthetic methods[1–4]

Staining Applications Alkaline phosphatase;[5] amino acids;[6] bone;[7] calcification front;[8] fish;[9] mineralized nodule;[10] mineralized tissues;[11] tumor tissues;[12] copper ions;[13,14] calcium ions;[15] cadmium ions;[16] iron (II) ions;[17] iron (III) ions;[3] fluoride ions;[18,19] lanthanides ions;[20] magnesium ions;[21] silver ions;[22] sulfate ions;[23] zinc ions[24]

Biological Applications Copper indicator;[13,14] calcium indicator;[15] cadmium indicator;[16] iron (II) indicator;[17] iron (III) indicator;[3] fluoride indicator;[18,19] lanthanides indicator;[20] magnesium indicator;[21] silver indicator;[22] sulfate indicator;[23] zinc indicator;[24] treating atherosclerosis,[25] restenosis,[25] hypertension[25]

Industrial Applications Laser materials;[26] semiconductor wafer-cleansing solutions;[27] detergent[28]

Safety/Toxicity No data available

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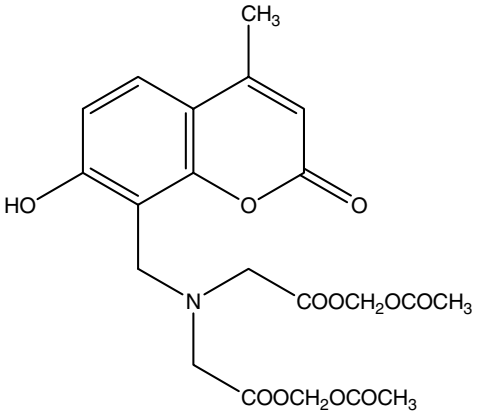
CALCEIN BLUE AM

CAS Registry Number 168482-84-6

Chemical Structure



CA Index Name Glycine, *N*-[2-[(acetyloxy)methoxy]-2-oxoethyl]-*N*-[(7-hydroxy-4-methyl-2-oxo-2*H*-1-benzopyran-8-yl)methyl]-, (acetyloxy)methyl ester

Other Names Calcein Blue AM; Calcein Blue acetoxymethyl ester

Merck Index Number Not listed

Chemical/Dye Class Coumarin

Molecular Formula $C_{21}H_{23}NO_{11}$

Molecular Weight 465.41

Physical Form Solid

Solubility Soluble in dimethyl sulfoxide, methanol

Melting Point >200°C

Boiling Point (Calcd.) 617.0 ± 55.0°C, pressure: 760 Torr

pK_a (Calcd.) 8.88 ± 0.40, most acidic, temperature: 25°C; 2.66 ± 0.50, most basic, temperature: 25°C

Absorption (λ_{max}) 322 nm

Emission (λ_{max}) 437 nm

Synthesis Synthetic method[1]

Staining Applications Bacteria,[2] cells[1]

Biological Applications Drug delivery;[3] fluorescent viability assay;[1] monitoring bacterial transport[2]

Industrial Applications Not reported

Safety/Toxicity Cytotoxicity[3]

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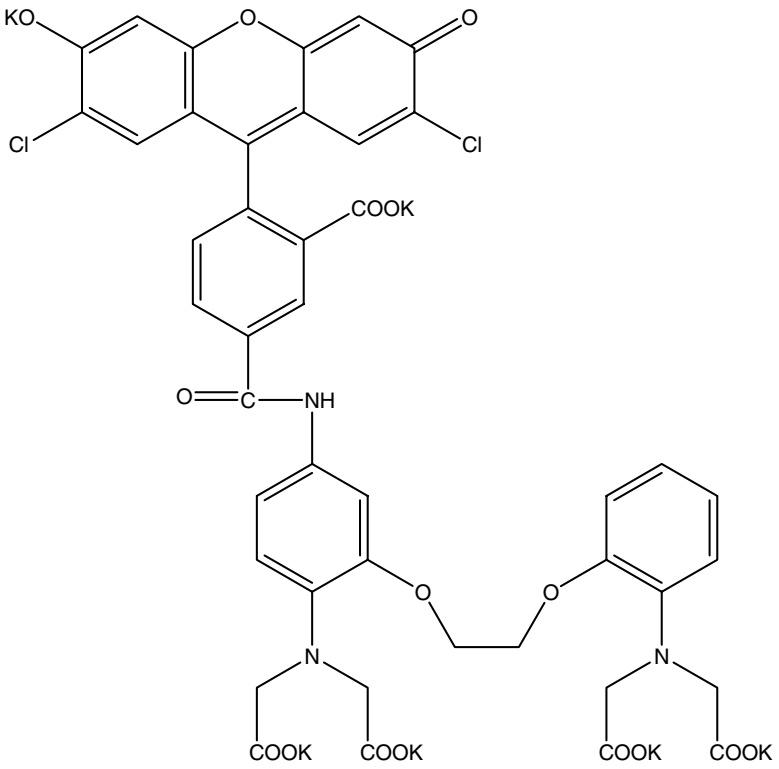
CALCIUM GREEN 1

CAS Number 154719-40-1

Chemical Structure



Chemical/Dye Class Xanthene

Molecular Formula $C_{43}H_{27}Cl_2K_6N_3O_{16}$

Molecular Weight 1147.19

Physical Form Solid

CA Index Name Glycine, *N*-[2-[2-[2-[bis(carboxymethyl)amino]-5-[[(2′,7′-dichloro-3′,6′-dihydroxy-3-oxospiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-5-yl)carbonyl]amino]phenoxy]ethoxy]phenyl]-*N*-(carboxymethyl)-, potassium salt (1:6)

Other Names Glycine, *N*-[2-[2-[2-[bis(carboxymethyl) amino]-5-[[(2′,7′-dichloro-3′,6′-dihydroxy-3-oxospiro [isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-5-yl)carbonyl] amino]phenoxy]ethoxy]phenyl]-*N*-(carboxymethyl)-, hexapotassium salt; Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthene], glycine deriv.; Calcium Green 1; Calcium Green I

Merck Index Number Not listed

Solubility Soluble in water

Melting Point >250°C

pK_a 6.7

Absorption (λ_{max}) 506 nm

Emission (λ_{max}) 531 nm

Synthesis Synthetic methods[1,2]

Staining Applications Calcium ions;[4–27] cells,[3] neurons[7,8,10,11,13,21]

Biological Applications Calcium indicator[4–27]

Industrial Applications Not reported

Safety/Toxicity Phloem mobility of xenobiotics[28]

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CALCIUM GREEN 2

CAS Registry Number 170516-40-2

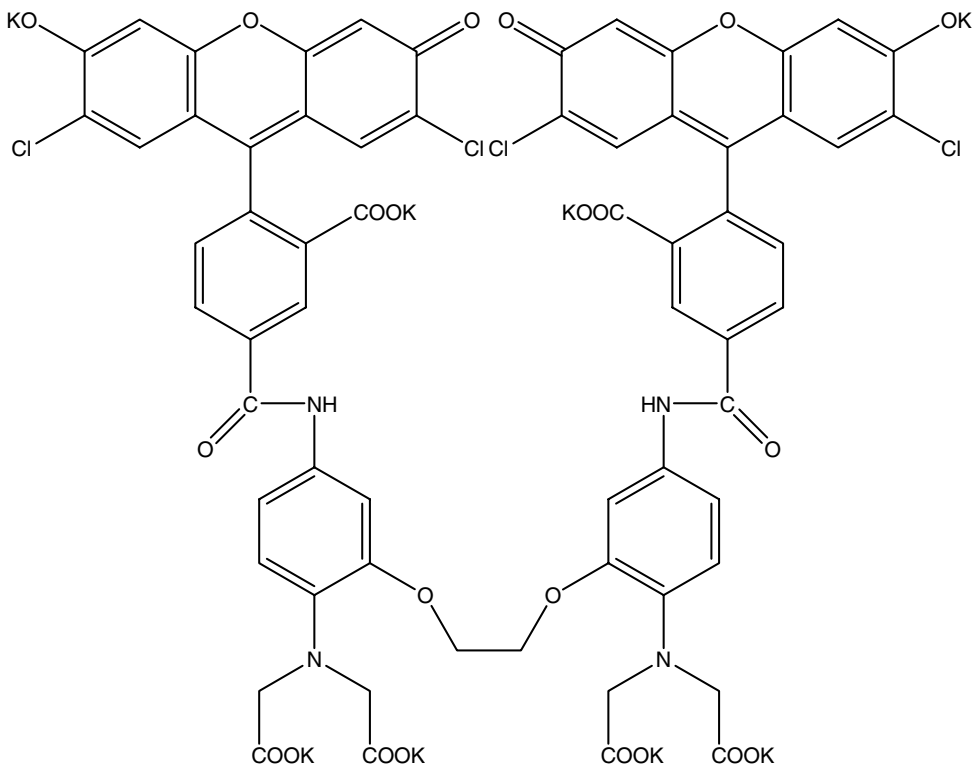
Chemical Structure

Molecular Weight 1665.58

Physical Form Solid

Solubility Soluble in water

Melting Point >250°C



CA Index Name Glycine, *N*,*N*′-[1,2-ethanediylbis[oxy[4-[[(2′,7′-dichloro-3′,6′-dihydroxy-3-oxospiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-5-yl)carbonyl]amino]-2,1-phenylene]]]bis[*N*-(carboxymethyl)-, potassium salt (1:8)

Other Names Glycine, *N*,*N*′-[1,2-ethanediylbis[oxy[4-[[(2′,7′-dichloro-3′,6′-dihydroxy-3-oxospiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-5-yl)carbonyl]amino]-2,1-phenylene]]]bis[*N*-(carboxymethyl)-, octapotassium salt; CG 2; Calcium Green 2

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{64}H_{34}Cl_4K_8N_4O_{22}$

Absorption (λ_{max}) 503 nm

Emission (λ_{max}) 536 nm

Synthesis Synthetic methods[1,2]

Staining Applications Calcium ions[1–6]

Biological Applications Calcium indicator;[1–6] identifying ryanodine receptors modulators,[3] taste receptors modulators[6]

Industrial Applications Not reported

Safety/Toxicity No data available

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1. Kuhn, M. A.; Haugland, R. P. Reactive derivatives of BAPTA used to make ion-selective chelators. U.S. Patent 5453517, 1995; *Chem. Abstr.* **1995**, *124*, 86585.

2. Kuhn, M. A.; Hoyland, B.; Carter, S.; Zhang, C.; Haugland, R. P. Fluorescent ion indicators for detecting heavy metals. *Proc. SPIE-Int. Soc. Opt. Eng.* **1995**, *2388*, 238–244.

3. Dong, C. J.; Hare, W. A. Methods of determining activity of ryanodine receptor modulators. U.S. Pat. Appl. Publ. US 2007196856, 2007; *Chem. Abstr.* **2007**, *147*, 292267.
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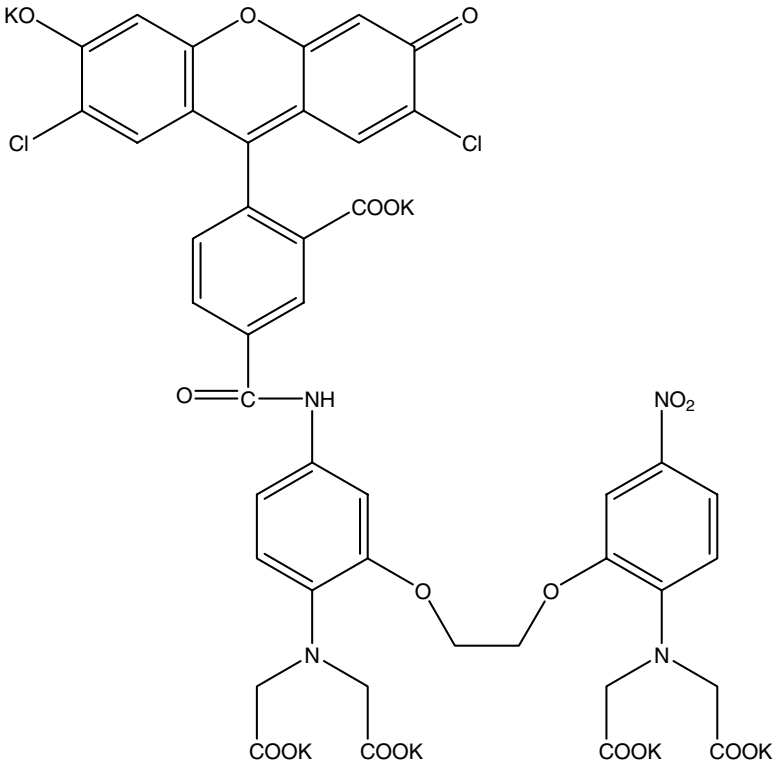
CALCIUM GREEN 5N

CAS Registry Number 153130-66-6

Chemical Structure



CA Index Name Glycine, *N*-[2-[2-[2-[bis(carboxymethyl)amino]-5-[[(2′,7′-dichloro-3′,6′-dihydroxy-3-oxospiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-5-yl)carbonyl]amino]phenoxy]ethoxy]-4-nitrophenyl]-*N*-(carboxymethyl)-, hexapotassium salt

Other Names Calcium green 5N

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{43}H_{26}Cl_2K_6N_4O_{18}$

Molecular Weight 1192.19

Physical Form Solid

Solubility Soluble in water

Melting Point >250°C

Absorption (λ_{max}) 506 nm

Emission (λ_{max}) 532 nm

Synthesis Synthetic methods[1,2]

Staining Applications Calcium ions[1–12]

Biological Applications Calcium indicator[1–12]

Industrial Applications Not reported

Safety/Toxicity No data available

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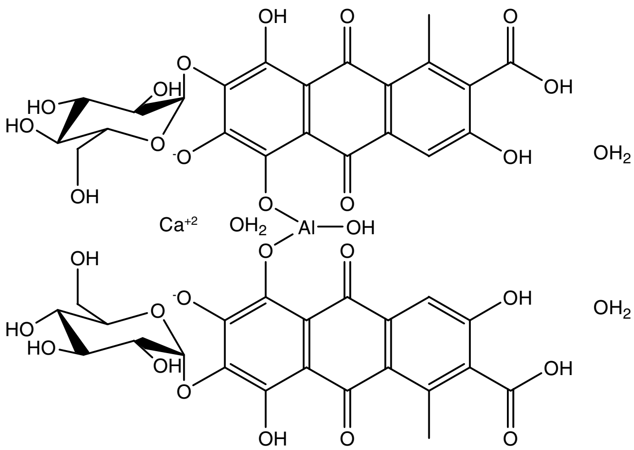
CARMINE

CAS Registry Number 1390-65-4

Chemical Structure



CA Index Name Carmine

Other Names Alum carmine; Alum lake; Alum lake of carminic acid; B Rose Liquid; C.I. 75470; Carmine; Carmine alum lake; Carmine red; Cochineal; Cochineal extract; Nacarat; Natural Red 4

Merck Index Number Not listed

Chemical/Dye Class Anthraquinone

Molecular Formula $C_{44}H_{43}AlCaO_{32}$

Molecular Weight 1150.86

Physical Form Red powder

Solubility Slightly soluble in water; soluble in alkali solution; insoluble in cold water

Melting Point 138–140°C (darkens)

Absorption (λ_{max}) 531 nm, 563 nm

Synthesis Synthetic methods[1–11]

StainingApplications Beverages;[12] candies;[13] cheese;[14] chewing gum;[15] noodle seasoning;[16] sweeteners;[17] confectionery products;[18,19] fish;[20] meat;[20] food casings;[21] fruits;[22] vegetables;[22] bacteria;[23] cells;[24] chromatin;[25] glycogen;[26] mucus;[26] nuclei;[26] microorganisms;[27] nucleic acids;[28] proteins;[29] capsules;[30] cough syrups;[31] tablets;[13,19,32] lips;[35,36,40,41] lip gloss;[33] lipstick;[34] cheek color;[34] nails;[36,37] eyelashes;[35] eyebrows;[36] sunscreen;[38] skin;[35,39–41] hairs[35,42,43]

Biological Applications Drug delivery products;[44] preventing coronary artery disease;[45] cancer chemopreventive activity;[46] lipid metabolism;[47] treating Alzheimer's disease;[48] soaps;[49,50] whitening teeth;[51] in food products;[52] pharmaceuticals;[52] cosmetics;[52] medical devices[53]

Industrial Applications Adhesives;[54] paints;[54] inks;[54] toners;[55] coloring cigarette papers,[56] textiles[57]

Safety/Toxicity Carcinogenicity;[58] chronic toxicity;[58] clastogenic effects;[59] DNA repair;[61] embryotoxicity;[60] food allergy;[62] hepatotoxicity;[61] occupational asthma;[62] reproductive toxicity;[63] teratogenicity[60]

Certification/Approval Certified by Biological Stain Commission (BSC)

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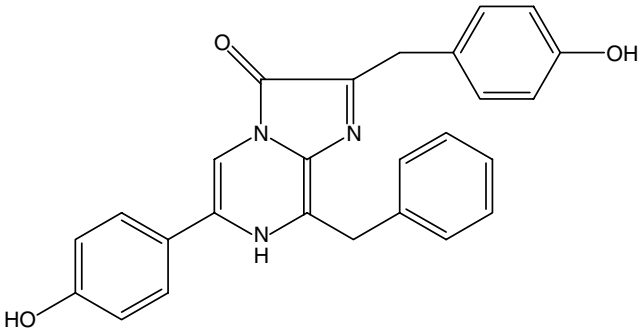
COELENTERAZINE

CAS Registry Number 55779-48-1

Chemical Structure



CA Index Name Imidazo[1,2-*a*]pyrazin-3(7*H*)-one, 6-(4-hydroxyphenyl)-2-[(4-hydroxyphenyl)methyl]-8-(phenylmethyl)-

Other Names 8-Benzyl-2-(4-hydroxybenzyl)-6-(4-hydroxyphenyl)imidazo[1,2-a]pyrazin-3(7*H*)-one; CLZN; Coelenterazin; Coelenterazine; Coelenterazine native; 3,2-Dihydro-2-(*p*-hydroxybenzyl)-6-(*p*-hydroxyphenyl)-8-benzylimidazolo[1,2-*a*]pyrazin-3-one; Luciferin; Luciferin (Oplophorus); NanoFuel; Preluciferin; Preluciferin (*Watasenia*); Watasenia preluciferin

Merck Index Number Not listed

Chemical/Dye Class Heterocycle; Imidazo[1,2-*a*]pyrazin-3(7*H*)-one

Molecular Formula $C_{26}H_{21}N_3O_3$

Molecular Weight 423.46

Physical Form Orange-yellow crystals or powder

Solubility Soluble in ethanol, methanol

Melting Point 176–181°C (decompose)

Boiling Point (Calcd.) 641.4 ± 65.0°C, pressure: 760 Torr

pK_a (Calcd.) 9.91 ± 0.15, most acidic, temperature: 25°C; 6.63 ± 0.60, most basic, temperature: 25°C

Absorption (λ_{max}) 429 nm

Emission (λ_{max}) 466 nm; 514 nm

Synthesis Synthetic methods[1–15]

Staining Applications Calcium ions;[12,13,17–31,51] cells,[16] erythrocytes[62]

Biological Applications Calcium indicator;[12,13,17–31,51] detecting luciferase,[34] protease, [35] gene expression,[36] nucleic acids,[37–40] proteins,[41,42] stem cells,[43] quantum dot conjugates,[44–46] superoxide;[47–50] tracing protein dynamics;[51,52] as a substrate for luciferase,[53–56] alkaline phosphatase,[57] galactosidase;[58] treating epilepsy,[59] pain syndromes,[59] hepatitis C virus (HCV) infections,[60] herpes virus infection,[61] *Plasmodium falciparum* infection,[61] human immunodeficiency virus infection[61]

Industrial Applications Not reported

Safety/Toxicity Fish toxicity;[62] vascular toxicity[63]

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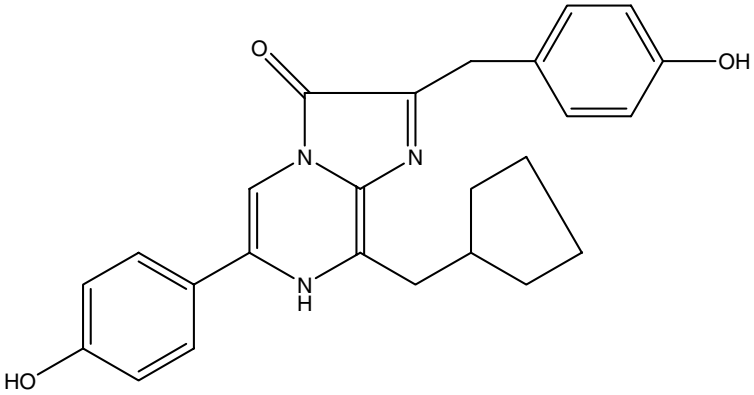
COELENTERAZINE cp

CAS Registry Number 123437-25-2

Chemical Structure

CA Index Name Imidazo[1,2-*a*]pyrazin-3(7*H*)-one, 8-(cyclopentylmethyl)-6-(4-hydroxyphenyl)-2-[(4-hydroxyphenyl)methyl]-



Other Names CLZN-cp; Coelenterazine cp

Merck Index Number Not listed

Chemical/Dye Class Heterocycle; Imidazo[1,2-*a*]pyrazin-3(7*H*)-one

Molecular Formula $C_{25}H_{25}N_3O_3$

Molecular Weight 415.48

Physical Form Yellow powder

Solubility Soluble in ethanol, methanol

Melting Point >200°C

Boiling Point (Calcd.) 615.1 ± 65.0°C, pressure: 760 Torr

pK_a (Calcd.) 9.91 ± 0.15, most acidic, temperature: 25°C; 6.65 ± 0.60, most basic, temperature: 25°C

Absorption (λ_{max}) 430 nm

Emission (λ_{max}) 442 nm

Synthesis Synthetic method[1]

Staining Applications Calcium ions[1–6]

Biological Applications Calcium indicator;[1–6] measuring luciferase activity;[7–9] as a substrate for luciferase; screening HIV-1 protease inhibitors[10]

Industrial Applications Not reported

Safety/Toxicity No data available

REFERENCES

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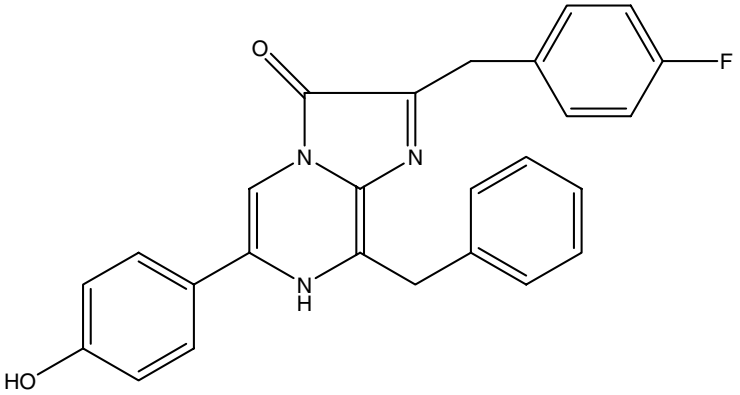
COELENTERAZINE f

CAS Registry Number 123437-16-1

Chemical Structure



CA Index Name Imidazo[1,2-*a*]pyrazin-3(7*H*)-one, 2-[(4-fluorophenyl)methyl]-6-(4-hydroxyphenyl)-8-(phenylmethyl)-

Other Names CLZN-f; Coelenterazine f

Merck Index Number Not listed

Chemical/Dye Class Heterocycle; Imidazo[1,2-*a*]pyrazin-3(7*H*)-one

Molecular Formula $C_{26}H_{20}FN_3O_2$

Molecular Weight 425.45

Physical Form Orange powder

Solubility Soluble in ethanol, methanol

Melting Point >200°C

Boiling Point (Calcd.) 596.7 ± 60.0°C, pressure: 760 Torr

pK_a (Calcd.) 10.48 ± 0.30, most acidic, temperature: 25°C; 6.49 ± 0.60, most basic, temperature: 25°C

Absorption (λ_{max}) 437 nm

Emission (λ_{max}) 472 nm

Synthesis Synthetic methods[1,2]

Staining Applications Calcium ions[2–9]

Biological Applications Calcium indicator;[2–9] assaying luminescent enzyme;[10] measuring luciferase activity;[11] as a substrate for luciferase;[12,13] screening HIV-1 protease inhibitors[14]

Industrial Applications Not reported

Safety/Toxicity No data available

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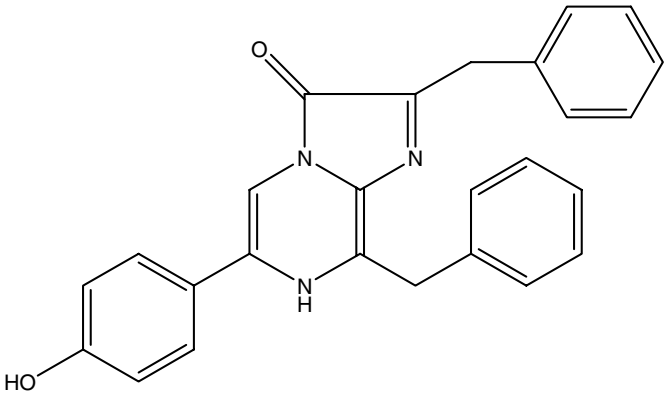
COELENTERAZINE h

CAS Registry Number 50909-86-9

Chemical Structure



CA Index Name Imidazo[1,2-*a*]pyrazin-3(7*H*)-one, 6-(4-hydroxyphenyl)-2,8-bis(phenylmethyl)-

Other Names CLZN-h; 2-Deoxycoelenterazine; Coelenterazine h; Luciferin; Luciferin (Renilla); Renilla luciferin; h-Coelenterazine

Merck Index Number Not listed

Chemical/Dye Class Heterocycle; Imidazo[1,2-*a*]pyrazin-3(7*H*)-one

Molecular Formula $C_{26}H_{21}N_3O_2$

Molecular Weight 407.46

Physical Form Yellow powder

Solubility Soluble in methanol, ethanol

Melting Point >200°C

Boiling Point (Calcd.) 593.5 ± 60.0°C, pressure: 760 Torr

pK_a (Calcd.) 10.48 ± 0.30, most acidic, temperature: 25°C; 6.15 ± 0.60, most basic, temperature: 25°C

Absorption (λ_{max}) 437 nm

Emission (λ_{max}) 466 nm

Synthesis Synthetic methods[1–4]

Staining Applications Calcium ions[3,5–14]

Biological Applications Calcium indicator;[3,5–14] assaying luminescent enzyme;[15] measuring luciferase activity;[16,17] as a substrate for luciferase;[18] screening HIV-1 protease inhibitors;[19] bioluminescence resonance energy transfer (BRET) detection system[20]

Industrial Applications Not reported

Safety/Toxicity No data available

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for high-throughput screening of calcium ion flux in cell. PCT Int. Appl. WO 2003082904, 2003; *Chem. Abstr.* **2003**, *139*, 287962.

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16. Zhao, H.; Doyle, T. C.; Wong, R. J.; Cao, Y.; Stevenson, D. K.; Piwnica-Worms, D.; Contag, C. H. Characterization of coelenterazine analogs for measurements of *Renilla luciferase* activity in live cells and living animals. *Mol. Imaging* **2004**, *3*, 43–54.
17. Inoue, S.; Sasaki, S. Fluorescent activity-possessing luciferase activity enhancement method. Jpn. Kokai Tokkyo Koho JP 2006271327, 2006; *Chem. Abstr.* **2006**, *145*, 413077.
18. Inouye, S.; Shimomura, O. The use of *Renilla luciferase*, *Oplophorus luciferase*, and apoaequorin as bioluminescent reporter protein in the presence of coelenterazine analogs as substrate. *Biochem. Biophys. Res. Commun.* **1997**, *233*, 349–353.
19. Daunert, S.; Deo, S. K.; Dikici, E.; Rowe, L. Aequorin and obelin mutants with differing wavelengths and biolumine-scence and their uses in screening inhibitors of HIV-1 protease. U.S. Pat. Appl. Publ. US 2005214776, 2005; *Chem. Abstr.* **2005**, *143*, 341493.
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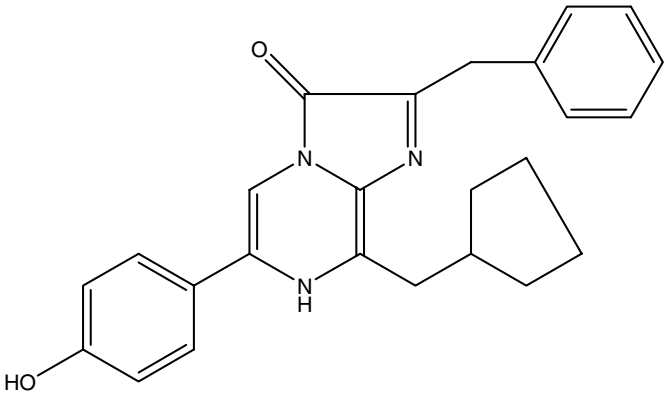
COELENTERAZINE hcp

CAS Registry Number 123437-32-1

Chemical Structure



CA Index Name Imidazo[1,2-*a*]pyrazin-3(7*H*)-one, 8-(cyclopentylmethyl)-6-(4-hydroxyphenyl)-2-(phenylmethyl)-

Other Names CLZN-hcp; Coelenterazine hcp

Merck Index Number Not listed

Chemical/Dye Class Heterocycle; Imidazo[1,2-a]pyrazin-3(7*H*)-one

Molecular Formula $C_{25}H_{25}N_3O_2$

Molecular Weight 399.48

Physical Form Yellow powder

Solubility Soluble in ethanol, methanol

Melting Point >200°C

Boiling Point (Calcd.) 568.2 ± 60.0°C, pressure: 760 Torr

pKa (Calcd.) 10.48 ± 0.30, most acidic, temperature: 25°C; 6.17 ± 0.60, most basic, temperature: 25°C

Absorption (λ_{max}) 433 nm

Emission (λ_{max}) 445 nm

Synthesis Synthetic method[1]

Staining Applications Calcium ions[1–7]

Biological Applications Calcium indicator;[1–7] assaying luminescent enzyme;[8] measuring luciferase activity;[9] as a substrate for luciferase;[10] screening HIV-1 protease inhibitors;[11] bioluminescence resonance energy transfer (BRET) detection system[12]

Industrial Applications Not reported

Safety/Toxicity No data available

REFERENCES

1. Shimomura, O.; Musicki, B.; Kishi, Y. Semi-synthetic aequorins with improved sensitivity to calcium ions. *Biochem. J.* **1989**, *261*, 913–920.
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3. Inouye, S.; Sahara, Y. Expression, purification and char-acterization of a photoprotein, clytin, from *Clytia gregarium*. *Protein Expression Purif.* **2007**, *53*, 384–389.
4. Inouye, S.; Sasaki, S. Imidazole-assisted catalysis of lumine-scence reaction in blue fluorescent protein from the photo-protein aequorin. *Biochem. Biophys. Res. Commun.* **2007**, *354*, 650–655.
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6. Shimomura, O.; Kishi, Y.; Inouye, S. The relative rate of aequorin regeneration from apoaequorin and coelenterazine analogs. *Biochem. J.* **1993**, *296*, 549–551.
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8. Inoue, S.; Sasaki, T. Method for assaying luminescent enzyme in presence of organic solvent. Jpn. Kokai Tokkyo Koho JP 2008000073, 2008; *Chem. Abstr.* **2008**, *148*, 115514.
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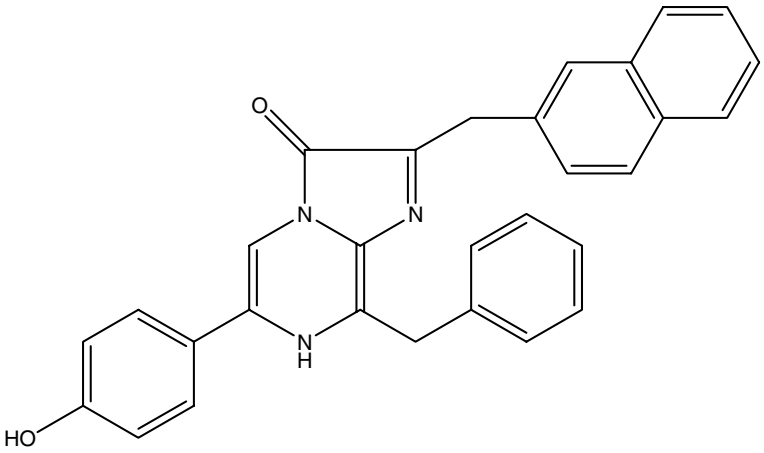
COELENTERAZINE n

CAS Registry Number 123437-22-9

Chemical Structure



CA Index Name Imidazo[1,2-*a*]pyrazin-3(7*H*)-one, 6-(4-hydroxyphenyl)-2-(2-naphthalenylmethyl)-8-(phenylmethyl)-

Other Names CLZN-n; Coelenterazine n

Merck Index Number Not listed

Chemical/Dye Class Heterocycle; Imidazo[1,2-*a*]pyrazin-3(7*H*)-one

Molecular Formula $C_{30}H_{23}N_3O_2$

Molecular Weight 457.52

Physical Form Yellow powder

Solubility Soluble in ethanol, methanol

Melting Point >200°C

Boiling Point (Calcd.) 663.4 ± 65.0°C, pressure: 760 Torr

pK_a (Calcd.) 10.48 ± 0.30, most acidic, temperature: 25°C; 6.52 ± 0.60, most basic, temperature: 25°C

Absorption (λ_{max}) 431 nm

Emission (λ_{max}) 468 nm

Synthesis Synthetic method[1]

Staining Applications Calcium ions[1–7]

Biological Applications Calcium indicator;[1–7] assaying luminescent enzyme;[8] measuring luciferase activity;[9] as a substrate for luciferase;[10] screening HIV-1 protease inhibitors[11]

Industrial Applications Not reported

Safety/Toxicity No data available

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8. Inoue, S.; Sasaki, T. Method for assaying luminescent enzyme in presence of organic solvent. Jpn. Kokai Tokkyo Koho. JP 2008000073, 2008; *Chem. Abstr.* **2008**, *148*, 115514.
9. Zhao, H.; Doyle, T. C.; Wong, R. J.; Cao, Y.; Stevenson, D. K.; Piwnica-Worms, D.; Contag, C. H. Characterization of coelenterazine analogs for measurements of *Renilla luciferase* activity in live cells and living animals. *Mol. Imaging* **2004**, *3*, 43–54.
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CONGO RED

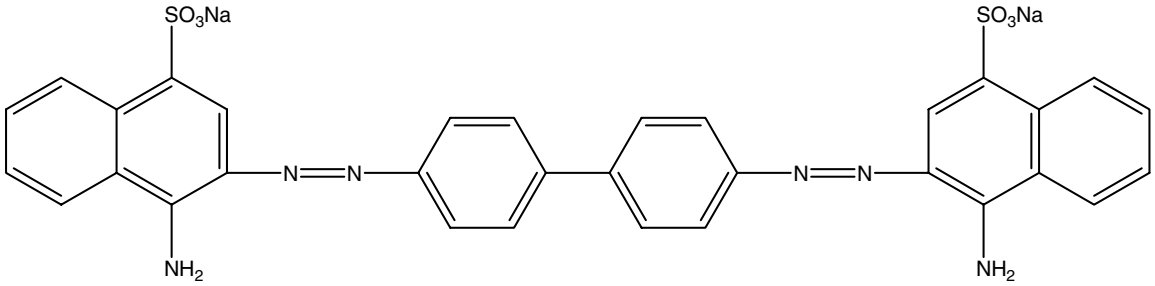
CAS Registry Number 573-58-0

Chemical Structure

Molecular Weight 696.66

Physical Form Brownish-red powder

Solubility Soluble in water, ethanol; very slightly soluble in acetone; practically insoluble in ether, xylene



CA Index Name 1-Naphthalenesulfonic acid, 3,3′-[[1,1′-biphenyl]-4,4′-diylbis(2,1-diazenediyl)]bis[4-amino-, sodium salt (1 : 2)

Other Names 3,3′-[[1,1′-Biphenyl]-4,4′-diylbis-(azo)] bis[4-amino-1-naphthalenesulfonic acid] disodium salt; 1-Naphthalenesulfonic acid, 3,3′-[[1,1′-biphenyl]-4,4′-diylbis(azo)]bis[4-amino-, disodium salt; C.I. Direct Red 28, disodium salt; Atlantic Congo Red; Atul Congo Red; Azocard Red Congo; Benzo Congo Red; Brasilamina Congo 4B; Cerven Kongo; Cerven Prima 28; C.I. 22120; C.I. Direct Red 28; Congo Red 4B; Congo Red 4BX; Congo Red CR; Congo Red H; Congo Red K; Congo Red L; Congo Red M; Congo Red N; Congo Red R; Congo Red RS; Congo Red TS; Congo Red W; Congo Red WS; Congo Red sodium salt; Congo red; Cotton Red 4BC; Cotton Red 5B; Cotton Red L; Congorot; Diacotton Congo Red; Direct Congo Red; Direct Red 28; Direct Red C; Direct Red DC-CF; Direct Red K; Erie Congo 4B; Haemomedical; Haemonorm; Hemorrhagyl; Hispamin Congo 4B; Kayaku Congo Red; Kongorot; Mitsui Congo Red; Peeramine Congo Red; Red K; Sodium diphenyl-diazo-bis-α-naphthylaminesulfonate; Solucongo; Sugai Congo Red; Tertrodirect Red C; Trisulfon Congo Red; Vondacel Red CL

Merck Index Number 2498

Chemical/Dye Class Azo

Molecular Formula $C_{32}H_{22}N_6\,Na_2O_6S_2$

Melting Point >360°C

pH Range 3.0–5.0

Color Change at pH Blue (3.0) to red (5.0)

pK_a 4.1

Absorption (λ_{max}) 497 nm, 488 nm

Synthesis Synthetic methods[1–9]

Staining Applications Amyloid-β (Aβ) protein;[1,10–18] bacteria;[19] carious tissue;[20] collagen;[21] fungi;[22] fungal cell wall mutants;[23] liposome;[24] polyglutamine protein oligomers;[25] prion;[26] skin;[27] α-synuclein;[28] tissue section[29]

Biological Applications Detecting bacteria,[30] protein folding disorders;[31] treating dermatological disorders,[32] neurodegenerative diseases,[1,33] Alzheimer's disease[1,34]

Industrial Applications Display devices;[1,35] optical films;[35] alignment layers;[36] fiber-optic sensors;[1,37] optical waveguides;[1,38] highlighters;[39] textiles[40]

Safety/Toxicity Acute toxicity;[1,41] algal toxicity;[42] bacterial toxicity;[42] protozoan toxicity;[42] carcinogenicity;[1,43] cutaneous toxicity;[1,44] cytotoxicity;[1,45,46] environmental toxicity;[47] genotoxicity;[1,48] hematotoxicity;[49] microbial toxicity;[50] mutagenicity;[1,51–54] neurotoxicity;[1,55] yeast toxicity[56]

Certification/Approval Certified by Biological Stain Commission (BSC)

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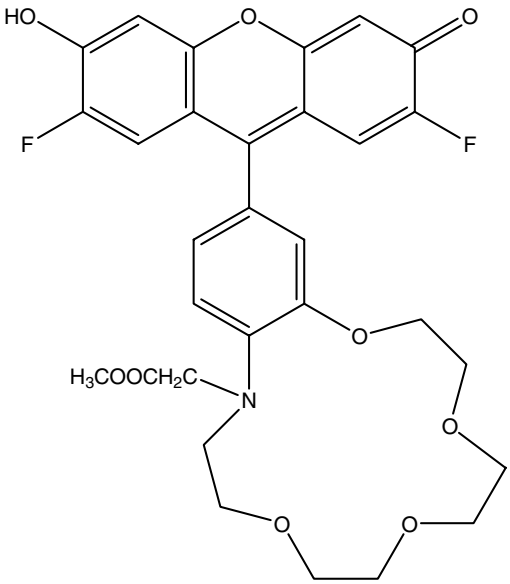
CoroNa GREEN

CAS Registry Number 690993-66-9

Chemical Structure



CA Index Name 13*H*-1,4,7,10,13-Benzotetraoxaazacyclopentadecine-13-acetic acid, 16-(2,7-difluoro-6-hydroxy-3-oxo-3*H*-xanthen-9-yl)-2,3,5,6,8,9,11,12-octahydro-, methyl ester

Other Names CoroNA Green; CoroNa Green Sodium Indicator

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{30}H_{29}F_2NO_9$

Molecular Weight 585.55

Physical Form Orange powder

Solubility Soluble in water

Melting Point >200°C

Boiling Point (Calcd.) 777.7 ± 60.0 °C, pressure: 760 Torr

pK_a (Calcd.) 7.89 ± 0.60, most acidic, temperature: 25°C; 2.92 ± 0.20, most basic, temperature: 25°C

Absorption (λ_{max}) 492 nm

Emission (λ_{max}) 516 nm

Synthesis Synthetic methods[1–3]

Staining Applications Sodium ions;[1–8] neurons;[4] dendrites[4]

Biological Applications Sodium indicator[1–8]

Industrial Applications Not reported

Safety/Toxicity No data available

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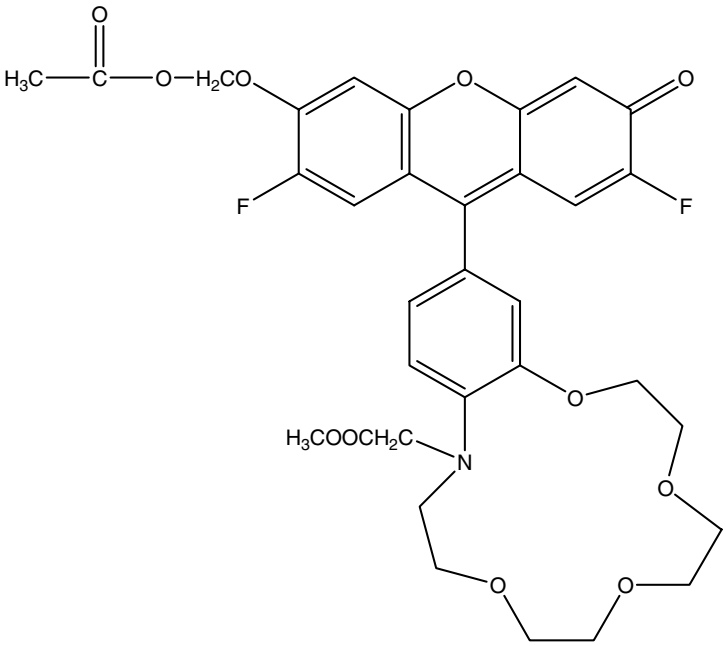
CoroNa GREEN AM

CAS Registry Number 690993-67-0

Chemical Structure



CA Index Name 13*H*-1,4,7,10,13-Benzotetraoxaaza-cyclopentadecine-13-acetic acid, 16-[6-[(acetyloxy) methoxy]-2,7-difluoro-3-oxo-3*H*-xanthen-9-yl]-2,3,5,6,8,9,11,12-octahydro-, methyl ester

Other Names CoroNA Green AM; CoroNa Green acetoxymethyl ester

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{33}H_{33}F_2NO_{11}$

Molecular Weight 657.61

Physical Form Orange powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >200°C

Boiling Point (Calcd.) 821.4 ± 65.0°C, pressure: 760 Torr

pK_a (Calcd.) 2.85 ± 0.20 most basic, temperature: 25°C

Absorption (λ_{max}) 454 nm

Emission (λ_{max}) 516 nm

Synthesis Synthetic methods[1–3]

Staining Applications Sodium ions[1–3]

Biological Applications Sodium indicators[1–3]

Industrial Applications Not reported

Safety/Toxicity No data available

REFERENCES

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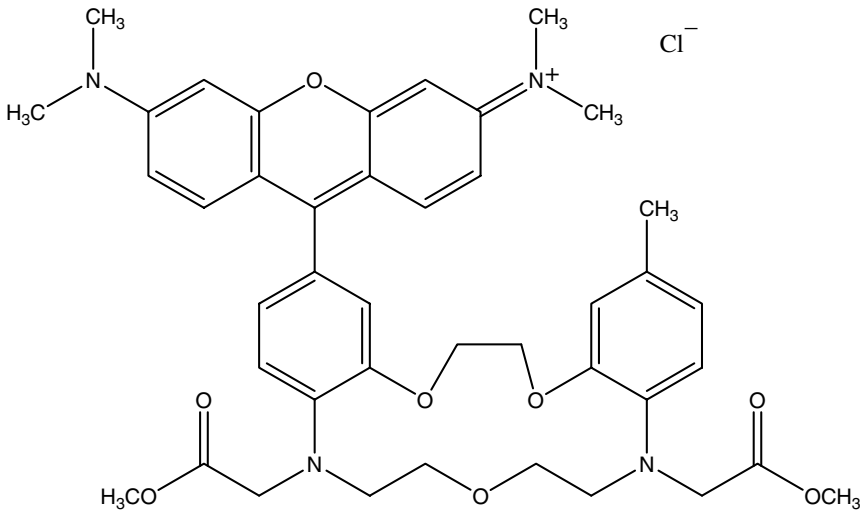
CoroNa RED

CAS Registry Number 481667-01-0

Chemical Structure



Molecular Formula $C_{42}H_{49}ClN_4O_8$

Molecular Weight 773.32

Physical Form Crimson powder

Solubility Soluble in water, dimethyl sulfoxide

CA Index Name Xanthylium, 3,6-bis(dimethylamino)-9-[6,7,10,11,17,18-hexahydro-5,11-bis(2-methoxy-2-oxoethyl)-14-methyl-5*H*,9*H*-dibenzo[*e*,*n*][1,4,10,7,13]trioxadiazacyclopentadecin-2-yl]-, chloride (1:1)

Other Names Xanthylium, 3,6-bis(dimethylamino)-9-[6,7,10,11,17,18-hexahydro-5,11-bis(2-methoxy-2-oxoethyl)-14-methyl-5*H*,9*H*-dibenzo[*e*,*n*][1,4,10,7,13]trioxadiazacyclopentadecin-2-yl]-, chloride; CoroNa Red; CoroNa Red Sodium Indicator; CoroNa Red chloride

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Melting Point >200°C

Absorption (λ_{max}) 547 nm

Emission (λ_{max}) 570 nm

Synthesis Synthetic methods[1–4]

Staining Applications Sodium ions[1–9]

Biological Applications Sodium indicator;[1–9] detecting prostate cancer[10]

Industrial Applications Not reported

Safety/Toxicity No data available

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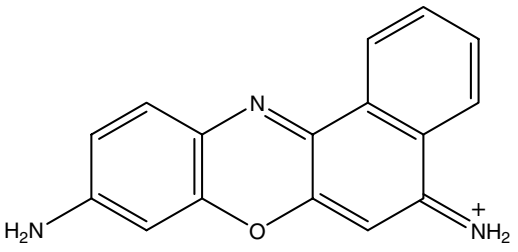
CRESYL VIOLET ACETATE

CAS Registry Number 10510-54-0

Chemical Structure



CA Index Name Benzo[*a*]phenoxazin-7-ium, 5,9-diamino-, acetate (1:1)

Other Names 9-Amino-5-imino-5*H*-benzo(*a*)phenoxazine acetate salt; 5*H*-Benzo[*a*]phenoxazin-9-amine, 5-imino-, monoacetate; 5*H*-Benzo[*a*]phenoxazine, 9-amino-5-imino-, acetate; Benzo[*a*]phenoxazin-7-ium, 5,9-diamino-, acetate; 5,9-Diaminobenzo[*a*]phenoxazin-7-ium acetate; Cresyl violet acetate

Merck Index Number Not listed

Chemical/Dye Class Phenoxazine

Molecular Formula $C_{18}H_{15}N_3O_3$

Molecular Weight 321.33

Physical Form Dark green powder

Solubility Soluble in water, ethanol

Melting Point 140–143°C

Absorption (λ_{max}) 596 nm, 601 nm

Emission (λ_{max}) 630 nm

Synthesis Synthetic method[1,2]

Staining Applications Brain;[3–6] spinal cord;[6] sperms;[7] tissues;[8,9] white blood cells[10]

Biological Applications Biochemical and clinical analysis;[11] detecting cellular proteins;[12] treating cardiovascular diseases[13]

Industrial Applications Dye lasers;[14,15] optical recording materials[16]

Safety/Toxicity No data available

Certification/Approval Certified by Biological Stain Commission (BSC)

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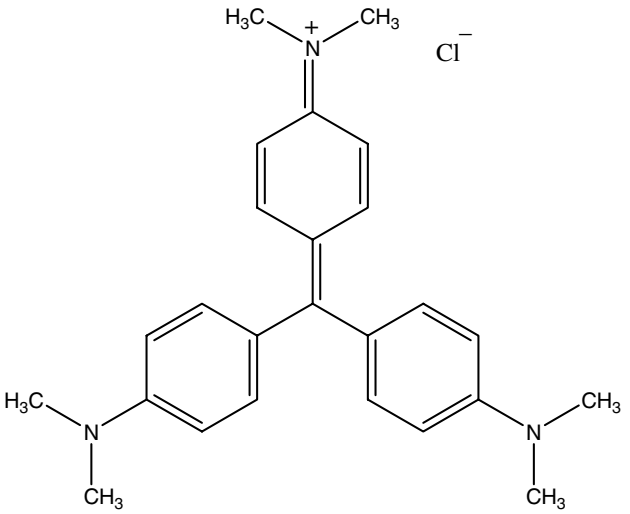
CRYSTAL VIOLET

CAS Registry Number 548-62-9

Chemical Structure



CA Index Name Methanaminium, *N*-[4-[bis[4-(dimethylamino)phenyl]methylene]-2,5-cyclohexadien-1-ylidene]-*N*-methyl-, chloride (1:1)

Other Names C.I. Basic Violet 3; 12416 Violet; Adergon; Aizen Crystal Violet; Aizen Crystal Violet Extra Pure; Aniline violet; Aniline violet pyoktanine; Atmonil; Avermin; Axuris; Badil; Basic Violet 3; Basic Violet BN; Basonyl Violet 610; C.I. 42555; Calcozine Violet 6BN; Calcozine Violet C; Crystal Violet 10B; Crystal Violet 5BO; Crystal Violet 6B; Crystal Violet 6BO; Crystal Violet AO; Crystal Violet AON; Crystal Violet BP; Crystal Violet BPC; Crystal Violet Extra Pure; Crystal Violet Extra Pure APN; Crystal Violet Extra Pure APNX; Crystal Violet FN; Crystal Violet HL 2; Crystal Violet O; Crystal Violet Pure DSC; Crystal Violet Pure DSC Brilliant; Crystal Violet SS; Crystal Violet Technical; Crystal Violet USP; Crystal Violet chloride; Crystal violet; Gentersal; Gentian Violet B; Gentian violet; Gentiaverm; Genticid; Gentioletten; Hecto Violet R; Hectograph Violet SR; Hexamethyl violet; Hexamethyl-*p*-rosaniline chloride; Hexamethylpararosaniline chloride; Hidaco Brilliant Crystal Violet; Kristall-violett; Meroxyl; Meroxyl-Wander; Meroxylan; Meroxylan-Wander; Methyl Violet 10B; Methyl Violet 10BD; Methyl Violet 10BK; Methyl Violet 10BN; Methyl Violet 10BNS; Methyl Violet 10BO; Methyl Violet 5BNO; Methyl Violet 5BO; Methyl Violet 6B; Methyl Violet 6B (biological stain); Methyl Violett; Methylrosaniline chloride; Methylrosanilinium chlorid; Methylrosanilinium chloride; Mitsui Crystal Violet; Oxiuran; Oxycolor; Oxyozyl; Paper Blue R; Pararosaniline, *N*,*N*,*N*′,*N*′,*N*″,*N*″-hexamethyl-, chloride; Plastoresin Violet 5BO; Pyoktanin; Sanyo Fanal Violet R; Vermicid; Vianin; Viocid; Violet 5BO; Violet 6BN; Violet CP; Violet XXIII

Merck Index Number 4395

Chemical/Dye Class Triphenylmethane

Molecular Formula $C_{25}H_{30}ClN_3$

Molecular Weight 407.98

Physical Form Dark Green powder

Solubility Soluble in water, acetone, chloroform; very soluble in ethanol; practically insoluble in ether; insoluble in xylene

Melting Point 205–215°C (decompose)

pH Range 0.0–2.0

Color Change at pH Yellow (0.0) to blue-violet (2.0)

Absorption (λ_{max}) 590 nm

Synthesis Synthetic methods[1–13]

Staining Applications β-Amyloid plaques;[14] α-synuclein; bacteria;[15] cells;[16] liposomes;[17] nucleic acids;[18] proteins;[19] skin;[20,21] thrombocytes;[22] vaginal smears;[23] hairs[1,24,25]

Biological Applications Detecting microorganisms;[26] treating atopic dermatitis,[27] dermatological diseases,[28,29] skin wounds,[30] lesions,[30] hemorrhoids,[1,31] multiple myeloma,[32] Non-Hodgkin's lymphoma,[32] breast cancer,[32] neurodegenerative diseases,[33] onychomycosis;[34] wound dressing;[35] drug delivery system;[1,36] dosage form;[37] antimicrobial agent;[1,38] antifungal agent;[1,39] antimalarial agent[1,40]

Industrial Applications Thin film transistors;[41,42] lithographic printing plates;[1,43] batteries;[44] photoresists;[45] inks;[46] printed circuit boards;[47] detergents;[48]

Safety/Toxicity Acute oral toxicity;[1,49] carcinogenicity;[1,50–52] chronic toxicity;[1,51,52] cytotoxicity;[1,53] chromosome damage;[54] DNA damage;[55] genotoxicity;[1,56–58] mutagenicity;[1,59–62] ototoxicity;[1,63] percutaneous toxicity;[1,64] phototoxicity[1,65]

Certification/Approval Certified by Biological Stain Commission (BSC)

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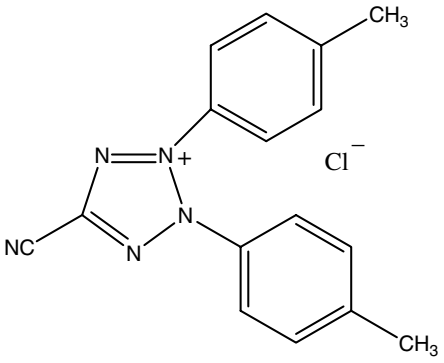
CYANOTOLYL TETRAZOLIUM CHLORIDE (CTC)

CAS Registry Number 90217-02-0

Chemical Structure



CA Index Name 2*H*-Tetrazolium, 5-cyano-2,3-bis(4-methylphenyl)-, chloride (1:1)

Other Names 2*H*-Tetrazolium, 5-cyano-2,3-bis(4-methylphenyl)-, chloride; 5-Cyano-2,3-di-(*p*-tolyl)tetrazolium chloride; cyanotolyl tetrazolium, CTC; CTC (biological stain)

Merck Index Number Not listed

Chemical/Dye Class Tetrazolium salt

Molecular Formula $C_{16}H_{14}ClN_5$

Molecular Weight 311.77

Physical Form Off-white powder

Solubility Soluble in water

Melting Point 225°C

Absorption (λ_{max}) 450 nm (of formazan)

Synthesis Synthetic method[1]

Staining Applications Bacteria;[2–12] cells;[13] microorganisms;[14,15] plasma membrane[16]

Biological Applications NADPH-cytochrome P 450 reductase activity assays;[17] detecting gamma-hydroxybutyric acid (GHB),[18] metabolic activity,[19] microorganisms;[20] localizing glucose-6-phosphate dehydrogenase activity;[21] monitoring respiratory activity;[22–31] treating cancer[32]

Industrial Applications Not reported

Safety/Toxicity Bacterial toxicity[25,33]

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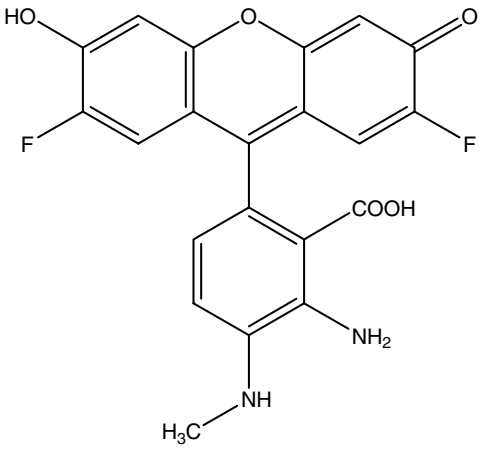
DAF FM

CAS Registry Number 254109-20-1

Chemical Structure



CA Index Name Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-3-one, 4-amino-2′,7′-difluoro-3′,6′-dihydroxy-5-(methylamino)-

Other Names 4-Amino-5-methylamino-2′,7′-difluorofluorescein; DAF-FM

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{21}H_{14}F_2N_2O_5$

Molecular Weight 412.34

Physical Form Solid

Solubility Soluble in dimethyl sulfoxide, methanol

Melting Point 265 °C

Boiling Point (Calcd.) 693.7 ± 55.0 °C, pressure: 760 Torr

pK_a (Calcd.) 6.88 ± 0.20, most acidic, temperature: 25 °C; 3.99 ± 0.20, most basic, temperature: 25 °C

Absorption (λ_{max}) 487 nm, 495 nm

Emission (λ_{max}) 515 nm

Synthesis Synthetic method[1]

Staining Applications Nitric oxide ions[1–10]

Biological Applications Nitric oxide indicator;[1–10] detecting microorganisms;[11] measuring Gα i-coupled or Gα o-coupled receptors activity[12]

Industrial Applications Not reported

Safety/Toxicity No data available

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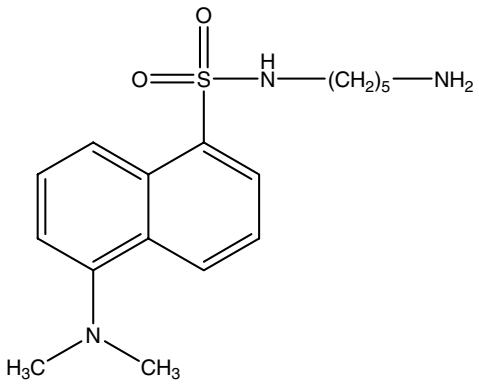
DANSYL CADAVERINE

CAS Registry Number 10121-91-2

Chemical Structure



CA Index Name 1-Naphthalenesulfonamide, *N*-(5-aminopentyl)-5-(dimethylamino)-

Other Names Dansylcadaverine; Monodansylcadaverine; *N*-(5-Aminopentyl)-5-dimethylamino-1-naphthalenesulfonamide; 5-Dimethylaminonaphthalene-1-(*N*-(5-aminopentyl))sulfonamide

Merck Index Number Not listed

Chemical/Dye Class Naphthalene

Molecular Formula $C_{17}H_{25}N_3O_2S$

Molecular Weight 335.46

Physical Form Yellow to yellowish green powder

Solubility Soluble in ethanol, *N*,*N*-dimethylformamide

Melting Point 137 °C

Boiling Point (Calcd.) 505.5 ± 60.0 °C, pressure: 760 Torr

pK_a (Calcd.) 11.96 ± 0.50, most acidic, temperature: 25 °C; 10.49 ± 0.10, most basic, temperature: 25 °C

Absorption (λ_{max}) 335 nm

Emission (λ_{max}) 518 nm

Synthesis Synthetic methods[1–4]

Staining Applications Autophagy/autophagic vacuoles;[5–10] transglutaminase activity[11–15]

Biological Applications Measuring cardiac autophagic flux;[16] treating cataract,[17] fibrosis,[18] Parkinson's disease,[19] peritoneal ovarian tumor dissemination,[20] respiratory diseases,[21] lung diseases,[21] Huntington's disease,[22] spinobulbar atrophy,[22] spinocerebellar ataxia,[22] dentatorubralpallidoluysian atrophy,[22] multiple sclerosis,[22] rheumatoid arthritis,[22] insulin-dependent diabetes mellitus[22]

Industrial Applications Not reported

Safety/Toxicity Cytotoxicity;[23,24] neurotoxicity[25]

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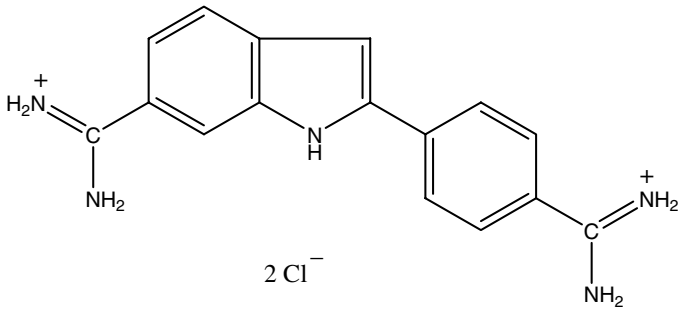
DAPI

CAS Registry Number 28718-90-3

Chemical Structure



CA Index Name 1*H*-Indole-6-carboximidamide, 2-[4-(aminoiminomethyl)phenyl]-, dihydrochloride

Other Names Indole-6-carboxamidine, 2-(*p*-amidinophenyl)-, dihydrochloride; 4′,6-Diamidino-2-phenylindole dihydrochloride; 6-Amidino-2-(4-amidinophenyl) indole dihydrochloride; DAPI

Merck Index Number Not listed

Chemical/Dye Class Indole

Molecular Formula $C_{16}H_{17}Cl_2N_5$

Molecular Weight 350.25

Physical Form Yellow powder

Solubility Soluble in water, *N*,*N*-dimethylformamide

Melting Point >200 °C

Absorption (λ_{max}) 358 nm, 342 nm

Emission (λ_{max}) 461 nm, 450 nm

Synthesis Synthetic methods[1–6]

Staining Applications Nucleic acids;[3,7–10] bacteria;[11,12] cells;[13] chromosomes;[14] microorganisms;[15] neuron-specific nuclear protein NeuN;[16] polynucleotide;[17] proteins[18]

Biological Applications Nuclear apoptosis assay;[19] targeting drug to cerebral neuron;[20] treating amyloidosis,[21] neurodegenerative diseases,[21] Alzheimer's disease,[22] Down's syndrome,[22] type II diabetes;[22] monitoring bioaerosols[23]

Industrial Applications Not reported

Safety/Toxicity No data available

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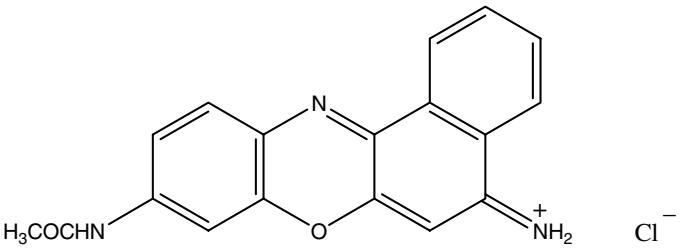
DARROW RED

CAS Registry Number 15391-59-0

Chemical Structure



CA Index Name Acetamide, *N*-(5-imino-5*H*-benzo[*a*] phenoxazin-9-yl)-chloride

Other Names 9-Acetylamino-5-aminobenzo[α]phenoxazonium chloride; 5*H*-Benzo[*a*]phenoxazine, acetamide derivative; Darrow red; NSC 364163

Merck Index Number Not listed

Chemical/Dye Class Phenoxazine

Molecular Formula $C_{18}H_{14}ClN_3O_2$

Molecular Weight 339.79

Physical Form Brown powder

Solubility Soluble in water, ethanol

Boiling Point (Calcd.) 536.3 ± 50.0 °C, pressure: 760 Torr

pK_a (Calcd.) 14.07 ± 0.20, most acidic, temperature: 25 °C; 3.33 ± 0.20, most basic, temperature: 25 °C

Absorption (λ_{max}) 502 nm

Synthesis Synthetic methods[1,2]

Staining Applications Brain;[3,4] spinal cord;[3,4] cells;[5,6] leukocytes[7]

Biological Applications Treatment of diabetes-associated pain[8]

Industrial Applications Pesticides[9]

Safety/Toxicity No data available

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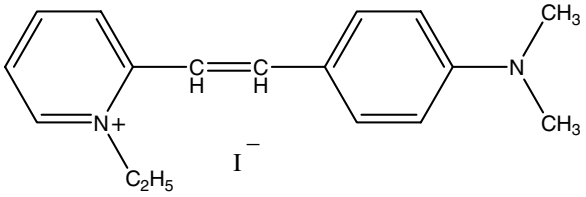
DASPEI

CAS Registry Number 3785-01-1

Chemical Structure



CA Index Name Pyridinium, 2-[2-[4-(dimethylamino) phenyl]ethenyl]-1-ethyl-, iodide (1 : 1)

Other Names 2-[*p*-(Dimethylamino)styryl]-1-ethylpyridinium iodide; Pyridinium, 2-[2-[4-(dimethylamino) phenyl]ethenyl]-1-ethyl-, iodide; Pyridinium, 2-[*p*-(dimethylamino)styryl]-1-ethyl-, iodide; 2-[4-(Dimethylamino)styryl]-1-ethylpyridinium iodide; D 426; DASPEI; NK 557; Pinaflavol

Merck Index Number Not listed

Chemical/Dye Class Styryl

Molecular Formula $C_{17}H_{21}IN_2$

Molecular Weight 380.27

Physical Form Red powder

Solubility Soluble in methanol, *N*,*N*-dimethylformamide, dimethyl sulfoxide

Melting Point 267 °C (decompose)

Absorption (λ_{max}) 461 nm

Emission (λ_{max}) 589 nm

Synthesis Synthetic method[1–7]

Staining Applications Mitochondria;[8–10,19] amyloid plaques;[11] bacteria;[12] epidermal cells;[13] nerve terminals;[14,15] phospholipid vesicles;[16] hairs[17,18]

Biological Applications Detecting prostate cancer;[19] drug screening assays;[20] treating amyloidosis disorder[11]

Industrial Applications Photoresists;[21] photography[22]

Safety/Toxicity No data available

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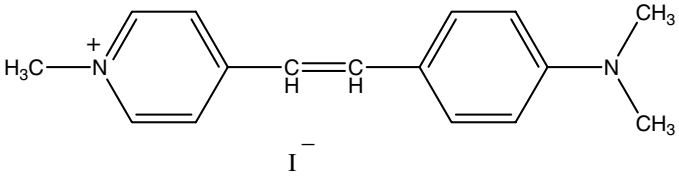
DASPMI

CAS Registry Number 959-81-9

Chemical Structure



CA Index Name Pyridinium, 4-[2-[4-(dimethylamino) phenyl]ethenyl]-1-methyl-, iodide (1 : 1)

Other Names 4-[*p*-(Dimethylamino)styryl]-1-methylpyridinium iodide; Pyridinium, 4-[2-[4-(dimethylamino) phenyl]ethenyl]-1-methyl-, iodide; Pyridinium, 4-[*p*-(dimethylamino)styryl]-1-methyl-, iodide; 4-[2-[4-(Dimethylamino)phenyl]ethenyl]-1-methylpyridinium iodide; 4-[4-(Dimethylamino)-α-styryl]-1-methylpyridinium iodide; 4-[4-(Dimethylamino)styryl]-1-methylpyridinium iodide; 4-[4-(Dimethylamino)styryl]-*N*-methylpyridinium iodide; 4′-Dimethylamino-1-methylstilbazolium iodide; 4′-Dimethylamino-*N*-methyl-4-stilbazolium iodide; D 288; DASPMI; DASPI; 4-Di-1-ASP; ω-(*N*′-Methylpyridyl-4′)-4-dimethylaminostyrene iodide

Merck Index Number Not listed

Chemical/Dye Class Styryl

Molecular Formula $C_{16}H_{19}IN_2$

Molecular Weight 366.24

Physical Form Solid

Solubility Soluble in methanol, *N*,*N*-dimethylformamide

Melting Point 261–262 °C

Absorption (λ_{max}) 475 nm

Emission (λ_{max}) 605 nm

Synthesis Synthetic method[1–21]

Staining Applications Mitochondria;[22–24] cells;[1] amyloid plaques[25]

Biological Applications Detecting nucleic acids,[26] prostate cancer;[27] treating amyloidosis disorders,[25] bacterial infection[28]

Industrial Applications Organic thin films;[29] nonlinear optical materials;[13] photoconductors;[30] glass[31]

Safety/Toxicity No data available

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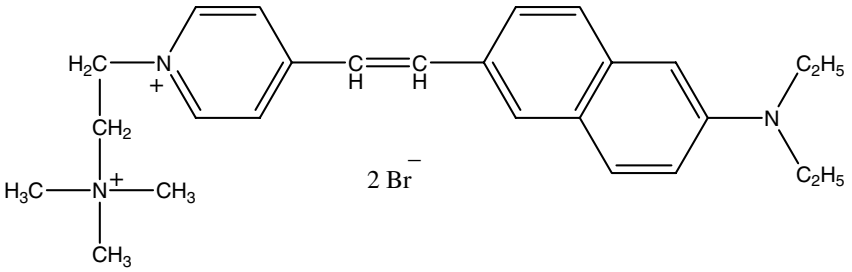
Di-2-ANEPEQ

CAS Registry Number 160605-94-7

Chemical Structure



CA Index Name Pyridinium, 4-[2-[6-(diethylamino)-2-naphthalenyl]ethenyl]-1-[2-(trimethylammonio)ethyl]-, bromide (1 : 2)

Other Names Pyridinium, 4-[2-[6-(diethylamino)-2-naphthalenyl]ethenyl]-1-[2-(trimethylammonio)ethyl]-, dibromide; Di-2-ANEPEQ; JPW 1114

Merck Index Number Not listed

Chemical/Dye Class Styryl

Molecular Formula $C_{26}H_{35}Br_2N_3$

Molecular Weight 549.39

Physical Form Solid

Solubility Soluble in water, ethanol, dimethyl sulfoxide

Melting Point >200 °C

Absorption (λ_{max}) 517 nm

Emission (λ_{max}) 721 nm

Synthesis Synthetic method[1]

Staining Applications Dorsal cochlear nucleus;[2] neurons[3]

Biological Applications Measuring membrane potential;[4] examining activity of ion channels[5]

Industrial Applications Not reported

Safety/Toxicity No data available

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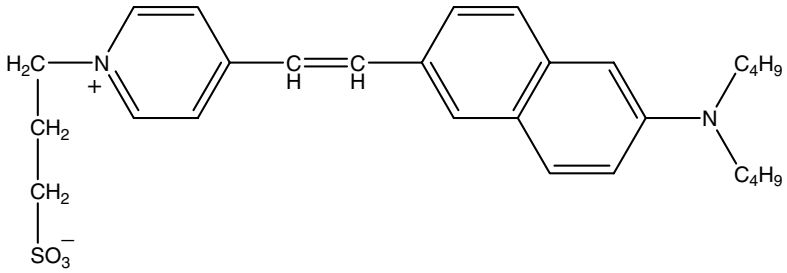
Di-4-ANEPPS

CAS Registry Number 90134-00-2

Chemical Structure



CA Index Name Pyridinium, 4-[2-[6-(dibutylamino)-2-naphthalenyl]ethenyl]-1-(3-sulfopropyl)-, inner salt

Other Names 6-[2-(*N*,*N*-Dibutylamino)naphthyl]ethenyl-4′-pyridinium propanesulfonate; 4-(2-(6-(Dibutylamino)-2-naphthalenyl)ethenyl)-1-(3-sulfopropyl)pyridinium hydroxide inner salt; Di-4-ANEPPS; JPW 211; 1-(3-Sulfonatopropyl)4-[β-[2-(di-*n*-butylamino)-6-naphthyl] vinyl]pyridinium betaine

Merck Index Number Not listed

Chemical/Dye Class Styryl

Molecular Formula $C_{28}H_{36}N_2O_3S$

Molecular Weight 480.66

Physical Form Orange to red powder

Solubility Soluble in ethanol, methanol, *N*,*N*-dimethylformamide, dimethyl sulfoxide

Melting Point 122–124 °C

Absorption (λ_{max}) 495 nm

Emission (λ_{max}) 705 nm

Synthesis Synthetic method[1]

Staining Applications Bacteria;[2] cardiac tissues;[3–6] myocardium;[7] neurons;[8–11] proteins[12]

Biological Applications Measuring membrane potential;[13–16] preventing arrhythmias;[17] probes for Na,K-ATPase reaction mechanism;[18] assays for identifying taste-specific genes;[19] quantum dots[20]

Industrial Applications Monitoring polymerization[21]

Safety/Toxicity Cardiac toxicity;[7] photodynamic damage[22]

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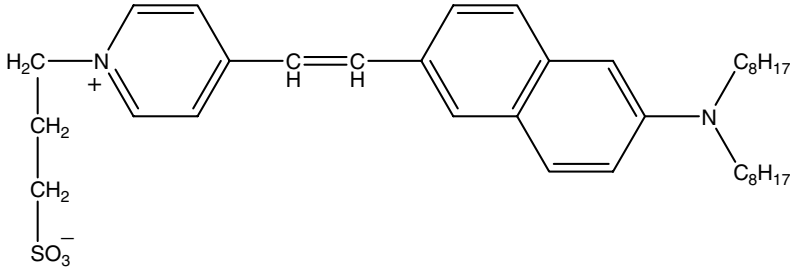
Di-8-ANEPPS

CAS Registry Number 157134-53-7

Chemical Structure



CA Index Name Pyridinium, 4-[2-[6-(dioctylamino)-2-naphthalenyl]ethenyl]-1-(3-sulfopropyl)-, inner salt

Other Names Di-8-ANEPPS; 4-(2-[6-(Dioctylamino)-2-naphthalenyl]ethenyl)-1-(3-sulfopropyl)pyridinium inner salt; JPW 1153

Merck Index Number Not listed

Chemical/Dye Class Styryl

Molecular Formula $C_{36}H_{52}N_2O_3S$

Molecular Weight 592.88

Physical Form Orange to red powder

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide

Melting Point >200 °C

Absorption (λ_{max}) 498 nm

Emission (λ_{max}) 713 nm

Synthesis Synthetic methods[1,2]

Staining Applications Cardiac myocytes;[3] lipid membrane surfaces;[4] lipid particles;[5] neurons;[6,7] prestin;[8] proteins;[9] sea urchin eggs[19]

Biological Applications Measuring membrane potential;[10–18] imaging exocytosis at fertilization[19]

Industrial Applications Not reported

Safety/Toxicity No data available

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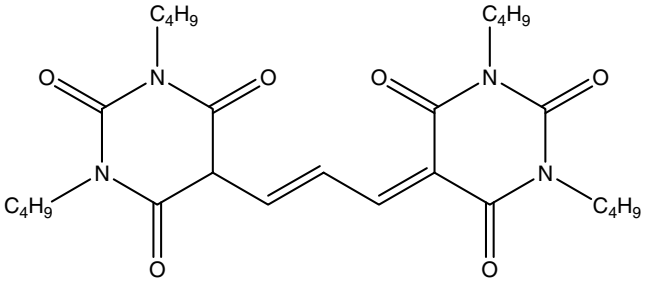
DiBAC$_4$(3)

CAS Registry Number 70363-83-6

Chemical Structure



CA Index Name 2,4,6(1*H*,3*H*,5*H*)-Pyrimidinetrione, 1,3-dibutyl-5-[3-(1,3-dibutylhexahydro-2,4,6-trioxo-5-pyrimidinyl)-2-propen-1-ylidene]-

Other Names 2,4,6(1*H*,3*H*,5*H*)-Pyrimidinetrione, 1,3-dibutyl-5-[3-(1,3-dibutylhexahydro-2,4,6-trioxo-5-pyrimidinyl)-2-propenylidene]-; Bis(1,3-dibutylbarbituric acid) trimethine oxonol; DiBAC$_4$(3)

Merck Index Number Not listed

Chemical/Dye Class Oxonol

Molecular Formula $C_{27}H_{40}N_4O_6$

Molecular Weight 516.63

Physical Form Orange or brown-red powder

Solubility Soluble in ethanol, methanol, *N*,*N*-dimethylformamide, dimethyl sulfoxide

Melting Point >200 °C

Boiling Point (Calcd.) 614.3 ± 65.0 °C, pressure: 760 Torr

pK_a (Calcd.) 4.20 ± 0.20, most acidic, temperature: 25 °C; -2.17 ± 0.20, most basic, temperature: 25 °C

Absorption (λ_{max}) 493 nm

Emission (λ_{max}) 516 nm

Synthesis Synthetic methods[1–8]

Staining Applications Bacteria;[9–13] α- and β-cells in islets of Langerhans;[14] *Bacillus* spores;[15] cells;[16] fungi;[17,18] yeast[19,20]

Biological Applications Measuring membrane potential;[21–28] HCN channel modulators;[29] BK channel activator;[30] treating Alzheimer's disease;[31] antimicrobial susceptibility test;[2] ion channel screening assays;[32] hERG channel assay[33]

Industrial Applications Photographic materials[1]

Safety/Toxicity Neurotoxicity[34]

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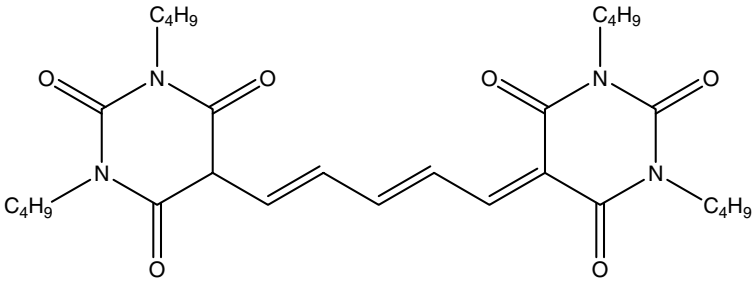
DiBAC$_4$(5)

CAS Registry Number 63560-89-4

Chemical Structure



CA Index Name 2,4,6(1*H*,3*H*,5*H*)-Pyrimidinetrione, 1,3-dibutyl-5-[5-(1,3-dibutylhexahydro-2,4,6-trioxo-5-pyrimidinyl)-2,4-pentadien-1-ylidene]-

Other Names Bis(1,3-dibutylbarbituric acid)pentamethine oxonol; 2,4,6(1*H*,3*H*,5*H*)-Pyrimidinetrione, 1,3-dibutyl-5-[5-(1,3-dibutylhexahydro-2,4,6-trioxo-5-pyrimidinyl)-2,4-pentadienylidene]-; DiBAC$_4$(5)

Merck Index Number Not listed

Chemical/Dye Class Oxonol

Molecular Formula $C_{29}H_{42}N_4O_6$

Molecular Weight 542.67

Physical Form Grey powder

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide

Melting Point >200 °C

Boiling Point (Calcd.) 642.6 ± 65.0 °C, pressure: 760 Torr

pK$_a$ (Calcd.) 4.79 ± 0.20, most acidic, temperature: 25 °C; − 2.16 ± 0.20, most basic, temperature: 25 °C

Absorption (λ_{max}) 590 nm

Emission (λ_{max}) 616 nm

Synthesis Synthetic methods[1–4]

Staining Applications Liposomes[5]

Biological Applications Measuring membrane potential;[6–9] HCN channel modulators;[10] potassium channel openers[11]

Industrial Applications Not reported

Safety/Toxicity No data available

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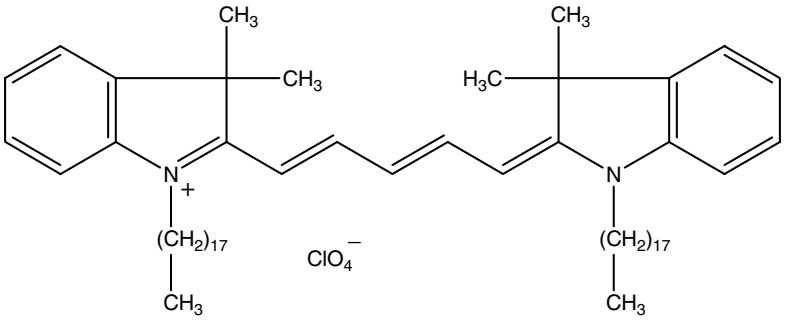
DiD

CAS Registry Number 127274-91-3

Chemical Structure



CA Index Name 3*H*-Indolium, 2-[5-(1,3-dihydro-3,3-dimethyl-1-octadecyl-2*H*-indol-2-ylidene)-1,3-pentadien-1-yl]-3,3-dimethyl-1-octadecyl-, perchlorate (1 : 1)

Other Names 3*H*-Indolium, 2-[5-(1,3-dihydro-3,3-dimethyl-1-octadecyl-2*H*-indol-2-ylidene)-1,3-pentadienyl]-3,3-dimethyl-1-octadecyl-, perchlorate; 1,1′-Dioctadecyl-3,3,3′,3′-tetramethylindodicarbocyanine perchlorate; D 307; DiD; DiD oil; DiIC18(5); Lipophilic dye DiD

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{61}H_{99}ClN_2O_4$

Molecular Weight 959.90

Physical Form Dark brown crystals

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide

Absorption (λ_{max}) 644 nm

Emission (λ_{max}) 665 nm

Synthesis Synthetic method[1]

Staining Applications Cells;[2] circulating apoptotic cells;[3] liposomes;[4,5] membranes;[6–9] neurons[10–12]

Biological Applications Detecting cell lysis,[13] microorganisms,[14] nucleic acids,[15] lipid diffusion in giant unilamellar vesicles,[16] lipid diffusion in phospholipid bilayers,[16] lipids and proteins diffusion in membranes;[17,18] monitoring cell migration[19]

Industrial Applications Optical recording materials;[20] thin films[21]

Safety/Toxicity No data available

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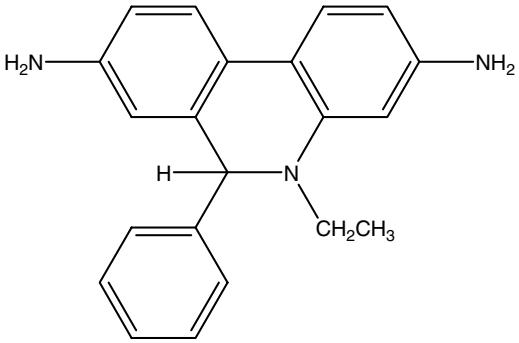
DIHYDROETHIDIUM

CAS Registry Number 104821-25-2

Chemical Structure



CA Index Name 3,8-Phenanthridinediamine, 5-ethyl-5,6-dihydro-6-phenyl-

Other Names 3,8-Phenanthridinediamine, 5-ethyl-5,6-dihydro-6-phenyl-, (±)-; Dihydroethidium; Hydroethidine; HE; HYD; PD-MY 003

Merck Index Number Not listed

Chemical/Dye Class Phenanthridine

Molecular Formula $C_{21}H_{21}N_3$

Molecular Weight 315.41

Physical Form Pink to dark brown powder

Solubility Soluble in *N*,*N*-dimethylformamide, dimethyl sulfoxide, acetonitrile, methanol, chloroform

Boiling Point (Calcd.) 580.4 ± 50.0 °C, pressure: 760 Torr

pK_a (Calcd.) 5.30 ± 0.40, most basic, temperature: 25 °C

Absorption (λ_{max}) 355 nm

Emission (λ_{max}) 420 nm

Synthesis Synthetic methods[1–4]

Staining Applications Superoxide ions;[5–15] nucleic acids;[16–18] cells;[19,20,29] myocardium;[21] bacteria;[22] prokaryotes[23]

Biological Applications Apoptosis assay;[24,25] generating and detecting reactive oxygen species (ROS);[5–15,26,27] detecting nucleic acids,[16–18] cells;[19,20,29] measuring respiratory burst;[28] superoxide indicator;[5–15,26,27] viability assay[29,30]

Industrial Applications Assaying reactive oxidants in smoke[31]

Safety/Toxicity Metabolic toxicity;[32] neutotoxicity;[33–36] parasite toxicity;[37] vascular toxicity[38]

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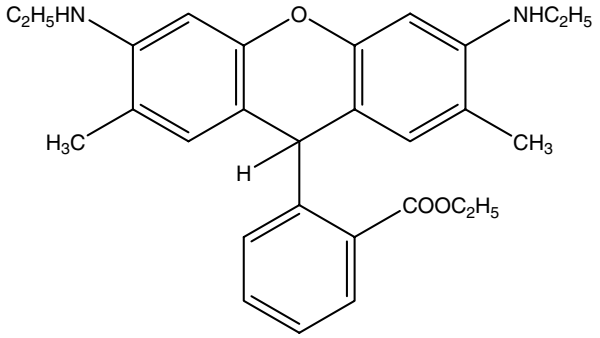
DIHYDRORHODAMINE 6G

CAS Registry Number 217176-83-5

Chemical Structure



CA Index Name Benzoic acid, 2-[3,6-bis(ethylamino)-2,7-dimethyl-9*H*-xanthen-9-yl]-, ethyl ester

Other Names D 633; Dihydrorhodamine 6G; d-R 6G

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{28}H_{32}N_2O_3$

Molecular Weight 444.57

Physical Form Solid

Solubility Soluble in *N*,*N*-dimethylformamide, dimethyl sulfoxide, methanol

Boiling Point (Calcd.) 572.4 ± 50.0 °C, pressure: 760 Torr

pK_a (Calcd.) 4.97 ± 0.40, most basic, temperature: 25 °C

Absorption (λ_{max}) 296 nm

Synthesis Synthetic method[1]

Staining Applications Mitochondria[2]

Biological Applications Detecting genetic anomalies,[3] methylation in DNA,[4] intracellular hydrogen peroxide in tumor cells,[5] intracellular active oxygen and reduced glutathione,[6] gene expression,[7]reactive oxygen species (ROS),[8] small RNAs;[9] nucleic acid ligation assays[10]

Industrial Applications Solar cells[11]

Safety/Toxicity No data available

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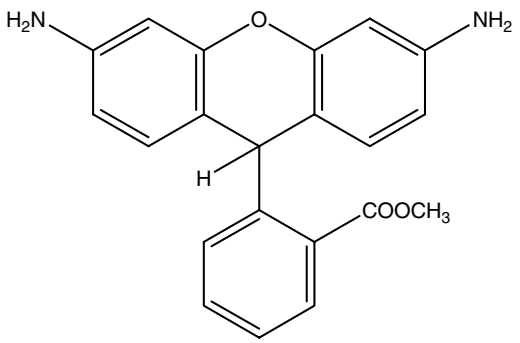
DIHYDRORHODAMINE 123

CAS Registry Number 109244-58-8

Chemical Structure



CA Index Name Benzoic acid, 2-(3,6-diamino-9*H*-xanthen-9-yl)-, methyl ester

Other Names D 23806; D 632; Dihydrorhodamine 123

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{21}H_{18}N_2O_3$

Molecular Weight 346.38

Physical Form Light red or pinkish-white powder

Solubility Soluble in *N*,*N*-dimethylformamide, dimethyl sulfoxide, methanol

Melting Point 163–165 °C

Boiling Point (Calcd.) 526.9 ± 50.0 °C, pressure: 760 Torr

pK_a (Calcd.) 4.70 ± 0.40, most basic, temperature: 25 °C

Absorption (λ_{max}) 289 nm

Synthesis Synthetic methods[1–3]

Staining Applications Mitochondria;[4,5] blood samples;[6] leukocytes;[6] cells;[7] microbes;[8] granulocytes;[9] epithelial cells;[10] myeloid cells;[11] neutrophils[12]

Biological Applications Generating, detecting & measuring reactive oxygen species;[13–18] generating, detecting & measuring reactive nitrogen species;[18,19] detecting phosphates,[20] peroxynitrile;[21] measuring respiratory burst;[22] chronic granulomatous disease DHR assay;[23] screening antioxidant activity assay;[24] peroxidase substrate[25]

Industrial Applications Not reported

Safety/Toxicity Cytotoxicity;[26] hepatotoxicity;[27] nephrotoxicity;[28] neurotoxicity;[29,30] skin toxicity[31]

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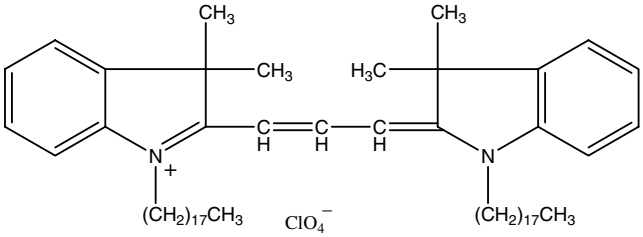
DiI

CAS Registry Number 41085-99-8

Chemical Structure



CA Index Name 3*H*-Indolium, 2-[3-(1,3-dihydro-3,3-dimethyl-1-octadecyl-2*H*-indol-2-ylidene)-1-propen-1-yl]-3,3-dimethyl-1-octadecyl-, perchlorate (1 : 1)

Other Names 3*H*-Indolium, 2-[3-(1,3-dihydro-3,3-dimethyl-1-octadecyl-2*H*-indol-2-ylidene)-1-propenyl]-3,3-dimethyl-1-octadecyl, perchlorate; 1,1′-Dioctadecyl-3,3,3′,3′-tetramethylindocarbocyanine perchlorate; D 282; D 282 (dye); DiI; DiI (dye); DilC18(3)

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{59}H_{97}ClN_2O_4$

Molecular Weight 933.87

Physical Form Burgundy to purples-violet crystals or powder

Solubility Soluble in ethanol, methanol, *N*,*N*-dimethylformamide, dimethyl sulfoxide

Melting Point 68 °C (decompose)

Absorption (λ_{max}) 549 nm

Emission (λ_{max}) 565 nm

Synthesis Synthetic methods[1–5]

Staining Applications Axons;[6] bovine brain tissues;[7] mitral/tufted cells;[8] retinal ganglion cells;[9] bacteria;[10] cells;[11] lipid bilayers;[12] lipid monolayers;[13] lipid membranes;[14] lipoproteins;[15,16] liposomes;[17–19] membranes;[20,21] neurons;[22,23] neural tracers;[24,25] vessel;[26] peptides;[3,4] proteins;[3,4] antibodies[3,4]

Biological Applications Detecting cell fusion,[27] cell adhesion,[28] cell migration,[28] cell proliferation;[28] membrane fusion assay;[29] exocytosis and/or endocytosis assay[29]

Industrial Applications Silicon-chip[30]

Safety/Toxicity Neurotoxicity[31]

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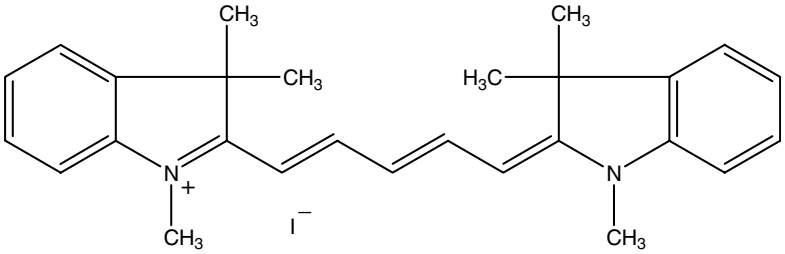
DiIC$_1$(5)

CAS Registry Number 36536-22-8

Chemical Structure



CA Index Name 3*H*-Indolium, 2-[5-(1,3-dihydro-1,3,3-trimethyl-2*H*-indol-2-ylidene)-1,3-pentadien-1-yl]-1,3,3-trimethyl-, iodide (1 : 1)

Other Names 1,3,3-Trimethyl-2-[5-(1,3,3-trimethyl-2-indolinylidene)-1,3-pentadienyl]-3*H*-indolium iodide; 3*H*-Indolium, 2-[5-(1,3-dihydro-1,3,3-trimethyl-2*H*-indol-2-ylidene)-1,3-pentadienyl]-1,3,3-trimethyl-, iodide; 1,1′,3,3,3′,3′-Hexamethylindodicarbocyanine iodide; 1,1′,3,3,3′,3′-Hexamethylindoledicarbocyanine iodide; 1,3,3,1′,3′,3′-Hexamethylindoledicarbocyanine iodide; HIDC; HIDCI; HIDC iodide; Hexacyanine 2; NK 529; PK 643; SNC 6

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{27}H_{31}IN_2$

Molecular Weight 510.45

Physical Form Blue green crystals

Solubility Soluble in methanol, dimethyl sulfoxide; partially soluble in water

Melting Point 266–267 °C (decompose)

Absorption (λ_{max}) 638 nm

Emission (λ_{max}) 658 nm

Synthesis Synthetic methods[1–8]

Staining Applications Fungi;[9] sperms;[9] microorganism;[10] proteoliposomes;[11] analytical samples;[12] reticulocytes;[13] leukocytes[13]

Biological Applications Measuring membrane potential;[11,14] detecting prostate cancer;[15] analyzing urine;[9] apoptosis assays;[16] *in vivo* hematotoxicity assays[17]

Industrial Applications Dye laser;[18] photoresists;[19] liquid crystals;[20] semiconductor integrated circuits;[21] thin films;[22] recording materials;[23,24] inks;[24,25] toners;[24] photographic materials[4,5,26]

Safety/Toxicity No data available

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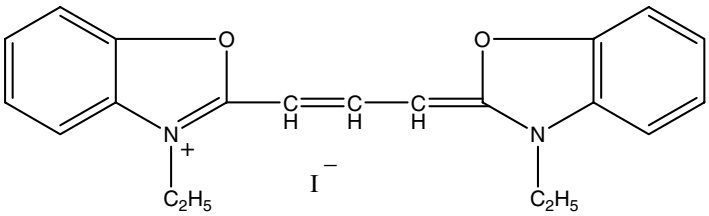
DiOC$_2$(3)

CAS Registry Number 905-96-4

Chemical Structure



CA Index Name Benzoxazolium, 3-ethyl-2-[3-(3-ethyl-2(3*H*)-benzoxazolylidene)-1-propen-1-yl]-, iodide (1 : 1)

Other Names 3-Ethyl-2-[3-(3-ethyl-2-benzoxazolinylidene)propenyl]benzoxazolium iodide; Benzoxazolium, 3-ethyl-2-[3-(3-ethyl-2(3*H*)-benzoxazolylidene)-1-propenyl]-, iodide; Benzoxazolium, 3-ethyl-2-[3-(3-ethyl-2-benzoxazolinylidene)propenyl]-, iodide; 3,3′-Diethyl-2,2′-oxacarbocyanine iodide; 3,3′-Diethyloxacarbocyanine iodide; 3-Ethyl-2-[3-ethyl-2(3*H*)-benzoxazolylidene)-1-propenyl]benzoxazolium iodide); DOC; DOC (dye); DOC iodide; DOCI; DiOC$_2$; DiOC2(3); G 1745; NK 85

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{21}H_{21}IN_2O_2$

Molecular Weight 460.31

Physical Form Dark red crystals or powder

Solubility Soluble in methanol, dimethyl sulfoxide

Melting Point 278 °C (decompose); 210 °C (decompose) (impure)

Absorption (λ_{max}) 482 nm

Emission (λ_{max}) 497 nm

Synthesis Synthetic methods[1–9]

Staining Applications Hepatocytes;[10] P-glycoprotein;[11] malaria infected cells;[12] nucleic acids;[13] sperms;[14] hairs[15]

Biological Applications Measuring membrane potential;[16] detecting prostate cancer,[17] nucleic acid hybridization,[18] polynucleotides;[19] treating acute myelogenous leukemia,[20] metastatic breast cancer,[20] cancers expressing P-glycoprotein[20]

Industrial Applications Dye laser;[21] displays;[22] recording materials;[23] light emitting diode lens;[24] thin films;[25] photographic materials;[9,26,27] nonlinear optical materials;[28] solar panels[29]

Safety/Toxicity Carcinogenicity[30]

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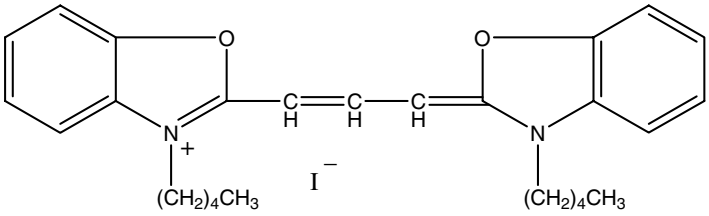
$DiOC_5(3)$

CAS Registry Number 53213-81-3

Chemical Structure



CA Index Name Benzoxazolium, 3-pentyl-2-[3-(3-pentyl-2(3*H*)-benzoxazolylidene)-1-propenyl]-, iodide

Other Names 3,3′-Dipentyloxacarbocyanine iodide, $DiOC_5(3)$

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{27}H_{33}IN_2O_2$

Molecular Weight 544.47

Physical Form Red powder

Solubility Soluble in methanol, dimethyl sulfoxide

Melting Point 214–215 °C

Absorption (λ_{max}) 484 nm

Emission (λ_{max}) 500 nm

Synthesis Synthetic method[1]

Staining Applications Cells;[2] leukocytes;[3,4] squamous epithelial cells;[4] microorganisms;[4,5] proteins;[6] sperms;[7] hairs[8]

Biological Applications Detecting prostate cancer;[9] monitoring membrane potential;[10–15] cytotoxicity assay;[15,16] drug screening assay;[17] susceptibility assay[18]

Industrial Applications Photoresists[19]

Safety/Toxicity No data available

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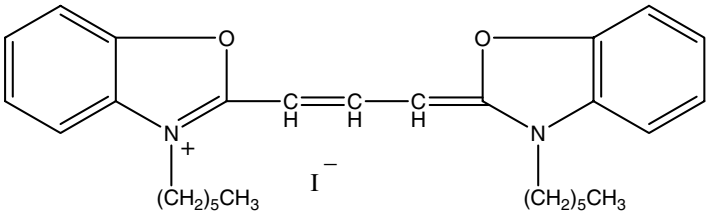
DiOC$_6$(3)

CAS Registry Number 53213-82-4

Chemical Structure



CA Index Name Benzoxazolium, 3-hexyl-2-[3-(3-hexyl-2(3*H*)-benzoxazolylidene)-1-propen-1-yl]-, iodide (1 : 1)

Other Names Benzoxazolium, 3-hexyl-2-[3-(3-hexyl-2(3*H*)-benzoxazolylidene)-1-propenyl]-, iodide; 3,3′-Dihexyloxacarbocyanine iodide; D 273; DiOC$_6$(3); NK 2280

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{29}H_{37}IN_2O_2$

Molecular Weight 572.52

Physical Form Red powder

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide

Melting Point 222–224 °C

Absorption (λ_{max}) 484 nm

Emission (λ_{max}) 501 nm

Synthesis Synthetic methods[1–3,16]

Staining Applications Mitochondria;[4–17] endoplasmic reticulum;[16–37] bacteria;[38,39] fungi;[40] nucleic acids;[41] leukocytes;[42] lymphocytes;[43] microtubules;[59] myelin;[44] presynaptic nerve terminals;[45] sperms;[46] spores[51]

Biological Applications Detecting mitochondrial membrane potential,[3,10–16,47,48] nucleic acid hybridization,[49] prostate cancer,[50] germination *Bacillus anthracis* spores;[51] apoptosis assays;[52,53] diagnostic assays;[54] in photodynamic therapy;[55] treating malaria,[56] leishmaniasis, trypanosomiasis,[56] trichomoniasis,[56] neosporosis,[56] coccidiosis[56]

Industrial Applications Photoresists;[57] photography[58]

Safety/Toxicity Photodamage of microtubules and inactivation of organelle motility[59]

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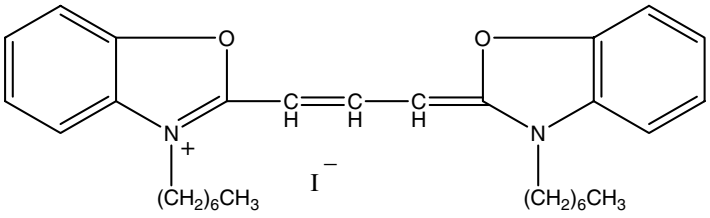
DiOC$_7$(3)

CAS Registry Number 53213-83-5

Chemical Structure



CA Index Name Benzoxazolium, 3-heptyl-2-[3-(3-heptyl-2(3*H*)-benzoxazolylidene)-1-propenyl]-, iodide

Other Names D 378; DiOC$_7$(3)

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{31}H_{41}IN_2O_2$

Molecular Weight 600.57

Physical Form Red crystals

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide

Melting Point 194–197 °C

Absorption (λ_{max}) 482 nm

Emission (λ_{max}) 504 nm

Synthesis Synthetic method[1]

Staining Applications Mitochondria;[2] cells;[3,4] fungi;[5] tumors[6]

Biological Applications Detecting cells,[3] fungal stress,[5] membrane potential;[1,2] cytotoxicity assays[7,8]

Industrial Applications Not reported

Safety/Toxicity No data available

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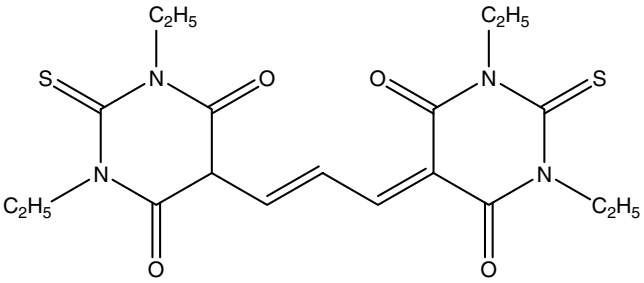
DiSBAC$_2$(3)

CAS Registry Number 47623-98-3

Chemical Structure



CA Index Name 4,6(1*H*,5*H*)-Pyrimidinedione, 5-[3-(1,3-diethylhexahydro-4,6-dioxo-2-thioxo-5-pyrimidinyl)-2-propen-1-ylidene]-1,3-diethyldihydro-2-thioxo-

Other Names 4,6(1*H*,5*H*)-Pyrimidinedione, 5-[3-(1,3-diethylhexahydro-4,6-dioxo-2-thioxo-5-pyrimidinyl)-2-propenylidene]-1,3-diethyldihydro-2-thioxo-; Bis(1,3-diethylthiobarbituric acid)trimethine oxonol; DiSBAC$_2$(3)

Merck Index Number Not listed

Chemical/Dye Class Oxonol

Molecular Formula $C_{19}H_{24}N_4O_4S_2$

Molecular Weight 436.55

Physical Form Purple powder

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide

Boiling Point (Calcd.) $545.0 \pm 60.0\,^{\circ}C$, pressure 760 Torr

pK_a (Calcd.) 3.72 ± 0.20, most acidic, temperature: 25 °C; -2.49 ± 0.20, most basic, temperature: 25 °C

Absorption (λ_{max}) 535 nm

Emission (λ_{max}) 560 nm

Synthesis Synthetic methods[1,2]

Staining Applications Cells;[3] clostridial toxin substrate;[4] endothelial cells;[5] lipid particles;[6] myocardium;[7] neurons;[8] islets of Langerhans;[9] epithelial cells[14]

Biological Applications Measuring membrane potential;[3,5,7,10,11] ion channel screening assays;[12] taste modulators screening assays;[13] detecting cystic fibrosis transmembrane conductance regulator (CFTR);[14] HCN channel modulators;[15] BK channel openers[16]

Industrial Applications Photographic materials[17]

Safety/Toxicity No data available

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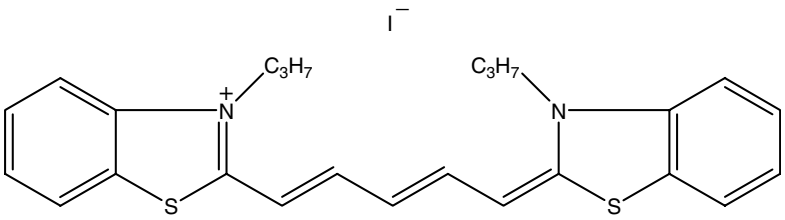
DiSC$_3$(5)

CAS Registry Number 53213-94-8

Chemical Structure



CA Index Name Benzothiazolium, 3-propyl-2-[5-(3-propyl-2(3*H*)-benzothiazolylidene)-1,3-pentadien-1-yl]-, iodide (1:1)

Other Names Benzothiazolium, 3-propyl-2-[5-(3-propyl-2(3*H*)-benzothiazolylidene)-1,3-pentadienyl]-, iodide; 3,3′-Dipropyl-2,2′-thiadicarbocyanine iodide; 3,3′-Dipropylthiadicarbocyanine iodide; Di-S-C3-5; NK 2251

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{25}H_{27}IN_2S_2$

Molecular Weight 546.53

Physical Form Dark green powder

Solubility Soluble in methanol, *N*,*N*-dimethylformamide, dimethyl sulfoxide

Melting Point 248–249 °C

Absorption (λ_{max}) 651 nm

Emission (λ_{max}) 675 nm

Synthesis Synthetic method[1]

Staining Applications Bacteria;[2] cells;[3] cytochrome *c* oxidase-reconstituted proteoliposomes;[4] fungus;[5] sperms;[5] epithelial cells;[6] erythrocytes;[7] lipid bilayer;[8] lipid membranes;[9] lipid particles;[10] liposome;[11] lymphocytes;[12] lysosomes;[13] microorganisms;[14] mitochondrial neuroblastoma cells;[15,16] neutrophils;[17] red blood cells;[18] tumor cells;[19] yeast[20,21]

Biological Applications Measuring membrane potential;[1–3,15–25] measuring membrane fusion;[26,27] detecting prostate cancer,[28] nucleic acid hybridization;[29] immunoassays;[30] nucleic acid assays;[30] as anticancer agents[31]

Industrial Applications Not reported

Safety/Toxicity No data available

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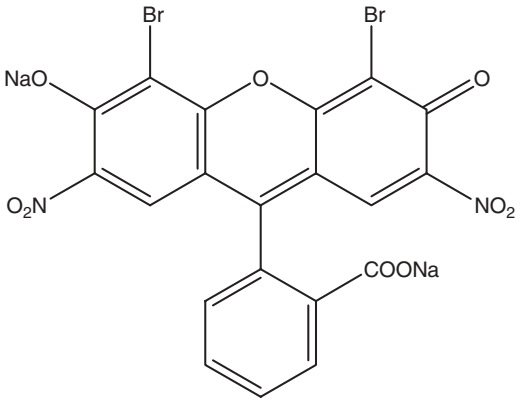
EOSIN B

CAS Registry Number 548-24-3

Chemical Structure



CA Index Name Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-3-one, 4′,5′-dibromo-3′,6′-dihydroxy-2′,7′-dinitro-, sodium salt (1 : 2)

Other Names Fluorescein, 4′,5′-dibromo-2′,7′-dinitro-, disodium salt; Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-3-one, 4′,5′-dibromo-3′,6′-dihydroxy-2′,7′-dinitro-, disodium salt; C.I. 45400; C.I. Acid Red 91; Dibromodinitrofluorescein sodium; Eosin B; Eosin BA; Eosine B; Eosine BA; Eosine BN; Eosine BNX; Eosine I Bluish; Saffrosine; Simacid Nitro Eosin 24669

Merck Index Number 3602

Chemical/Dye Class Xanthene

Molecular Formula $C_{20}H_6Br_2N_2Na_2O_9$

Molecular Weight 624.06

Physical Form Red-brown to green crystals or powder

Solubility Freely soluble in water; soluble in ethanol

Melting Point 295 °C

Absorption (λ_{max}) 514 nm, 395 nm

Emission (λ_{max}) 544 nm

Synthesis Synthetic method[1–4]

Staining Applications Brain;[5] cells;[6] microorganisms;[7] nucleic acids;[8] peptides;[9] proteins;[9–13] enzyme substrates;[14,15] hairs[16]

Biological Applications Antimalarial agent;[17] protein assay;[18] detecting enzyme activity;[14] treating cancer,[19] malaria,[19] diabetes,[20] a variety of conditions affecting skin,[21] mouth,[21] digestive tract,[21] urinary tract,[21] reproductive tract,[21] respiratory tract,[21] circulatory system,[21] head,[21] neck,[21] endocrine system,[21] lymphoreticular system;[21] dental materials[22,23]

Industrial Applications Color filters;[24,25] liquid crystal displays;[25] inks;[26–28] NLO materials;[29] photographic materials;[30] laundry detergent;[31] textiles[32]

Safety/Toxicity No data available

Certification/Approval Certified by Biological Stain Commission (BSC)

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transition zone and terminally differentiating fiber cells in the adult canine ocular lens. *Arch. Histol. Cytol.* **2001**, *64*, 379–391.

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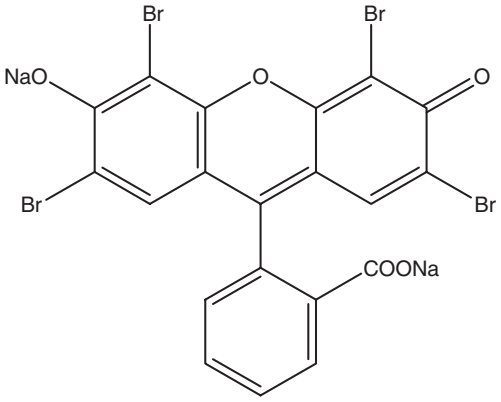
EOSIN Y

CAS Registry Number 17372-87-1

Chemical Structure



CA Index Name Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-3-one, 2′,4′,5′,7′-tetrabromo-3′,6′-dihydroxy-, sodium salt (1 : 2)

Other Names Eosin Yellowish; Fluorescein, 2′,4′,5′,7′-tetrabromo-, disodium salt; Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-3-one, 2′,4′,5′,7′-tetrabromo-3′,6′-dihydroxy-, disodium salt; 11445 Red; 11731 Red; 1903 Yellow Pink; ABCO Eosin; Abbey Eosin; Acid Red 87; Acid Red 87-39014; Aizen Eosine; Aizen Eosine GH; Basacid Red 316; Bromo 4D; Bromo 4DC; Bromo 4DL; Bromo B; Bromo FL; Bromo JPS; Bromo TS; Bromo X 100; Bromo XX; Bromo acid; Bromoeosine; Bromofluoresceic acid; Bromofluorescein; Bronze Bromo; C.I. 45380; C.I. Acid Red 87; Certiqual Eosine; Chugai Ink Red AM 5; Cogilor Orange 212.10; Conacid Red ML; D and C Red No. 22; D&C Red 22; D&C Red No. 22; D&C Red No. 22-90133; Daiwa Red 103WB; Dawn red; Dinacid Eosine Red; Disodium eosin; Dycosweak Acid Red A; Eosin; Eosin A; Eosin OJ; Eosin Y; Eosin Y 17255; Eosin YS; Eosin yellow; Eosine; Eosine 3G; Eosine 3Y; Eosine A; Eosine AG; Eosine BPC; Eosine BS; Eosine BS-SF; Eosine DA; Eosine DWC 73; Eosine Extra Conc. A. Export; Eosine Extra Yellowish; Eosine FA; Eosine G; Eosine GF; Eosine GH; Eosine J; Eosine K; Eosine K Salt Free; Eosine Lake Red Y; Eosine OJ; Eosine S; Eosine S 13; Eosine SSO; Eosine Salt Free; Eosine Y; Eosine Y 90133; Eosine YB; Eosine YS; Eosine Yellow; Eosine Yellowish; Eosine sodium; Eosine sodium salt; Eosine w/s; Eosine water-soluble; Fenazo Eosine XG; Food Red 103; Hidacid Boiling Bromo; Hidacid Bromo acid regular; Hidacid Dibromo Fluorescein; Hidacid Eosine Soda Salt; Hidacid White Bromo; Irgalite Bronze Red CL; Japan Red 103; Japan Red 230-1; Japan Red 230-2; Japan Red No. 103; Japan Red No. 230-1; Morning red; Neelicol Eosine; Orient Water Red 2; Orient Watger Red 2; Phlox Red Toner X 1354; Phloxine Red 20-7600; Phloxine Toner B; Pure Eosine YY; Red 103; Red 17255; Red No. 103; Red No. 230-1; Silk Discharge Orange 3R; Simacid Eosine Y; Sodium eosin; Sodium eosinate; Sodium eosine; Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-3-one, 2′,4′,5′,7′-tetrabromo-3′,6′-dihydroxy-, disodium salt; Symuler Eosin Toner; Tetrabromofluorescein; Tetrabromofluorescein D; Tetrabromofluorescein S; Tetrabromofluorescein soluble; Toyo Eosine G; Triacid Eosine; Vicoacid Eosine; Water Red 2

Merck Index Number 3603

Chemical/Dye Class Xanthene

Molecular Formula $C_{20}H_6Br_4Na_2O_5$

Molecular Weight 691.85

Physical Form Red-brown crystals or powder

Solubility Freely soluble in water; slightly soluble in ethanol, methanol; insoluble in ether

Melting Point 295.5 °C

pH Range 0.0–3.0

Color Change at pH Non-fluorescence (0.0) to green fluorescence (3.0)

pK_a 2.9, 4.5

Absorption (λ_{max}) 517 nm

Emission (λ_{max}) 538 nm

Synthesis Synthetic methods[1–11]

Staining Applications Blood;[12] blood smears;[13] bone marrow;[12] cells;[14] nucleus;[15] cytoplasm;[15] membrane;[15] candies;[16] drinks;[16] keloid;[17] orthodontic adhesives;[18] proteins;[19] tissues;[20] thrombocytes;[21] eye lens;[22] eye shadow;[23] lips;[24] skin;[24,25] hairs;[1,26] keratin fibers[27]

Biological Applications Treating age-related macular degeneration,[28] burns,[1,29] cancer,[1,30] diabetes,[1,31] obesity,[1,31] dental bone defects,[1,32] gastroesophageal reflux disease,[33] prostate cancer,[34] viral diseases;[35] stents;[1,36] wound-healing materials[1,37]

Industrial Applications Solar cell;[38] semiconductor devices;[39] color filters;[1,40] Light-emitting devices;[41] photovoltaic devices;[1,42] electrochromic devices;[43] thin films;[44] sol–gel materials;[45] inks;[1,46,47] colored bubbles[48]

Safety/Toxicity Acute toxicity;[1,49] carcinogenicity;[50] cardiotoxicity;[51] ecotoxicity;[52] environmental toxicity;[53,54] microbial toxicity;[55] mutagenicity;[1,56] neurotoxicity;[57] nucleic acid damage;[58] phototoxicity;[1,59] pulmonary toxicity;[60] reproductive toxicity;[61] skin toxicity[62]

Certification/Approval Certified by Biological Stain Commission (BSC)

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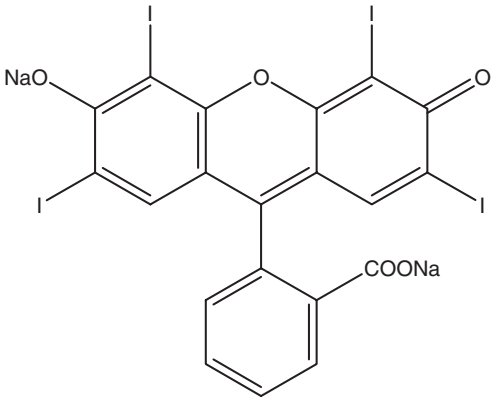
ERYTHROSIN

CAS Registry Number 16423-68-0

Chemical Structure



CA Index Name Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-3-one, 3′,6′-dihydroxy-2′,4′,5′,7′-tetraiodo-, sodium salt (1 : 2)

Other Names Erythrosine B; Fluorescein, 2′,4′,5′,7′-tetraiodo-, disodium salt; Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-3-one, 3′,6′-dihydroxy-2′,4′,5′,7′-tetraiodo-, disodium salt; 1427 Red; 1671 Red; 2′,4′,5′,7′-Tetraiodofluorescein disodium salt; 2,4,5,7-Tetraiodofluorescein disodium salt; Acid Red 51; Aizen Erythrosine; Aizen Food Red 3; Basovit Red 425E; C.I. 45430; C.I. Acid Red 51; C.I. Food Red 14; Calcocid Erythrosine N; Canacert Erythrosine BS; Ceplac; Cilefa Pink B; Cogilor Red 312.10; D and C Red No. 3; D&C Red No. 3; Dolkwal Erythrosine; E 127; Edicol Supra Erythrosin AS; Edicol Supra Erythrosine A; Erythrosin; Erythrosin B; Erythrosin B sodium salt; Erythrosin BS; Erythrosine; Erythrosine 307046; Erythrosine 36003; Erythrosine 37003; Erythrosine 3B; Erythrosine B-FO; Erythrosine BS; Erythrosine Bluish; Erythrosine Extra; Erythrosine Extra Conc. A Export; Erythrosine Extra Pure A; Erythrosine I; Erythrosine K-FO; Erythrosine TB; Erythrosine TB Extra; Erythrosine Extra Bluish; Eurocert Erythrosine 311807; FD & C Red No. 3-307020; FD and C Red 3; FD and C Red No. 3; FD&C Red No. 3; FD&C Red No. 3-37003; FDC Red 3; FDC Red 3 dye; Food Color Red 3; Food Dye Red 3; Food Red 14; Food Red 3; Food Red No. 3; Hexacert Red No. 3; Hexacol Erythrosine BS; Japan Food Red No. 3; Japan Red 3; Japan Red No. 3; Maple Erythrosine; Necol Erythrosine; Neelicol Erythrosine; New Ink Bluish Geigy; Red 1799; Red 3; Red No. 3; S 887; Simacid Pink 24107; Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-3-one, 3′,6′-dihydroxy-2′,4′,5′,7′-tetraiodo-, disodium salt; Synerid; Tetraiodofluorescein sodium salt; Usacert FD & C Red No. 3-310116; Usacert Red No. 3; Water Pink 176575

Merck Index Number 3693

Chemical/Dye Class Xanthene

Molecular Formula $C_{20}H_6I_4Na_2O_5$

Molecular Weight 879.86

Physical Form Red to brown powder

Solubility Soluble in water, ethanol

Melting Point >250 °C

pH Range 2.5–4.0

Color Change at pH Non-fluorescence (2.5) to light green or reddish fluorescence (4.0)

pK_a 4.1

Absorption (λ_{max}) 525 nm

Emission (λ_{max}) 555 nm

Synthesis Synthetic methods[1–8]

Staining Applications Blood;[9] bone marrow;[9] bacterial plaque;[10] cancer cells;[11] dental plaque;[12,13] human serum albumin (HSA);[19] lymph node;[14] microorganisms;[15] neurons;[16] nucleic acids;[17,18] prions;[20] spores;[11] animal feeds;[21] alcohol;[22] baked food;[23] beverages;[24] candies;[25] caramels;[26] confectionery;[27,28] cotton candy;[29] drinks;[25,27] fish;[30] olives;[31] orange juices;[32] papaya fruit;[33] soft drinks;[28] sport drink;[22] sweetener;[34] capsules;[35,36] tablets;[37,38] sunscreen;[39] eyelids;[41] lips;[40,41] skin;[41–43] tattoos;[44] teeth;[45,46] hairs;[1,47–49] keratin fibers[49,50]

Biological Applications Detecting gene expression,[51] phosphoproteins,[52] protease,[53] stress biomarkers;[54] treating age-related macular degeneration,[55] arteriosclerosis,[56] bone metabolic diseases,[57] burns,[1,58] cancer,[1,59] diabetes,[1,60] human immunodeficiency virus infection,[61] obesity,[1,60] viral diseases;[1,62] medical devices;[63] photodynamic therapy[1,64,65]

Industrial Applications Solar cells;[66] photoelectric device;[67] light emitting diodes;[1,68] color filters;[1,69] liquid-crystal displays;[69] thin films;[70] inks;[1,71–74] lithographic plate;[75] photographic materials;[76] recording materials;[77] sol-gel materials;[78] photonics;[78] adhesive;[79] paints;[1,80] thermoplastics;[81] colored bubbles;[1,82] textiles,[83] entertainment products;[84] toys[85]

Safety/Toxicity Acute toxicity;[1,86] carcinogenicity;[1,87,88,95,96] cytotoxicity;[1,89] developmental toxicity;[90] DNA-damage;[98] embryotoxicity;[1,91] genotoxicity;[1,92–94] lifetime toxicity;[95,96] mutagenicity;[1,97–100] neurotoxicity;[1,101,102] phototoxicity;[103] psychotoxicity;[90] reproductive toxicity[1,104–106]

Certification/Approval Certified by Biological Stain Commission (BSC); Approved by Food & Drugs Administration (FDA)

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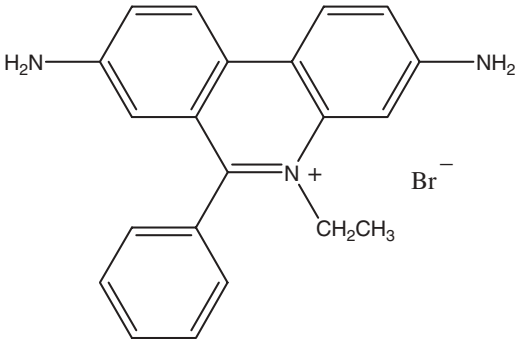
ETHIDIUM BROMIDE

CAS Registry Number 1239-45-8

Chemical Structure



CA Index Name Phenanthridinium, 3,8-diamino-5-ethyl-6-phenyl-, bromide (1:1)

Other Names 3,8-Diamino-5-ethyl-6-phenylphenanthridinium bromide; Phenanthridinium, 3,8-diamino-5-ethyl-6-phenyl-, bromide; 2,7-Diamino-10-ethyl-9-phenylphenanthridinium bromide; 2,7-Diamino-9-phenyl-10-ethylphenanthridinium bromide; 2,7-Diamino-9-phenylphenanthridine ethobromide; Dromilac; Ethidium bromide; Homidium bromide

Merck Index Number 4731

Chemical/Dye Class Phenanthridine

Molecular Formula $C_{21}H_{20}BrN_3$

Molecular Weight 394.31

Physical Form Dark red crystals

Solubility Soluble in water, chloroform, dimethyl sulfoxide, ethanol

Melting Point 238–240°C

Absorption (λ_{max}) 518 nm, 210 nm, 285 nm, 316 nm, 343 nm, 480 nm, 525 nm

Emission (λ_{max}) 605 nm, 620 nm

Synthesis Synthetic methods[1–11]

Staining Applications Nucleic acids;[12–16] cells;[17] HeLa cells;[18] bacteria[19]

Biological Applications Nucleic acid hybridization;[20] detecting nucleic acids,[12–16] cells,[17] cancer cells,[21] human cytomegalovirus,[22] hydrogenase A (hydA) of *Clostridia*,[23] influenza A virus,[24] oligonucleotides,[25] viable *Plesiomonas shigelloides*;[26] apoptosis assay;[27] nucleic acid amplification;[28] nucleic acid quantification;[29] treating diseases associated with androgens,[30] cancer,[31] plasma cell disorders,[32] neurodegenerative diseases[33]

Industrial Applications Not reported

Safety/Toxicity Carcinogenicity;[34] cytotoxicity;[35] DNA damage;[36] embryotoxicity;[37] genotoxicity;[38,39] mutagenicity;[40–42] neurotoxicity;[43] phototoxicity[44]

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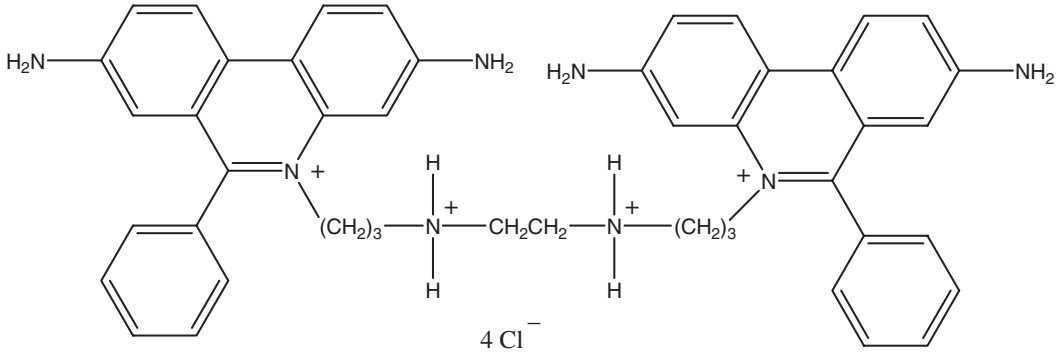
ETHIDIUM HOMODIMER-1 (EthD-1)

CAS Registry Number 61926-22-5

Chemical Structure



CA Index Name Phenanthridinium, 5,5′-[1,2-ethanediylbis(imino-3,1-propanediyl)]bis[3,8-diamino-6-phenyl-, chloride, hydrochloride (1:2:2)

Other Names Phenanthridinium, 5,5′-[1,2-ethanediylbis(imino-3,1-propanediyl)]bis[3,8-diamino-6-phenyl-, dichloride, dihydrochloride; 5,5′-(4,7-Diazadecamethylene)bis(3,8-diamino-6-phenylphenanthridinium) dichloride dihydrochloride; EB2; ETDI; EthD 1; EtDi; Ethidium dimer; Ethidium homodimer; Ethidium homodimer 1

Merck Index Number Not listed

Chemical/Dye Class Phenanthridine

Molecular Formula $C_{46}H_{50}Cl_4N_8$

Molecular Weight 856.77

Physical Form Red powder

Solubility Soluble in water, *N*,*N*-dimethylformamide, dimethyl sulfoxide

Melting Point 275°C

Absorption (λ_{max}) 528 nm

Emission (λ_{max}) 617 nm

Synthesis Synthetic methods[1–5]

Staining Applications Nucleic acids;[6–9,18,19] cells;[10,20–22] leukocytes;[11,29] nuclei;[29] megakaryocytes;[12] microorganisms;[13] nucleated red blood cells;[14] sperms;[15,16] Schwann cells (SCs) in whole nerves[17]

Biological Applications Nucleic acid hybridization;[18] detecting nucleic acids,[6–9,18,19] cells,[10,20–22] retinoblastoma susceptibility gene protein (pRB),[23] enzymes,[24] PCR products,[25] viral infection;[26] nucleic acid amplification;[27] nucleic acid fragment sizing;[28] counting embryoblasts;[29] treating cancer[30]

Industrial Applications For authentification[31]

Safety/Toxicity Cytotoxicity;[32] gastric toxicity;[33] neurotoxicity;[34] retinal toxicity[35,36]

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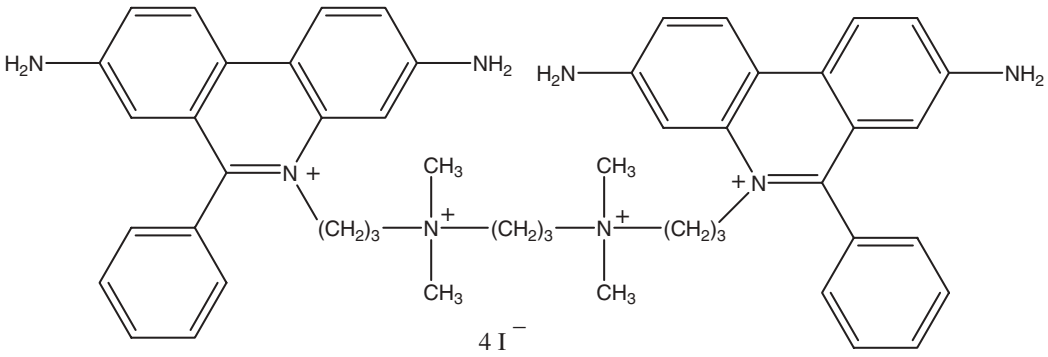
ETHIDIUM HOMODIMER-2 (EthD-2)

CAS Registry Number 180389-01-9

Chemical Structure



CA Index Name Phenanthridinium, 5,5′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl]]bis[3,8-diamino-6-phenyl]-, iodide (1:4)

Other Names Phenanthridinium, 5,5′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl]]bis[3,8-diamino-6-phenyl]-, tetraiodide; EthD 2; Ethidium homodimer 2

Merck Index Number Not listed

Chemical/Dye Class Phenanthridine

Molecular Formula $C_{51}H_{60}I_4N_8$

Molecular Weight 1292.71

Physical Form Red powder

Solubility Soluble in dimethyl sulfoxide, water

Melting Point >200°C

Absorption (λ_{max}) 535 nm

Emission (λ_{max}) 624 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[2–4] cells;[1,5] leukocytes;[6,14] megakaryocyte;[7] bone marrow cells;[8] sperms[9]

Biological Applications Nucleic acid hybridization;[10,15] detecting nucleic acids,[2–4,10,11] proteins,[11] cells,[1,5] spores,[12] cancer cells,[12] stress biomarkers;[13] counting embryoblasts;[14] hybridization assay;[15] viability assay[1]

Industrial Applications Not reported

Safety/Toxicity No data available

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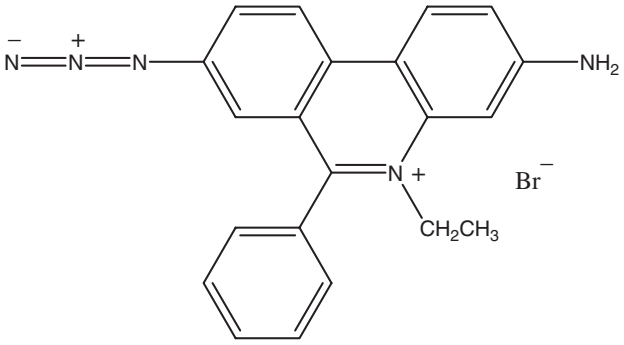
ETHIDIUM MONOAZIDE (EMA)

CAS Registry Number 58880-05-0

Chemical Structure



CA Index Name Phenanthridinium, 3-amino-8-azido-5-ethyl-6-phenyl-, bromide (1:1)

Other Names Phenanthridinium, 3-amino-8-azido-5-ethyl-6-phenyl-, bromide; Ethidium monoazide; Ethidium monoazide bromide

Merck Index Number Not listed

Chemical/Dye Class Phenanthridine

Molecular Formula $C_{21}H_{18}BrN_5$

Molecular Weight 420.31

Physical Form Orange powder

Solubility Soluble in ethanol, *N*,*N*-dimethylformamide

Melting Point >200°C

Absorption (λ_{max}) 462 nm

Emission (λ_{max}) 625 nm

Synthesis Synthetic methods[1,2]

Staining Applications Nucleic acids;[3–6] polynucleotide;[6] bacteria;[7,8] leukocyte;[9] micronuclei;[10,11] chromatin;[10,11] nucleus[12]

Biological Applications Biochips;[13] DNA chips;[14] nucleic acid hybridization;[15,16] detecting nucleic acids,[3–6,17,18] cells,[19] bacteria,[7,8,20] spore contents[21]

Industrial Applications Not reported

Safety/Toxicity Mutagenicity;[22] nucleic acid damage[23]

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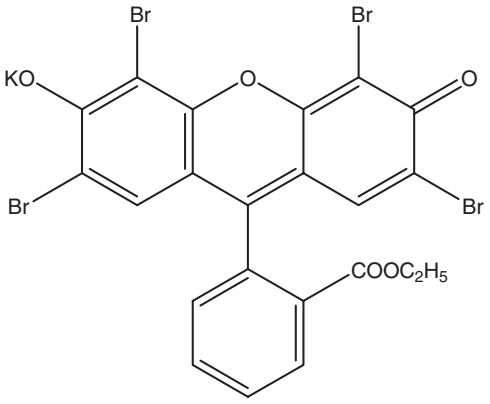
ETHYL EOSIN

CAS Registry Number 6359-05-3

Chemical Structure



CA Index Name Benzoic acid, 2-(2,4,5,7-tetrabromo-6-hydroxy-3-oxo-3*H*-xanthen-9-yl)-, ethyl ester, potassium salt

Other Names Ethyl eosin; Fluorescein, 2′,4′,5′,7′-tetrabromo-, ethyl ester, potassium derivative; Fluorescein, 2′,4′,5′,7′-tetrabromo-, ethyl ester, potassium salt; C.I. 45386; C.I. Solvent Red 45; Ethyl eosine Y; NSC 8670; Spirit Eosine; Spirit Primrose DH

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{22}H_{11}Br_4KO_5$

Molecular Weight 714.03

Physical Form Red-brown crystals or powder

Solubility Soluble in hot water; slightly soluble in ethanol

Melting Point >200°C

Absorption (λ_{max}) 532 nm

Synthesis Synthetic method[1–3]

Staining Applications Cells;[4] gelatin;[5] lysosomes;[6] mammalian tissues;[7] mitochondria;[8] neurons;[9] nucleic acids;[10,11] proteins;[12] urine[13]

Biological Applications Drug delivery and tissue engineering;[14] photodynamic therapy;[15] dental materials;[16] treating cancer,[17] diabetes;[18] wound dressing materials[19]

Industrial Applications Liquid crystal display device;[20] lithographic printing plates;[21–23] inks;[24] recording materials;[25] photographic materials;[26] polymer waveguides[27]

Safety/Toxicity No data available

Certification/Approval Certified by Biological Stain Commission (BSC)

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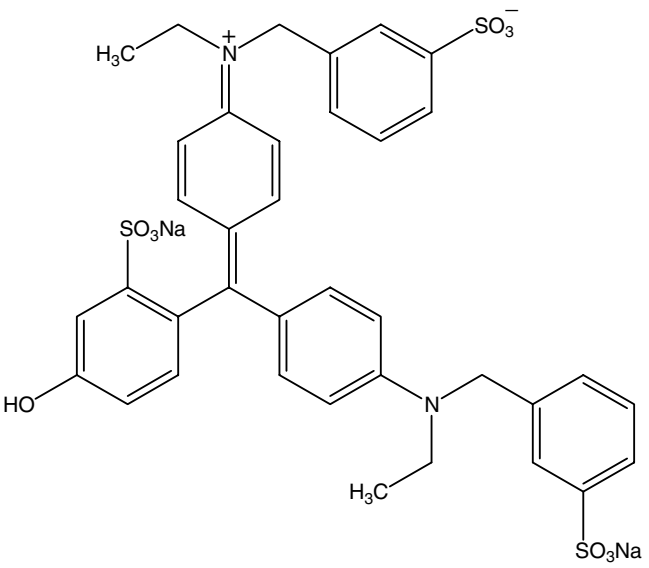
FAST GREEN FCF

CAS Registry Number 2353-45-9

Chemical Structure



CA Index Name Benzenemethanaminium, *N*-ethyl-*N*-[4-[[4-[ethyl[(3-sulfophenyl)methyl]amino]phenyl](4-hydroxy-2-sulfophenyl)methylene]-2,5-cyclohexadien-1-ylidene]-3-sulfo-, inner salt, sodium salt (1:2)

Other Names Benzenemethanaminium, *N*-ethyl-*N*-[4-[[4-[ethyl[(3-sulfophenyl)methyl]amino]phenyl](4-hydroxy-2-sulfophenyl)methylene]-2,5-cyclohexadien-1-ylidene]-3-sulfo-, hydroxide, inner salt, disodium salt; Benzenemethanaminium, *N*-ethyl-*N*-[4-[[4-[ethyl[(3-sulfophenyl)methyl]amino]phenyl](4-hydroxy-2-sulfophenyl)methylene]-2,5-cyclohexadien-1-ylidene]-3-sulfo-, inner salt, disodium salt; C.I. Food Green 3; C.I. Food Green 3, disodium salt; Fast Green FCF; C.I. 42053; FD and C Green No. 3; FD&C Green No. 3; FDC Green 3; Food Green 3; Food Green No. 3; Green No. 3; Japan Food Green No. 3; Japan Green 3; Japan Green No. 3; NSC 379443

Merck Index Number 3941

Chemical/Dye Class Triphenylmethane

Molecular Formula $C_{37}H_{34}N_2Na_2O_{10}S_3$

Molecular Weight 808.85

Physical Form Dark green or red-brown powder

Solubility Soluble in water, ethanol; insoluble in xylene

Melting Point 290°C (decompose)

Absorption (λ_{max}) 624 nm

Synthesis Synthetic method[1–7]

Staining Applications Brain;[8] cytoplasm;[9] cytoskeleton;[9] nuclei;[9] nucleoli;[9] aluminum;[10] cells;[9,11] microorganisms;[12] stain for endoscopy;[13] beverages;[14,15] candies;[16] drinks;[16] fish;[17] sweeteners;[18,19] capsules;[20] tablets;[21] skin;[22–24] lips;[22,23] tattoos;[25] tooth;[26] hairs[27–29]

Biological Applications Detecting proteins;[30] medical devices[31]

Industrial Applications Inks;[32,33] highlighters;[34] paints;[35] detergents;[36] colored bubbles;[37] entertainment products[38]

Safety/Toxicity Acute toxicity;[39] carcinogenicity;[40,41] chronic toxicity;[42] cytotoxicity;[43] effects on chromosomes;[44] genotoxicity;[45,46] mutagenicity:[47,48] neurotoxicity[49]

Certification/Approval Certified by Biological Stain Commission (BSC); Approved by Food & Drugs Administration (FDA)

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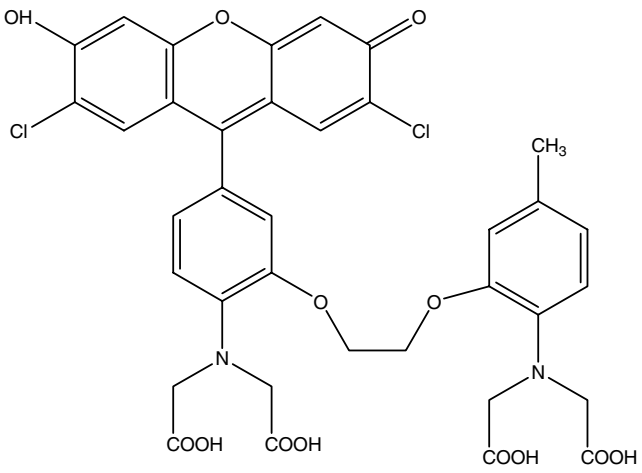
FLUO 3

CAS Registry Number 123632-39-3

Chemical Structure



CA Index Name Glycine, *N*-[2-[2-[2-[bis(carboxymethyl)amino]-5-(2,7-dichloro-6-hydroxy-3-oxo-3*H*-xanthen-9-yl)phenoxy]ethoxy]-4-methylphenyl]-*N*-(carboxymethyl)-

Other Names Fluo 3

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{36}H_{30}Cl_2N_2O_{13}$

Molecular Weight 769.53

Physical Form Dark reddish-brown powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250°C

Boiling Point (Calcd.) 1056.0 ± 65.0°C, pressure: 760 Torr

pK_a (Calcd.) 1.66 ± 0.10, most acidic temperature: 25°C; 6.18 ± 0.50, most basic temperature: 25°C

Absorption (λ_{max}) 506 nm

Emission (λ_{max}) 526 nm

Synthesis Synthetic methods[1–3]

Staining Applications Calcium ions;[2,3,8–22] zinc ions;[23] bone;[4] cells;[5,6] neurons;[7] peptides;[1] proteins;[1] antibodies[1]

Biological Applications Calcium indicator;[2,3,8–22] zinc indicator;[23] identifying taste modulators;[24] measuring membrane potential;[25] treating defective skeletal muscle function during heart failure,[26] pain[27]

Industrial Applications Not reported

Safety/Toxicity Cardiac toxicity;[28] cytotoxicity;[29,30] excitotoxicity;[31] genotoxicity;[32] neurotoxicity[33,34]

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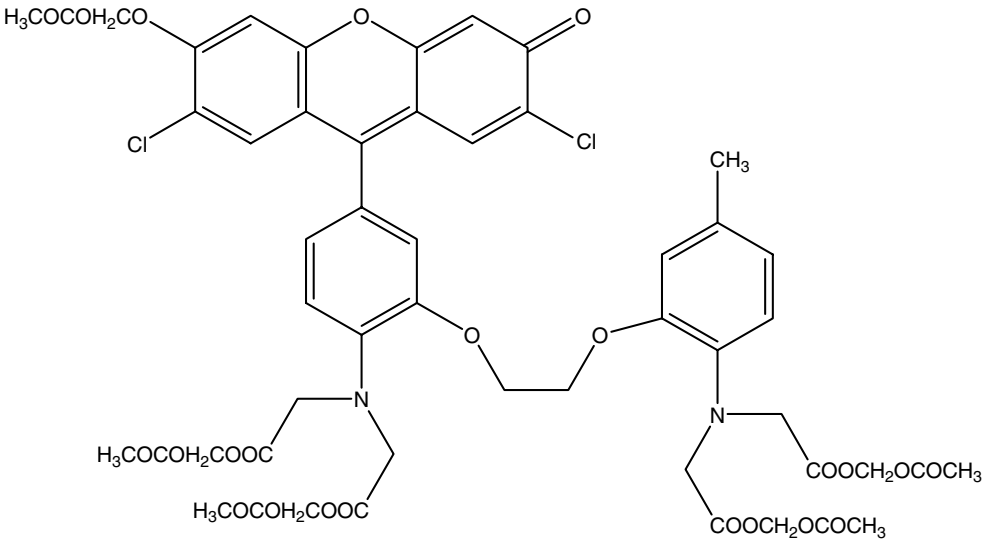
FLUO 3 AM

CAS Registry Number 121714-22-5

Chemical Structure



CA Index Name Glycine, *N*-[4-[6-[(acetyloxy)methoxy]-2,7-dichloro-3-oxo-3*H*-xanthen-9-yl]-2-[2-[2-[bis[2-[(acetyloxy)methoxy]-2-oxoethyl]amino]-5-methylphenoxy]ethoxy]phenyl]-*N*-[2-[(acetyloxy)methoxy]-2-oxoethyl]-, (acetyloxy)methyl ester

Other Names Fluo 3 pentaacetoxymethyl ester; Fluo 3AM

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{51}H_{50}Cl_2N_2O_{23}$

Molecular Weight 1129.85

Physical Form Dark red crystals

Solubility Soluble in dimethyl sulfoxide, methanol

Melting Point >250°C

Boiling Point (Calcd.) 1090.9 ± 65.0°C, pressure: 760 Torr

pK_a (Calcd.) 2.03 ± 0.50, most basic, temperature: 25°C

Absorption (λ_{max}) 464 nm

Emission (λ_{max}) Fluorescence is very weak

Synthesis Synthetic methods[1,2]

Staining Applications Calcium ions;[1,2,7–16] cells;[3,4] sperms;[5] neurons[6]

Biological Applications Calcium indicator;[1,2,7–16] detecting leukocyte tumor cells;[17] identifying taste modulators;[18] treating pain[19]

Industrial Applications Light emitting diodes[20]

Safety/Toxicity Cellular toxicity;[21] phototoxicity[20]

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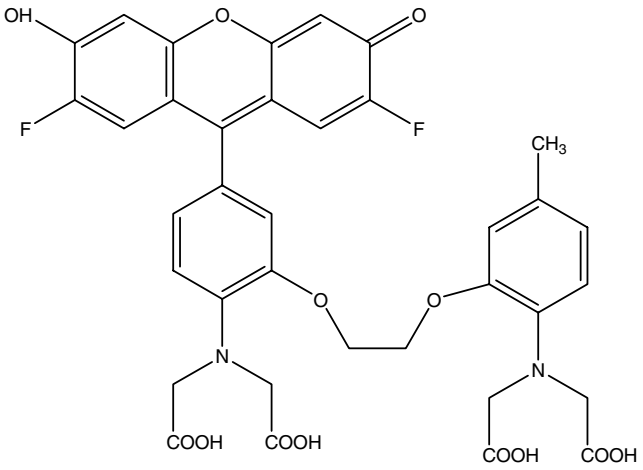
FLUO 4

CAS Registry Number 273221-59-3

Chemical Structure



CA Index Name Glycine, *N*-[2-[2-[2-[bis(carboxymethyl)amino]-5-(2,7-difluoro-6-hydroxy-3-oxo-3*H*-xanthen-9-yl)phenoxy]ethoxy]-4-methylphenyl]-*N*-(carboxymethyl)-

Other Names Fluo 4

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{36}H_{30}F_2N_2O_{13}$

Molecular Weight 736.63

Physical Form Solid

Solubility Soluble in dimethyl sulfoxide

Melting Point >250°C

Boiling Point (Calcd.) 1026.1 ± 65.0°C, pressure: 760 Torr

pK_a (Calcd.) 1.66 ± 0.10, most acidic temperature: 25°C; 6.18 ± 0.50, most basic temperature: 25°C

Absorption (λ_{max}) 494 nm

Emission (λ_{max}) 516 nm

Synthesis Synthetic methods[1,2]

Staining Applications Calcium ions;[1,2,7–14] cells;[3] neurons;[4,5] pancreatic islets[6]

Biological Applications Calcium indicator;[1,2,7–14] identifying taste modulators;[15,16] measuring membrane potential;[17] treating pain[18,19]

Industrial Applications Not reported

Safety/Toxicity No data available

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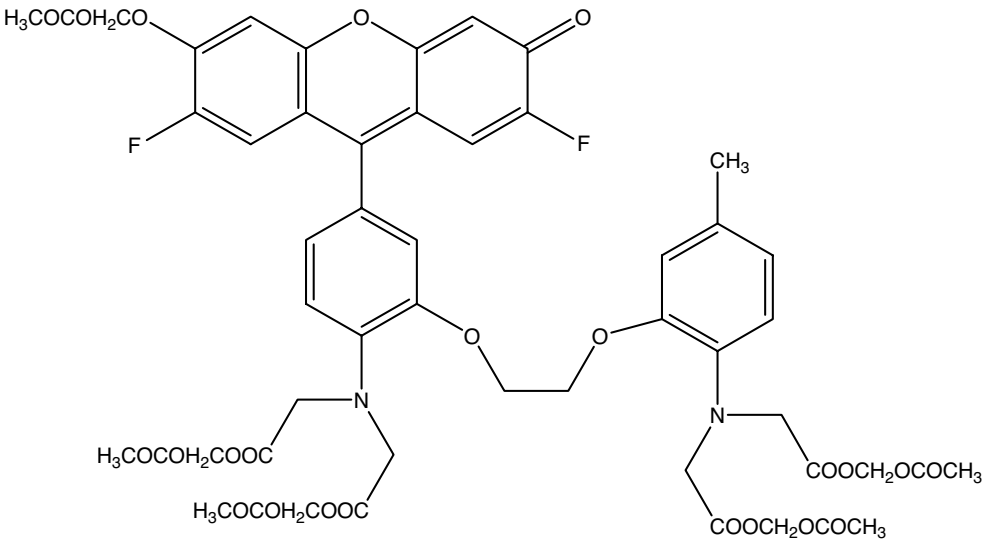
19. Sun, Q. Preparation of heteroaryl substituted benzamides for treating pain. PCT Int. Appl. WO 2005030766, 2005; *Chem. Abstr.* **2005**, *142*, 373565.

FLUO 4 AM

CAS Registry Number 273221-67-3

Chemical Structure



CA Index Name Glycine, *N*-[4-[6-[(acetyloxy)methoxy]-2,7-difluoro-3-oxo-3*H*-xanthen-9-yl]-2-[2-[2-[bis[2-[(acetyloxy)methoxy]-2-oxoethyl]amino]-5-methylphenoxy]ethoxy]phenyl]-*N*-[2-[(acetyloxy)methoxy]-2-oxoethyl]-, (acetyloxy)methyl ester

Other Names Fluo 4AM; Fluo 4AM ester; Fluo 4 acetoxymethyl ester

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{51}H_{50}F_2N_2O_{23}$

Molecular Weight 1096.94

Physical Form Solid

Solubility Soluble in dimethyl sulfoxide, methanol

Melting Point >200°C

Boiling Point (Calcd.) 1063.2 ± 65.0°C, pressure: 760 Torr

pK_a (Calcd.) 2.02 ± 0.50, most basic, temperature: 25°C

Absorption (λ_{max}) 456 nm

Emission (λ_{max}) Fluorescence is very weak

Synthesis Synthetic methods[1,2]

Staining Applications Calcium ions;[1,2,5–8] cells;[3] neurons;[4]

Biological Applications Calcium indicator[1,2,5–8]

Industrial Applications Not reported

Safety/Toxicity Cytotoxicity;[9] hepatotoxicity[9]

REFERENCES

1. Gee, K. R.; Brown, K. A.; Chen, W. N. U.; Bishop-Stewart, J.; Gray, D.; Johnson, I. Chemical and physiological characterization of fluo-4 Ca^{2+}-indicator dyes. *Cell Calcium* **2000**, *27*, 97–106.
2. Kreitzer, A. C.; Gee, K. R.; Archer, E. A.; Regehr, W. G. Monitoring presynaptic calcium dynamics in projection fibers by *in vivo* loading of a novel calcium indicator. *Neuron* **2000**, *27*, 25–32.
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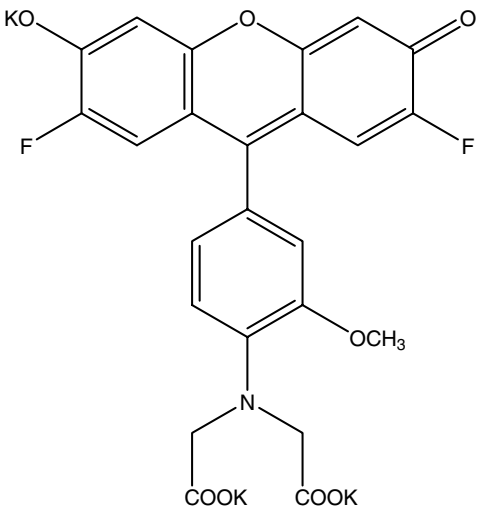
FLUOZIN 1

CAS Registry Number 411209-53-5

Chemical Structure



CA Index Name Glycine, *N*-(carboxymethyl)-*N*-[4-(2,7-difluoro-6-hydroxy-3-oxo-3*H*-xanthen-9-yl)-2-methoxyphenyl]-, tripotassium salt

Other Names FluoZin 1; FluoZin 1 tripotassium salt

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{24}H_{14}F_2K_3NO_8$

Molecular Weight 599.67

Physical Form Solid

Solubility Soluble in water

Melting Point >200°C

Absorption (λ_{max}) 495 nm

Emission (λ_{max}) 517 nm

Synthesis Synthetic method[1]

Staining Applications Zinc ions;[1–4] copper ions[5]

Biological Applications Zinc indicator;[1–4] copper indicator;[5] detecting modulators of ion channels;[6] identifying genes[7]

Industrial Applications Not reported

Safety/Toxicity No data available

REFERENCES

1. Gee, K. R.; Zhou, Z. L.; Ton-That, D.; Sensi, S. L.; Weiss, J. H. Measuring zinc in living cells. A new generation of sensitive and selective fluorescent probes. *Cell Calcium* **2002**, *31*, 245–251.
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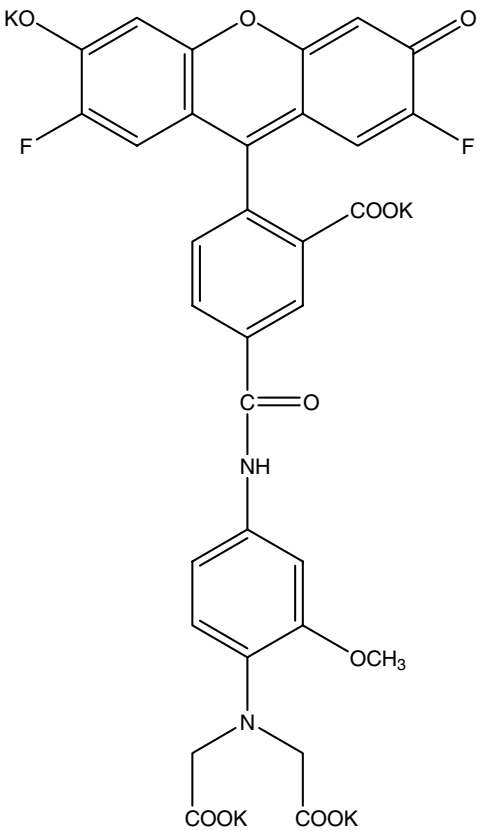
FLUOZIN 2

CAS Registry Number 411209-54-6

Chemical Structure



CA Index Name Glycine, *N*-(carboxymethyl)-*N*-[4-[[(2′,7′-difluoro-3′,6′-dihydroxy-3-oxospiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-5-yl)carbonyl]amino]-2-methoxyphenyl]-, tetrapotassium salt

Other Names FluoZin 2; FluoZin 2 tetrapotassium salt

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{32}H_{18}F_2K_4N_2O_{11}$

Molecular Weight 800.89

Physical Form Solid

Solubility Soluble in water

Melting Point >200°C

Absorption (λ_{max}) 494 nm

Emission (λ_{max}) 522 nm

Synthesis Synthetic method[1]

Staining Applications Zinc ions[1,2]

Biological Applications Zinc indicator;[1,2] detecting modulators of ion channels[3]

Industrial Applications Not reported

Safety/Toxicity No data available

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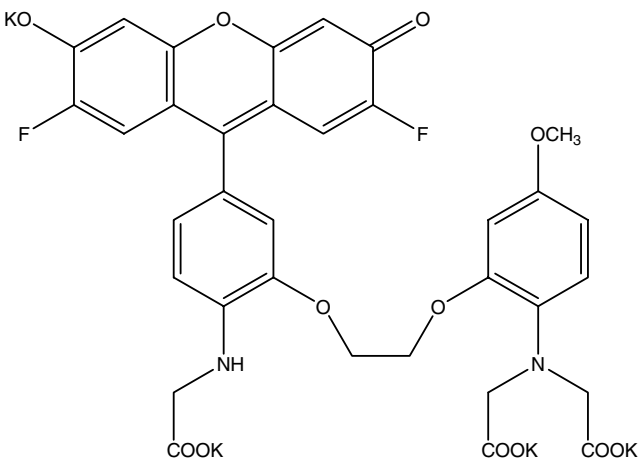
FLUOZIN 3

CAS Registry Number 404335-95-1

Chemical Structure



CA Index Name Glycine, *N*-(carboxymethyl)-*N*-[2-[2-[2-[(carboxymethyl)amino]-5-(2,7-difluoro-6-hydroxy-3-oxo-3*H*-xanthen-9-yl)phenoxy]ethoxy]-4-methoxyphenyl]-, potassium salt (1:4)

Other Names Glycine, *N*-(carboxymethyl)-*N*-[2-[2-[2-[(carboxymethyl)amino]-5-(2,7-difluoro-6-hydroxy-3-oxo-3*H*-xanthen-9-yl)phenoxy]ethoxy]-4-methoxyphenyl]-, tetrapotassium salt; FluoZin 3

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{34}H_{24}F_2K_4N_2O_{12}$

Molecular Weight 846.96

Physical Form Solid

Solubility Soluble in water

Melting Point >200°C

Absorption (λ_{max}) 494 nm

Emission (λ_{max}) 516 nm

Synthesis Synthetic method[1]

Staining Applications Zinc;[1–15] chromium;[3] manganese;[3] iron;[3] cobalt;[3] copper;[3] nickel;[3] cadmium ions[3]

Biological Applications Zinc indicator[1–15]

Industrial Applications Not reported

Safety/Toxicity No data available

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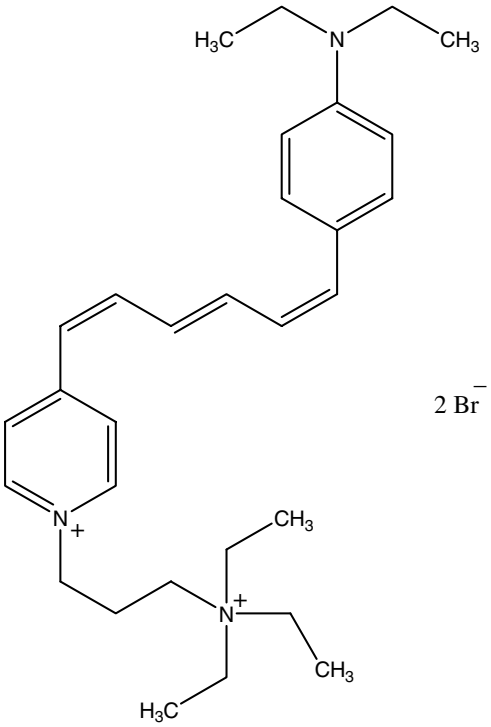
FM 4-64

CAS Registry Number 162112-35-8

Chemical Structure



CA Index Name Pyridinium, 4-[6-[4-(diethylamino) phenyl]-1,3,5-hexatrien-1-yl]-1-[3-(triethylammonio) propyl]-, bromide (1:2)

Other Names Pyridinium, 4-[6-[4-(diethylamino)phenyl]-1,3,5-hexatrienyl]-1-[3-(triethylammonio)propyl]-, dibromide; FM 4-64; SynaptoRed C2; *N*-(3-Triethylammoniopropyl)-4-(6-(4-(diethylamino)phenyl)hexatrienyl) pyridinium dibromide

Merck Index Number Not listed

Chemical/Dye Class Styryl

Molecular Formula $C_{30}H_{45}Br_2N_3$

Molecular Weight 607.51

Physical Form Dark purple powder

Solubility Soluble in water, dimethyl sulfoxide, methanol

Melting Point >200°C

Absorption (λ_{max}) 505 nm

Emission (λ_{max}) 725 nm

Synthesis Synthetic method[1]

Staining Applications Vacuolar membrane;[2,3] plasma membrane;[8,20] bacterial membrane;[4,5] lipid membrane;[6,7] plasma membrane-bound flavoproteins;[8,20]nuclear envelope (NE);[9] synaptic vesicles;[10] secretory vesicles;[11] lactotroph vesicles;[12] synaptic terminals;[13] neurons;[14,15] endocytosis;[2,23–26] exocytosis;[27]smooth-muscle-associated airway receptors (SMARs) in lungs;[16] embryos[17]

Biological Applications Detecting FRET in cells;[18] monitoring fast neuronal activity and signaling;[19] quantifying plasma membrane expression;[20] cytotoxicity assay;[21] membrane fusion assay;[22] probe for endocytosis;[23–26] probe for exocytosis[27]

Industrial Applications Not reported

Safety/Toxicity No data available

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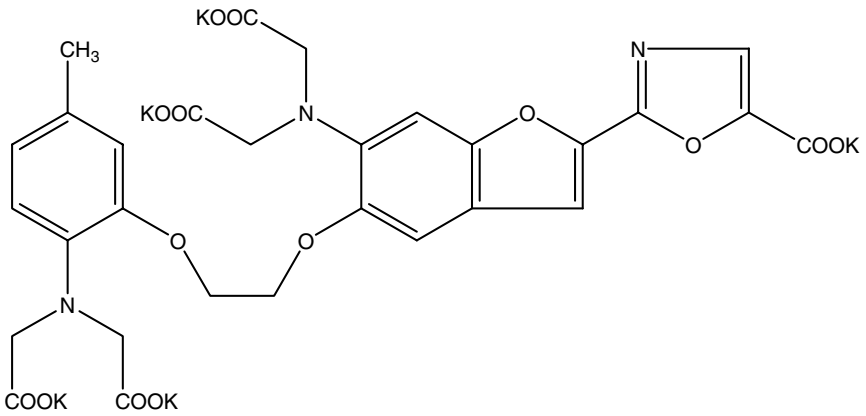
FURA 2

CAS Registry Number 113694-64-7

Chemical Structure



CA Index Name 5-Oxazolecarboxylic acid, 2-[6-[bis (carboxymethyl)amino]-5-[2-[2-[bis(carboxymethyl) amino]-5-methylphenoxy]ethoxy]-2-benzofuranyl]-, potassium salt (1:5)

Other Names 5-Oxazolecarboxylic acid, 2-[6-[bis(carboxymethyl)amino]-5-[2-[2-[bis(carboxymethyl)amino]-5-methylphenoxy]ethoxy]-2-benzofuranyl]-, pentapotassium salt; Fura 2; Fura 2 pentapotassium salt

Merck Index Number Not listed; 4293 for Free Acid

Chemical/Dye Class Benzofuran

Molecular Formula $C_{29}H_{22}K_5N_3O_{14}$

Molecular Weight 831.99

Physical Form Yellow powder

Solubility Soluble in water

Melting Point >250°C

Absorption (λ_{max}) 363 nm; 335 nm

Emission (λ_{max}) 512 nm; 505 nm

Synthesis Synthetic methods[1,2]

Staining Applications Calcium ions;[4,5,8–15] zinc ions;[6,16–18] cells;[3] neurons;[4–6] peptides;[7] proteins;[7] antibodies[7]

Biological Applications Calcium indicator;[4,5,8–15] zinc indicator;[6,16–18] identifying taste modulators;[19,20] measuring membrane potential;[21] treating epilepsy;[22] neurological disorders[23]

Industrial Applications Not reported

Safety/Toxicity No data available

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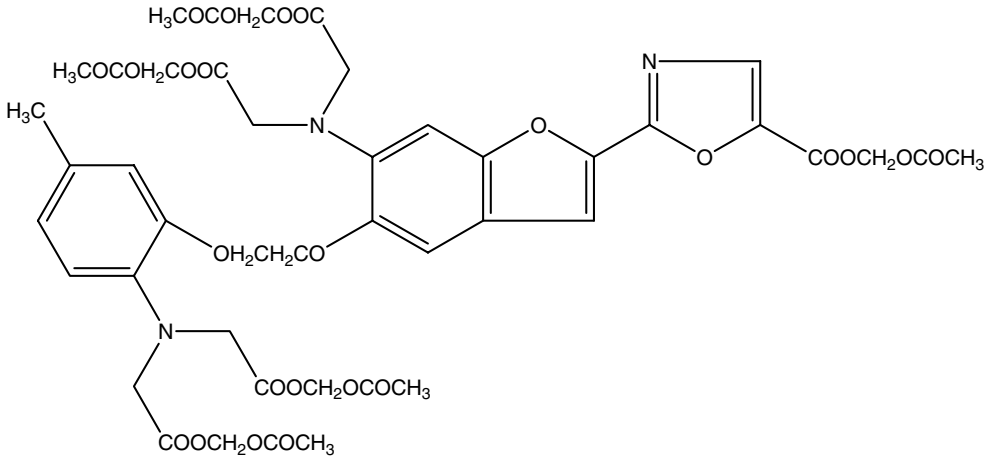
FURA 2 AM

CAS Registry Number 108964-32-5

Chemical Structure



CA Index Name 5-Oxazolecarboxylic acid, 2-[6-[bis [2-[(acetyloxy)methoxy]-2-oxoethyl]amino]-5-[2-[2-[bis [2-[(acetyloxy)methoxy]-2-oxoethyl]amino]-5-methyl-phenoxy]ethoxy]-2-benzofuranyl]-, (acetyloxy)methyl ester

Other Names Fura 2 acetoxymethyl ester; Fura 2AM; Fura 2 AM ester

Merck Index Number Not listed

Chemical/Dye Class Benzofuran

Molecular Formula $C_{44}H_{47}N_3O_{24}$

Molecular Weight 1001.85

Physical Form Yellow powder

Solubility Insoluble in water; soluble in dimethyl sulfoxide, ethyl acetate

Melting Point >250°C

Boiling Point (Calcd.) 975.9 ± 75.0°C, pressure: 760 Torr

pK_a (Calcd.) 1.91 ± 0.50, most basic, temperature: 25°C

Absorption (λ_{max}) 370 nm

Emission (λ_{max}) 476 nm

Synthesis Synthetic method[1]

Staining Applications Calcium ions;[7–15] cells;[2,3] leukocyte tumor cells;[4] neurons;[5,6] sperms[7]

Biological Applications Calcium indicator;[7–15] monitoring membrane potential;[16] treating ischemia[17]

Industrial Applications Not reported

Safety/Toxicity No data available

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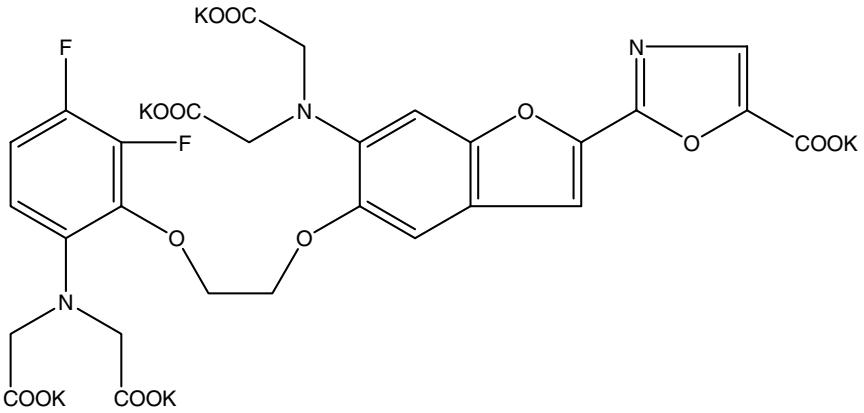
FURA 2FF

CAS Registry Number 192140-58-2

Chemical Structure



CA Index Name 5-Oxazolecarboxylic acid, 2-[6-[bis (carboxymethyl)amino]-5-[2-[6-[bis(carboxymethyl) amino]-2,3-difluorophenoxy]ethoxy]-2-benzofuranyl]-, potassium salt (1:5)

Other Names 5-Oxazolecarboxylic acid, 2-[6-[bis(carboxymethyl)amino]-5-[2-[6-[bis(carboxymethyl)amino]-2,3-difluorophenoxy]ethoxy]-2-benzofuranyl]-, pentapotassium salt; Fura 2FF; Fura FF pentapotassium salt

Merck Index Number Not listed

Chemical/Dye Class Benzofuran

Molecular Formula $C_{28}H_{18}F_2K_5N_3O_{14}$

Molecular Weight 853.94

Physical Form Solid

Solubility Soluble in water

Melting Point >250°C

Absorption (λ_{max}) 364 nm, 335 nm

Emission (λ_{max}) 510 nm, 506 nm

Synthesis Synthetic methods[1,2]

Staining Applications Calcium ions;[2,4–9] proteins[1,3]

Biological Applications Calcium indicator;[2,4–9] treating pain[9]

Industrial Applications Not reported

Safety/Toxicity No data available

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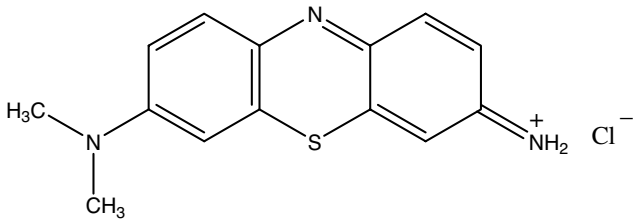
GIEMSA STAIN

CAS Registry Number 51811-82-6

Chemical Structure



CA Index Name Giemsa's stain

Other Names Azure Mixture sicc.; 3-(Dimethylamino)-7-aminophenothiazin-5-ium chloride; Giemsa; Giemsa stain

Merck Index Number Not listed

Chemical/Dye Class Phenothiazine

Molecular Formula $C_{14}H_{14}ClN_3S$

Molecular Weight 291.80

Physical Form Dark green to black crystals or powder

Solubility Soluble in water; ethanol, methanol

Melting Point 300 °C

Absorption (λ_{max}) 521 nm, 648 nm

Synthesis Synthetic methods[1–6]

Staining Applications Blood smears;[1–8] bone marrow cells;[9,10] adrenaline- and noradrenaline-containing cells;[11] cancer cells;[12] cells;[13–15] chromosomes;[16–22] DNA;[23–25] embryos;[26] germ cells;[27] lipids;[28] nucleus;[29] nucleous;[30] oral lesions;[31] oral mucosa;[32] parasites;[1–6,8,33–35] sperms;[36] spinal fluid;[37] tissues[38]

Biological Applications Diagnosis of fetal aneuploidies,[39] cancer cells,[12] herpes simplex virus-1 keratitis,[40] malaria,[1–6,8,33–35] spermatogenesis disorders;[27] detection of INK4 gene and cell proliferation markers,[41] lymphocyte subgroups,[42] eperythrozoon,[43] mouse bone marrow micronucleus;[44] treating gastritis,[45] lupus,[9] microorganisms in the oral cavity,[46,47] pathogens[48]

Industrial Applications Not reported

Safety/Toxicity Genotoxicity;[49] immunotoxicity[50,51]

Certification/Approval Certified by Biological Stain Commission (BSC)

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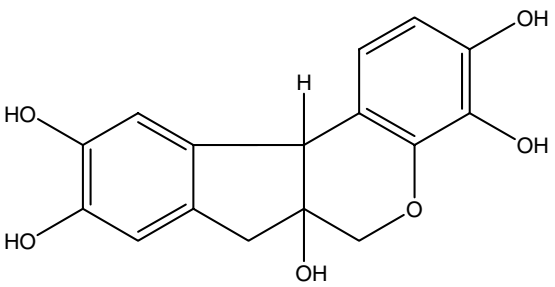
HEMATOXYLIN

CAS Registry Number 517-28-2

Chemical Structure



CA Index Name Benz[*b*]indeno[1,2-*d*]pyran-3,4,6a,9,10(6*H*)-pentol, 7,11b-dihydro, (6aS,11bR)-

Other Names *cis*-(+)-7,11b-Dihydrobenz[*b*]indeno[1,2-*d*]pyran-3,4,6a,9,10(6*H*)-pentol; Benz[*b*]indeno[1,2-*d*]pyran-3,4,6a,9,10(6*H*)-pentol, 7,11b-dihydro; Benz[*b*]indeno[1,2-*d*]pyran-3,4,6a,9,10(6*H*)-pentol, C.I. 75290; C.I. Natural Black 1; 7,11b-Dihydro, (6aS-*cis*)-; Hematoxiline; (+)-Hematoxylin; Haematoxylin; Hematoxylin; Hematoxyline; Hydroxybrasilin; Hydroxybrazilin; NSC 270085

Merck Index Number 4637

Chemical/Dye Class Flavone

Molecular Formula $C_{16}H_{14}O_6$

Molecular Weight 302.28

Physical Form White to yellowish crystals turns red on exposure to light

Solubility Soluble in water, ethanol, ethylene glycol, methyl cellosolve

Melting Point 140°C; 200°C (decompose)

Boiling Point (Calcd.) 579.9 ± 50.0°C, pressure: 760 Torr

pH Range 0.0–1.0; 5.0–6.0

Color Change at pH Red (0.0) to yellow (1.0); pale yellow (5.0) to violet (6.0)

Absorption (λ_{max}) 292 nm

Synthesis Synthetic methods[1–17]

Staining Applications Aluminum;[34] antigen;[1,18] blood smears;[19] cells;[20,21] collagen;[22] epithelial cells;[23] eye lens;[24] fish;[25] genes;[32] gluten structure;[26] horny cells;[27] lipid;[26,28] liver tissues;[29] malignant melanoma;[30] myocardial biopsies;[31] neurons;[32] nucleic acids;[32] nucleus;[33] oil droplets;[26] proteins;[26,35] starch granules;[26] tissues;[36] hairs;[1,37,38] keratin fibers[39]

Biological Applications Detecting breast cancer,[1,40] collagen,[1,41] genes,[1,42] microorganism;[43] treating age-related macular degeneration,[1,44] burns,[1,45] cancer,[1,46] diabetes,[1,47] obesity,[1,47] gastroesophageal reflux disease,[48] peripheral neural and vascular ailments,[1,49] prostate cancers,[1,50] skin disorders,[1,51] viral diseases[1,52]

Industrial Applications Plasma display panel;[1,53] textiles[1,54]

Safety/Toxicity Carcinogenicity;[1,55,56] cytotoxicity;[57] genotoxicity;[1,58] mutagenicity;[1,59] neurotoxicity;[1,60,61] pulmonary toxicity[62]

Certification/Approval Certified by Biological Stain Commission (BSC)

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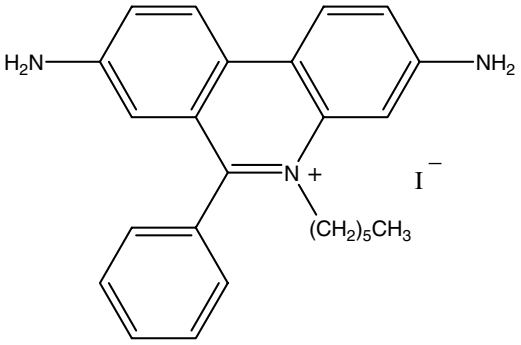
HEXIDIUM IODIDE

CAS Registry Number 211566-66-4

Chemical Structure



CA Index Name Phenanthridinium, 3,8-diamino-5-hexyl-6-phenyl-, iodide (1:1)

Other Names Phenanthridinium, 3,8-diamino-5-hexyl-6-phenyl-, iodide; Hexidium iodide

Merck Index Number Not listed

Chemical/Dye Class Phenanthridine

Molecular Formula $C_{25}H_{28}IN_3$

Molecular Weight 497.42

Physical Form Solid

Solubility Soluble in dimethyl sulfoxide, water

Melting Point >250 °C

Absorption (λ_{max}) 518 nm. 482 nm

Emission (λ_{max}) 600 nm, 625 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[2–4] bacteria;[5,6] fungi;[7] microorganisms;[8] nuclei[9]

Biological Applications Detecting nucleic acids;[3] microbes;[10] molds;[11] nucleic acid binding proteins;[12] polynucleotides;[13] pRB in single cells;[14] carrying out polymerase chain reaction (PCR);[15] measuring membrane potential[16]

Industrial Applications Not reported

Safety/Toxicity No data available

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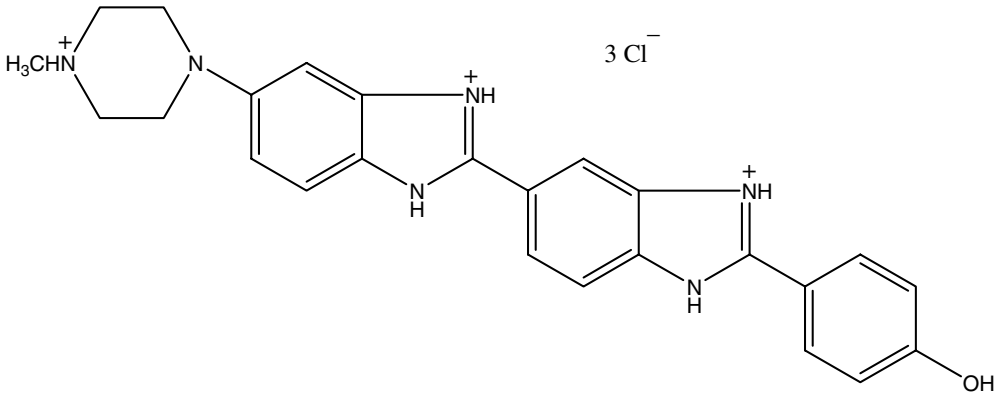
HOECHST 33258

CAS Registry Number 23491-45-4

Chemical Structure



Molecular Formula $C_{25}H_{27}Cl_3N_6O$

Molecular Weight 533.88

Physical Form Dark yellow to tan powder with green cast

CA Index Name Phenol, 4-[5-(4-methyl-1-piperazinyl) [2,5′-bi-1*H*-benzimidazol]-2′-yl]-, hydrochloride (1:3)

Other Names Phenol, 4-[5-(4-methyl-1-piperazinyl) [2,5′-bi-1*H*-benzimidazol]-2′-yl]-, trihydrochloride; Phenol, *p*-[5-[5-(4-methyl-1-piperazinyl)-2-benzimidazolyl]-2-benzimidazolyl]-, trihydrochloride; 2′-(4-Hydroxyphenyl)-5-(4-methyl-1-piperazinyl)-2,5′-bi-1*H*-benzimidazole; 2-[2-(4-Hydroxyphenyl)-6-benzimidazolyl]-6-(1-methyl-4-piperazinyl)benzimidazole trihydrochloride; 2-[2-(4-Hydroxyphenyl)-6-benzimidazolyl]-6-(1-methyl-4-piperazyl)-benzimidazole trihydrochloride; 2-[2-(4-Hydroxyphenyl)-6-benzimidazolyl]-6-(1-methyl-4-piperazyl)benzimidazole trichloride; 2-[2-(4-Hydroxyphenyl)-6-benzimidazolyl]-6-(1-methyl-4-piperazyl)benzimidazole-3HCl; 4-[5-[5-(4-Methyl-1-piperazinyl)-2-benzimidazolyl]-2-benzimidazolyl]phenol trihydrochloride; Bisbenzimide; Bisbenzimide (quenchant); Bisbenzimide trihydrochloride; H 33258; HOE 33258; Ho 33258; Hoechst 33258

Merck Index Number Not listed

Chemical/Dye Class Benzimidazole

Solubility Soluble in water, *N*,*N*-dimethyl formamide

Melting Point >300 °C

Absorption (λ_{max}) 352 nm, 343 nm

Emission (λ_{max}) 461 nm

Synthesis Synthetic methods[1–16]

Staining Applications Nucleic acids;[17–23] cells;[24] embryos;[25] microorganisms;[26] nuclei;[27] sperms[28,29]

Biological Applications Nucleic acid hybridization;[30] detecting nucleic acids,[17–23,31,32] cancer cells,[33] spores,[33] hepatitis C virus,[34] human papilloma virus (HPV),[35] single nucleotide polymorphism (SNP),[36] stress biomarkers;[37] nucleic acid amplification;[38] nucleic acid quantification;[39] nucleic acid sequencing;[40] treating of cancer,[41,42] allergy,[42] autoimmune disease,[42] neoplasia,[43] sexually transmitted diseases[44]

Industrial Applications Not reported

Safety/Toxicity Carcinogenicity;[45] cytotoxicity;[46] DNA damage;[47,48] genotoxicity;[49] neurotoxicity;[50] oral toxicity;[51,52] radiotoxicity;[53] retinal toxicity[54]

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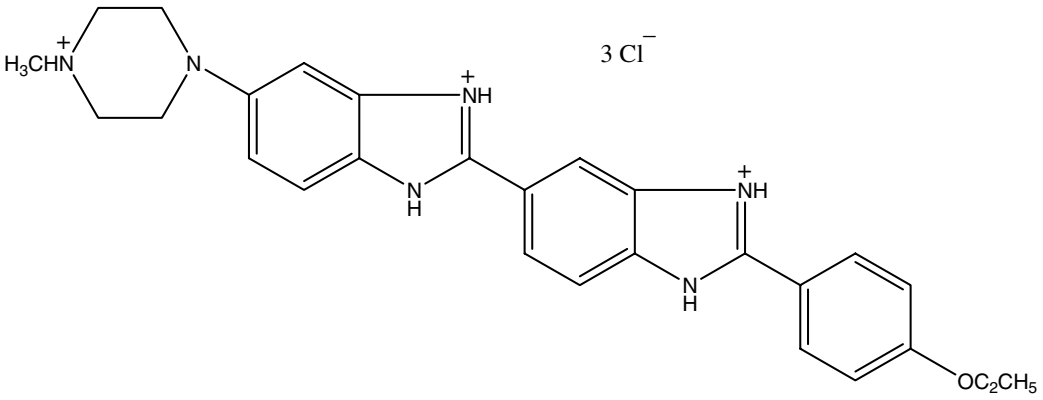
HOECHST 33342

CAS Registry Number 23491-52-3

Chemical Structure



CA Index Name 2,5′-Bi-1*H*-benzimidazole, 2′-(4-ethoxyphenyl)-5-(4-methyl-1-piperazinyl)-,hydrochloride (1:3)

Other Names 2,5′-Bibenzimidazole, 2′-(*p*-ethoxyphenyl)-5-(4-methyl-1-piperazinyl)-; 2′-(4-Ethoxyphenyl)-5-(4-methyl-1-piperazinyl)-2,5′-bi-1*H*-benzimidazole; 2-[2-(4-Ethoxyphenyl)-6-benzimidazolyl]-6-(1-methyl-4-piperazinyl)benzimidazole; Bisbenzimide; HOE 33342; Ho 342; Hoechst 33342; NSC 334072

Merck Index Number Not listed

Chemical/Dye Class Benzimidazole

Molecular Formula $C_{27}H_{31}Cl_3N_6O$

Molecular Weight 561.93

Physical Form Yellow to green powder

Solubility Soluble in water, *N*,*N*-dimethyl formamide

Melting Point >300 °C

Boiling Point (Calcd.) 725.9 ± 70.0 °C, pressure: 760 Torr

pK_a (Calcd.) 11.08 ± 0.69, most acidic, temperature: 25 °C; 7.66 ± 0.42, most basic, temperature: 25 °C

Absorption (λ_{max}) 350 nm

Emission (λ_{max}) 461 nm

Synthesis Synthetic methods[1–7]

Staining Applications Nucleic acids;[7–10] cells;[11,12] neurons;[13] endothelial cells;[13] inflammatory cells;[13] cancer stem cells;[11,14] animal mammary gland stem cells;[15] hematopoietic stem cells;[16–18] hepatocytes stem cells;[19] human tumor cell;[20] SV40 human corneal epithelial cell;[21] microorganisms;[22] nuclei;[23,24] parasites;[25] chromosomes;[26] sperms[27]

Biological Applications Detecting abnormal gametes,[27] apoptosis,[28] human papilloma virus (HPV),[29] single nucleotide polymorphism (SNP),[30] mitochondrial membrane potential change,[31] polynucleotides,[32] proteins,[33] peptides;[33] nucleic acid amplification;[34] nucleic acid quantification;[35] nucleic acid sequencing;[36] treating of cancer,[37,38] Alzheimers disease,[38] multiple sclerosis,[38] epilepsy[39]

Industrial Applications Not reported

Safety/Toxicity Carcinogenicity;[40,41] cytotoxicity;[42–44] DNA damage;[41,43,44] genotoxicity;[45,46] metabolic toxicity;[47] mutagenicity;[44] neurotoxicity;[48–50] radiotoxicity;[51] reproductive toxicity[52,53]

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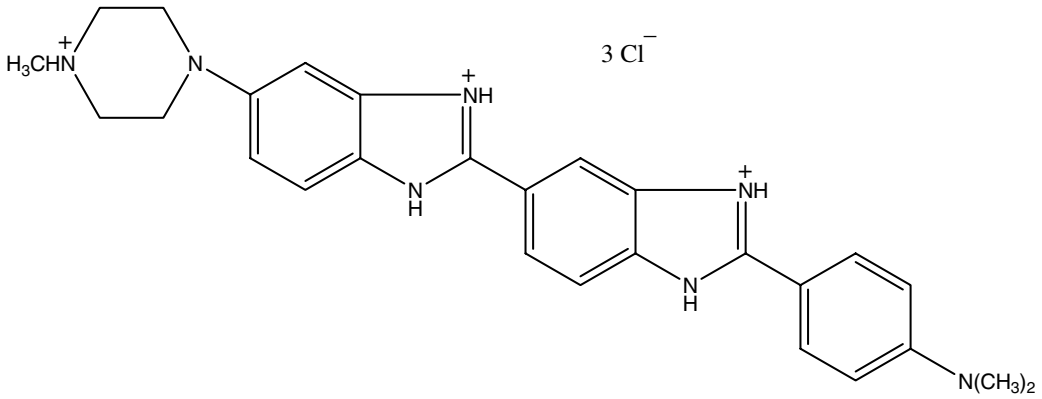
HOECHST 34580

CAS Registry Number 23555-00-2

Chemical Structure



CA Index Name Benzenamine, *N*,*N*-dimethyl-4-[5-(4-methyl-1-piperazinyl)[2,5′-bi-1*H*-benzimidazol]-2′-yl]-, hydrochloride (1:3)

Other Names 2,5′-Bibenzimidazole, 2′-[*p*-(dimethylamino)phenyl]-5-(4-methyl-1-piperazinyl)-; HOE 34580; Hoechst 34580; Proamine

Merck Index Number Not listed

Chemical/Dye Class Benzimidazole

Molecular Formula $C_{27}H_{32}Cl_3N_7$

Molecular Weight 560.96

Physical Form Yellow to green powder

Solubility Soluble in dimethyl sulfoxide, water

Melting Point >300°C

Boiling Point (Calcd.) 733.2 ± 70.0°C, pressure: 760 Torr

pK_a (Calcd.) 12.46 ± 0.69, most acidic, temperature: 25 °C; 7.66 ± 0.42, most basic, temperature: 25 °C

Absorption (λ_{max}) 392 nm

Emission (λ_{max}) 440 nm

Synthesis Synthetic methods[1–5]

Staining Applications Nucleic acids;[3,6–8] cells;[9] granules[8]

Biological Applications Detecting malaria infected red blood cells,[10] polynucleotides;[11] nucleic acid amplification;[12] nucleic acid sequencing[13]

Industrial Applications Not reported

Safety/Toxicity No data available

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Pat. Appl. Publ. US 2004185447, 2004; *Chem. Abstr.* **2004**, *141*, 291842.

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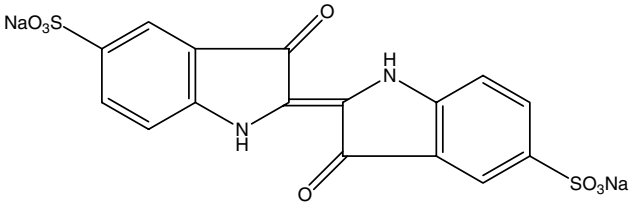
INDIGO CARMINE

CAS Registry Number 860-22-0

Chemical Structure



CA Index Name 1*H*-Indole-5-sulfonic acid, 2-(1,3-dihydro-3-oxo-5-sulfo-2*H*-indol-2-ylidene)-2,3-dihydro-3-oxo-, sodium salt

Other Names 1*H*-Indole-5-sulfonic acid, 2-(1,3-dihydro-3-oxo-5-sulfo-2*H*-indol-2-ylidene)-2,3-dihydro-3-oxo-, disodium salt; C.I. Acid Blue 74; [Δ2,2′-Biindoline]-5,5′-disulfonic acid, 3,3′-dioxo-, disodium salt; 12070 Blue; 1311 Blue; 5,5′-Indigodisulfonic acid disodium salt; A.F. Blue No. 2; Acid Blue 74; Acid Blue W; Acid Leather Blue IC; Airedale Blue IN; Amacid Brilliant Blue; Aniline Carmine Powder; Ariavit Indigo Carmine; Atul Indigo Carmine; Basovit Blue 665E; Blue 2; Bucacid Indigotine B; C.I. 73015; C.I. 75781; C.I. Food Blue 1; C.I. Natural Blue 2; Canacert Indigo Carmine; Carmine Blue; Cilefa Blue R; Cogilor Blue 511.11; Disodium 5,5′-indigodisulfonate; Disodium 5,5′-indigotin disulfonate; Dolkwal Indigo Carmine; E 132; Edicol Supra Blue X; Eurocert Indigo Carmine 311811; FD & C Blue 2; FD & C Blue No. 2-307045; FD and C Blue 2; FD and C Blue No. 2; FD&C Blue No. 2; FD&C Blue No. 2-37006; Food Blue 1; Food Blue 2; Food Blue No. 1; Food Blue No. 2; Grape Blue A; HD Indigo Carmine; HD Indigo Carmine Supra; Hexacert Blue No. 2; Hexacol Indigo Carmine Supra; Indigo Carmine 307019; Indigo Carmine 36009; Indigo Carmine 37006; Indigo Carmine A; Indigo Carmine AC; Indigo Carmine BP; Indigo Carmine Conc. FQ; Indigo Carmine Powder; Indigo Carmine X; Indigo Extract; Indigo carmine; Indigo carmine NB; Indigotin; Indigotin (solubilized); Indigotine; Indigotine B; Indigotine Blue LZ; Indigotine Carmine; Indigotine Extra Pure A; Indigotine I; Indigotine IA; Indigotine Lake; Indigotine N; Indigotine disodium salt; Indocarmine F; Intense Blue; Japan Blue 2; Japan Food Blue No. 2; L Blue 5010; Maple Indigo Carmine; Mitsui Indigo Carmine; Necol Indigo Carmine; Neelicol Indigo Carmine; San-ei Indigo Carmine; Sepisperse Dry 1003; Sodium 5,5′-indigodisulfonate; Sodium 5,5′-indigotindisulfonate; Soluble indigo; Soluble indigo blue; Sumitomo Wool Blue SBC; Usacert Blue No. 2; Usacert FD & C Blue No. 2-310118; Usacert FD and C Blue No. 2; WAS 35; Water Blue 177557; Water Blue 177558

Merck Index Number 4944

Chemical/Dye Class Indole

Molecular Formula $C_{16}H_8N_2Na_2O_8S_2$

Molecular Weight 466.35

Physical Form Dark blue-purple powder, sensitive to light

Solubility Soluble in water; slightly soluble in ethanol

Melting Point >250 °C

pH Range 11.5–14.0

Color Change at pH Blue (11.5) to yellow (14.0)

Absorption (λ_{max}) 608 nm

Synthesis Synthetic methods[1–23]

Staining Applications Cells;[24,25] beverages;[26–28] chewing gum;[29] candies;[30] drinks;[30] frozen products;[31] sweetener;[32] tablets;[33,34] dosage form;[35] sunscreen;[36] skin;[37] hairs[1,38–40]

Biological Applications Detecting microorganisms;[41] treating amyloidosis,[42] testicular cancer;[43] medical devices;[44] drug delivery system[45]

Industrial Applications Color filters;[46] display devices;[1,47] inks;[1,48,49] toners;[50] lithographic printing plates;[51,52] paints;[53] photographic material;[1,54] colored bubbles;[1,55] toys[56]

Safety/Toxicity Acute toxicity;[57] carcinogenicity;[1,58,59,61] chromosome aberrations;[60] chronic toxicity;[61] cytotoxicity;[1,62] genotoxicity;[1,63] hypertension;[1,64] hypotension;[1,65] mutagenicity;[1,66,68] nucleic acid damage[66,67]

Certification/Approval Certified by Biological Stain Commission (BSC); Approved by Food & Drugs Administration (FDA)

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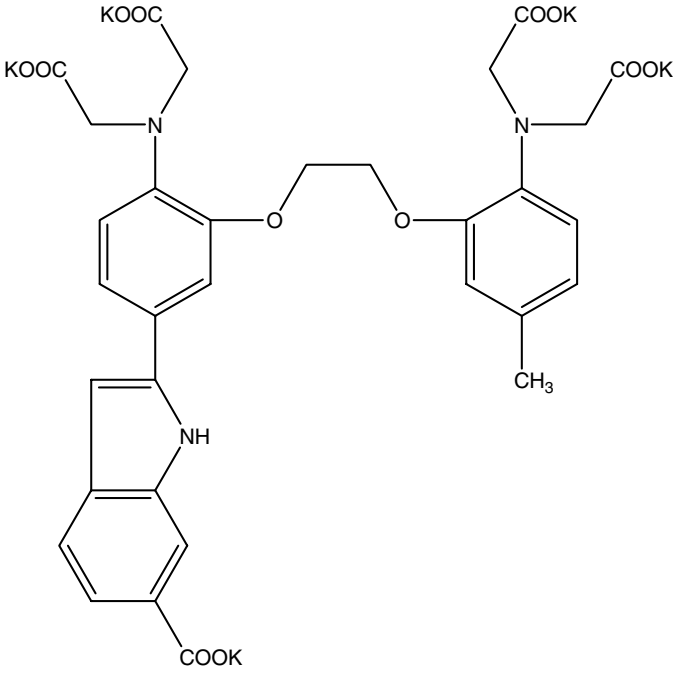
INDO 1

CAS Registry Number 132319-56-3

Chemical Structure



CA Index Name 1*H*-Indole-6-carboxylic acid, 2-[4-[bis(carboxymethyl)amino]-3-[2-[2-[bis(carboxymethyl) amino]-5-methylphenoxy]ethoxy]phenyl]-, potassium salt (1 : 5)

Other Names 1*H*-Indole-6-carboxylic acid, 2-[4-[bis (carboxymethyl)amino]-3-[2-[2-[bis(carboxymethyl) amino]-5-methylphenoxy]ethoxy]phenyl]-, pentapotassium salt

Merck Index Number Not listed (Free acid: 4960)

Chemical/Dye Class Indole

Molecular Formula $C_{32}H_{26}K_5N_3O_{12}$

Molecular Weight 840.05

Physical Form Light grey crystals

Solubility Soluble in water

Melting Point >250 °C

Absorption (λ_{max}) 346 nm, 330 nm

Emission (λ_{max}) 475 nm, 401 nm

Synthesis Synthetic methods[1–3]

Staining Applications Calcium ions;[2–11] cadmium ions;[12] lead ions;[13] zinc ions;[14] peptides;[1] proteins;[1] antibodies[1]

Biological Applications Calcium indicator;[2–11] cadmium indicator;[12] lead indicator;[13] zinc indicator;[14] identifying taste modulators;[15] measuring membrane potential;[16] nucleic acid sequencing;[17] preventing arrhythmias[18]

Industrial Applications Not reported

Safety/Toxicity Neurotoxicity[19,20]

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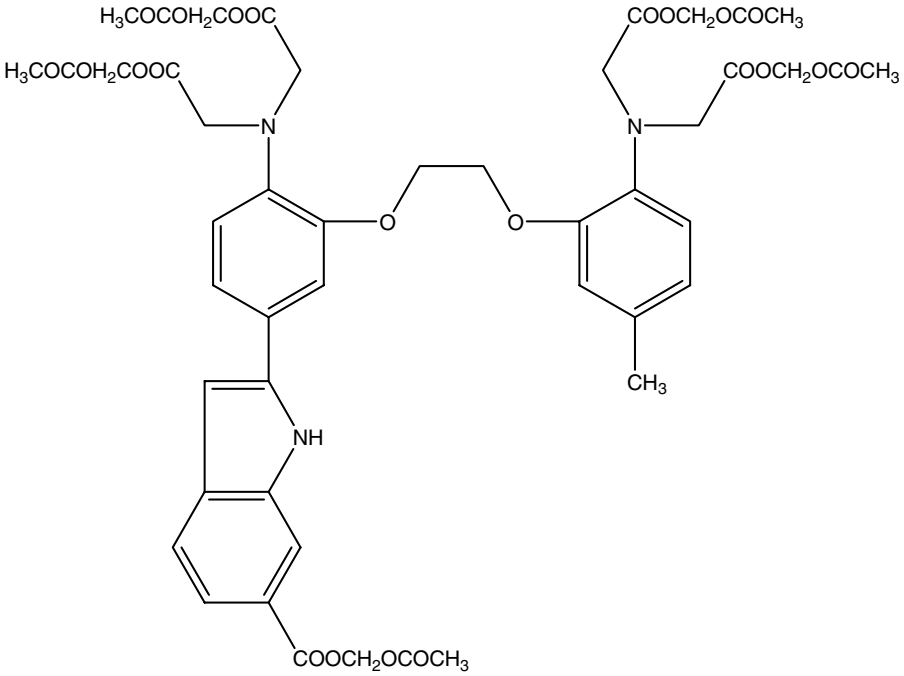
INDO 1 AM

CAS Registry Number 112926-02-0

Chemical Structure



CA Index Name 1*H*-Indole-6-carboxylic acid, 2-[4-[bis[2-[(acetyloxy)methoxy]-2-oxoethyl]amino]-3-[2-[2-[bis[2-[(acetyloxy)methoxy]-2-oxoethyl]amino]-5-methylphenoxy]ethoxy]phenyl]-, (acetyloxy)methyl ester

Other Names Indo 1 acetoxymethyl ester; Indo 1 AM; Indo 1 AM ester

Merck Index Number Not listed

Chemical/Dye Class Indole

Molecular Formula $C_{47}H_{51}N_3O_{22}$

Molecular Weight 1009.91

Physical Form Light yellow powder

Solubility Soluble in dimethyl sulfoxide, methanol

Melting Point >250 °C

Boiling Point (Calcd.) 1009.2 ± 65.0 °C, pressure: 760 Torr

pK_a (Calcd.) 14.85 ± 0.30, most acidic temperature: 25 °C; 1.92 ± 0.50, most basic temperature: 25 °C

Absorption (λ_{max}) 356 nm

Emission (λ_{max}) 478 nm

Synthesis Synthetic methods[1,2]

Staining Applications Calcium ions;[2,4–11] leukocyte tumor cells[3]

Biological Applications Calcium indicator;[2,4–11] preventing arrhythmias[12]

Industrial Applications Not reported

Safety/Toxicity Cytotoxicity[13]

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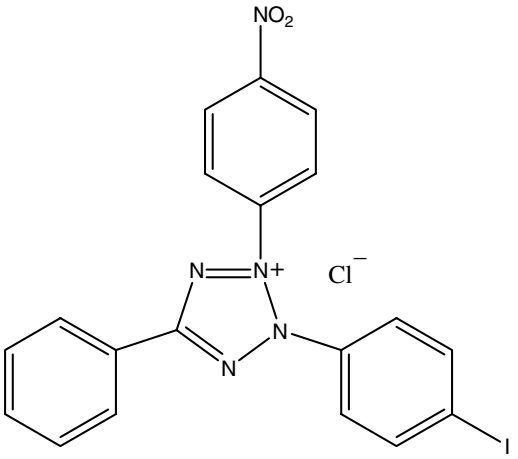
IODONITRO TETRAZOLIUM (INT)

CAS Registry Number 146-68-9

Chemical Structure



CA Index Name 2*H*-Tetrazolium, 2-(4-iodophenyl)-3-(4-nitrophenyl)-5-phenyl-, chloride (1 : 1)

Other Names 2*H*-Tetrazolium, 2-(4-iodophenyl)-3-(4-nitrophenyl)-5-phenyl-, chloride; 2*H*-Tetrazolium, 2-(*p*-iodophenyl)-3-(*p*-nitrophenyl)-5-phenyl-, chloride; [2-(*p*-Iodophenyl)-3-(*p*-nitrophenyl)-5-phenyl-2*H*-tetrazolium chloride]; 2-(4-Iodophenyl)-3-(4-nitrophenyl)-5-phenyl-2*H*-tetrazolium chloride; 2-(4-Iodophenyl)-3-(4-nitrophenyl)-5-phenyltetrazolium chloride; 2-(*p*-Iodophenyl)-3-(*p*-nitrophenyl)-5-phenyltetrazolium chloride; 3-(*p*-Nitrophenyl)-2-(*p*-iodophenyl)-5-phenyltetrazolium chloride; INT; Iodonitro tetrazolium; Iodonitrotetrazolium purple; Iodonitrotetrazolium violet; NSC 27620; *p*-Iodonitrotetrazolium violet

Merck Index Number Not listed

Chemical/Dye Class Tetrazolium salt

Molecular Formula $C_{19}H_{13}ClIN_5O_2$

Molecular Weight 505.70

Physical Form Light yellow powder

Solubility Soluble in water, ethanol, dimethyl sulfoxide

Melting Point 229–231 °C (decompose)

Absorption (λ_{max}) 248 nm

Synthesis Synthetic methods[1–7]

Staining Applications Cells;[8] oxidized nicotinamide adenine dinucleotide kinase;[9] sperms[10]

Biological Applications Bacterial vaginosis diagnosis assay;[11] dehydrogenase enzyme assay;[12–14] diagnostic assay;[15] food and beverage analytes assays;[16] microbial growth assay;[17] detecting bacteria,[18] yeast,[18] fungi,[18] gamma-hydroxybutyric acid (GHB),[19] microbial growth;[20] measuring niacin,[21] bacterial respiratory activity,[22] superoxide dismutase;[23] treating cancer[24]

Industrial Applications Steel products[25]

Safety/Toxicity Bacterial toxicity;[22] heavy metal inhibition;[26] microbial toxicity[27]

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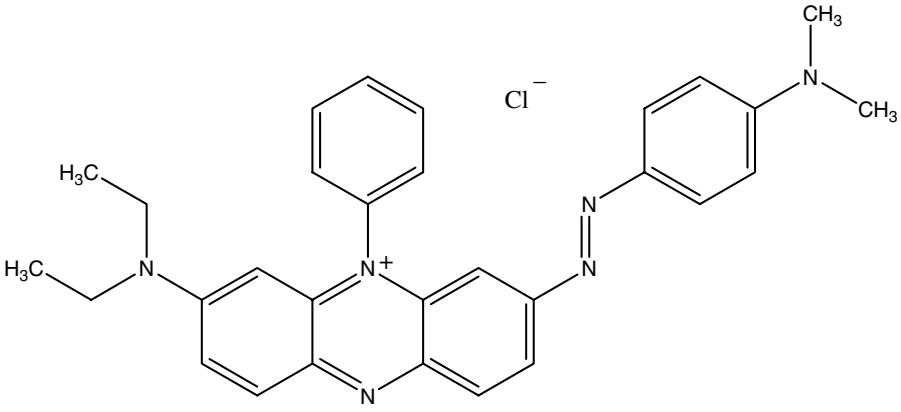
JANUS GREEN B

CAS Registry Number 2869-83-2

Chemical Structure



CA Index Name Phenazinium, 3-(diethylamino)-7-[2-[4-(dimethylamino)phenyl]diazenyl]-5-phenyl-, chloride (1 : 1)

Other Names Diazin Green S; Diazine Green S; 3-Diethylamino-7-(4-dimethylaminophenylazo)-5-phenylphenazinium chloride; 3-Diethylamino-7-(*p*-dimethylaminophenylazo)-5-phenylphenazinium chloride; Janus Green B; Phenazinium, 3-(diethylamino)-7-[[4-(dimethylamino)phenyl]azo]-5-phenyl-, chloride; Phenazinium, 3-(diethylamino)-7-[[*p*-(dimethylamino)phenyl]azo]-5-phenyl-, chloride; C.I. 11050; Janus Green V; Union Green B

Merck Index Number 5255

Chemical/Dye Class Phenazine

Molecular Formula $C_{30}H_{31}ClN_6$

Molecular Weight 511.06

Physical Form Dark green to dark brown to dark black powder

Solubility Soluble in water; slightly soluble in ethanol

Melting Point >200 °C

Absorption (λ_{max}) 660 nm, 395 nm

Synthesis Synthetic methods[1,2]

Staining Applications Biomolecules;[3] brain;[4,24] spinal cord;[4] chromosomes;[5] DNA;[6–8] embryos;[9,10] fungi;[11] lymph vessels;[12] mitochondria;[13–21] neurons;[22–24] nucleic acids;[25] sperms;[26] tissue culture monolayers;[27] yeast cell;[28] hairs[29,30]

Biological Applications Antimalarial agents;[31] diagnosis of diseases related to amyloid accumulation;[32] diagnostic assays;[33] detecting fungi;[11] nucleic acids;[34] sugars[35]

Industrial Applications Copper electroplating;[36–39] electronic devices;[40] semiconductor chips;[41] adhesives;[42,43] paints[44]

Safety/Toxicity Bacterial toxicity;[45] cytotoxicity;[46] germ morphogenesis[47]

Certification/Approval Certified by Biological Stain Commission (BSC)

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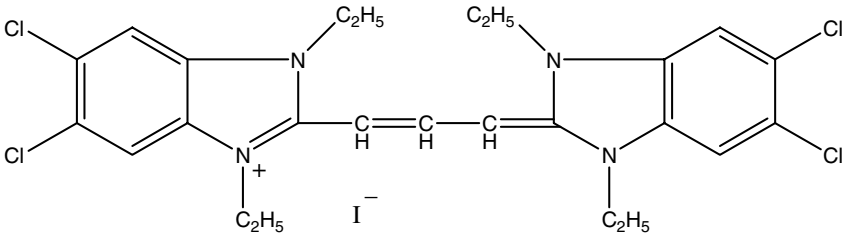
JC 1

CAS Registry Number 3520-43-2

Chemical Structure



Molecular Weight 652.23

Physical Form Deep red crystals

CA Index Name 1*H*-Benzimidazolium, 5,6-dichloro-2-[3-(5,6-dichloro-1,3-diethyl-1,3-dihydro-2*H*-benzimidazol-2-ylidene)-1-propen-1-yl]-1,3-diethyl-, iodide (1 : 1)

Other Names 1*H*-Benzimidazolium, 5,6-dichloro-2-[3-(5,6-dichloro-1,3-diethyl-1,3-dihydro-2*H*-benzimidazol-2-ylidene)-1-propenyl]-1,3-diethyl-, iodide; 5,6-Dichloro-2-[3-(5,6-dichloro-1,3-diethyl-2-benzimidazolinylidene)propenyl]-1,3-diethylbenzimidazolium iodide; Benzimidazolium, 5,6-dichloro-2-[3-(5,6-dichloro-1,3-diethyl-2-benzimidazolinylidene)propenyl]-1,3-diethyl-, iodide; Benzimidazolocarbocyanine iodide, 5,5′,6,6′-tetrachloro-1,1′,3,3′-tetraethyl-; Imidacarbocyanine iodide, 1,1′,3,3′-tetraethyl-5,5′,6,6′-tetrachloro-; 1,1′,3,3′-Tetraethyl-5,5′,6,6′-tetrachlorobenzimidazolocarbocyanine iodide; 1,1′,3,3′-Tetraethyl-5,5′,6,6′-tetrachloroimidacarbocyanine iodide; 5,5′,6,6′-Tetrachloro-1,1′,3,3′-tetraethylbenzimidazolocarbocyanine iodide; Bis(5,6-dichloro-1,3-diethyl-2-benzimidazole)trimethinecyanine iodide; CBIC2; JC 1; NK 1420

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{25}H_{27}Cl_4IN_4$

Solubility Soluble in methanol, *N*,*N*-dimethyl formamide, dimethyl sulfoxide

Melting Point 275–278 °C

Absorption (λ_{max}) 514 nm

Emission (λ_{max}) 529 nm

Synthesis Synthetic methods[1–10]

Staining Applications Mitochondria;[11–20] blood cells;[21] fungi;[22] microbes;[23] proteins;[24] pulmonary neuroepithelial body;[25] sperms;[26,27] hairs[28]

Biological Applications Detecting mitochondrial membrane potential,[20,29–35] ABCB1, ABCC1, and ABCG2 transporters inhibitors,[36] nucleic acid hybridization,[37] prostate cancer;[38] treating cellular death,[39] Alzheimer's disease;[40] apoptosis assay;[41] cytotoxicity assay;[42] hematotoxicity assay;[21] drug screening assay;[43] P-glycoprotein (P-gp) activity acute myeloid leukemia (AML) assay;[44,45] multidrug resistance assay[46]

Industrial Applications Nonlinear optical material;[47] photographic material;[1,4,7–10,48] Semiconductors[49]

Safety/Toxicity Hepatotoxicity[50]

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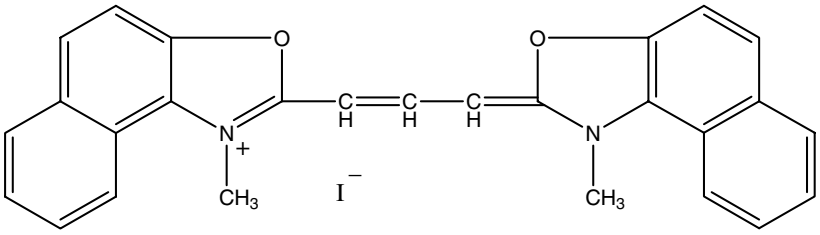
JC 9

CAS Registry Number 522592-13-8

Chemical Structure



CA Index Name Naphth[1,2-*d*]oxazolium, 1-methyl-2-[3-(1-methylnaphth[1,2-*d*]oxazol-2(1*H*)-ylidene)-1-propen-1-yl], iodide (1 : 1)

Other Names D 22421; $DiNOC_1(3)$; 3,3′-Dimethyl-α-naphthoxacarbocyanine iodide; JC 9; Naphth[1,2-*d*]oxazolium, 1-methyl-2-[3-(1-methylnaphth[1,2-*d*]oxazol-2(1*H*)-ylidene)-1-propenyl]-, iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{27}H_{21}IN_2O_2$

Molecular Weight 532.38

Physical Form Solid

Solubility Soluble in *N*,*N*-dimethyl formamide, dimethyl sulfoxide

Melting Point >200 °C

Absorption (λ_{max}) 522 nm

Emission (λ_{max}) 535 nm

Synthesis Synthetic method[1]

Staining Applications Mitochondria;[2] blood cells;[3] proteins[4]

Biological Applications Identifying genes for transport proteins;[4] treating male infertility,[5] Kennedy disease,[5] prostate cancer,[5] breast cancer,[5] liver cancer,[5] bladder cancer,[5] benign prostate hyperplasia,[5] acne,[5] baldness,[5] hirsutism,[5] exposed wounds,[5] unwanted pregnancy;[5] apoptosis assay;[6] hematotoxicity assay[3]

Industrial Applications Not reported

Safety/Toxicity No data available

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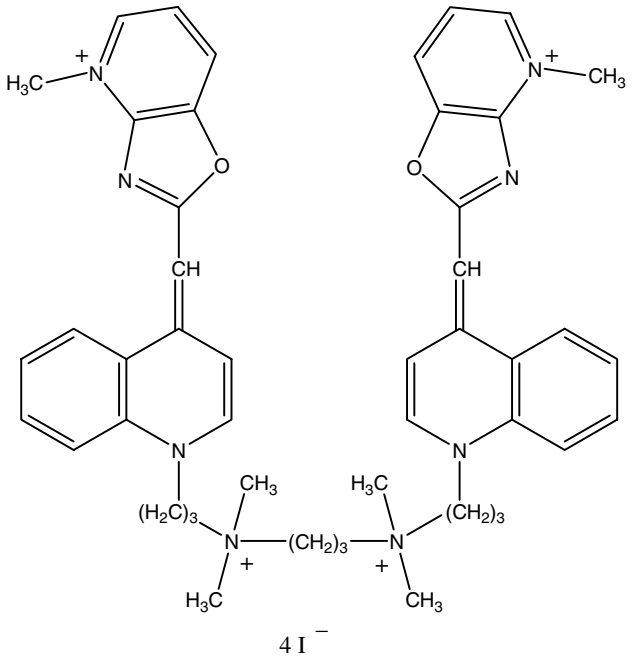
JOJO 1

CAS Registry Number 305801-87-0

Chemical Structure



CA Index Name Oxazolo[4,5-*b*]pyridinium, 2,2′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl-1(4*H*)-quinolinyl-4-ylidenemethylidyne]]bis[4-methyl]-, tetraiodide

Other Names JOJO 1; JOJO 1 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{47}H_{56}I_4N_8O_2$

Molecular Weight 1272.63

Physical Form Yellow-brown powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250 °C

Absorption (λ_{max}) 529 nm

Emission (λ_{max}) 545 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[2–5] cells;[6] hairs[7]

Biological Applications Nucleic acid hybridization;[4,8,9] detecting nucleic acids,[2–5] cells;[6] nucleic acid sequencing[3]

Industrial Applications Not reported

Safety/Toxicity No data available

REFERENCES

1. Haugland, R. P.; Yue, S. T. Aza-benzazolium-containing cyanine dyes and their use in fluorescent biological stains. PCT Int. Appl. WO 2000066664, 2000; *Chem. Abstr*. **2000**, *133*, 351506.
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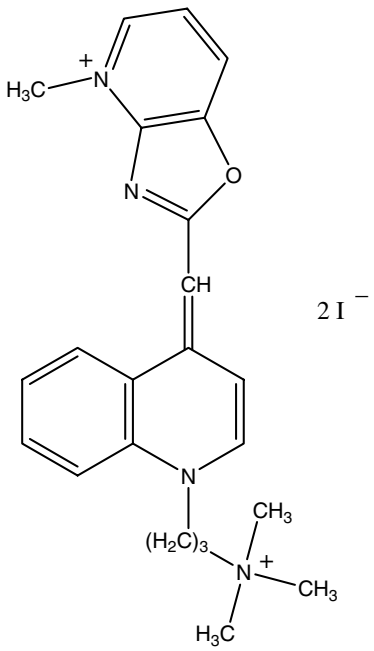
JO-PRO 1

CAS Registry Number 305801-86-9

Chemical Structure



CA Index Name Quinolinium, 4-[(4-methyloxazolo[4,5-*b*]pyridin-2(4*H*)-ylidene)methyl]-1-[3-(trimethylammonio)propyl]-, diiodide

Other Names JO-PRO 1, JO-PRO 1 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{23}H_{28}I_2N_4O$

Molecular Weight 630.31

Physical Form Yellow-brown powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250 °C

Absorption (λ_{max}) 530 nm

Emission (λ_{max}) 546 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[2–5] cells[6]

Biological Applications Nucleic acid hybridization;[7,8] detecting nucleic acids,[2–5] cells;[6] nucleic acid sequencing[4]

Industrial Applications Not reported

Safety/Toxicity No data available

REFERENCES

1. Haugland, R. P.; Yue, S. T. Aza-benzazolium-containing cyanine dyes and their use in fluorescent biological stains. PCT Int. Appl. WO 2000066664, 2000; *Chem. Abstr*. **2000**, *133*, 351506.
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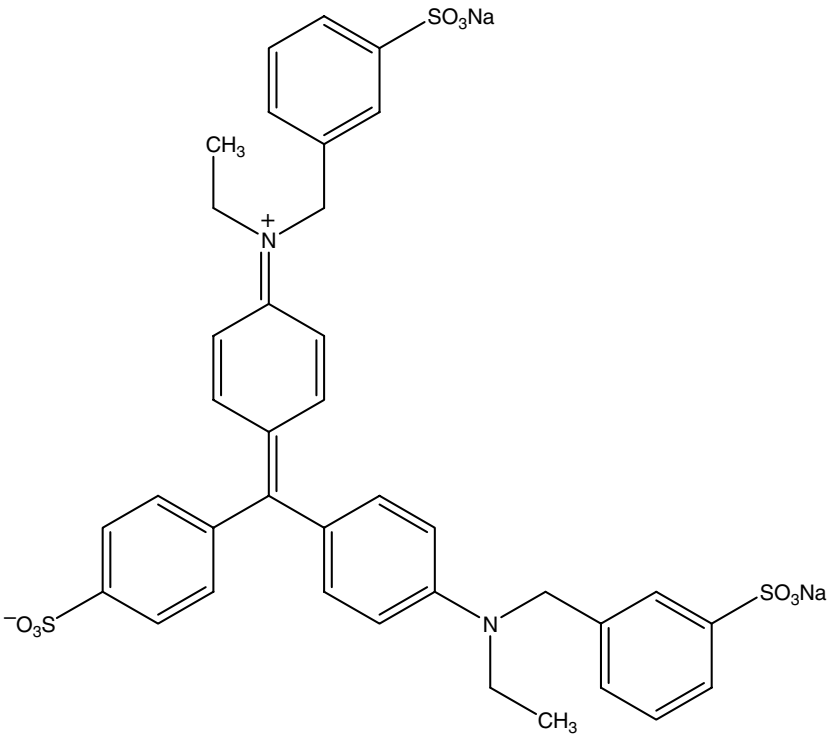
8. Erikson, G. H. Method for modifying transcription and/or translation in an organism by heteropolymeric probes and duplex, triplex or quadruplex hybridization for therapeutic, prophylactic and/or analytic uses. U.S. Pat. Appl. Publ. US 2003181412, 2003; *Chem. Abstr*. **2003**, *139*, 272000.

LIGHT GREEN SF YELLOWISH

CAS Registry Number 5141-20-8

Chemical Structure



CA Index Name Benzenemethanaminium, *N*-ethyl-*N*-[4-[[4-[ethyl[(3-sulfophenyl)methyl]amino]phenyl](4-sulfophenyl)methylene]-2,5-cyclohexadien-1-ylidene]-3-sulfo-, inner salt, sodium salt (1 : 2)

Other Names Benzenemethanaminium, *N*-ethyl-*N*-[4-[[4-[ethyl[(3-sulfophenyl)methyl]amino]phenyl](4-sulfophenyl)methylene]-2,5-cyclohexadien-1-ylidene]-3-sulfo-, hydroxide, inner salt, disodium salt; Benzenemethanaminium, *N*-ethyl-*N*-[4-[[4-[ethyl[(3-sulfophenyl) methyl]amino]phenyl](4-sulfophenyl)methylene]-2,5-cyclohexadien-1-ylidene]-3-sulfo-, inner salt, disodium salt; C.I. Acid Green 5; C.I. Acid Green 5, disodium salt; Light Green SF; A F Green No. 2; Acid Brilliant Green SF; Acid Green 5; Acid Green A; Acidal Light Green SF; Acilan Green SFG; Acilan Light Green SFG; Amacid Green G; C.I. 42095; C.I. Food Green 2; D and C Green No. 4; FD and C Green No. 2; Fenazo Green 7G; Food Green 2; Green No. 203; Japan Green 205; Japan Green No. 205; Leather Green SF; Light Green Lake; Light Green SF Yellowish; Light Green SFA; Light Green SFD; Light Green Yellowish; Light SF Yellowish; Lissamine Green SF; Lissamine Lake Green SF; MY/68; Merantine Green SF; NSC 9619; Pencil Green SF; Sulfo Green J; Sumitomo Light Green SF Yellowish

Merck Index Number 5485

Chemical/Dye Class Triphenylmethane

Molecular Formula $C_{37}H_{34}N_2Na_2O_9S_3$

Molecular Weight 792.85

Physical Form Reddish-brown powder or crystals

Solubility Soluble in water; slightly soluble in ethanol; insoluble in xylene

Melting Point 288 °C (decompose)

Absorption (λ_{max}) 630 nm, 422 nm

Synthesis Synthetic methods[1–5]

Staining Applications Cell;[6,7] cytoplasm;[8] endoscope;[9] microorganisms;[10] eye membranes;[11] retina;[12–14] proteins;[15] hairs[16]

Handbook of Biological Dyes and Stains By R. W. Sabnis

Biological Applications Cosmetics;[17] oral hygiene products;[18] sunscreen;[19] detecting proteins;[20] treating apolipoprotein E-related diseases[21]

Industrial Applications Color filters;[22] recording materials;[23] inks;[24,25] highlighters;[26] adhesives;[27] photographic materials;[28] detergents;[29] textiles;[30,31] leather[32]

Safety/Toxicity Acute toxicity;[33,34] carcinogenicity;[35–38] chronic toxicity;[39] genotoxicity;[40] mutagenicity;[41,42] retinal toxicity[12–14]

Certification/Approval Certified by Biological Stain Commission (BSC)

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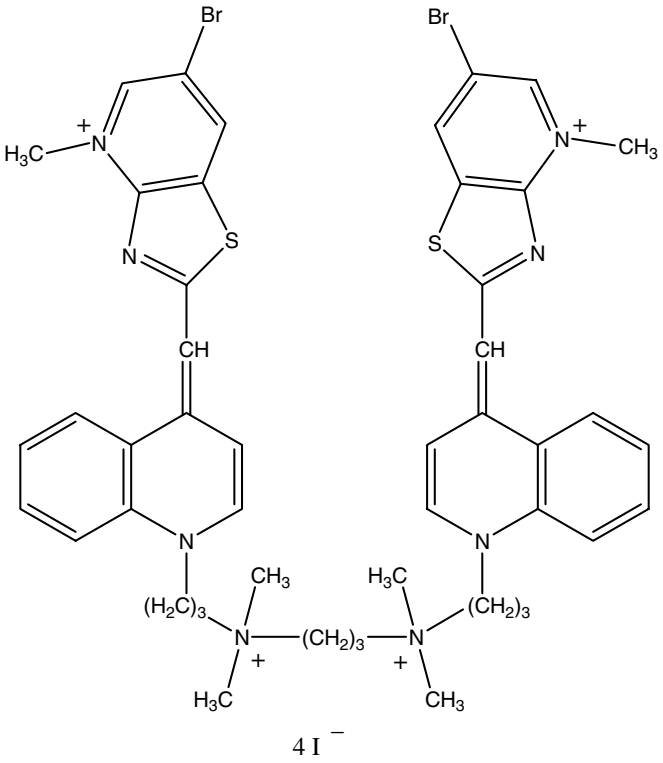
LOLO 1

CAS Registry Number 305802-06-6

Chemical Structure



CA Index Name Thiazolo[4,5-*b*]pyridinium, 2,2′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl-1(4*H*)-quinolinyl-4-ylidenemethylidyne]]bis[6-bromo-4-methyl]-, tetraiodide

Other Names LOLO 1, LOLO iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{47}H_{54}Br_2I_4N_8S_2$

Molecular Weight 1462.54

Physical Form Yellow-brown powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250 °C

Absorption (λ_{max}) 565 nm

Emission (λ_{max}) 579 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[2–5] cells;[6] hairs[7]

Biological Applications Nucleic acid hybridization;[3,8,9] detecting nucleic acids,[2–5] cells,[6] pathogens;[10] DNA sequencing[5]

Industrial Applications Not reported

Safety/Toxicity No data available

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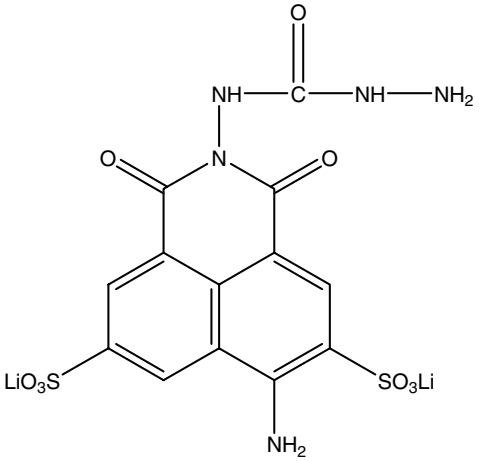
LUCIFER YELLOW CH

CAS Registry Number 67769-47-5

Chemical Structure



CA Index Name 1*H*-Benz[*de*]isoquinoline-5,8-disulfonic acid, 6-amino-2-[(hydrazinylcarbonyl)amino]-2,3-dihydro-1,3-dioxo-, lithium salt (1 : 2)

Other Names 1*H*-Benz[*de*]isoquinoline-5,8-disulfonic acid, 6-amino-2-[(hydrazinocarbonyl)amino]-2,3-dihydro-1,3-dioxo-, dilithium salt; Lucifer Yellow CH; Lucifer Yellow carbohydrazide

Merck Index Number 5594

Chemical/Dye Class Naphthalimide

Molecular Formula $C_{13}H_9Li_2N_5O_9S_2$

Molecular Weight 457.25

Physical Form Orange powder

Solubility Soluble in water; soluble in ethanol

Melting Point >200 °C

Absorption (λ_{max}) 280 nm, 428 nm

Emission (λ_{max}) 540 nm

Synthesis Synthetic methods[1,2]

Staining Applications Avidin;[4] bovine serum albumin;[4] bacteria;[5] cardiac fibers;[6] cells;[3,7,8] cell surface glycoconjugates;[9] cholesterol;[10] phospholipids;[10] exocytotic secretory processes;[11] gangliosides;[12] glycoprotein;[13] islet cells;[14] liposomes;[15] mitochondria;[16] neurons;[2,3] oxidized antibody;[17] plant cell;[18,19] protoplasts;[18,19] potato tuber storage tissues;[20] proteins;[21] retina;[22–24] saccharides;[25,26] skeletal muscle cells;[27] skin;[28] tissues;[29] plant vacuoles[30–34]

Biological Applications Antiviral agents[35,36]

Industrial Applications Optical nanosensors;[37] printing plates[38]

Safety/Toxicity Carcinogenicity[39]

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Int. Appl. WO 9004394, 1990; *Chem. Abstr*. **1991**, *114*, 75181.

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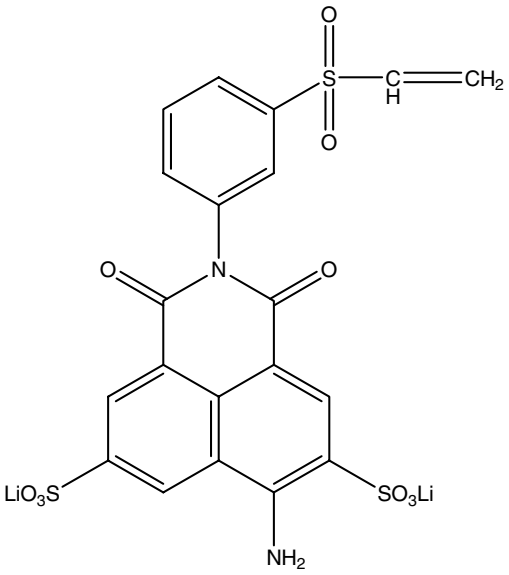
LUCIFER YELLOW VS

CAS Registry Number 71231-14-6

Chemical Structure



CA Index Name 1*H*-Benz[*de*]isoquinoline-5,8-disulfonic acid, 6-amino-2-[3-(ethenylsulfonyl)phenyl]-2,3-dihydro-1,3-dioxo-, lithium salt (1 : 2)

Other Names 1*H*-Benz[*de*]isoquinoline-5,8-disulfonic acid, 6-amino-2-[3-(ethenylsulfonyl)phenyl]-2,3-dihydro-1,3-dioxo-, dilithium salt; Lucifer Yellow VS

Merck Index Number 5594

Chemical/Dye Class Naphthalimide

Molecular Formula $C_{20}H_{12}Li_2N_2O_{10}S_3$

Molecular Weight 550.39

Physical Form Dark yellow powder

Solubility Soluble in water; insoluble in ethanol

Melting Point >200 °C

Absorption (λ_{max}) 280 nm, 428 nm

Emission (λ_{max}) 540 nm

Synthesis Synthetic methods[1,2]

Staining Applications Cells;[3] neurons;[3] albumin;[4,5] cholesterol;[6] phospholipids;[6] collagenase;[7] polynucleotides;[8] proteins;[9,10] progesterone derivative;[11] testosterone;[12] estriol[12]

Biological Applications Detecting nucleic acids;[8,13] lipid probes;[6] measuring collagenase,[7] target nucleic acid sequence;[13] fluorescent immunoassays[4,5,11,12]

Industrial Applications Not reported

Safety/Toxicity No data available

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2. Stewart, W. W. Functional connections between cells as revealed by dye-coupling with a highly fluorescent naphthalimide tracer. *Cell* **1978**, *14*, 741–759.
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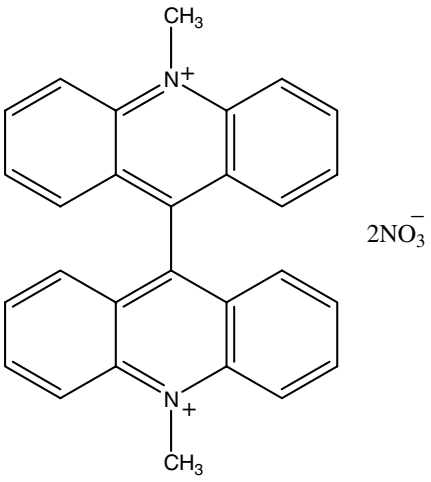
LUCIGENIN

CAS Registry Number 2315-97-1

Chemical Structure



CA Index Name 9,9′-Biacridinium, 10,10′-dimethyl-, nitrate (1 : 2)

Other Names 10,10′-Dimethyl-9,9′-biacridinium dinitrate; *N*,*N*′-Dimethyl-9,9′-biacridinium dinitrate; 9,9′-Biacridinium, 10,10′-dimethyl-, dinitrate; 9,9′-Bis(*N*-methylacridinium nitrate); Bis-*N*-methylacridinium nitrate; L 6868; Lucigenin; Lucigenin nitrate; Lucigenine; *N*,*N*′-Dimethyl-9,9′-biacridinium dinitrate; NSC 151912

Merck Index Number Not listed

Chemical/Dye Class Acridine

Molecular Formula $C_{28}H_{22}N_4O_6$

Molecular Weight 510.50

Physical Form Yellow powder with orange to brown cast

Solubility Soluble in water, ethanol, dimethyl sulfoxide

Melting Point >330 °C

Absorption (λ_{max}) 455 nm

Emission (λ_{max}) 505 nm

Synthesis Synthetic methods[1–8]

Staining Applications Chloride ions;[14–18] mitochondria;[9–12] nuclei[13]

Biological Applications Chloride indicator;[14–18] diagnosis of hemostatic disorders;[19] detecting bacteria,[20,21] nucleic acids,[22] proteins,[22] pathogens;[23] identifying respiratory infections;[24] generating and detecting reactive oxygen species;[10–12,25–34] chemiluminescent indicator;[35–43] chemiluminescence determination of chromium,[44] cobalt,[45] arsenic,[46] iron,[47] vanadium,[48] molybdenum[49]

Industrial Applications Lamp;[50] optical nanosensor[51]

Safety/Toxicity Bacterial toxicity;[52] bone marrow toxicity;[53] carcinogenicity;[54,55] cytotoxicity;[56,57] hematotoxicity;[58] hepatotoxicity;[59] nephrotoxicity;[60] neurotoxicity;[61] immunotoxicity;[61] cardiovascular toxicity;[62,63] respiratory toxicity;[63,64] vascular toxicity[65]

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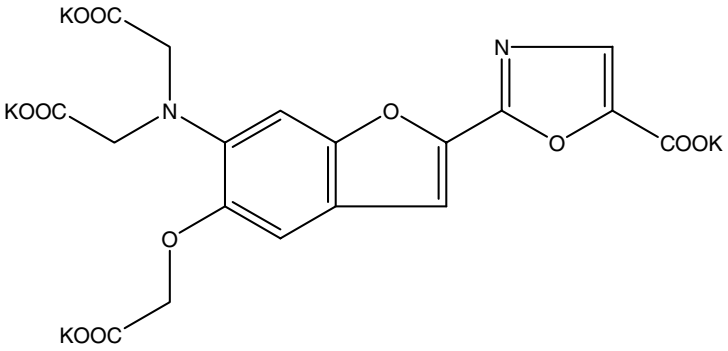
MAG-FURA 2 (FURAPTRA)

CAS Registry Number 132319-57-4

Chemical Structure



CA Index Name 5-Oxazolecarboxylic acid, 2-[6-[bis (carboxymethyl)amino]-5-(carboxymethoxy)-2-benzofuranyl]-, potassium salt (1:4)

Other Names 5-Oxazolecarboxylic acid, 2-[6-[bis(carboxymethyl)amino]-5-(carboxymethoxy)-2-benzofuranyl]-, tetrapotassium salt; Mag-Fura-2 tetrapotassium salt

Merck Index Number Not listed

Chemical/Dye Class Benzofuran

Molecular Formula $C_{18}H_{10}K_4N_2O_{11}$

Molecular Weight 586.68

Physical Form Light yellow powder

Solubility Soluble in water

Melting Point >200 °C

Absorption (λ_{max}) 369 nm, 330 nm

Emission (λ_{max}) 511 nm, 491 nm

Synthesis Synthetic method[1]

Staining Applications Magnesium ions;[1–27] calcium ions;[11,22,28–46] zinc ions[47–49]

Biological Applications Magnesium indicator;[1–27] calcium indicator;[11,22,28–46] zinc indicator[47–49]

Industrial Applications Not reported

Safety/Toxicity Neurotoxicity[47]

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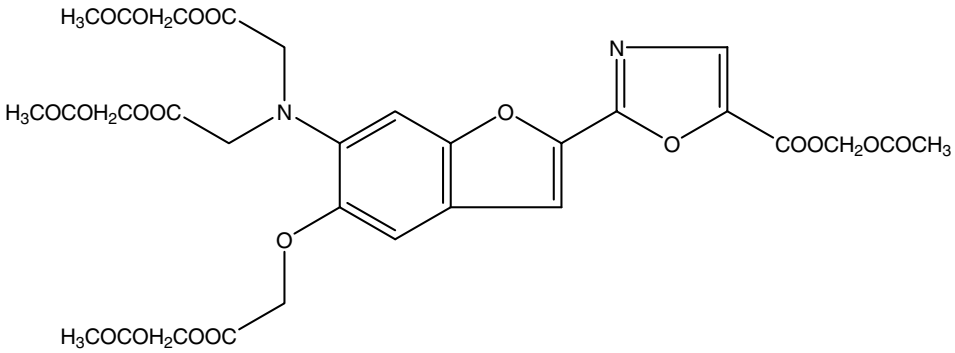
MAG-FURA 2 AM

CAS Registry Number 130100-20-8

Chemical Structure



CA Index Name 5-Oxazolecarboxylic acid, 2-[5-[2-[(acetyloxy)methoxy]-2-oxoethoxy]-6-[bis[2-[(acetyloxy)methoxy]-2-oxoethyl]amino]-2-benzofuranyl]-, (acetyloxy)methyl ester

Other Names Mag-Fura-2; Mag-Fura-2 AM; Mag-Fura-2 AM ester; Mag-Fura-2 acetoxymethyl ester; Furaptra AM; Furaptra AM ester; Furaptra acetoxymethyl ester

Merck Index Number Not listed

Chemical/Dye Class Benzofuran

Molecular Formula $C_{30}H_{30}N_2O_{19}$

Molecular Weight 722.56

Physical Form Light yellow powder

Solubility Insoluble in water; soluble in dimethyl sulfoxide, ethyl acetate

Melting Point >200 °C

Boiling Point (Calcd.) 797.5 ± 70.0 °C, pressure: 760 Torr

pK_a (Calcd.) −2.88 ± 0.70, most basic, temperature: 25 °C

Absorption (λ_{max}) 366 nm

Emission (λ_{max}) 475 nm

Synthesis Synthetic method[1]

Staining Applications Magnesium ions;[1–15] calcium ions;[16–30] zinc ions[31–33]

Biological Applications Magnesium indicator;[1–15] calcium indicator;[16–30] zinc indicator[31–33]

Industrial Applications Not reported

Safety/Toxicity No data available

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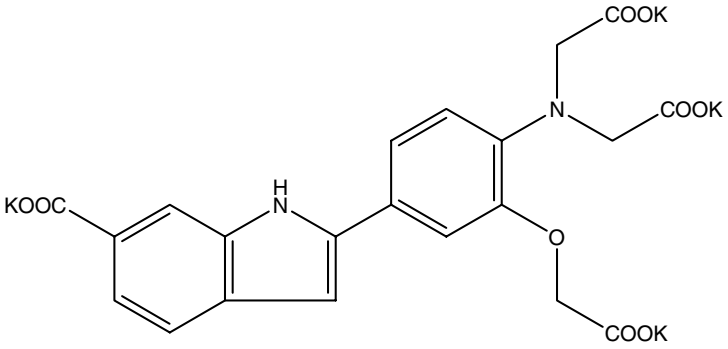
MAG-INDO 1

CAS Registry Number 132299-21-9

Chemical Structure



CA Index Name 1*H*-Indole-6-carboxylic acid, 2-[4-[bis(carboxymethyl)amino]-3-(carboxymethoxy)phenyl]-, potassium salt (1:4)

Other Names 1*H*-Indole-6-carboxylic acid, 2-[4-[bis(carboxymethyl)amino]-3-(carboxymethoxy)phenyl]-, tetrapotassium salt; Mag-indo-1; Mag-indo-1 tetrapotassium salt

Merck Index Number Not listed

Chemical/Dye Class Indole

Molecular Formula $C_{21}H_{14}K_4N_2O_9$

Molecular Weight 594.74

Physical Form Solid

Solubility Soluble in water

Melting Point >200 °C

Absorption (λ_{max}) 349 nm, 330 nm

Emission (λ_{max}) 480 nm, 417 nm

Synthesis Synthetic method[1]

Staining Applications Magnesium ions;[2–10] calcium ions[4,11–13]

Biological Applications Magnesium indicator;[2–10] calcium indicator;[4,11–13] identifying genes;[14] probing unfolding and refolding protein sequences,[15] protein subdomains[16,17]

Industrial Applications Not reported

Safety/Toxicity No data available

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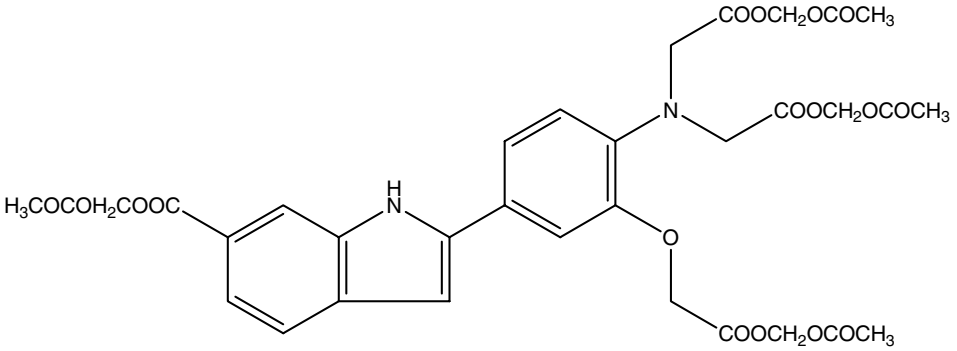
MAG-INDO 1 AM

CAS Registry Number 130926-94-2

Chemical Structure



CA Index Name 1*H*-Indole-6-carboxylic acid, 2-[3-[2-[(acetyloxy)methoxy]-2-oxoethoxy]-4-[bis[2-[(acetyloxy)methoxy]-2-oxoethyl]amino]phenyl]-, (acetyloxy) methyl ester

Other Names Mag-indo-1/AM; Mag-indo-1 AM ester; Mag-indo-1 acetoxymethyl ester

Merck Index Number Not listed

Chemical/Dye Class Indole

Molecular Formula $C_{33}H_{34}N_2O_{17}$

Molecular Weight 730.63

Physical Form Pale yellow powder

Solubility Soluble in dimethyl sulfoxide, methanol

Melting Point >200 °C

Boiling Point 837.1 ± 65.0 °C, pressure: 760 Torr

pK_a 14.81 ± 0.30, most acidic, temperature: 25 °C; 1.37 ± 0.50, most basic, temperature: 25 °C

Absorption (λ_{max}) 354 nm

Emission (λ_{max}) 472 nm

Synthesis Synthetic method[1]

Staining Applications Magnesium ions;[2–4] calcium ions[5,6]

Biological Applications Magnesium indicator;[2–4] calcium indicator[5,6]

Industrial Applications Not reported

Safety/Toxicity No data available

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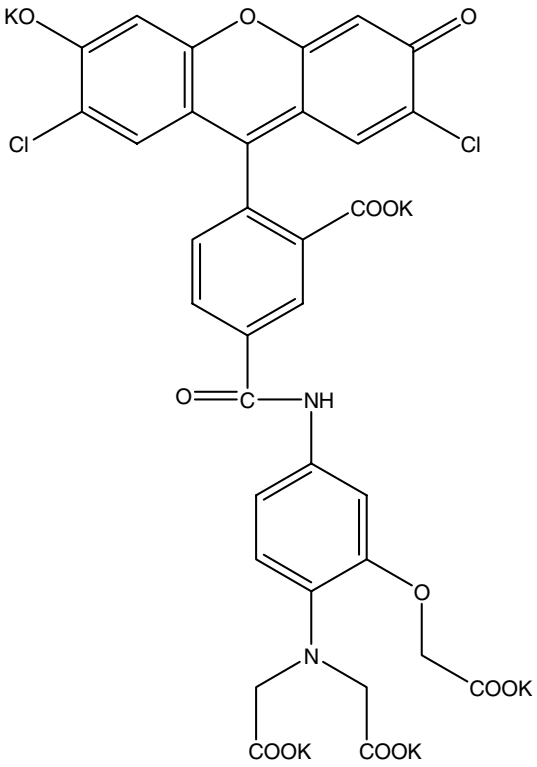
MAGNESIUM GREEN

CAS Registry Number 170516-41-3

Chemical Structure



CA Index Name Glycine, *N*-[2-(carboxymethoxy)-4-[[(2′,7′-dichloro-3′,6′-dihydroxy-3-oxospiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-5-yl)carbonyl]amino]phenyl]-*N*-(carboxymethyl)-, potassium salt (1:5)

Other Names Glycine, *N*-[2-(carboxymethoxy)-4-[[(2′,7′-dichloro-3′,6′-dihydroxy-3-oxospiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-5-yl)carbonyl]amino]phenyl]-*N*-(carboxymethyl)-, pentapotassium salt; Magnesium Green; Magnesium green pentapotassium salt

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{33}H_{17}Cl_2K_5N_2O_{13}$

Molecular Weight 915.90

Physical Form Solid

Solubility Soluble in water

Melting Point >250 °C

Absorption (λ_{max}) 506 nm

Emission (λ_{max}) 531 nm

Synthesis Synthetic methods[1,2]

Staining Applications Magnesium ions;[3–11] calcium ions;[12–23] zinc ions[1]

Biological Applications Magnesium indicator;[3–11] calcium indicator;[12–23] zinc indicator;[1] detecting nucleic acids[24]

Industrial Applications Not reported

Safety/Toxicity No data available

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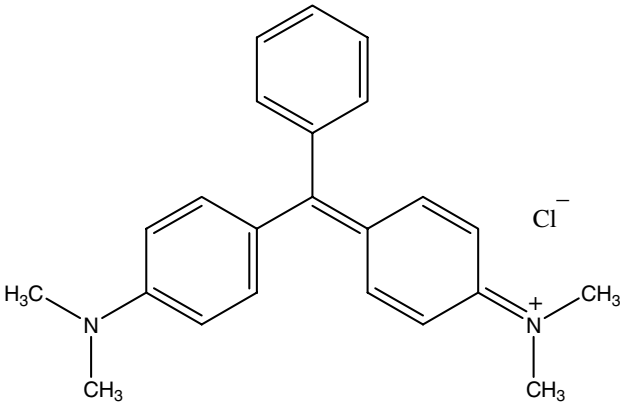
MALACHITE GREEN

CAS Registry Number 569-64-2

Chemical Structure



CA Index Name Methanaminium, *N*-[4-[[4-(dimethylamino)phenyl]phenylmethylene]-2,5-cyclohexadien-1-ylidene]-*N*-methyl-, chloride (1:1)

Other Names C.I. Basic Green 4; Methanaminium, *N*-[4-[[4-(dimethylamino)phenyl]phenylmethylene]-2,5-cyclohexadien-1-ylidene]-*N*-methyl-, chloride; Victoria Green WB; ADC Malachite Green Crystals; Acryl Brilliant Green B; Aizen Malachite Green; Aizen Malachite Green Crystals; Aizen Malachite Green Liquid; Aniline Green; Astra Malachite Green; Astra Malachite Green B; Astra Malachite Green BXX; Atlantic Malachite Green; Basacryl Green X-BF; Basic Green 4; Basonyl Green 830; Basonyl Green NB 832; Benzal Green; Benzaldehyde Green; Bronze Green Toner A 8002; Burma Green B; C.I. 42000; Calcozine Green V; China Green; Diabasic Malachite Green; Diamond Green B; Diamond Green B Extra; Diamond Green BX; Diamond Green P Extra; Green MX; Green Malaquite; Grenoble Green; Hidaco Malachite Green Base; Hidaco Malachite Green LC; Hidaco Malachite Green SC; LC 6220; Light Green N; Lincoln Green Toner B 15-2900; Malachite Green 4; Malachite Green A; Malachite Green AN; Malachite Green B; Malachite Green CP; Malachite Green Crystals; Malachite Green Crystals BPC; Malachite Green J 3E; Malachite Green Powder; Malachite Green WS; Malachite Green XLS; Malachite Lake Green A; Malachite Green; Malachite Green Chloride; Mitsui Malachite Green; New Victoria Green Extra I; New Victoria Green Extra II; New Victoria Green Extra O; Oji Malachite Green; Solid Green Crystals O; Solid Green O; Super Ick Cure; Tertrophene Green M; Tokyo Aniline Malachite Green; Verona Basic Green M; Victoria Green; Victoria Green (basic dye); Victoria Green B; Victoria Green S; Victoria Green WPB

Merck Index Number 5699

Chemical/Dye Class Triphenylmethane

Molecular Formula $C_{23}H_{25}ClN_2$

Molecular Weight 364.91

Physical Form Green crystals with metallic luster

Solubility Very soluble in water; soluble in ethanol, methanol, amyl alcohol

Melting Point 112–114 °C

pH Range 0.0–2.0; 11.6–14.0

Color Change at pH Yellow (0.0) to green (2.0); green (11.6) to colorless (14.0)

pK_a 6.90

Absorption (λ_{max}) 614 nm, 425 nm

Synthesis Synthetic methods[1–17]

Staining Applications Antigens;[18] antibodies;[18] bacteria;[19] bone cement;[20] collagen;[21] oxidized regenerated cellulose;[21] alginates;[21] chitosans;[21] galactomannans;[21] glycosaminoglycans;[21] erythroblast;[22] nucleic acids;[23,24] peptides;[25] proteins;[25] skin[26,27]

Biological Applications Antiseptic formulation;[28] detecting nucleic acids;[1,29] early diagnosis of tuberculosis;[30] identifying mammal genes;[1,31] treating cancers,[32] fungal diseases,[33] pulmonary tuberculosis;[1,34] medical device[35]

Industrial Applications Color filters;[1,36] light-emitting devices;[37] liquid crystal displays;[1,38] optical recording materials;[39] photoresists;[1,40,41] inks;[1,42] highlighters;[1,43] toners;[44] printed circuit board;[1,45] photographic materials;[46] adhesives;[47] textiles[48,49]

Safety/Toxicity Acute toxicity;[1,50–52] chronic toxicity;[52] carcinogenicity;[1,53,54] cytotoxicity;[1,55,56] genotoxicity;[1,57] mitochondrial toxicity;[58] mutagenicity;[1,59] nucleic acid damage[60]

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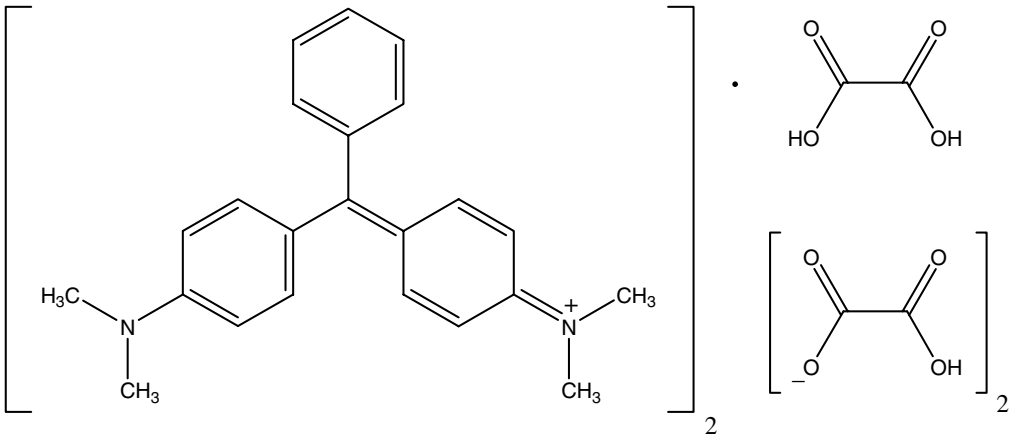
MALACHITE GREEN OXALATE SALT

CAS Registry Number 2437-29-8

Chemical Structure



CA Index Name Methanaminium, *N*-[4-[[4-(dimethylamino)phenyl]phenylmethylene]-2,5-cyclohexadien-1-ylidene]-*N*-methyl-, ethanedioate, ethanedioate (2:2:1)

Other Names Ammonium, [4-[*p*-(dimethylamino)-α-phenylbenzylidene]-2,5-cyclohexadien-1-ylidene]dimethyl, oxalate (1:1), oxalate (1:1); Malachite green oxalate; Ethanedioic acid, ion(1-), *N*-[4-[[4-(dimethylamino)phenyl]phenylmethylene]-2,5-cyclohexadien-1-ylidene]-*N*-methylmethanaminium, ethanedioate (2:1); Malachite green oxalate salt

Merck Index Number 5699

Chemical/Dye Class Triphenylmethane

Molecular Formula $C_{52}H_{54}N_4O_{12}$

Molecular Weight 927.00

Physical Form Green crystals or powder

Solubility Soluble in water, ethanol; insoluble in xylene

Melting Point 164 °C (decompose)

pH Range 0.0–2.0; 11.6–14.0

Color Change at pH Yellow (0.0) to green (2.0); green (11.6) to colorless (14.0)

pK_a 6.90

Absorption (λ_{max}) 614 nm, 425 nm

Synthesis Synthetic methods[1–7]

Staining Applications Brain;[8] spinal cord;[8] phosphohydrolase[9]

Biological Applications Detecting bacterial growth;[10] treating fish diseases,[11] malignant neoplasm[12]

Industrial Applications Inks;[13] toners;[14] photoresists;[15,16] printing plates;[16] photosensitive resins;[17] recording materials;[18] printed circuit boards;[19] solar cells;[20] photoelectrographic materials;[21] laser dyes;[22] NLO dyes;[22] textiles[23]

Safety/Toxicity Cytotoxicity;[24,25] developmental abnormalities;[26] estrogenicity[27]

Certification/Approval Certified by Biological Stain Commission (BSC)

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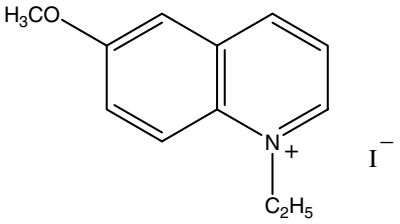
MEQ

CAS Registry Number 34373-76-7

Chemical Structure



CA Index Name Quinolinium, 1-ethyl-6-methoxy-, iodide (1:1)

Other Names Quinolinium, 1-ethyl-6-methoxy-, iodide; MEQ; 6-Methoxy-*N*-ethylquinolinium iodide; 6-Methoxyquinoline ethiodide

Merck Index Number Not listed

Chemical/Dye Class Quinoline

Molecular Formula $C_{12}H_{14}INO$

Molecular Weight 315.15

Physical Form Solid

Solubility Soluble in water, dimethyl sulfoxide

Melting Point 182–183 °C

Absorption (λ_{max}) 344 nm

Emission (λ_{max}) 442 nm

Synthesis Synthetic methods[1–3]

Staining Applications Chloride ions[4–11]

Biological Applications Chloride indicator[4–11]

Industrial Applications Not reported

Safety/Toxicity No data available

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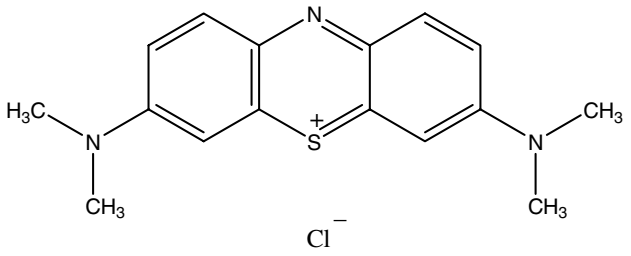
METHYLENE BLUE

CAS Registry Number 61-73-4

Chemical Structure



CA Index Name Phenothiazin-5-ium, 3,7-bis(dimethylamino)-, chloride (1:1)

Other Names C.I. Basic Blue 9; Phenothiazin-5-ium, 3,7-bis(dimethylamino)-, chloride; Aizen Methylene Blue BH; Aizen Methylene Blue FZ; Basic Blue 9; Basic Lake Blue; C.I. 52015; C.I. Solvent Blue 8; Calcozine Blue ZF; Chromosmon; Duasyn Basic Blue IAD; Ext D and C Blue No. 1; External Blue 1; Hidaco Methylene Blue Salt Free; Izit Crystal Dye; Leather Pure Blue HB; Maxilon Blue SG; Methylene Blue 2B; Methylene Blue 2BF; Methylene Blue 2BN; Methylene Blue 2BP; Methylene Blue A; Methylene Blue B; Methylene Blue BB; Methylene Blue BBA; Methylene Blue BD; Methylene Blue BP; Methylene Blue BPC; Methylene Blue BX; Methylene Blue BZ; Methylene Blue D; Methylene Blue FZ; Methylene Blue G; Methylene Blue GZ; Methylene Blue HGG; Methylene Blue IAD; Methylene Blue JFA; Methylene Blue MB; Methylene Blue N; Methylene Blue NF; Methylene Blue NZ; Methylene Blue SG; Methylene Blue SP; Methylene Blue ZF; Methylene Blue ZX; Methylene Blue Zinc Free; Methylene Blue chloride; Methylene Blue; Methylene Blue polychrome; Methylenium ceruleum; Methylthionine chloride; Methylthioninium chloride; Mitsui Methylene Blue; NSC 617593; Sandocryl Blue BRL; Schultz 1038; Solvent Blue 8; Swiss blue; Tetramethylthionine; Tetramethylthionine chloride; Urolene Blue; Yamamoto Methylene Blue B; Yamamoto Methylene Blue ZF

Merck Index Number 6060

Chemical/Dye Class Phenothiazine

Molecular Formula $C_{16}H_{18}ClN_3S$

Molecular Weight 319.85

Physical Form Green powder

Solubility Soluble in water, ethanol, ethylene glycol, methyl cellosolve

Melting Point 100–110 °C (decompose)

pK_a 2.6, 11.2

Absorption (λ_{max}) 661 nm

Synthesis Synthetic methods[1–8]

Staining Applications Blood;[9] bone marrow;[9] eye lens;[10] sentinel lymph nodes;[11] mammary tissues;[12] nucleic acids[13]

Biological Applications Detecting microorganisms;[14] treating diabetic retinopathy,[15] macular degeneration,[15] malignant uveal melanomas,[15] erysipelas,[16] hidradenitis suppurativa,[17] inflammation,[18] skin diseases[19]

Industrial Applications Thin films;[20] inks;[21,22] packaging material[23]

Safety/Toxicity Effluent toxicity;[24] genotoxicity;[25,26] hematotoxicity;[27] microbial toxicity;[28] mutagenicity;[29] neurotoxicity;[30] nucleic acid damage;[31,32] photodynamic toxicity;[33] reproductive toxicity;[34] teratogenicity[35]

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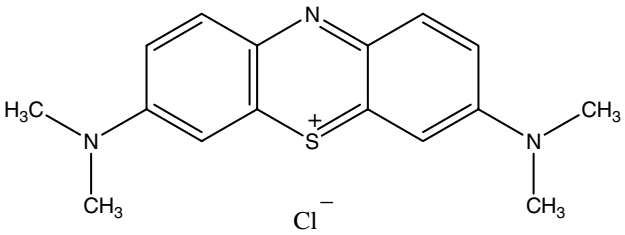
METHYLENE BLUE TRIHYDRATE

CAS Registry Number 7220-79-3

Chemical Structure



• $3H_2O$

CA Index Name Phenothiazin-5-ium, 3,7-bis(dimethylamino)-, chloride, hydrate (1:1:3)

Other Names C.I. Basic Blue 9, trihydrate; C.I. 52015; Phenothiazin-5-ium, 3,7-bis(dimethylamino)-, chloride, trihydrate; 3,7-Bis(dimethylamino)phenazathionium chloride trihydrate; Methylene blue trihydrate

Merck Index Number 6060

Chemical/Dye Class Phenothiazine

Molecular Formula $C_{16}H_{18}ClN_3S{\cdot}3H_2O$

Molecular Weight 373.90

Physical Form Dark green needles or crystals or powder

Solubility Soluble in water, chloroform; sparingly soluble in ethanol

Melting Point 190 °C

pK_a 2.6, 11.2

Absorption (λ_{max}) 668 nm, 609 nm

Synthesis Synthetic methods[1–3]

Staining Applications Bacteria[4]

Biological Applications Diagnosis of tauopathy,[2] Alzheimer's disease (AD),[2] Pick's disease;[2] treating prophylaxis;[2] dental materials[5]

Industrial Applications Thin films;[6] data storage media;[7,8] photothermographic materials;[9] crayons[10]

Safety/Toxicity Acute toxicity;[11] cytotoxicity[12]

Certification/Approval Certified by Biological Stain Commission (BSC)

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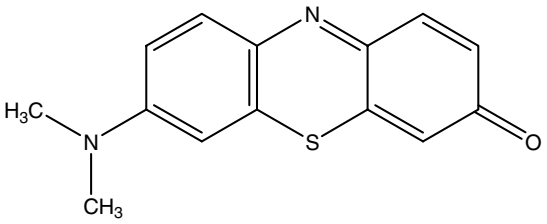
METHYLENE VIOLET (METHYLENE VIOLET BERNTHSEN)

CAS Registry Number 2516-05-4

Chemical Structure



CA Index Name 3*H*-Phenothiazin-3-one, 7-(dimethylamino)-

Other Names C.I. 52041; Dimethylthionoline; Methylene Violet; Methylene Violet (biological stain); Methylene Violet Bernthsen; NSC 187694

Merck Index Number Not listed

Chemical/Dye Class Phenothiazine

Molecular Formula $C_{14}H_{12}N_2OS$

Molecular Weight 256.32

Physical Form Dark green powder

Solubility Insoluble in water, soluble in ethanol

Melting Point 216 °C (decompose)

Boiling Point (Calcd.) 429.6 ± 45.0 °C, pressure: 760 Torr

pK_a (Calcd.) 5.08 ± 0.20, most basic, temperature: 25 °C

Absorption (λ_{max}) 580 nm

Synthesis Synthetic method[1–7]

Staining Applications Bacteria;[8] chromosomes;[9] neurons;[10,11] nuclei;[12] nucleic acids;[13,14] skin;[15] yeast[16,17]

Biological Applications Detecting microorganisms;[18] medical devices[19]

Industrial Applications Adhesives;[20,21] liquid crystal displays;[22,23] recording materials;[24] toners;[25] photographic films[26]

Safety/Toxicity No data available

Certification/Approval Certified by Biological Stain Commission (BSC)

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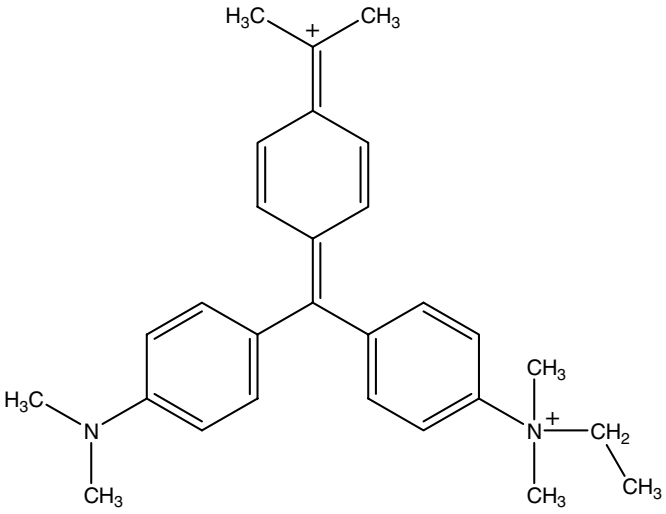
METHYL GREEN

CAS Registry Number 7114-03-6

Chemical Structure



Chemical/Dye Class Triphenylmethane

Molecular Formula $C_{27}H_{35}BrClN_3 \cdot xZnCl_2$

Molecular Weight 653.24

Physical Form Red-brown powder

CA Index Name Benzenaminium, 4-[[4-(dimethylamino)phenyl][4-(dimethyliminio)-2,5-cyclohexadien-1-ylidene]methyl]-*N*-ethyl-*N*,*N*-dimethyl-, bromide chloride, compd. with zinc chloride ($ZnCl_2$) (1:1:1:?)

Other Names Ammonium, [α-[*p*-(dimethylamino)phenyl]-α-[*p*-(dimethyliminio)-2,5-cyclohexadien-1-ylidene]-*p*-tolyl]ethyldimethyl-, bromide chloride, compd. with zinc chloride; Benzenaminium, 4-[[4-(dimethylamino)phenyl][4-(dimethyliminio)-2,5-clohexadien-1-ylidene]methyl]-*N*-ethyl-*N*,*N*-dimethyl-, bromide chloride, compd. with zinc chloride; Benzenaminium, 4-[[4-(dimethylamino)phenyl][4-(dimethyliminio)-2,5-cyclohexadien-1-ylidene]methyl]-*N*-ethyl-*N*,*N*-dimethyl-, bromide chloride, compd. with zinc chloride ($ZnCl_2$); Zinc chloride ($ZnCl_2$), compd. with 4-[[4-(dimethylamino)phenyl][4-(dimethyliminio)-2,5-cyclohexadien-1-ylidene] methyl]-*N*-ethyl-*N*,*N*-dimethylbenzenaminium bromide chloride; Ethyl green; Methyl green; Sigma Ethyl green; Sigma Methyl green; C. I. 42590

Merck Index Number Not listed

Solubility Soluble in water, ethanol; insoluble in xylene

Melting Point >300 °C

pH Range 0.1–2.3

Color Change at pH Yellow (0.1) to greenish-blue (2.3)

Absorption (λ_{max}) 629 nm, 423 nm

Synthesis Synthetic method[1]

Staining Applications Brain;[2] spinal cord;[2] bacteria;[3] chromosomes;[4] nicotinic acetylcholine receptor;[5] nucleic acids;[6–8] phosphates;[9] polyphosphates;[9] tocopherol;[10] tocopherol acetate[10]

Biological Applications Detecting phosphates,[9] polyphosphates,[9] tocopherol,[10] tocopherol acetate[10]

Industrial Applications Spatial light modulators;[11] security applications[12]

Safety/Toxicity No data available

Certification/Approval Certified by Biological Stain Commission (BSC)

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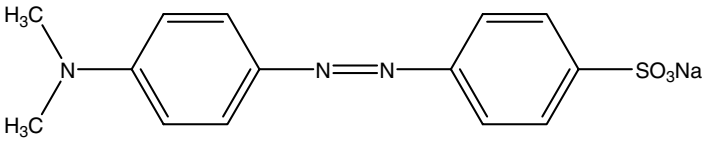
METHYL ORANGE (ORANGE III)

CAS Registry Number 547-58-0

Chemical Structure



CA Index Name Benzenesulfonic acid, 4-[2-[4-(dimethylamino)phenyl]diazenyl]-, sodium salt (1:1)

Other Names Benzenesulfonic acid, 4-[[4-(dimethylamino)phenyl]azo]-, sodium salt; Benzenesulfonic acid, *p*-[[*p*-(dimethylamino)phenyl]azo]-, sodium salt; Orange III; 4-Dimethylaminoazobenzene-4′-sulfonic acid sodium salt; Acid Orange 52; Albion Methyl Orange; C.I. 13025; C.I. Acid Orange 52; Diazoben; Eniamethyl Orange; Gold Orange; Helianthine; Helianthine B; KCA Methyl Orange; Methyl Orange B; Methyl Orange; Orange 3; Sodium 4′-(dimethylamino)azobenzene-4-sulfonate; Sodium 4-(dimethylamino)azobenzene-4′-sulfonate; Sodium 4-[4-(dimethylamino)phenylazo]benzenesulfonate; Sodium *p*-[[*p*-(dimethylamino)phenyl]azo]benzenesulfonate; Sodium *p*-dimethylaminoazobenzenesulfonate; Tropaeolin D

Merck Index Number 6105

Chemical/Dye Class Azo

Molecular Formula $C_{14}H_{14}N_3NaO_3S$

Molecular Weight 327.33

Physical Form Orange-yellow powder or crystals

Solubility Slightly soluble in water, more soluble in hot water; practically insoluble in ethanol

Melting Point >300 °C

pH Range 3.0–4.4

Color Change at pH Red (3.0) to yellow (4.4)

p*Ka* 3.76, 3.40

Absorption (λ_{max}) 507 nm

Synthesis Synthetic methods[1–11]

Staining Applications Albumin;[12] leukocytes;[13] nucleic acids;[1,14,15] protein;[16] nails;[17] skin;[18] hairs[19]

Biological Applications Detecting microorganisms;[20] treating dermatological diseases,[21] vaginal affections;[22] dental materials;[1,23] wound dressing materials[1,24,25]

Industrial Applications Thin films;[1,26,27] nanoparticles;[28] liquid crystals;[1,29–31] sol–gel matrix;[1,32] waveguides;[1,33] paints;[1,34] glass[1,35]

Safety/Toxicity Carcinogenicity;[1,36,37] genotoxicity;[1,31,38,39] mutagenicity[1,40–42]

Certification/Approval Certified by Biological Stain Commission (BSC)

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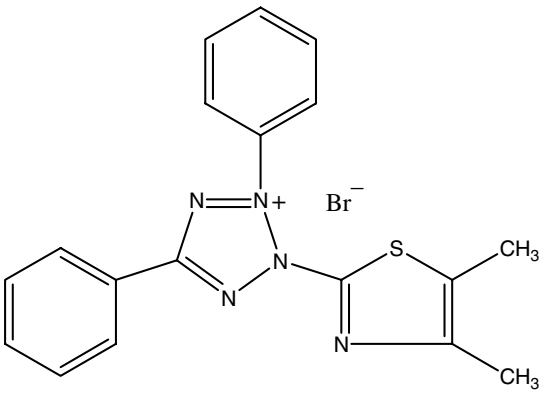
METHYLTHIAZOLETETRAZOLIUM (MTT)

CAS Registry Number 298-93-1

Chemical Structure



CA Index Name 2*H*-Tetrazolium, 2-(4,5-dimethyl-2-thiazolyl)-3,5-diphenyl-, bromide (1:1)

Other Names 2*H*-Tetrazolium, 2-(4,5-dimethyl-2-thiazolyl)-3,5-diphenyl, bromide; 3-(4,5-Dimethyl-2-thiazolyl)-2,5-diphenyl-2*H*-tetrazolium bromide; 2,5-Diphenyl-3-(4,5-dimethylthiazol-2-yl)-2*H*-tetrazolium bromide; 2,5-Diphenyl-3-(4,5-dimethylthiazol-2-yl)tetrazolium bromide; 2-(4,5-Dimethylthiazol-2-yl)-3,5-diphenyl-2*H*-tetrazolium bromide; 3-(4′,5′-Dimethyl-2-thiazolyl)-2,5-diphenyltetrazolium bromide; 3-(4,5-Dimethyl-2-thiazolyl)-2,5-diphenyltetrazolium bromide; 3-(4,5-Dimethylthiazolyl)-2,5-diphenyl-2*H*-tetrazolium bromide; 3-(4,5-Dimethylthiazolyl)-2,5-diphenyltetrazolium bromide; MMT Tetrazolium; MTT; MTT Tetrazolium; Methylthiazoletetrazolium; NSC 60102; Methylthiazolyldiphenyl Tetrazolium; Thiazolyl Blue Monotetrazolium; Thiazolyl blue; Thiazolyl blue (Sigma); Thiazolyl blue tetrazolium bromide

Merck Index Number Not listed

Chemical/Dye Class Tetrazolium salt

Molecular Formula $C_{18}H_{16}BrN_5S$

Molecular Weight 414.32

Physical Form Yellow to orange powder

Solubility Soluble in water, ethanol, methanol, dimethyl sulfoxide

Melting Point 195 °C (decompose)

Absorption (λ_{max}) 378 nm, 242 nm

Synthesis Synthetic methods[1–6]

Staining Applications Apoptotic and necrotic cells;[7] cells;[8–10] endospores;[11] glutathione peroxidase;[12] lyases;[13,14] neurons;[15] nucleic acids;[16] oospores;[17] serum cholinesterase;[18] skin;[19] sperms;[20,21] tissues[22]

Biological Applications Cell viability assay;[8–10] microbial growth assays;[23,24] DNA quantification assays;[25] tissue viability assays;[22] detecting enzymes;[26] measuring membrane potential;[27] treating Alzheimer's disease,[28] asthma,[29] cancer[30]

Industrial Applications Display devices;[31] photographic materials[32]

Safety/Toxicity Aquatic toxicity;[33] bacterial toxicity;[34] carcinogenicity;[35] cytotoxicity;[36–39] dental toxicity;[40,41] DNA damage;[42] embryotoxicity;[43,44] genotoxicity;[45] immunotoxicity;[46] mitochondrial toxicity;[47] nephrotoxicity;[48] neurotoxicity;[49–52] phototoxicity;[53] skin toxicity[54]

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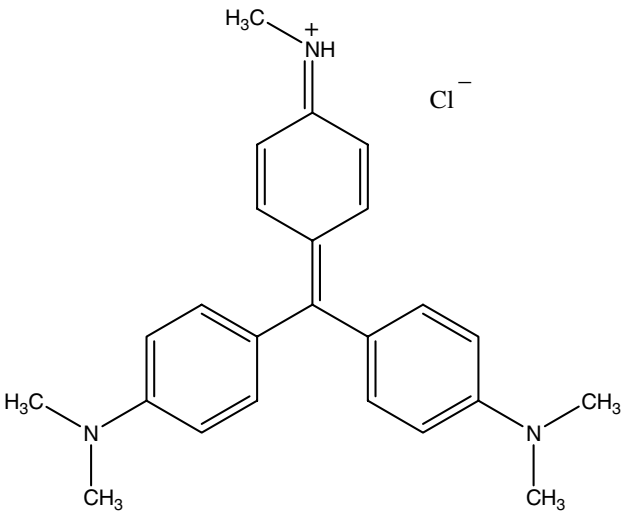
METHYL VIOLET 2B (METHYL VIOLET)

CAS Registry Number 8004-87-3

Chemical Structure



CA Index Name C.I. Basic Violet 1

Other Names Methyl Violet; Aizen Methyl Violet BB; Aizen Methyl Violet Pure Special; Basic Violet 1; Basic Violet 5BN; Basic Violet K; Basonyl Violet 600; C Ext. Violet 5; C.I. 42535; Gentian Violet B; Methyl Violet 2B; Methyl Violet 6B; Methyl Violet B; Methyl Violet BB; Methyl Violet FN; Methyl Violet N; Methyl Violet Pure Special; Methyl Violet Pure SP; Paris Violet R; Pyoktanin Blue; Pyoktaninum coeruleum; Violet Powder H 2503

Merck Index Number Not listed

Chemical/Dye Class Triphenylmethane

Molecular Formula Mixture (tetra, penta and hexa) of the hydrochloride salts of N-methylated forms of para-rosanilines, predominantly the penta (chemical structure given above)

Molecular Weight Mixture (tetra, penta and hexa) of the hydrochloride salts of N-methylated forms of para-rosanilines, predominantly the penta (chemical structure given above)

Physical Form Green to dark green crystalline powder

Solubility Soluble in water, ethanol; insoluble in xylene

Melting Point 137 °C (decompose)

pH Range 0.15–3.2

Color Change at pH Yellow (0.15) to violet (3.2)

Absorption (λ_{max}) 584 nm

Emission (λ_{max}) 590 nm

Synthesis Synthetic method[1–21]

Staining Applications Bacteria;[22] cells;[23] fish;[24] heparin;[25] nematicide granules;[26] nucleic acids;[1,27] polypeptides;[38] proteins;[28,29] skin;[30,31] carious tissue;[32] viscous tissue;[33] keratin fibers;[34] hairs[1,35,36]

Biological Applications Antimalarial agent;[37] detecting enzyme activity,[38] protein–protein interactions;[38] treating diabetes,[39] ringworm;[40] agrochemicals;[41] pesticides;[41] cosmetics;[1,42] wound dressing materials[1,43]

Industrial Applications Solar cells;[1,44] solar energy;[45] display devices;[1,46] photoresists;[1,47] inks;[1,48] toners;[49] highlighters;[1,50] adhesives;[51,52] detergent;[53] packaging materials;[1,54] lithium battery;[1,55] rubber;[1,56] cement;[57] stainless steel;[58] petroleum products;[1,59] leather;[60] paper;[61,62] textiles[63]

Safety/Toxicity Acute toxicity;[1,64] aquatic toxicity;[1,65] carcinogenicity;[1,66] microbial toxicity;[1,67,68] mutagenicity[1,69,70]

Certification/Approval Certified by Biological Stain Commission (BSC)

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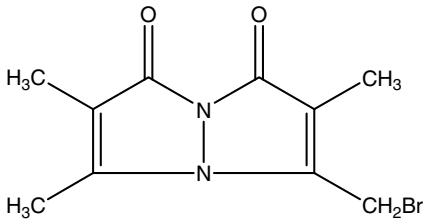
MONOBROMOBIMANE (mBBr)

CAS Registry Number 71418-44-5

Chemical Structure



CA Index Name 1*H*,7*H*-Pyrazolo[1,2-*a*]pyrazole-1,7-dione, 3-(bromomethyl)-2,5,6-trimethyl-

Other Names Bromobimane; Monobromobimane; NSC 608544; Thiolyte MB

Merck Index Number Not listed

Chemical/Dye Class Pyrazole

Molecular Formula $C_{10}H_{11}BrN_2O_2$

Molecular Weight 271.11

Physical Form Yellow powder

Solubility Soluble in acetonitrile, dichloromethane, methanol, *N*,*N*-dimethyl formamide, dimethyl sulfoxide

Melting Point 160–161 °C, 152–154 °C

Boiling Point (Calcd.) 327.8 ± 44.0 °C, pressure: 760 Torr

pK_a (Calcd.) -3.57 ± 0.70, most basic, temperature: 25 °C

Absorption (λ_{max}) 398 nm

Emission (λ_{max}) 490 nm

Synthesis Synthetic method[1–11]

Staining Applications Cystine;[12,13] cysteine;[14–16] cysteine-17;[17] cysteine-111;[17] captopril;[18] erythrocytes;[19] mutants;[20] neurons;[21] nucleic acids;[22] proteins;[23–28] peptides;[28] sulfhydryls[29,30]

Biological Applications Glutathione S-transferase substrates;[31] detecting glutathione S-transferase,[32–38] thiols,[39–42] sulfite,[43] homocysteine,[44] mycothiol,[45] sulfur compounds;[45] thiol-reactive probes[11,39–42]

Industrial Applications Photographic materials[46]

Safety/Toxicity Hepatotoxicity;[47] mutagenicity;[48] reproductive toxicity[49]

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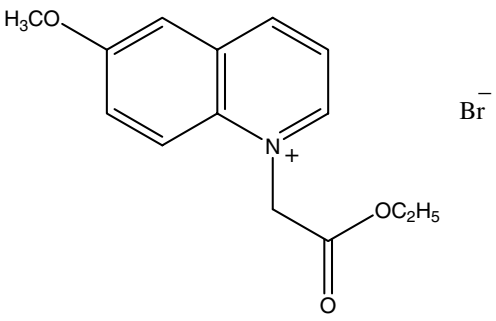
MQAE

CAS Registry Number 162558-52-3

Chemical Structure



CA Index Name Quinolinium, 1-(2-ethoxy-2-oxoethyl)-6-methoxy-, bromide (1:1)

Other Names 1-(Ethoxycarbonylmethyl)-6-methoxyquinolinium bromide; (6-Methoxyquinolinio)acetic acid ethyl ester bromide; MQAE; Quinolinium, 1-(2-ethoxy-2-oxoethyl)-6-methoxy-, bromide

Merck Index Number Not listed

Chemical/Dye Class Quinoline

Molecular Formula $C_{14}H_{16}BrNO_3$

Molecular Weight 326.19

Physical Form White powder

Solubility Soluble in water, methanol, dimethyl sulfoxide

Melting Point 177–179 °C

Absorption (λ_{max}) 350 nm

Emission (λ_{max}) 460 nm

Synthesis Synthetic method[1]

Staining Applications Chloride ions[1–6]

Biological Applications Chloride indicator;[1–6] diagnosis of diseases caused by elemental imbalances;[7] detecting cancer cells,[8] spores,[8] stress biomarkers[9]

Industrial Applications Pulp fiber products[10]

Safety/Toxicity Reproductive toxicity[11]

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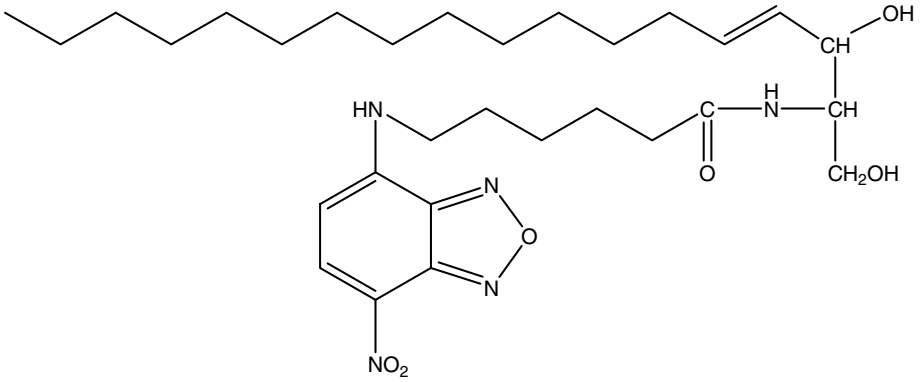
NBD C_6-CERAMIDE

CAS Registry Number 86701-10-2

Chemical Structure



CA Index Name Hexanamide, *N*-[2-hydroxy-1-(hydroxymethyl)-3-heptadecen-1-yl]-6-[(7-nitro-2,1,3-benzoxadiazol-4-yl)amino]-

Other Names Hexanamide, *N*-[2-hydroxy-1-(hydroxymethyl)-3-heptadecenyl]-6-[(7-nitro-2,1,3-benzoxadiazol-4-yl)amino]-; Hexanamide, *N*-[2-hydroxy-1-(hydroxymethyl)-3-heptadecenyl]-6-[(7-nitro-4-benzofurazanyl) amino]-; 2,1,3-Benzoxadiazole, hexanamide derivative; *N*-(NBD-aminohexanoyl)sphingosine; NBD C_6-ceramide

Merck Index Number Not listed

Chemical/Dye Class Benzoxadiazole

Molecular Formula $C_{30}H_{49}N_5O_6$

Molecular Weight 575.74

Physical Form Orange powder

Solubility Soluble in chloroform, methanol, dimethyl sulfoxide

Melting Point >200 °C

pK_a (Calcd.) 13.54 ± 0.20, most acidic, temperature: 25 °C; -0.78 ± 0.70, most basic, temperature: 25 °C

Absorption (λ_{max}) 466 nm

Emission (λ_{max}) 536 nm

Synthesis Synthetic methods[1–12]

Staining Applications Golgi apparatus;[9–11,13–27] lipids;[8,28–32] lipopolysaccharides;[33] lipoproteins;[34–36] sphingolipids;[37–39] vacuoles[40]

Biological Applications Analyzing lipoproteins;[34–36] lipid metabolism;[8,28–32] sphingolipid metabolism;[37] sphingolipid transport;[38] drug screening assay;[41] inositol phosphatidyl ceramide (IPC) synthase assay;[42] sphingomyelinase activity assay;[43] treating fungal infections[44]

Industrial Applications Semiconductors[45]

Safety/Toxicity Fungal toxicity;[44] tumor necrosis[5]

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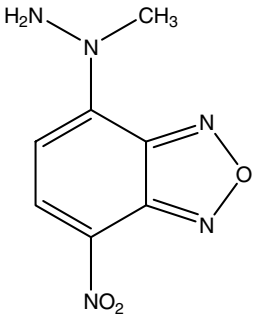
NBD METHYLHYDRAZINE

CAS Registry Number 214147-22-5

Chemical Structure



CA Index Name 2,1,3-Benzoxadiazole, 4-(1-methylhydrazinyl)-7-nitro-

Other Names 2,1,3-Benzoxadiazole, 4-(1-methylhydrazino)-7-nitro-; MNBDH; NBD methylhydrazine; 4-(1-Methylhydrazino)-7-nitrobenzofurazan; *N*-Methyl-4-hydrazino-7-nitrobenzofurazan; 4-(1-Methylhydrazino)-7-nitro-benzooxadiazole; 4-(*N*-Methylhydrazino)-7-nitro-1,2,3-benzooxadiazole

Merck Index Number Not listed

Chemical/Dye Class Benzoxadiazole

Molecular Formula $C_7H_7N_5O_3$

Molecular Weight 209.16

Physical Form Dark brown powder

Solubility Soluble in acetonitrile, methanol

Melting Point 160 °C

Boiling Point (Calcd.) 425.7 ± 55.0 °C, pressure: 760 Torr

pK_a (Calcd.) 2.07 ± 0.30, most basic, temperature: 25 °C

Absorption (λ_{max}) 487 nm

Synthesis Synthetic methods[1,2]

Staining Applications Nitrite ions[3]

Biological Applications Nitrite indicator;[3] detecting aldehydes and/or ketones (carbonyl compounds),[1,2,4–9] nitroaromatic compounds,[10] creatinine in body fluids,[11] telmisartan,[12] hydrogen peroxide,[13] peroxides,[13] as a peroxidase substrate[14]

Industrial Applications Not reported

Safety/Toxicity No data available

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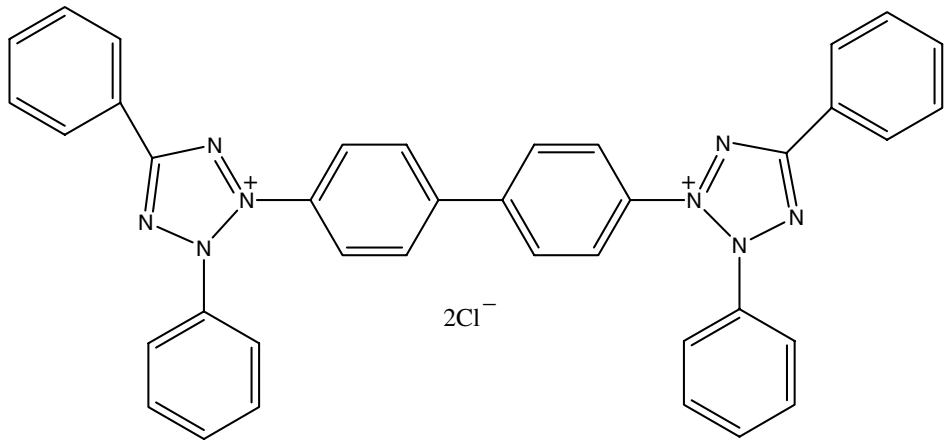
NEOTETRAZOLIUM (NT)

CAS Registry Number 298-95-3

Chemical Structure



CA Index Name 2*H*-Tetrazolium, 3,3′-[1,1′-biphenyl]-4,4′-diylbis[2,5-diphenyl]-,chloride (1:2)

Other Names 2*H*-Tetrazolium, 3,3′-(4,4′-biphenylylene)bis[2,5-diphenyl]-, dichloride; 2*H*-Tetrazolium, 3,3′-[1,1′-biphenyl]-4,4′-diylbis[2,5-diphenyl]-, dichloride; 3,3′-(4,4′-Biphenylylene)bis[2,5-diphenyl-2*H*-tetrazolium chloride]; 2,2′-(*p*-Diphenylene)bis(3,5-diphenyl) ditetrazolium chloride; 3,3′-(4,4′-Biphenylene)bis[2,5-diphenyltetrazolium chloride]; NSC 27621; NTC; Neo-T; Neotetrazolium; Neotetrazolium blue; Neotetrazolium chloride; TP

Merck Index Number 6466

Chemical/Dye Class Tetrazolium salt

Molecular Formula $C_{38}H_{28}Cl_2N_8$

Molecular Weight 667.59

Physical Form Light yellow or tan powder

Solubility Soluble in water, ethanol, *N*,*N*-dimethyl formamide; insoluble in ether

Melting Point 297 °C (decompose)

Absorption (λ_{max}) 248 nm

Synthesis Synthetic methods[1–7]

Staining Applications Lipoproteins;[8] skin[9]

Biological Applications Antifungal agent;[10] glucose-6-phosphate dehydrogenase activity assays;[11] microbial growth assays;[12] detecting bacteria,[13] cancer cells,[14] gamma-hydroxybutyric acid (GHB),[15] microorganisms;[16] treating cancer[17]

Industrial Applications Recording materials;[18,19] toner[20,21]

Safety/Toxicity No data available

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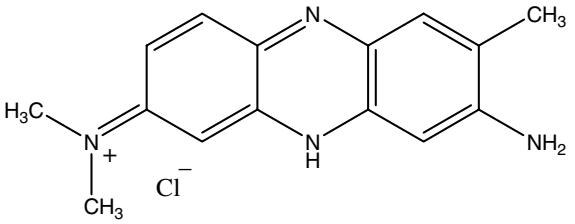
NEUTRAL RED

CAS Registry Number 553-24-2

Chemical Structure



CA Index Name 2,8-Phenazinediamine, N8,N8,3-trimethyl-, hydrochloride

Other Names 3-Amino-7-dimethylamino-2-methylphenazine hydrochloride; Aminodimethylaminotoluaminozine hydrochloride; Cerven neutralni; Cerven toluylenova; C.I. 50040; C.I. Basic Red 5; C.I. Basic Red 5, monohydrochloride; Kernechrot; Michrome No. 226; Neutral Red; Neutral Red W; Nuclear Fast Red (basic dye); 2,8-Phenazinediamine, N8,N8,3-trimethyl-, monohydrochloride; Toluylene red

Merck Index Number 6488

Chemical/Dye Class Phenazine

Molecular Formula $C_{15}H_{17}ClN_4$

Molecular Weight 288.78

Physical Form Dark green or brownish-black powder

Solubility Soluble in water, ethanol, ethylene glycol; practically insoluble in xylene

Melting Point 290 °C (decompose)

pH Range 6.8–8.0

Color Change at pH Red (6.8) to yellow (8.0)

pK_a 6.7, 7.4

Absorption (λ_{max}) 540 nm, 533 nm

Emission (λ_{max}) 640 nm

Synthesis Synthetic methods[1–3]

Staining Applications Cells;[4] lysosomes;[5,6] nuclei;[7] nucleic acids;[8,9] retina[10]

Biological Applications Detecting pathogens,[11] bacterial infections;[1,12] treating age-related macular degeneration,[1,13] burns,[1,14] cancer,[1,15] diabetes,[1,16] obesity,[1,16] fungal infections,[17,18] viral diseases[1,19]

Industrial Applications Liquid crystal displays;[1,20] fuel cells;[1,21] photovoltaic cells;[22] solar cells;[1,22] photochromic materials;[23] sensors;[1,24] thermochromic materials;[1,25] detergents;[1,26] wood[1,27]

Safety/Toxicity Combustion toxicity;[1,28] cytotoxicity;[1,29–31] DNA damage;[32,33] lysosomal stability;[32,33] genotoxicity;[1,34–36] microbial toxicity;[37] mutagenicity;[1,38,39] nephrotoxicity;[1,40] neurotoxicity;[32] phototoxocity;[1,41–43] soil toxicity[1,44]

Certification/Approval Certified by Biological Stain Commission (BSC)

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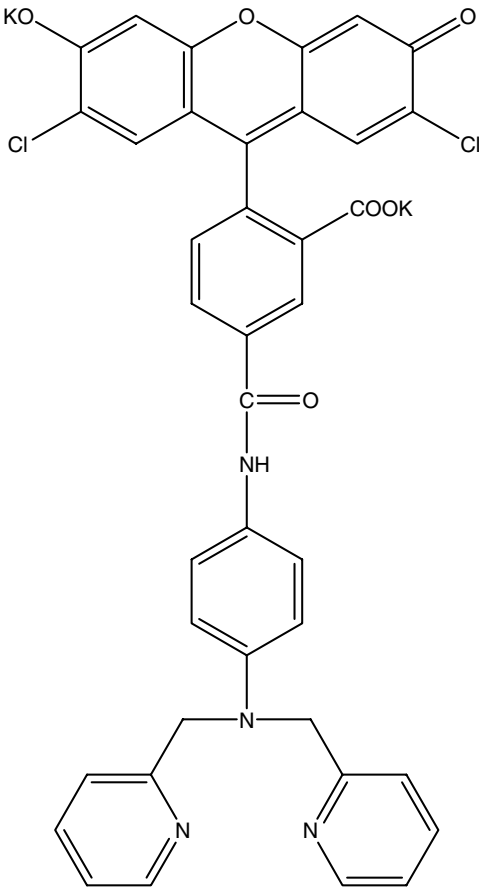
NEWPORT GREEN DCF

CAS Registry Number 288374-37-8

Chemical Structure



CA Index Name Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthene]-5-carboxamide, *N*-[4-[bis(2-pyridinylmethyl)amino]phenyl]-2′,7′-dichloro-3′,6′-dihydroxy-3-oxo-, potassium salt (1:2)

Other Names Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthene]-5-carboxamide, *N*-[4-[bis(2-pyridinylmethyl)amino]phenyl]-2′,7′-dichloro-3′,6′-dihydroxy-3-oxo-, dipotassium salt; Newport Green; Newport Green DCF dipotassium salt

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{39}H_{24}Cl_2K_2N_4O_6$

Molecular Weight 793.74

Physical Form Solid

Solubility Soluble in water

Melting Point >200 °C

Absorption (λ_{max}) 506 nm

Emission (λ_{max}) 535 nm

Synthesis Synthetic method[1]

Staining Applications Zinc ions;[1–12,16] chromium;[2] manganese;[2] iron;[2] cobalt;[2,16] copper;[2,15] nickel;[2] cadmium[12–16]

Biological Applications Zinc indicator;[1–12,16] early diagnosis of prostate cancer;[3] treating herpes virus infection[10]

Industrial Applications Not reported

Safety/Toxicity No data available

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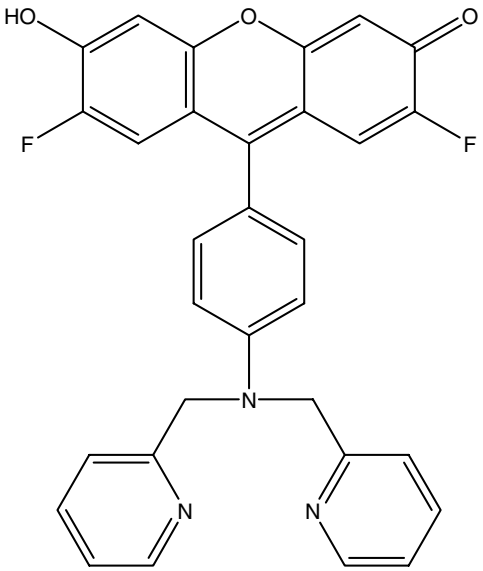
NEWPORT GREEN PDX

CAS Registry Number 612502-05-3

Chemical Structure



CA Index Name 3*H*-Xanthen-3-one, 9-[4-[bis(2-pyridinylmethyl)amino]phenyl]-2,7-difluoro-6-hydroxy-

Other Names Newport Green PDX

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{31}H_{21}F_2N_3O_3$

Molecular Weight 521.51

Physical Form Solid

Solubility Soluble in water

Melting Point >200 °C

Boiling Point (Calcd.) 750.1 ± 60.0 °C, pressure: 760 Torr

pK_a (Calcd.) 7.93 ± 0.60, most acidic, temperature: 25 °C; 4.28 ± 0.12, most basic, temperature: 25 °C

Absorption (λ_{max}) 490 nm

Emission (λ_{max}) 518 nm

Synthesis Synthetic method[1]

Staining Applications Zinc ions;[1] mitochondria[2]

Biological Applications Zinc indicator[1]

Industrial Applications Not reported

Safety/Toxicity No data available

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NIGROSIN

CAS Registry Number 8005-03-6

Chemical Structure No structure diagram available as it is a mixture

CA Index Name C.I. Acid Black 2

Other Names Nigrosine; ADC Nigrosine Black B; Acid Black 2; Acid Black WR; Acid Nigrosine; C.I. 50420; Calco Nigrosine O 2P; Conacid Black B; Cramity 81; Dinacid Nigrosine WS; Dyacid Nigrosine NBS Xtals; Dycosacid Nigrosine NBL (Bluish); Dycosacid Nigrosine NBL (Reddish); Lurazol Deep Blue EB; Nigrosin; Nigrosine (Crystals)NBL(Blush); Nigrosine (Crystals)NBL (Reddish); Nigrosine B; Nigrosine CBRS; Nigrosine Crystals; Nigrosine MS; Nigrosine NB; Nigrosine NB conc; Nigrosine NBSS Water Soluble; Nigrosine NN Water Soluble; Nigrosine WL Water Soluble; Nigrosine WLAH; Nigrosine WLF; Nigrosine WLF Uncut; Nigrosine WLL; Nigrosine WSB; Nigrosine Water Soluble; Nigrosine black; Nigtrosine WS; Nubian Black PA 9801; Nubian Black PA9803; Oil Black FS Special; Oil Black S; Orient Nigrosine BR; Orient Nigrosine OZ; Orient Nubian Black PA 9801; Orient Nubian Black PA 9803; Orient Water Black R 455; Orient Water Black R 456; Orient Water Black R 500; Orient Water Black R 510; Pacid Black 2; Pacid Leather Black; Sandopel Basic Black BHLN; Triacid Nigrosine WS; Vicoacid Nigrosine Black; Victacid Nigrosine Black Crystals; Water Black 179128; Water Black R 455; Water Black R 500; Water Black R 510

Merck Index Number Not listed

Chemical/Dye Class Azine

Molecular Formula Mixture, unspecified

Molecular Weight Mixture

Physical Form Black crystals or powder

Solubility Soluble in water; slightly soluble in ethanol

Melting Point Mixture

Absorption (λ_{max}) 570 nm

Synthesis Synthetic method[1–11]

Staining Applications Cells;[12] gel;[13] olives;[14] proteins;[15,16] soy sauce;[17] sperms;[18,19] lips;[20] eyelids;[20] eyebrows;[20] keratin fibers;[21] hairs[22]

Biological Applications Diagnostic assay;[23] rodenticide[24]

Industrial Applications Semiconductor devices;[25] fuel cells;[26] color filters;[27] liquid crystal displays;[27] electrophoretic display;[28] photoresists;[29,30] inks;[31–33] toners;[34,35] photography;[36] thermoplastic materials;[37,38] furniture and building materials;[39] paints;[40] leather;[41,42] plastics;[43] waxes;[43] cleaners;[43] steel;[44] wood[45]

Safety/Toxicity Genotoxicity;[46] mutagenicity;[47] percutaneous toxicity[48]

Certification/Approval Certified by Biological Stain Commission (BSC)

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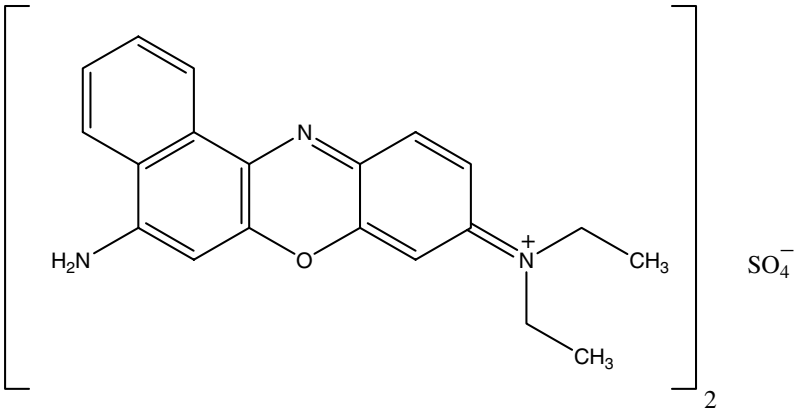
NILE BLUE A

CAS Registry Number 3625-57-8

Chemical Structure



CA Index Name Benzo[*a*]phenoxazin-7-ium, 5-amino-9-(diethylamino)-, sulfate (2:1)

Other Names Bis[5-amino-9-(diethylamino)benzo[*a*] phenazoxonium] sulfate; C.I. 51180; C.I. Basic Blue 12; Nile blue sulfate; 5-Amino-9-(diethylamino)benzo [*a*]phenoxazinium sulfate; Nile Blue A; Nile Blue A sulfate

Merck Index Number Not listed

Chemical/Dye Class Phenoxazine

Molecular Formula $C_{40}H_{40}N_6O_6S$

Molecular Weight 732.85

Physical Form Dark green powder

Solubility Soluble in water, ethanol

Melting Point >300 °C (decompose)

Absorption (λ_{max}) 633 nm

Synthesis Synthetic method[1–5]

Staining Applications Bacteria;[6] erythrocytes;[7] leukocytes;[8] erythroblasts;[8] fungi;[9] granulated cells;[10] intima;[11] lesions;[11] neurons;[12] nucleic acids;[13–16] phospholipids;[17] proteins;[18,19] lipids;[19–21] tumor cells[22]

Biological Applications Detecting microorganisms;[23] treating virus infectious diseases;[24] photodynamic therapy[25]

Industrial Applications Dye laser;[3] electrochromic display device;[26] light-emitting diode;[27] semiconductors;[28] thin film materials;[29] laundry detergent;[30] paper;[31] textiles[32]

Safety/Toxicity Acute toxicity;[33] cytotoxicity;[34] microbial toxicity[35]

Certification/Approval Certified by Biological Stain Commission (BSC)

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NITRO BLUE TETRAZOLIUM (NBT)

CAS Registry Number 298-83-9

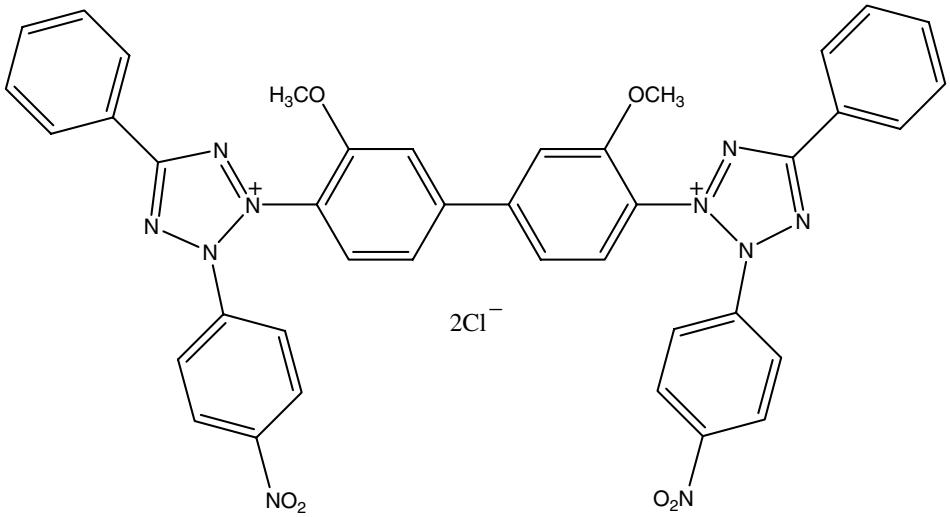
Chemical Structure

Merck Index Number Not listed

Chemical/Dye Class Tetrazolium salt

Molecular Formula $C_{40}H_{30}Cl_2N_{10}O_6$

Molecular Weight 817.64



CA Index Name 2*H*-Tetrazolium, 2,2′-(3,3′-dimethoxy [1,1′-biphenyl]-4,4′-diyl)bis[3-(4-nitrophenyl)-5-phenyl]-, chloride (1:2)

Other Names 2*H*-Tetrazolium, 2,2′-(3,3′-dimethoxy [1,1′-biphenyl]-4,4′-diyl)bis[3-(4-nitrophenyl)-5-phenyl]-, dichloride; 2*H*-Tetrazolium, 3,3′-(3,3′-dimethoxy-4,4′-biphenylylene)bis[2-(*p*-nitrophenyl)-5-phenyl]-, dichloride; Tetrazolium, 3,3′-(3,3′-dimethoxy-4,4′-biphenylylene)bis[2-(*p*-nitrophenyl)-5-phenyl-2*H*-chloride]; 2, 2′-Bis(*p*-nitrophenyl)-5,5′-diphenyl-3,3′-(3,3′-dimethoxy-4,4′-biphenylylene)ditetrazolium chloride; 2,2′-Bis(*p*-nitrophenyl)-5,5′-diphenyl-3,3′-(3,3′-dimethoxy-4,4′-diphenylene)ditetrazolium chloride; 2,2′-Di-*p*-nitrophenyl-5,5′-diphenyl-3,3′-bis(3,3′-dimethoxy-4,4′-biphenylene) ditetrazolium chloride; 2,2′-Dinitrophenyl-5,5′-diphenyl-3,3′-dimethoxy-4,4′-diphenylene)ditetrazolium chloride; 3,3′-(3,3′-Dimethoxy-4,4′-biphenylylene)bis[2-(*p*-nitrophenyl)-5-phenyl-2*H*-tetrazolium chloride]; 3,3′-(3,3′-Dimethoxy-4,4′-diphenylene)bis[2-(*p*-nitrophenyl)-5-phenyltetrazolium chloride]; NBT; NBT (dye); NSC 27622; NTB; Nitro BT; Nitro Blue Tetrazolium; Nitro Blue Tetrazolium chloride; Nitro Tetrazolium BT; Nitrotetrazolium Chloride Blue; Nitrotetrazolium blue; Tetrazolium Nitro BT; Tetrazolium nitro blue; *p*-NBT; *p*-Nitro blue tetrazolium; *p*-Nitro blue tetrazolium chloride; *p*-Nitrotetrazolium blue

Physical Form Yellow powder

Solubility Soluble in water, ethanol, methanol, dimethyl sulfoxide

Melting Point 189 °C

Absorption (λ_{max}) 256 nm

Synthesis Synthetic methods[1–6]

Staining Applications Antibody;[7] antigen;[8] cells;[9] dihydrolipoamide dehydrogenase (DLDH) diaphorase;[10] enzymes;[11,12] gene expression[13]

Biological Applications Diagnosis of Alzheimer's disease,[14] bacterial vaginosis,[15] behavioral disturbances in children,[16] Hirschsprung disease;[11] phosphatase assay;[17] phytase assay;[18] detecting bacteria,[19] microorganisms,[20] phosphoinositides,[21] yeast;[22] generating and detecting reactive oxygen species;[23–25] treating cancer,[26] neuropathic pain[27]

Industrial Applications Microchip[28]

Safety/Toxicity Carcinogenicity;[29] chronic toxicity;[30] cytotoxicity;[31–33] hepatotoxicity;[34] mitochondrial damage;[35] mutagenicity;[36] nephrotoxicity;[37] neurotoxicity;[38–40] ototoxicity;[41] phototoxicity;[42,43] pulmonary toxicity[44]

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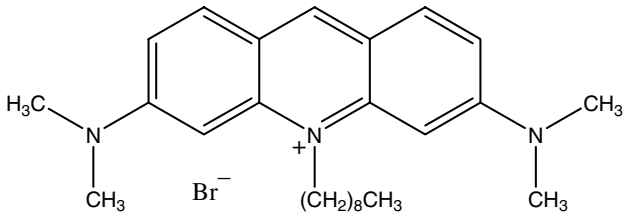
NONYL-ACRIDINE ORANGE (NAO)

CAS Registry Number 75168-11-5

Chemical Structure



CA Index Name Acridinium, 3,6-bis(dimethylamino)-10-nonyl-, bromide (1:1)

Other Names Acridinium, 3,6-bis(dimethylamino)-10-nonyl-, bromide; 10-nonyl acridine orange; A 1372; Acridine Orange 10-nonyl bromide; Nonylacridine orange; NAO

Merck Index Number Not listed

Chemical/Dye Class Acridine

Molecular Formula $C_{26}H_{38}BrN_3$

Molecular Weight 472.50

Physical Form Orange-red powder

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide

Melting Point >250 °C

Absorption (λ_{max}) 495 nm

Emission (λ_{max}) 519 nm

Synthesis Synthetic method[1]

Staining Applications Mitochondria;[1–11,21,23,25,28] liposomes;[12] nerve terminals;[13] cardiolipin;[14–18] blood cells[27]

Biological Applications Detecting cardiolipin,[14–18] mitochondrial membrane potential,[19,20] risk of type 2 diabetes,[21] cardiotoxicity,[22] prostate cancer;[23] apoptosis assay;[24,25] drug screening assay;[26] hematotoxicity assay;[27] treating arthritic disorders;[28] in photodynamic therapy;[29] ophthalmic applications[30]

Industrial Applications Not reported

Safety/Toxicity No data available

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Int. Appl. WO 2001020018, 2001; *Chem. Abstr*. **2001**, *134*, 231892.

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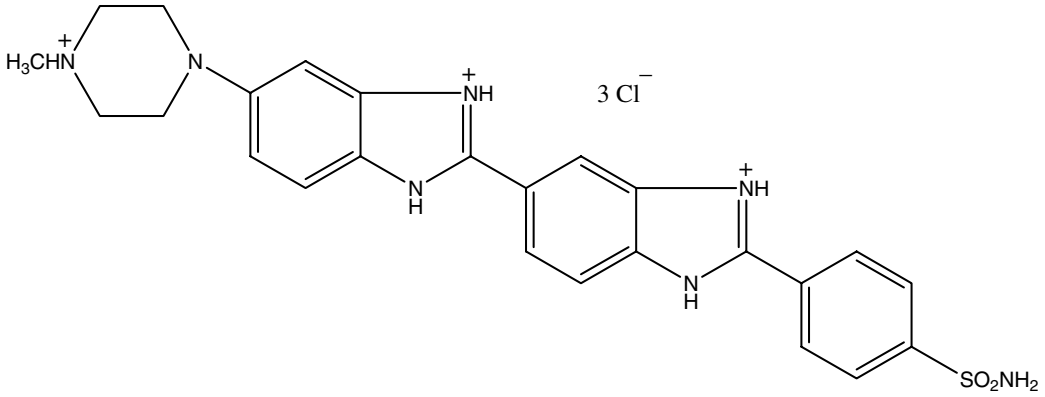
NUCLEAR YELLOW

CAS Registry Number 74681-68-8

Chemical Structure



CA Index Name Benzenesulfonamide, 4-[5-(4-methyl-1-piperazinyl)[2,5′-bi-1*H*-benzimidazol]-2′-yl]-, hydrochloride (1:3)

Other Names Benzenesulfonamide, 4-[5-(4-methyl-1-piperazinyl)[2,5′-bi-1*H*-benzimidazol]-2′-yl]-, trihydrochloride; 4-[5-(4-Methyl-1-piperazinyl)[2,5′-bi-1*H*-benzimidazol]-2′-yl]-benzenesulfonamide; Hoechst S769121; Hoechst S769121 trihydrochloride; Nuclear yellow

Merck Index Number Not listed

Chemical/Dye Class Benzimidazole

Molecular Formula $C_{25}H_{28}Cl_3N_7O_2S$

Molecular Weight 596.96

Physical Form Yellow to green powder

Solubility Soluble in dimethyl sulfoxide, water

Melting Point >300 °C

Absorption (λ_{max}) 355 nm

Emission (λ_{max}) 495 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[2–5] cells;[6] chromosomes;[7] lysosomes;[8] mitochondria;[9] neurons;[1,10–13] spinal cord[14]

Biological Applications Detecting nucleic acid,[2–5,15] proteins,[15] carbohydrates,[15] lipids;[15] carrying out polymerase chain reaction (PCR);[16] drug-targeting agent;[17] nerve mapping[18]

Industrial Applications Not reported

Safety/Toxicity No data available

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and sorting. U.S. Pat. Appl. Publ. US 2006172315, 2006; *Chem. Abstr*. **2006**, *145*, 183714.

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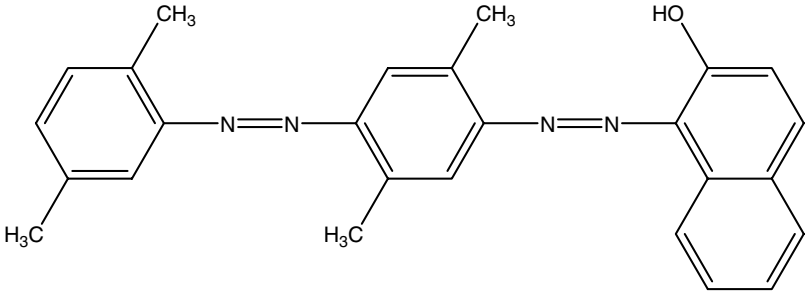
OIL RED O

CAS Registry Number 1320-06-5

Chemical Structure



CA Index Name 2-Naphthalenol, 1-[2-[4-[2-(dimethylphenyl)diazenyl]dimethylphenyl]diazenyl]-

Other Names 2-Naphthalenol, 1-[[4-[(dimethylphenyl) azo]dimethylphenyl]azo]-; C.I. Solvent Red 27; Oil Red O; Aizen SOT Red 2; C.I. 26125; D and C Red No. 18; Fat Red 5B; Fat Red 5B02; Oil Red 5303; Oil Red 5B; Oil Red 6B; Oil Red OS; Orient Oil Red 5B; Red OS; SOT Red 2; Solvent Red 27; 1-([4-(Xylylazo)xylyl]azo)-2-naphthol

Merck Index Number Not listed

Chemical/Dye Class Azo

Molecular Formula $C_{26}H_{24}N_4O$

Molecular Weight 408.49

Physical Form Red to dark greenish-brown powder

Solubility Slightly soluble in water, ethanol; soluble in acetone, benzene, ethyl acetate, toluene, xylene, ethylene glycol

Melting Point 120 °C (decompose)

Absorption (λ_{max}) 518 nm, 359 nm

Synthesis Synthetic method[1–4]

Staining Applications Aortic valves;[5] cornea verticillata;[6] human adipose-derived stem cells;[7] intramyocellular lipid;[8] lipids;[9,10] lipid droplets;[11–13] mitochondria;[13] liposomes;[14] lipoproteins;[15] apolipoproteins;[15] neutral lipids;[16] nematodes;[17] natural fibers;[18] plant cuticle;[18] pancreatic fibroblastoid/stellate cells;[19] plant;[20] sirolimus;[21] spinal fluid;[22] wheat flour;[23] fats/oils;[23] hairs[24]

Biological Applications Detecting early stages of atherosclerotic lesion formation;[25] treating obesity,[26] hyperlipidemia,[26] fatty liver,[26] leptin production disorders;[27] dental impression material;[28] measuring phagocytosis[29]

Industrial Applications Color filters;[30] liquid crystals;[31,32] photoresists;[33] liquid crystal displays;[34,35] inks;[36,37] toners;[38] adhesive paper;[39] electrophotography;[40] optical devices;[41] air freshners;[42] furniture polish;[43] pesticide;[44] plastic lenses;[45] steel materials;[46] textiles;[47] petroleum products;[48,49] perfumes;[50] wood products[51]

Safety/Toxicity Cytotoxicity;[52,53] deformation of lipid droplets;[12] cardiovascular toxicity;[54] nephrotoxicity[55]

Certification/Approval Certified by Biological Stain Commission (BSC)

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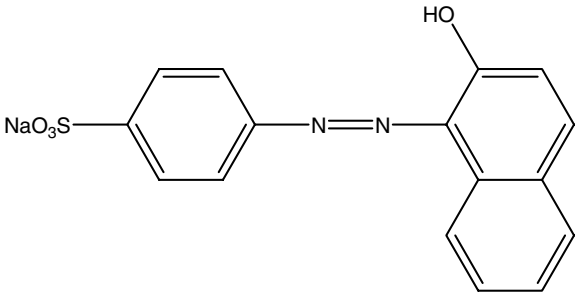
ORANGE II (TROPAEOLIN OOO)

CAS Registry Number 633-96-5

Chemical Structure



CA Index Name Benzenesulfonic acid, 4-[2-(2-hydroxy-1-naphthalenyl)diazenyl]-, sodium salt (1:1)

Other Names Acid Orange; Acid Orange A; Benzenesulfonic acid, 4-[(2-hydroxy-1-naphthalenyl)azo]-, monosodium salt; C.I. Acid Orange 7, monosodium salt; Benzenesulfonic acid, *p*-(2-hydroxy-1-naphthylazo)-, sodium salt; β-Naphthol Orange; β-Naphthyl orange; 11550 Orange; 2-Naphthol Orange II; AO 7; Acid Leather Orange PRW; Acid Leather Orange extra; Acid Orange 7; Acid Orange II; Acilan Orange II; Airedale Orange II; Amacid Orange Y; Amacid Orange Y Conc; Apollo Acid Orange II; Atul Acid Orange II; BTK Orange II; Basacid Orange 280; Basacid Orange 282; Benzenesulfonic acid, 4-[2-(2-hydroxy-1-naphthalenyl)diazenyl]-, monosodium salt; Betanaphthol orange; Borunil Orange A 2R; Brasilan Orange A; Bucacid Orange A; C Ext. Orange 8; C.I. 15510; C.I. Acid Orange 7; Calcocid Orange Y; Certiqual Orange II; Colacid Orange; Colocid Orange II; Colorosacid Orange; Conacid Orange L; Concorde Acid Orange II; Concorde Leather Orange MT; Covalene Orange II; Curol Orange; D and C Orange 4 Aluminum Lake; D and C Orange No. 4; D&C Orange #4; D&C Orange No. 4; D&C Orange No. 4-307005; D&C Orange No. 4-90121; Daedo Acid Orange 2G; Derma Fur Orange R 125; Dermacid Orange 2R; Diacid Orange II; Dinacid Orange II; Duasyn Acid Orange P; Dyacid Orange II; Dycosacid Orange Yellow II; Dynacid Orange Y; Egacid Orange II; Eniacid Orange II; Erio Orange II; Everacid Orange II; Fenazo Orange; Hidacid Orange II; Hispacid Orange AF; Ichoacid Orange II; Indacid Orange II; Japan Orange 205; Japan Orange No. 205; Java Orange II; Kemacid Orange II; Keyacid Orange II; Kiton Orange II; Kromon Lake Orange Toner; Lake Orange A; Lake Orange II YS; Leather Orange Extra; Libacid Orange LII; Lurazol Orange E; Lurazol Orange EBR; Lutetia Orange 3JR; Mandarin G; Multacid Orange II; Multicuer Orange II; Naphthalene Lake Orange G; Naphthalene Orange G; Naphthol Orange; Naphthol Red J; Naphtocard Orange II; Neelicol Orange II; Neklacid Orange II; No. 177 Orange Lake; Nubilon Orange R; Orange 2; Orange 2 sodium salt; Orange Extra N; Orange Extra P; Orange II; Orange II 307004; Orange II 90121; Orange II Special For Lacquer; Orange II for Lakes; Orange IIC; Orange IIP; Orange IIS; Orange IISM; Orange No. 205; Orange Toner GRT; Orange Y; Orange YA; Orange YZ; Pacid Orange II; Peeracid Orange II; Persian Orange; Persian Orange Lake; Persian Orange X; Pure Orange II S; Rifa Acid Orange 2G; Rifa Acid Orange II; Rifa Leather Orange BR; Ritacid Orange II; Romexal Orange; Rybacel Orange A; Sandal Acid Orange II; Sanyo Gum Orange A; Sodium 4-(2-hydroxy-1-naphthylazo)benzenesulfonate; Solar Orange; Special Orange GR; Special Orange H; Sulfacide Orange JR; Symuler Orange Lake 43; Symulon Acid Orange II; Takaoka Acid Orange II; Tangarine Lake X 917; Tertracid Orange II; Triacid Orange II; Tropaeolin OOO; Tropaeolin OOO 2; Tropeolin OOO; Vibra Color Orange AOR 7; Vicoacid Orange II; Vondacid Orange II; Vopsider Orange A; Water Orange 060506; Wool Orange A; *p*-(2-Hydroxy-1-naphthylazo)benzenesulfonic acid sodium salt

Merck Index Number 6858

Chemical/Dye Class Azo

Molecular Formula $C_{16}H_{11}N_2NaO_4S$

Molecular Weight 350.32

Physical Form Orange-brown powder

Solubility Very soluble in water; very slightly soluble in ethanol

Melting Point 164 °C

pH Range 7.4–8.6; 10.2–11.8

Color Change at pH Amber (7.4) to orange (8.6); orange (10.2) to red (11.8)

pK_a 8.26, 11.4

Absorption (λ_{max}) 483 nm

Synthesis Synthetic methods[1–9]

Staining Applications Drinks;[10] candies;[10] Heinz bodies in erythrocytes;[11] Horny cells;[12] eye shadow;[13] lips;[14,15] skin;[14–17] tooth;[18] hairs;[1,19–22] keratin fibers[23,24]

Biological Applications Cosmetics;[1,15,25] wound dressing materials[1,26]

Industrial Applications Organic light emitting devices;[1,27] inks;[1,28] cleansing products;[29] textiles[1,30]

Safety/Toxicity Acute toxicity;[1,31] carcinogenicity;[1,32] environmental toxicity;[33] fish toxicity;[1,34] genotoxicity;[1,35] mutagenicity[1,36,37]

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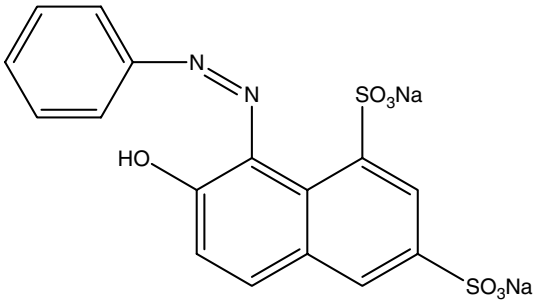
ORANGE G

CAS Registry Number 1936-15-8

Chemical Structure



CA Index Name 1,3-Naphthalenedisulfonic acid, 7-hydroxy-8-(2-phenyldiazenyl)-, sodium salt (1:2)

Other Names 1,3-Naphthalenedisulfonic acid, 7-hydroxy-8-(phenylazo)-, disodium salt; 2-Naphthol-6,8-disulfonic acid, 1-phenylazo-, disodium salt; C.I. Acid Orange 10; C.I. Acid Orange 10, disodium salt; 1370 Orange; Acid Crystal Orange; Acid Fast Orange EGG; Acid Fast Orange G; Acid Fast Orange GG; Acid Leather Orange G; Acid Leather Orange KG; Acid Leather Orange PGW; Acid Lightfast Orange; Acid Orange 10; Acid Orange 2G; Acid Orange 2GL; Acid Orange EGG; Acid Orange G; Acid Orange G Crystal; Acid Orange GG; Acid Orange Lightfast; Acidal Fast Orange; Acilan Orange GX; Amacid Crystal Orange; Amacid Light Orange G; Anadurm Orange A-G; Apocid Orange 2G; Atul Acid Crystal Orange G; Brasilan Orange 2G; Bucacid Fast Orange G; C.I. 16230; C.I. Food Orange 4; Calcocid Fast Light Orange 2G; Certicol Orange GS; Cetil Light Orange GG; Colacid Orange G; Colocid Orange 2G; Colorosacid Orange 10; Concorde Acid Orange L-GX; Crystal Orange 2G; Crystal Orange G; D and C Orange No. 3; Dinacid Crystal Orange G; Dolkwal Orange G; Duasyn Acid Orange GG; Dyacid Orange G; Dynacid Orange 2G; Egacid Orange GG; Eniacid Light Orange G; Erio Fast Orange AS; Fabracid Orange FL; Fast Acid Orange G; Fast Light Orange G; Fast Light Orange GA-CF; Fenazo Light Orange 2G; Food Orange 4; Food Orange GG; Hexacol Orange G; Hexacol Orange GG Crystals; Hidacid Fast Orange G; Hispacid Fast Orange 2G; Indacid Crystal Orange; Kemacid Crystal Orange G; Keyacid Orange 2G; Kiton Fast Orange G; Light Orange G; Multacid Orange 2G; Naphthalene Fast Orange 2G; Naphthalene Fast Orange 2GS; Naphthazine Orange 2G; Neelicol Orange G; Neklacid Fast Orange GG; Orange 2G; Orange BPC; Orange G; Orange G dye; Orange GBPC; Orange GG; Pacid Orange G 10; Sandolan Fast Orange E-GL; Sandolan Orange E-GL; Solar Light Orange GX; Straight Orange G; Tetracid Light Orange G; Triacid Light Orange 2G; Vicoacid Orange IJ; Victacid Orange IJ; Vondacid Light Orange 2G; Water Orange 145924; Wool Orange 2G; Wool Orange G; Xylene Fast Orange G

Merck Index Number Not listed

Chemical/Dye Class Azo

Molecular Formula $C_{16}H_{10}N_2Na_2O_7S_2$

Molecular Weight 452.37

Physical Form Orange to red powder

Solubility Soluble in water, methyl cellosolve; slightly soluble in ethanol; insoluble in xylene

Melting Point 141 °C

pH Range 11.5–14.0

Color Change at pH Yellow (11.5) to pink (14.0)

pK_a 12.8

Absorption (λ_{max}) 475 nm

Synthesis Synthetic method[1–6]

Staining Applications Adenohypophyseal cells;[7] clavanins;[8] cells;[9] eosinophil leukocyte granules;[10] fungi;[11] food;[12] drinks;[13] candies;[13] lymph nodes;[14] pap smears;[15] proteins;[16,17] keratin fibers;[18] hairs;[19] skin;[20,21] sputum;[22] glial tumors;[23] zein membranes;[24] urinary sediments[25]

Biological Applications Detecting lung cancer metastasis;[14] measuring glycated proteins;[26] ophthalmic devices[27]

Industrial Applications Inks;[28,29] highlighters;[30] photography;[31] plastics;[32] paper;[33] textiles;[34–36] wood[37]

Safety/Toxicity Acute oral toxicity;[38] bacterial toxicity;[40] carcinogenicity;[39,41–46] chromosomal aberration;[46–48] freshwater shrimp toxicity;[49] genotoxicity;[50,51] hematotoxicity;[52] mutagenicity;[41,42,53–57] serological toxicity;[52] short-term toxicity[58,59]

Certification/Approval Certified by Biological Stain Commission (BSC)

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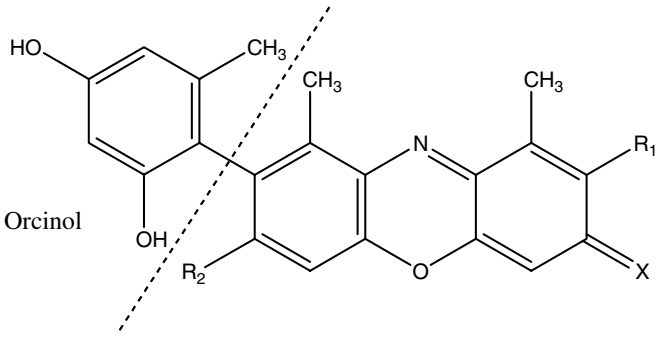
ORCEIN

CAS Registry Number 1400-62-0

Chemical Structure Note: Orcein is a mixture of 14 dyes. The major components of orcein are given below:



Orcein	R_1	R_2	X
α-Aminoorcein	H	NH_2	O
α-Hydroxyorcein	H	OH	O
β- and γ-Aminoorcein	Orcinol	NH_2	O
β- and γ-Hydroxyorcein	Orcinol	OH	O
β- and γ-Aminoorceimine	Orcinol	NH_2	NH

CA Index Name Orcein

Other Names C.I. 1242; C.I. Natural Red 28

Merck Index Number 6863

Chemical/Dye Class Phenoxazine

Molecular Formula Unspecified (it is a mixture)

Molecular Weight Unspecified (it is a mixture)

Physical Form Brownish-red or brownish-black powder or crystals

Solubility Insoluble in water, benzene, chloroform, ether; soluble in ethanol, acetone, acetic acid; soluble in aqueous alkali

Melting Point Unspecified (it is a mixture)

Boiling Point Unspecified (it is a mixture)

pK_a 4.0, 6.9, 13.4

Absorption (λ_{max}) 575 nm

Emission (λ_{max}) 585–590 nm

Synthesis Synthetic methods[1–17]

Staining Applications Bronchial elastic fibers;[18] chromosomes;[19] eosinophil granules;[20] elastic fibers;[21,22] embryos;[23] fibronectin;[24] vitronectin;[24] hepatocytes;[25] hepatitis B virus;[26] hepatitis;[27] hepatocellular carcinoma;[27–31] hepatitis B surface antigen (HBsAg);[32–34] histamine;[35] Kupffer cells;[36] leukocytes;[37] lipids;[38] mucins;[39] lipoproteins;[40] plasma proteins;[40] nucleic acids;[41] oocytes;[42] hairs[43,44]

Biological Applications Diagnosis of liver biopsy;[45] detecting *Candida*,[46] hepatitis B surface antigen in fixed tissues,[30] histamines,[35] HBsAg in liver cell,[32] microorganisms[47]

Industrial Applications Textiles[48]

Safety/Toxicity Carcinogenicity[49]

Certification/Approval Certified by Biological Stain Commission (BSC)

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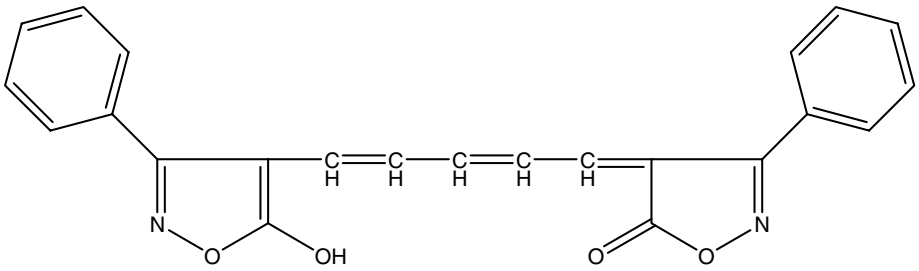
OXONOL V

CAS Registry Number 61389-30-8

Chemical Structure



CA Index Name 5(4*H*)-Isoxazolone, 4-[5-(5-hydroxy-3-phenyl-4-isoxazolyl)-2,4-pentadien-1-ylidene]-3-phenyl-

Other Names Bis[3-phenyl-5-oxoisoxazol-4-yl]pentamethineoxonol; 4-[5-(5-Hydroxy-3-phenyl-4-isoxazolyl)-2,4-pentadienylidene]-3-phenyl-5(4*H*)-isoxazolone; 5(4*H*)-Isoxazolone, 4-[5-(5-hydroxy-3-phenyl-4-isoxazolyl)-2,4-pentadienylidene]-3-phenyl-; 1,5-Penta-1,3-dien-1-yl-5-ylidene-bis(5-oxo-3-phenyl-4-isoxazole); OX-V; Oxonol V

Merck Index Number Not listed

Chemical/Dye Class Oxonol; Isoxazole

Molecular Formula $C_{23}H_{16}N_2O_4$

Molecular Weight 384.38

Physical Form Dark green powder

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide

Melting Point 200.5–201.5 °C (decompose)

Boiling Point (Calcd.) 634.1 ± 65.0 °C, pressure: 760 Torr

pK_a (Calcd.) 5.06 ± 0.50, most acidic, temperature: 25 °C; -3.45 ± 0.50, most basic, temperature: 25 °C

Absorption (λ_{max}) 610 nm

Emission (λ_{max}) 639 nm

Synthesis Synthetic methods[1,2]

Staining Applications Cerebral cortex;[3] chromaffin granule;[4] lipid vesicles;[5] liposomes;[6] proteoliposomes;[7] submitochondrial particles[8]

Biological Applications Measuring membrane potential;[4,7,9–14] potassium channel openers;[15] BK channel activator;[16] pyrophosphate assay[17]

Industrial Applications Photographic materials[18]

Safety/Toxicity No data available

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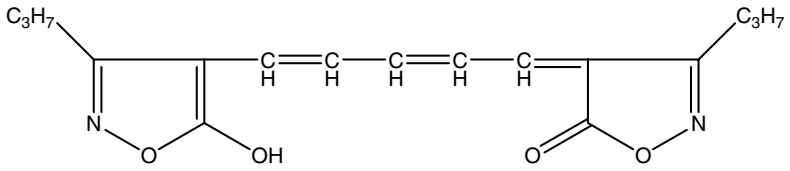
OXONOL VI

CAS Registry Number 64724-75-0

Chemical Structure



CA Index Name 5(4*H*)-Isoxazolone, 4-[5-(5-hydroxy-3-propyl-4-isoxazolyl)-2,4-pentadien-1-ylidene]-3-propyl-

Other Names 1,5-Bis(5-oxo-3-propylisoxazol-4-yl) pentamethine oxonol; Bis[3-porpyl-5-oxoisoxazol-4-yl] pentamethineoxonol; 5(4*H*)-Isoxazolone, 4-[5-(5-hydroxy-3-propyl-4-isoxazolyl)-2,4-pentadienylidene]-3-propyl-; OX-VI; Oxonol VI

Merck Index Number Not listed

Chemical/Dye Class Oxonol; Isoxazole

Molecular Formula $C_{17}H_{20}N_2O_4$

Molecular Weight 316.35

Physical Form Dark brown powder

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide

Boiling Point (Calcd.) 499.4 ± 55.0 °C, pressure: 760 Torr

pK_a (Calcd.) 5.40 ± 0.50, most acidic, temperature: 25 °C; -2.35 ± 0.50, most basic, temperature: 25 °C

Absorption (λ_{max}) 599 nm

Emission (λ_{max}) 634 nm

Synthesis Synthetic methods[1,2]

Staining Applications Bacteria;[3] liposomes;[4] proteoliposomes;[5,6] lipid particles;[7] lipid vesicles;[8,9] proteins;[10] sarcoplasmic reticulum;[11] submitochondrial particles[12]

Biological Applications Measuring membrane potential;[3,4,6,9,11,13–20] treating Alzheimer's disease;[21] potassium channel openers[22]

Industrial Applications Not reported

Safety/Toxicity No data available

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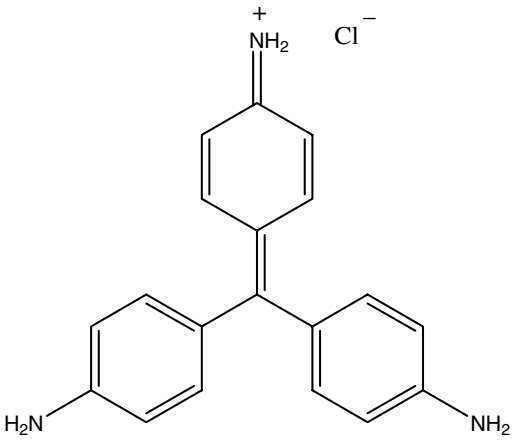
PARAROSANILINE HYDROCHLORIDE

CAS Registry Number 569-61-9

Chemical Structure



CA Index Name Benzenamine, 4,4′-[(4-imino-2,5-cyclohexadien-1-ylidene)methylene]bis-, hydrochloride (1:1)

Other Names Benzenamine, 4,4′-[(4-imino-2,5-cyclohexadien-1-ylidene)methylene]bis-, monohydrochloride; Benzenamine, 4-[(4-aminophenyl)(4-imino-2,5-cyclohexadien-1-ylidene)methyl]-, monohydrochloride; C.I. Basic Red 9, monohydrochloride; Para Magenta; Basic Parafuchsine; Basic Red 9; C.I. 42500; C.I. Basic Red 9; Calcozine Magenta N; Fuchsine DR 001; Fuchsine SP; Fuchsine SPC; Orient Para Magenta Base; Parafuchsin; Parafuchsine; Pararosaniline; Pararosaniline chloride; Pararosaniline hydrochloride; *p*-Fuchsin; *p*-Fuchsine; *p*-Rosaniline hydrochloride

Merck Index Number Not listed

Chemical/Dye Class Triphenylmethane

Molecular Formula $C_{19}H_{18}ClN_3$

Molecular Weight 323.82

Physical Form Dark green crystals

Solubility Soluble in water, ethanol; insoluble in ether

Melting Point 268–270 °C (decompose)

Absorption (λ_{max}) 545 nm

Synthesis Synthetic methods[1–11]

Staining Applications Cytokines;[12] antigen-specific antibody;[12] leukocytes;[13] nuclei;[14] nucleic acids;[15,16] parasites;[17] precancerous cells;[18] prions;[19] hairs;[20] keratine fibers[21]

Biological Applications Detecting breast cancer;[22] treating pathogens[23]

Industrial Applications Optical waveguides;[24] semiconductor materials;[25] nanoparticles;[26] inks;[27–29] highlighters;[30] toner;[31] textiles;[32] wood[33]

Safety/Toxicity Carcinogenicity;[34–41] chemical toxicity;[42] chromosomal aberration;[39,43,44] genotoxicity;[45] mutagenicity[37,42,46–48]

Certification/Approval Certified by Biological Stain Commission (BSC)

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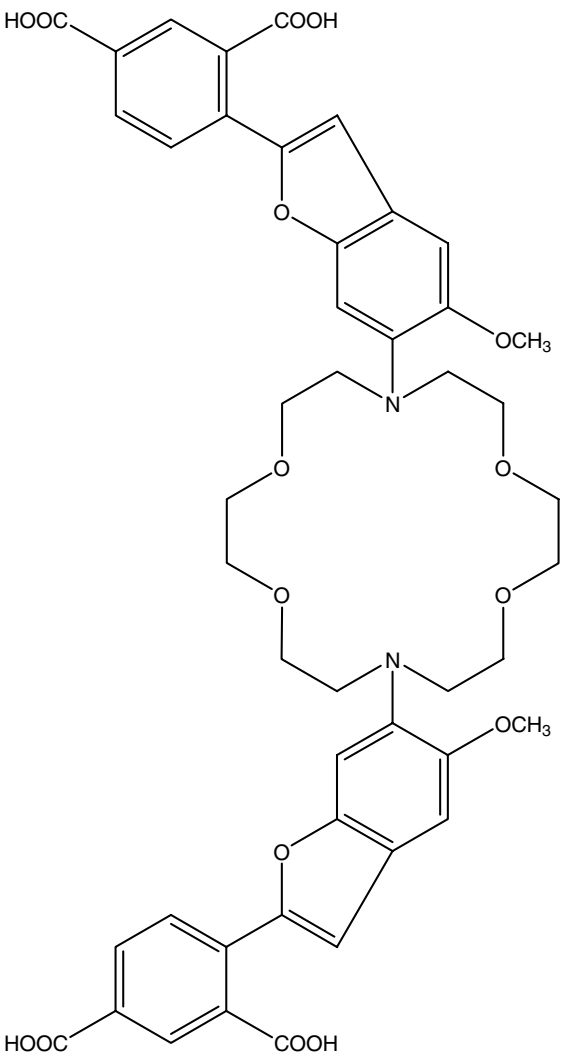
PBFI

CAS Registry Number 124549-11-7

Chemical Structure



CA Index Name 1,3-Benzenedicarboxylic acid, 4,4′-[1,4,10,13-tetraoxa-7,16-diazacyclooctadecane-7,16-diylbis(5-methoxy-6,2-benzofurandiyl)]bis-

Other Names 1,4,10,13-Tetraoxa-7,16-diazacyclooctadecane, 1,3-benzenedicarboxylic acid derivative; PBFI

Merck Index Number Not listed

Chemical/Dye Class Benzofuran

Molecular Formula $C_{46}H_{46}N_2O_{16}$

Molecular Weight 882.86

Physical Form Brownish-yellow powder

Solubility Soluble in methanol, dimethyl sulfoxide

Melting Point >200 °C

Boiling Point (Calcd.) 1058.8 ± 65.0 °C, pressure: 760 Torr

pK_a (Calcd.) 2.96 ± 0.36, most acidic, temperature: 25 °C; 4.06 ± 0.40, most basic, temperature: 25 °C

Absorption (λ_{max}) 336 nm

Emission (λ_{max}) 557 nm

Synthesis Synthetic methods[1–3]

Staining Applications Potassium ions;[1–15] cells;[16] liposomes[4]

Biological Applications Potassium indicator;[1–15] monitoring cellular processes[16]

Industrial Applications Not reported

Safety/Toxicity Carcinogenicity[17]

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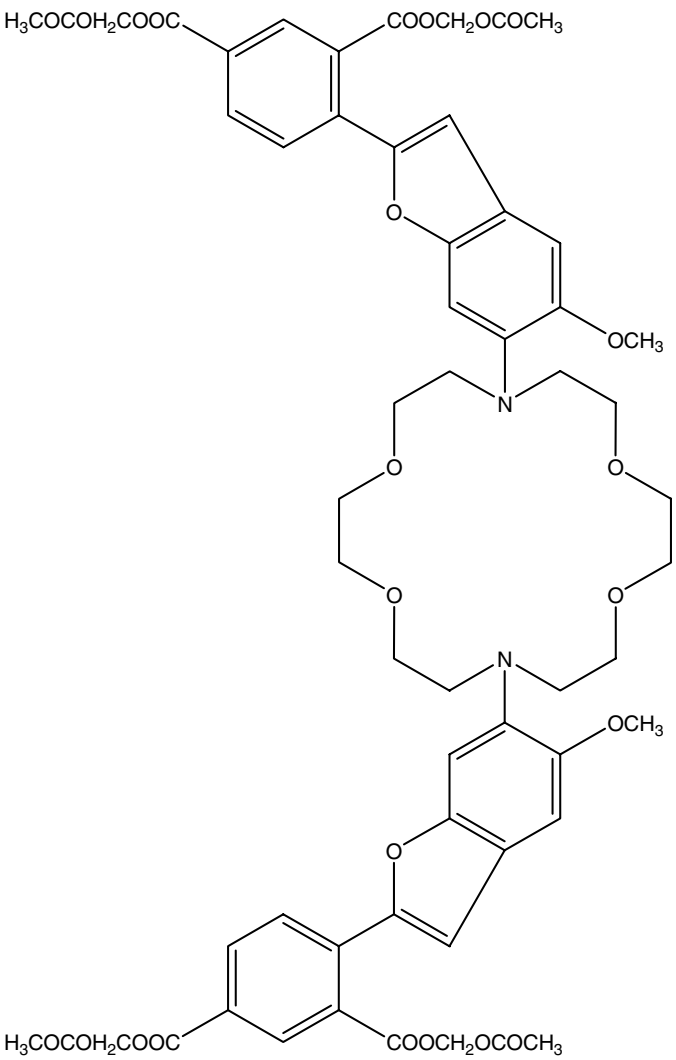
PBFI AM

CAS Registry Number 124549-23-1

Chemical Structure



CA Index Name 1,3-Benzenedicarboxylic acid, 4,4′-[1,4,10,13-tetraoxa-7,16-diazacyclooctadecane-7,16-diylbis(5-methoxy-6,2-benzofurandiyl)]bis-, tetrakis [(acetyloxy)methyl] ester

Other Names 1,4,10,13-Tetraoxa-7,16-diazacyclooctadecane, 1,3-benzenedicarboxylic acid derivative; PBFI AM

Merck Index Number Not listed

Chemical/Dye Class Benzofuran

Molecular Formula $C_{58}H_{62}N_2O_{24}$

Molecular Weight 1171.11

Physical Form Yellowish-brown powder

Solubility Soluble in methanol, dimethyl sulfoxide

Melting Point >200 °C

Boiling Point (Calcd.) 1136.6 ± 65.0 °C, pressure: 760 Torr

pK_a (Calcd.) 3.79 ± 0.40, most basic, temperature: 25 °C

Absorption (λ_{max}) 369 nm

Emission (λ_{max}) Fluorescence is very weak

Synthesis Synthetic methods[1,2]

Staining Applications Potassium ions[1,2]

Biological Applications Potassium indicator[1,2]

Industrial Applications Not reported

Safety/Toxicity No data available

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1. Tsien, R. Y.; Minta, A. Preparation and use of selective fluorescent indicator dyes for alkali metal cation analysis. Eur. Pat. Appl. EP 369733, 1990; *Chem. Abstr*. **1991**, *115*, 227789.

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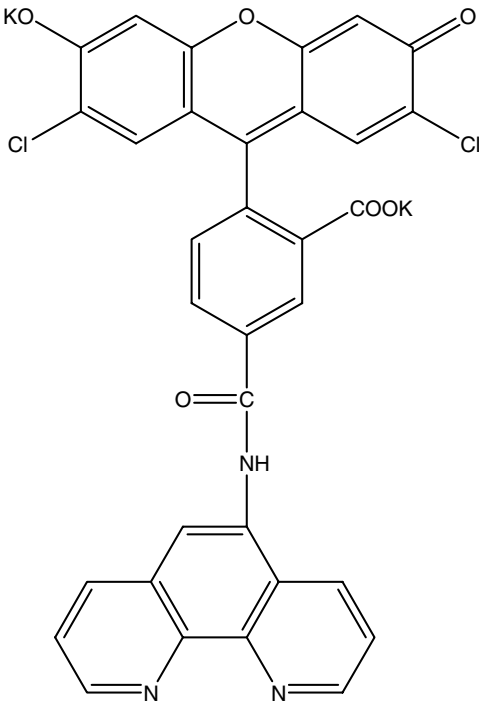
PHEN GREEN SK

CAS Registry Number 234075-34-4

Chemical Structure



CA Index Name Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthene]-5-carboxamide, 2′,7′-dichloro-3′,6′-dihydroxy-3-oxo-*N*-1,10-phenanthrolin-5-yl-, potassium salt (1:2)

Other Names Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthene]-5-carboxamide, 2′,7′-dichloro-3′,6′-dihydroxy-3-oxo-*N*-1,10-phenanthrolin-5-yl-, dipotassium salt; Phen Green SK; Phen Green dipotassium salt

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{33}H_{15}Cl_2K_2N_3O_6$

Molecular Weight 698.60

Physical Form Solid

Solubility Soluble in water

Melting Point >200 °C

Absorption (λ_{max}) 507 nm

Emission (λ_{max}) 532 nm

Synthesis Synthetic methods[1,2]

Staining Applications Copper ions;[1,2,5] iron ions;[6–8] cells;[3] neurons[4]

Biological Applications Copper indicators;[1,2,5] iron ions[6–8]

Industrial Applications Not reported

Safety/Toxicity No data available

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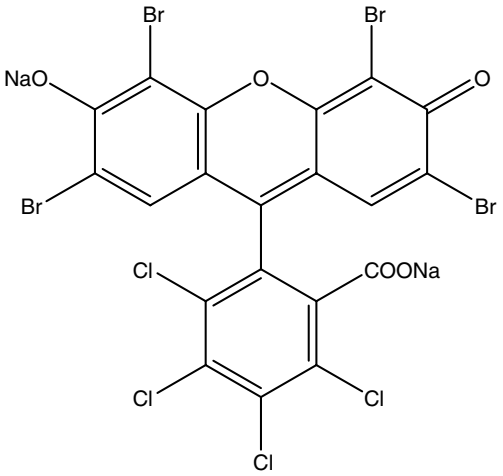
PHLOXINE B

CAS Registry Number 18472-87-2

Chemical Structure



CA Index Name Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-3-one, 2′,4′,5′,7′-tetrabromo-4,5,6,7-tetrachloro-3′,6′-dihydroxy-, sodium salt (1:2)

Other Names Fluorescein, 2′,4′,5′,7′-tetrabromo-4,5,6,7-tetrachloro-, disodium salt; Phloxin B; Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-3-one, 2′,4′,5′,7′-tetrabromo-4,5,6,7-tetrachloro-3′,6′-dihydroxy-, disodium salt; 11969 Red; 3427 Veri Pur Pink; Acid Red 92; Aizen Acid Phloxine PB; C.I. 45410; C.I. Acid Red 92; Cyanosin; Cyanosin (acid dye); Cyanosin B; Cyanosine; D and C Red No. 28; D&C Red 28; D&C Red 28-308267; D&C Red No. 28; D&C Red No. 28-15347; D&C Red No. 28-38015; Daiwa Red 104WB; Daiwa Red 45; Disodium 9-(3′,4′,5′,6′-tetrachloro-*o*-carboxyphenyl)-6-hydroxy-6-hydroxy-2,4,5,7-tetrabromo-3-isoxanthone; Eosin blue; Eosin bluish; Eosine blue; Eosine bluish; Food Red 104; Food Red No. 104; Japan Red 104; Japan Red 104-1; Japan Red No. 104-1; Orient Water Pink 2; Phloxine B; Phloxine B 38015; Phloxine P; Phyloxine B; Red 104; Red No. 104; Red No. 104-1; Triacid Floxine 2G; Water Pink 2

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{20}H_2Br_4Cl_4Na_2O_5$

Molecular Weight 829.66

Physical Form Red to brown crystals

Solubility Soluble in water, ethylene glycol; slightly soluble in ethanol, methanol

Melting Point >250 °C

pH Range 1.1–3.3; 3.4–5.0

Color Change at pH Colorless (1.1) to purple (3.3); colorless (3.4) to yellow (5.0)

Absorption (λ_{max}) 548 nm, 510 nm

Synthesis Synthetic methods[1–7]

Staining Applications Albumin;[8,9] aluminum;[10] bacteria;[11] candies;[12] drinks;[12] dental plaque;[1,13,14] lymph node;[15] proteins;[16,17] peptides;[17] carious tissue;[18] teeth;[19] sunscreen;[20,21] eyebrows;[29] eyelashes;[29] eye shadow;[22] fingerprint powders;[23] lipsticks;[24] lips;[1,25–27,29,30] nails;[30] skin;[1,25–34] hairs;[1,28,29,35–39] keratin fibers[40]

Biological Applications Detecting proteins;[41] treating microbial infection,[42] parasitic infection,[42] skin,[43,44] mouth,[43,44] digestive tract,[43,44] urinary tract,[43,44] reproductive tract,[43,44] respiratory tract,[43,44] circulatory system,[43,44] head,[43,44] neck,[43,44] endocrine system,[43,44] lymphoreticular system,[43,44] cystic fibrosis,[45] disseminated bronchectasis,[45] pulmonary infections,[45] chronic pancreatitis,[45] male infertility,[45] long QT syndrome,[45] protozoan infections,[46] yeast infection,[47] fungal infections;[47] antimicrobial agent;[48] insecticides;[49] herbicides[50]

Industrial Applications Color filter;[1,51] liquid-crystal displays;[51] solar cells;[52] optical waveguides;[1,53] electrochromic displays;[1,54] photoresists;[55] recording materials;[56] photographic materials;[57] inks;[1,58–61] toner;[62] highlighters;[1,63] paints;[64] adhesives;[65] petroleum markers;[66] cleansing products[67,68]

Safety/Toxicity Acute toxicity;[1,69] chronic toxicity;[1,69] cytotoxicity;[1,70–74] genotoxicity;[75] insect toxicity;[1,76] microbial toxicity;[77] mutagenicity;[1,78–80] oral toxicity;[1,81] photodynamic toxicity;[82] phototoxicity;[1,83,84] teratogenicity;[1,85] yeast toxicity[86]

Certification/Approval Certified by Biological Stain Commission (BSC)

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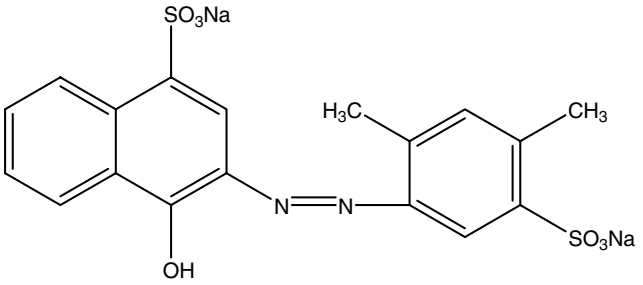
PONCEAU SX

CAS Registry Number 4548-53-2

Chemical Structure



CA Index Name 1-Naphthalenesulfonic acid, 3-[2-(2,4-dimethyl-5-sulfophenyl)diazenyl]-4-hydroxy-, sodium salt (1:2)

Other Names 1-Naphthalenesulfonic acid, 3-[(2,4-dimethyl-5-sulfophenyl)azo]-4-hydroxy-, disodium salt; C. I. Food Red 1; C.I. Food Red 1, disodium salt; Ponceau SX; 12101 Red; 1306 Red; C.I. 14700; Certicol Ponceau SXS; D and C Red No. 4; Edicol Supra Ponceau SX; FD and C Red No. 4; FD&C Red No. 4; FDC Red 4; Food Red 1; Food Red 4; Hexacol Ponceau SX; Japan Red 4; Japan Red 504; Japan Red No. 4; Japan Red No. 504; Red 4; Red No. 1; Red No. 504; Usacert Red No. 4

Merck Index Number 7591

Chemical/Dye Class Azo

Molecular Formula $C_{18}H_{14}N_2Na_2O_7S_2$

Molecular Weight 480.42

Physical Form Red crystals

Solubility Soluble in water, ethanol

Melting Point >300 °C

Absorption (λ_{max}) 500 nm

Synthesis Synthetic methods[1–4]

Staining Applications Animal feed;[5] drinks;[6] candies;[6] frozen food;[7] meat;[8] microorganisms;[9] sausage casings;[10] lotion;[11] eye shadows;[12] lips;[13,14] skin;[14–17] hairs;[18–21] keratin fibers[22,23]

Biological Applications Detecting proteins;[24] treating acquired resistance to GABAergic (ARG) agents;[25] Shampoos;[26] soaps[27]

Industrial Applications Inks;[28,29] cleansing products;[30] fabric softener;[31,32] herbicides;[33] perfumes[34]

Safety/Toxicity Acute toxicity;[35] carcinogenicity;[36,37] chronic toxicity;[38] Genotoxicity;[39,40] mutagenicity[41–44]

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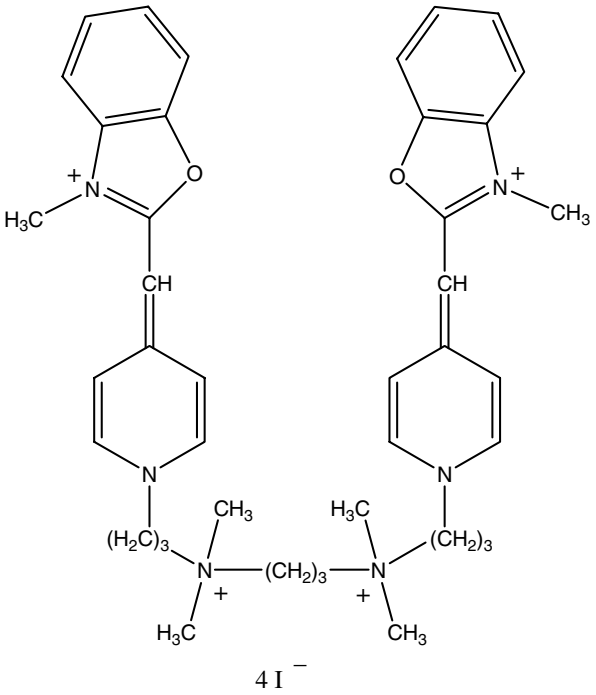
POPO 1

CAS Registry Number 169454-15-3

Chemical Structure



CA Index Name Benzoxazolium, 2,2′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl-1(4*H*)-pyridinyl-4-ylidenemethylidyne]]bis[3-methyl-, iodide (1:4)

Other Names Benzoxazolium, 2,2′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl-1(4*H*)-pyridinyl-4-ylidenemethylidyne]]bis[3-methyl-, tetraiodide; POPO 1; POPO 1 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{41}H_{54}I_4N_6O_2$

Molecular Weight 1170.53

Physical Form Yellow-brown powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250 °C

Absorption (λ_{max}) 434 nm

Emission (λ_{max}) 456 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[1–5] cells;[6,7] leukocytes;[16] nuclei;[16] megakaryocytes;[8] microorganisms;[9] sperms;[10] hairs[11]

Biological Applications Nucleic acid hybridization;[12,13] detecting nucleic acids,[1–5,14] cells,[6,7] pathogens;[15] counting embryoblasts[16]

Industrial Applications Not reported

Safety/Toxicity No data available

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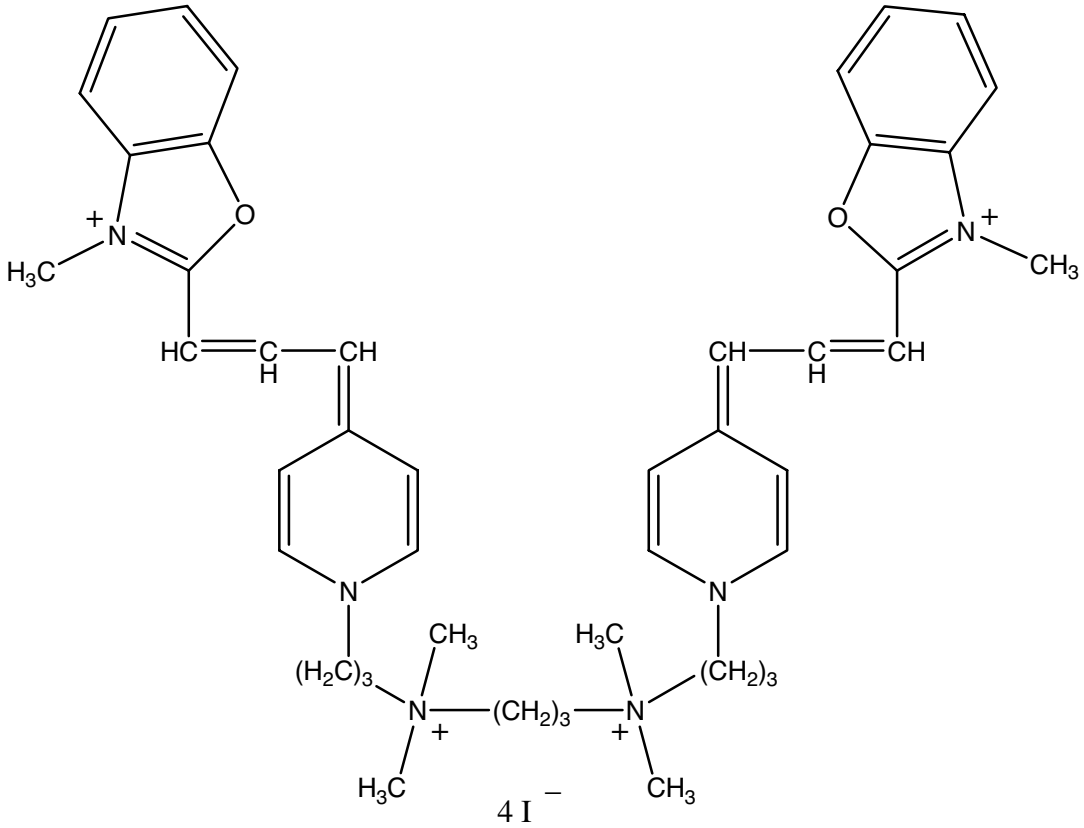
POPO 3

CAS Registry Number 154757-99-0

Chemical Structure



CA Index Name Benzoxazolium, 2,2′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl-1(4*H*)-pyridinyl-4-ylidene-1-propen-1-yl-3-ylidene]]bis[3-methyl, tetraiodide

Other Names POPO 3; POPO 3 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{45}H_{58}I_4N_6O_2$

Molecular Weight 1222.61

Physical Form Yellow-brown powder

Solubility Soluble in *N*,*N*-dimethylformamide

Melting Point >250 °C

Absorption (λ_{max}) 534 nm

Emission (λ_{max}) 570 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[2–7] cells;[8] leukocytes;[16] nuclei;[16] megakaryocyte;[9] microorganisms;[10] sperms[11]

Biological Applications Nucleic acid hybridization;[12,13] detecting nucleic acids,[2–7] cells,[8] hepatitis B virus,[14] pathogens;[15] counting embryoblasts;[16] biochips;[17] nucleic acid fragment sizing[6]

Industrial Applications Not reported

Safety/Toxicity No data available

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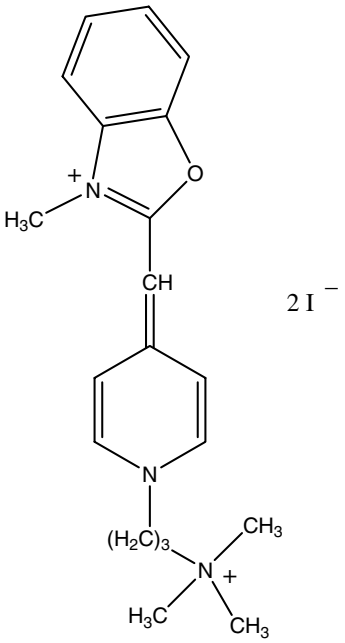
PO-PRO 1

CAS Registry Number 157199-56-9

Chemical Structure



CA Index Name Benzoxazolium, 3-methyl-2-[[1-[3-(trimethylammonio)propyl]-4(1*H*)-pyridinylidene]methyl]-, iodide (1:2)

Other Names Benzoxazolium, 3-methyl-2-[[1-[3-(trimethylammonio)propyl]-4(1*H*)-pyridinylidene]methyl]-, diiodide; PO-PRO 1; PO-PRO 1 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{20}H_{27}I_2N_3O$

Molecular Weight 579.26

Physical Form Yellow-brown powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250 °C

Absorption (λ_{max}) 435 nm

Emission (λ_{max}) 455 nm

Synthesis Synthetic methods[1,2]

Staining Applications Nucleic acids;[3–7] cells;[1,8,9] microorganisms[10]

Biological Applications Nucleic acid hybridization;[11,12] detecting nucleic acids;[3–7] cells;[1,8,9] nucleic acid sequencing[7]

Industrial Applications Not reported

Safety/Toxicity No data available

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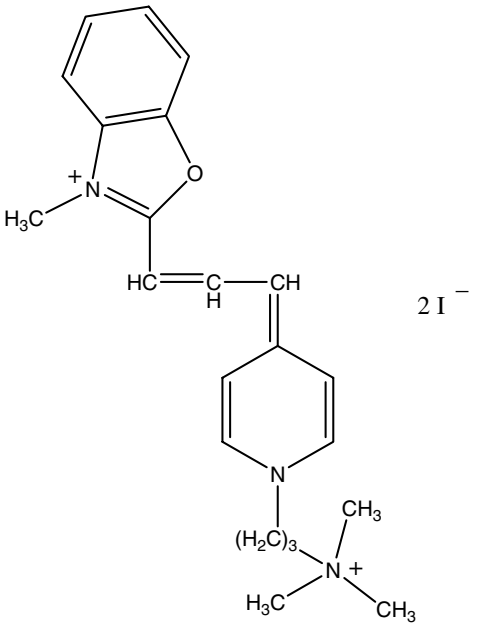
PO-PRO 3

CAS Registry Number 161016-55-3

Chemical Structure



CA Index Name Benzoxazolium, 3-methyl-2-[3-[1-[3-(trimethylammonio)propyl]-4(1*H*)-pyridinylidene]-1-propenyl]-, diiodide

Other Names PO-PRO 3; PO-PRO 3 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{22}H_{29}I_2N_3O$

Molecular Weight 605.30

Physical Form Yellow-brown powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250 °C

Absorption (λ_{max}) 539 nm

Emission (λ_{max}) 567 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[2–8] cells[1,9]

Biological Applications Nucleic acid hybridization;[10,11] detecting nucleic acids,[2–8] cells;[1,9] nucleic acid fingerprinting;[4] nucleic acid fragment sizing;[6] nucleic acid amplification[7]

Industrial Applications Not reported

Safety/Toxicity No data available

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1. Millard, P. J.; Roth, B. L.; Yue, S. T.; Haugland, R. P. Fluorescent viability assay using cyclic-substituted unsymmetrical cyanine dyes. U.S. Patent 5534416, 1996; *Chem. Abstr*. **1996**, *125*, 162751.
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US 2006172315, 2006; *Chem. Abstr*. **2006**, *145*, 183714.

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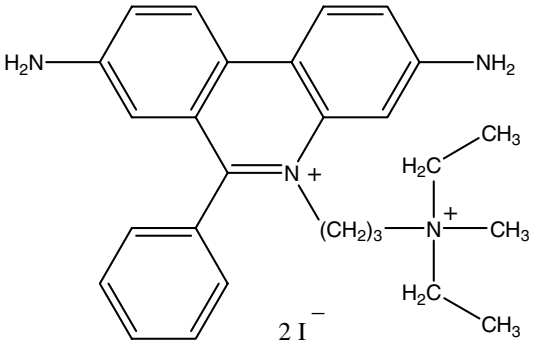
PROPIDIUM IODIDE

CAS Registry Number 25535-16-4

Chemical Structure



CA Index Name Phenanthridinium, 3,8-diamino-5-[3-(diethylmethylammonio)propyl]-6-phenyl-, iodide (1:2)

Other Names 3,8-Diamino-5-(3-diethylaminopropyl)-6-phenylphenanthridinium iodide methiodide; Phenanthridinium, 3,8-diamino-5-[3-(diethylmethylammonio) propyl]-6-phenyl-, diiodide; Ammonium, [3-(3,8-diamino-6-phenyl-5-phenanthridinio)propyl]diethylmethyl-, diiodide; 3,8-Diamino-5-(diethylmethylaminopropyl)-6-phenylphenanthridinium diiodide; PI; Propidium; Propidium diiodide; Propidium iodide

Merck Index Number Not listed

Chemical/Dye Class Phenanthridine

Molecular Formula $C_{27}H_{34}I_2N_4$

Molecular Weight 668.39

Physical Form Red powder

Solubility Soluble in water, *N*,*N*-dimethylformamide, dimethyl sulfoxide

Melting Point 220–225 °C (decompose)

Absorption (λ_{max}) 493 nm, 535 nm

Emission (λ_{max}) 636 nm, 617 nm

Synthesis Synthetic methods[1–5]

Staining Applications Nucleic acids;[5–7] cells;[8,9] HeLa cells;[10] metastatic cancer cells;[11] stem cells;[12] yeast cells;[13] leukocytes;[14] lymph nodes;[15] lymphoma cell lines;[26] megakaryocyte;[16] microorganisms;[17–19] parasites;[20] proteins;[5] sperms[21]

Biological Applications Detecting nucleic acids,[5–7,22] cancer cells,[23] spores,[23] activity of hydrolase,[24] microorganisms;[17–19] apoptosis assay;[25,26] measuring beta-amyloid in Alzheimer's disease (AD);[32] treating diseases associated with androgens,[27] cancer[28]

Industrial Applications Not reported

Safety/Toxicity Cytotoxicity;[29] embryotoxicity;[30] mutagenicity;[31] neurotoxicity[32]

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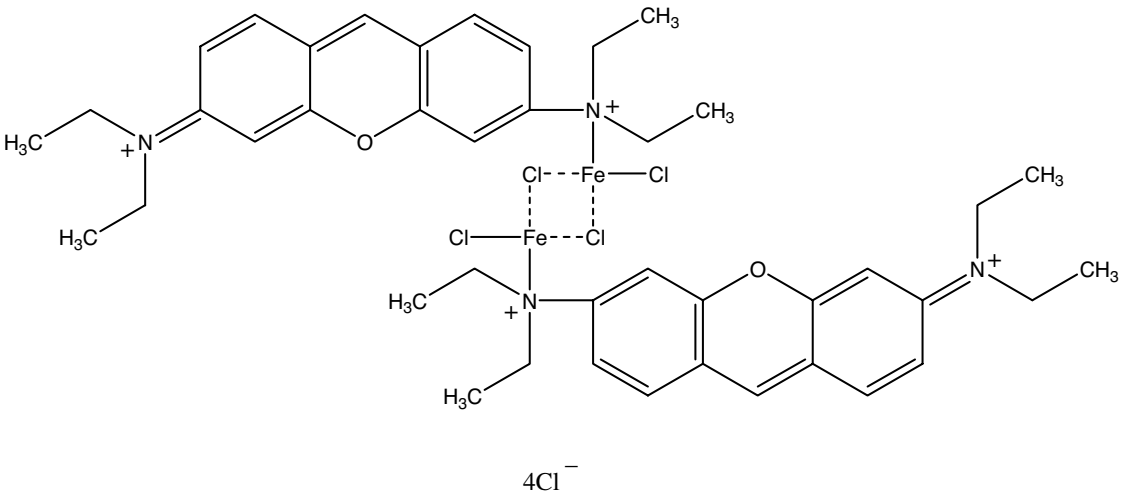
PYRONIN B

CAS Registry Number 2150-48-3

Chemical Structure



$4Cl^-$

Melting Point 176–178 °C

Absorption (λ_{max}) 553 nm

Synthesis Synthetic methods[1–3]

CA Index Name Xanthylium, 3,6-bis(diethylamino)-, chloride (1:1), ferric chloride complex

Other Names Ammonium, [6-(diethylamino)-3*H*-xanthen-3-ylidene]diethyl-, chloride; Ethanaminium, *N*-[6-(diethylamino)-3*H*-xanthen-3-ylidene]-*N*-ethyl-, chloride; Pyronine B; Xanthylium, 3,6-bis(diethylamino)-, chloride; 6-(Diethylamino)-3*H*-xanthen-3-ylidene]diethylammonium chloride; C.I. 45010; Pyronin B; Pyronine B (By)

Merck Index Number 8006

Chemical/Dye Class Xanthene

Molecular Formula $C_{42}H_{54}Cl_8Fe_2N_4O_2$

Molecular Weight 1042.28

Physical Form Green needles or crystals

Solubility Soluble in water, ethyl acetate, methyl acetate, ethylene glycol; slightly soluble in ethanol, methanol, methyl cellosolve

Staining Applications Cytoplasm;[4] nucleic acids;[5–7] plant cells;[8] urine sediments[9–11]

Biological Applications Detecting apoptosis in live cells;[12] determination of DNA,[13] hydrogen peroxide,[14] glucose;[14] diagnosis of diseases related to amyloid accumulation;[15] urinary tract infection;[16] treating protozoan infections in fish[17]

Industrial Applications Organic light emitting diodes;[18] photovoltaic devices;[19] transistors;[20] lithographic printing plates;[21] organic thin films;[22] semiconductor materials;[23] recording materials;[24] electrophotography;[25] determination of gold,[26] ruthenium,[27] thallium;[28] herbicides[29]

Safety/Toxicity No data available

Certification/Approval Certified by Biological Stain Commission (BSC)

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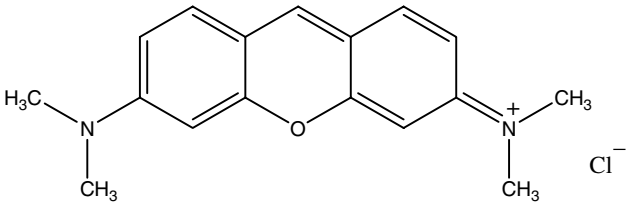
PYRONIN Y

CAS Registry Number 92-32-0

Chemical Structure



CA Index Name Xanthylium, 3,6-bis(dimethylamino)-, chloride (1:1)

Other Names Ammonium, [6-(dimethylamino)-3*H*-xanthen-3-ylidene]dimethyl-, chloride; Methanaminium, *N*-[6-(dimethylamino)-3*H*-xanthen-3-ylidene]-*N*-methyl-, chloride; Pyronine G; Xanthylium, 3,6-bis(dimethylamino), chloride; 3,6-Bis(dimethylamino)xanthylium chloride; C.I. 45005; Pyronin G; Pyronin GS; Pyronin J; Pyronin Y; Pyronin Yellow; Pyronine; Pyronine GS; Pyronine GY; Pyronine Y; Schultz no. 853

Merck Index Number 8007

Chemical/Dye Class Xanthene

Molecular Formula $C_{17}H_{19}ClN_2O$

Molecular Weight 302.80

Physical Form Green powder or crystals

Solubility Soluble in water; sparingly soluble in ethanol, ethylene glycol, methyl cellosolve

Melting Point 250–260 °C

Absorption (λ_{max}) 548 nm

Emission (λ_{max}) 570 nm

Synthesis Synthetic method[1–3]

Staining Applications Cells;[4,5] erythrocytes;[6] hemopoietic stem cells;[7] nucleic acids;[2,8–12] paraffin tissues;[13] precancerous and cancerous cells;[14] proteins;[12,15] human skin explant cultures;[16] spinal fluid;[17] tattoos;[18] urinary sediments;[19] hairs;[20,21] keratin fibers[22,23]

Biological Applications Antimalarial agent;[24] antiviral agent;[25] nucleic acid sequencing;[26] treating protozoan infections;[27] herbicides[28]

Industrial Applications Photovoltaic cells;[29] solar cells;[29] thin films;[30] lithographic printing plates[31]

Safety/Toxicity Bacterial toxicity;[32] chromosomal aberrations;[33] mutagenicity;[34] phototoxicity;[35,36] skin toxicity[16]

Certification/Approval Certified by Biological Stain Commission (BSC)

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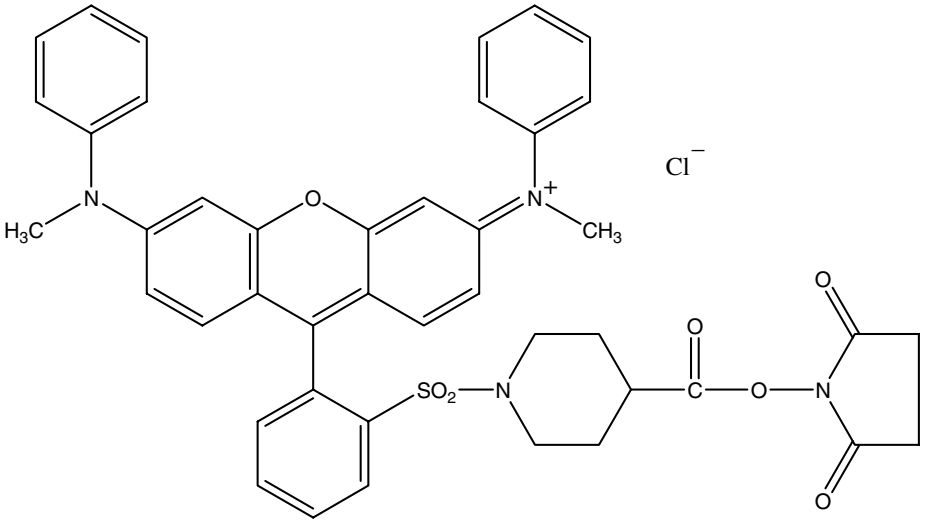
QSY 7 CARBOXYLIC ACID, SUCCINIMIDYL ESTER

CAS Registry Number 304014-12-8

Chemical Structure



CA Index Name Xanthylium, 9-[2-[[4-[[(2,5-dioxo-1-pyrrolidinyl)oxy]carbonyl]-1-piperidinyl]sulfonyl]phenyl]-3,6-bis(methylphenylamino)-, chloride (1:1)

Other Names Xanthylium, 9-[2-[[4-[[(2,5-dioxo-1-pyrrolidinyl)oxy]carbonyl]-1-piperidinyl]sulfonyl]phenyl]-3,6-bis(methylphenylamino)-, chloride; QSY 7 carboxylic acid succinimidyl ester; QSY 7SE; QSY-7 succinimidyl ester

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{43}H_{39}ClN_4O_7S$

Molecular Weight 791.32

Physical Form Solid

Solubility Soluble in dimethyl sulfoxide, methanol

Melting Point >200 °C

Absorption (λ_{max}) 560 nm

Synthesis Synthetic methods[1,2]

Staining Applications Nucleic acids;[13–15] oligonucleotides;[1] bacteria;[3] peptides;[4] tumors[5]

Biological Applications Amplification assays;[1] hybridization assays;[1,6,7] litigation assays;[1] FRET assays;[3,4,8] hepatitis C virus (HCV) NS3 protease;[9] FRET probes;[10–12] nucleic acid hybridization;[13,14] detecting nucleic acids,[13–15] human immunodeficiency virus type 1 DNA,[16] polymorphisms,[17,18] RNase enzyme,[19] protease enzyme;[20] nucleic acid quantitation;[21] oligonucleotide probes;[22,23] quenchers[5,24,25]

Industrial Applications Light-emitting device[26]

Safety/Toxicity No data available

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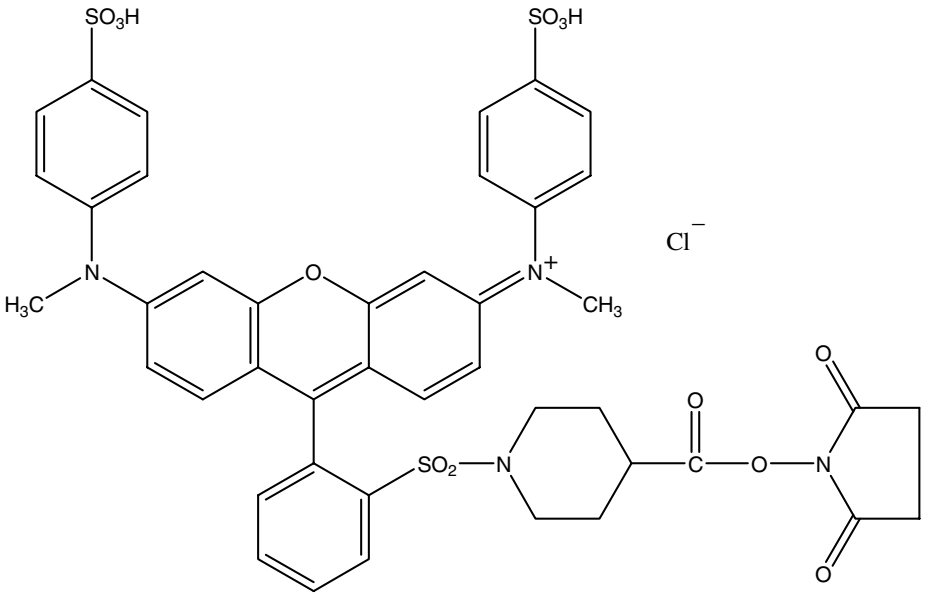
QSY 9 CARBOXYLIC ACID, SUCCINIMIDYL ESTER

CAS Registry Number 700834-40-8

Chemical Structure



CA Index Name Xanthylium, 9-[2-[[4-[[(2,5-dioxo-1-pyrrolidinyl)oxy]carbonyl]-1-piperidinyl]sulfonyl]phenyl]-3,6-bis[methyl(4-sulfophenyl)amino]-, chloride (1:1)

Other Names Xanthylium, 9-[2-[[4-[[(2,5-dioxo-1-pyrrolidinyl)oxy]carbonyl]-1-piperidinyl]sulfonyl]phenyl]-3,6-bis[methyl(4-sulfophenyl)amino]-, chloride; QSY 9; QSY 9 carboxylic acid succinimidyl ester

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{43}H_{39}ClN_4O_{13}S_3$

Molecular Weight 951.43

Physical Form Solid

Solubility Soluble in water, dimethyl sulfoxide, methanol

Melting Point >200 °C

Absorption (λ_{max}) 562 nm

Synthesis Synthetic methods[1,2]

Staining Applications Nucleic acids;[3] oligonucleotides;[1] antibody;[4] G-protein[5]

Biological Applications Amplification assays;[1] hybridization assays;[1] litigation assays;[1] ligand assays;[5,7] FRET assays;[6] detecting analyte,[8] antigen,[4] phosphoinositide kinase and phosphatase activity[9]

Industrial Applications Not reported

Safety/Toxicity No data available

REFERENCES

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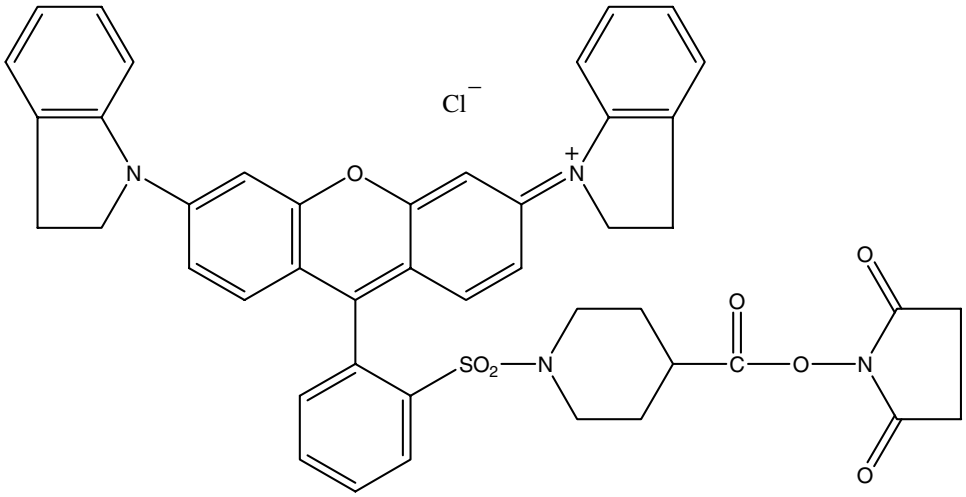
QSY 21 CARBOXYLIC ACID, SUCCINIMIDYL ESTER

CAS Registry Number 304014-13-9

Chemical Structure



Molecular Weight 815.34

Physical Form Solid

Solubility Soluble in dimethyl sulfoxide, methanol

Melting Point >200 °C

Absorption (λ_{max}) 661 nm

CA Index Name Xanthylium, 3,6-bis(2,3-dihydro-1*H*-indol-1-yl)-9-[2-[[4-[[(2,5-dioxo-1-pyrrolidinyl)oxy]carbonyl]-1-piperidinyl]sulfonyl]phenyl]-, chloride (1:1)

Other Names Xanthylium, 3,6-bis(2,3-dihydro-1*H*-indol-1-yl)-9-[2-[[4-[[(2,5-dioxo-1-pyrrolidinyl)oxy]carbonyl]-1-piperidinyl]sulfonyl]phenyl]-, chloride; QSY 21; QSY 21 carboxylic acid succinimidyl ester; QSY 21NHS

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{45}H_{39}ClN_4O_7S$

Synthesis Synthetic methods[1,2]

Staining Applications Nucleic acids;[3] cells;[4] oligonucleotides;[1] G-proteins;[5] cysteine protease;[6] tumors[7]

Biological Applications Amplification assays;[1] hybridization assays;[1] litigation assays;[1] ligand assays;[5] detecting analytes,[8] enzymes,[9] optical microcavities,[10] protein–DNA interactions;[11] imaging apoptosis,[12] β-lactamase activity;[13] FRET probes[14]

Industrial Applications Not reported

Safety/Toxicity No data available

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WO 2005121755, 2005; *Chem. Abstr*. **2005**, *144*, 45719.

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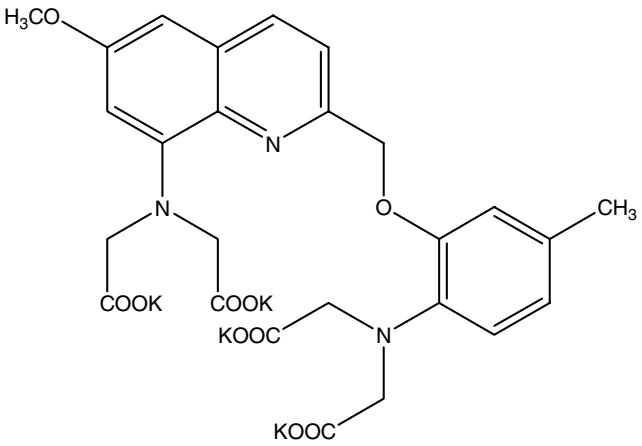
QUIN 2

CAS Registry Number 73630-23-6

Chemical Structure



CA Index Name Glycine, *N*-[2-[[8-[bis(carboxymethyl)amino]-6-methoxy-2-quinolinyl]methoxy]-4-methylphenyl]-*N*-(carboxymethyl)-, potassium salt (1:4)

Other Names 2-[(2-Amino-5-methylphenoxy)methyl]-6-methoxy-8-aminoquinoline-*N*,*N*,*N*′,*N*′-tetraacetic acid tetrapotassium salt; 2-{[2-Bis-(carboxymethyl)amino-5-methylphenoxy]-methyl}-6-methoxy-8-bis-(carboxymethyl)aminoquinoline tetrapotassium salt; Glycine, *N*-[2-[[8-[bis(carboxymethyl)amino]-6-methoxy-2-quinolinyl]methoxy]-4-methylphenyl]-*N*-(carboxymethyl)-, tetrapotassium salt; Quin 2; Quin 2 tetrapotassium salt

Merck Index Number 8042

Chemical/Dye Class Quinoline

Molecular Formula $C_{26}H_{23}K_4N_3O_{10}$

Molecular Weight 693.87

Physical Form Light yellow powder

Solubility Soluble in water

Melting Point >250 °C

Absorption (λ_{max}) 353 nm, 333 nm

Emission (λ_{max}) 495 nm

Synthesis Synthetic method[1]

Staining Applications Calcium ions;[3–18] cadmium ions;[19] iron ions;[20,21] lanthanum ions;[22] zinc ions;[23] cells[2]

Biological Applications Calcium indicator;[3–18] cadmium indicator;[19] iron indicator;[20,21] lanthanum indicator;[22] zinc indicator;[23] identifying taste modulators[24]

Industrial Applications Not reported

Safety/Toxicity DNA damage;[25] hepatotoxicity[26,27]

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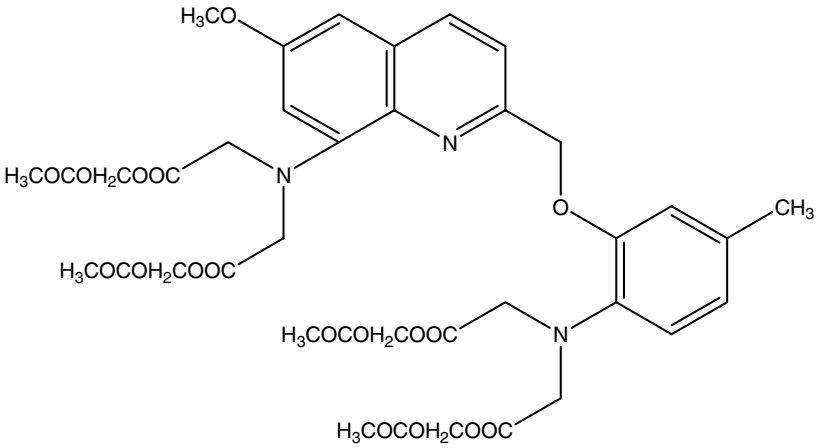
QUIN 2 AM

CAS Registry Number 83104-85-2

Chemical Structure



CA Index Name Glycine, *N*-[2-[(acetyloxy)methoxy]-2-oxoethyl]-*N*-[2-[[8-[bis[2-[(acetyloxy)methoxy]-2-oxoethyl]amino]-6-methoxy-2-quinolinyl]methoxy]-4-methylphenyl]-, (acetyloxy)methyl ester

Other Names 2-[(2-Amino-5-methylphenoxy)methyl]-6-methoxy-8-aminoquinoline-*N*,*N*,*N*′,*N*′-tetraacetic acid tetrakis(acetoxymethyl ester); 2-{[2-Bis(carboxymethyl)amino-5-methylphenoxy]-methyl}-6-methoxy-8-bis(carboxymethyl)aminoquinoline tetrakis(acetoxymethyl) ester; Quin 2 acetoxymethyl ester; Quin 2 AM; Quin 2 AM ester

Merck Index Number 8042

Chemical/Dye Class Quinoline

Molecular Formula $C_{38}H_{43}N_3O_{18}$

Molecular Weight 829.76

Physical Form Yellow powder

Solubility Insoluble in water; soluble in dimethyl sulfoxide, methanol

Melting Point 113 °C

Boiling Point (Calcd.) 865.6 ± 65.0 °C, pressure: 760 Torr

pK_a (Calcd.) 2.33 ± 0.50, most basic, temperature: 25 °C

Absorption (λ_{max}) 348 nm

Emission (λ_{max}) 446 nm

Synthesis Synthetic method[1]

Staining Applications Calcium ions;[1,3–21] leukocyte tumor cells[2]

Biological Applications Calcium indicator[1,3–21]

Industrial Applications Not reported

Safety/Toxicity Carcinogenicity;[22] cytotoxicity;[23,24] DNA damage;[25] hepatotoxicity[26–28]

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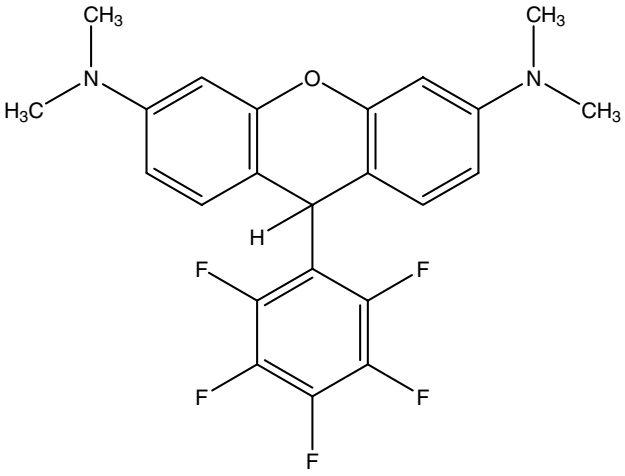
REDOXSENSOR RED CC-1

CAS Registry Number 296277-09-3

Chemical Structure



CA Index Name 9*H*-Xanthene-3,6-diamine, *N*,*N*,*N*′,*N*′-tetramethyl-9-(pentafluorophenyl)-

Other Names R 14060; RedoxSensor; RedoxSensor CC 1; RedoxSensor Red; RedoxSensor Red CC 1

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{23}H_{19}F_5N_2O$

Molecular Weight 434.40

Physical Form Off-white powder

Solubility Soluble in methanol, dimethyl sulfoxide

Melting Point >200 °C

Boiling Point (Calcd.) 445.1 ± 45.0 °C, pressure: 760 Torr

pK_a (Calcd.) 4.83 ± 0.40, most basic, temperature: 25 °C

Absorption (λ_{max}) 239 nm

Synthesis Synthetic method[1]

Staining Applications Mitochondria;[1,2,4] lysosomes;[1] cells[3]

Biological Applications Detecting prostate cancer[4]

Industrial Applications Assaying reactive oxidants on smoke[5]

Safety/Toxicity No data available

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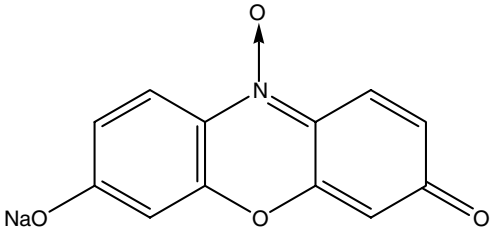
4. Dickman, D. Methods of detecting prostate cancer. PCT Int. Appl. WO 2006054296, 2006; *Chem. Abstr*. **2006**, *145*, 3346.
5. Huang, D.; Ou, B. Method for assaying reactive oxidants in smoke. U.S. Pat. Appl. Publ. US 2004126891, 2004; *Chem. Abstr*. **2004**, *141*, 66653.

Handbook of Biological Dyes and Stains By R. W. Sabnis

RESAZURIN SODIUM SALT

CAS Registry Number 62758-13-8

Chemical Structure



CA Index Name 3*H*-Phenoxazin-3-one, 7-hydroxy-, 10-oxide, sodium salt (1:1)

Other Names 3*H*-Phenoxazin-3-one, 7-hydroxy-, 10-oxide, sodium salt; Resazurin sodium salt; Sodium resazurin

Merck Index Number Not listed

Chemical/Dye Class Phenoxazine

Molecular Formula $C_{12}H_6NNaO_4$

Molecular Weight 251.17

Physical Form Dark green to black powder

Solubility Soluble in water; slightly soluble in ethanol, acetic acid; insoluble in ether

Melting Point >250 °C

pH Range 3.8–6.5

Color Change at pH Orange (3.8) to dark violet (6.5)

pK_a 6.71

Absorption (λ_{max}) 598 nm, 380 nm

Synthesis Synthetic methods[1–3]

Staining Applications D-Arabinitol;[4] bacteria;[5] hypoxic cells;[6] microorganisms;[7–9] hairs[10]

Biological Applications Detecting bile acids,[11] glycosidase activity;[12] as hydrolase substrate;[13] in beer production;[14] treating diabetic complications;[15] enzymatic microplate assay;[16] β-glucosidase assay;[17] glutathione transferase assay[18]

Industrial Applications Electrochemichromic devices;[19] oxygen-barrier packaging materials[20]

Safety/Toxicity No data available

Certification/Approval Certified by Biological Stain Commission (BSC)

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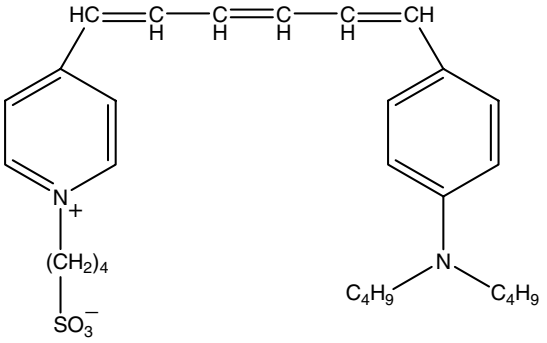
20. Kamiyama, M. Oxygen-barrier packaging materials. Jpn. Kokai Tokkyo Koho JP 09124076, 1997; *Chem. Abstr*. **1997**, *127*, 66976.

RH 237

CAS Registry Number 83668-91-1

Chemical Structure



CA Index Name Pyridinium, 4-[6-[4-(dibutylamino) phenyl]-1,3,5-hexatrienyl]-1-(4-sulfobutyl)-, inner salt

Other Names 4-(*N*,*N*-Dibutylanilino)hexatrienyl-4′-pyridinium butanesulfonate; RH 237

Merck Index Number Not listed

Chemical/Dye Class Styryl

Molecular Formula $C_{29}H_{40}N_2O_3S$

Molecular Weight 496.71

Physical Form Solid

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide

Melting Point >200 °C

Absorption (λ_{max}) 528 nm

Emission (λ_{max}) 782 nm

Synthesis Synthetic method[1]

Staining Applications Atria;[2] cardiac tissues;[3–5] cardiac myocytes;[6–8] neurons;[9,10] proteins;[11] Na^+/K^+-ATPase[12]

Biological Applications Measuring membrane potential;[7,8,13–16] detecting Na^+/K^+-ATPase;[12] examining activity of ion channels[17]

Industrial Applications Monitoring of polymerization[18]

Safety/Toxicity Cardiac toxicity[2]

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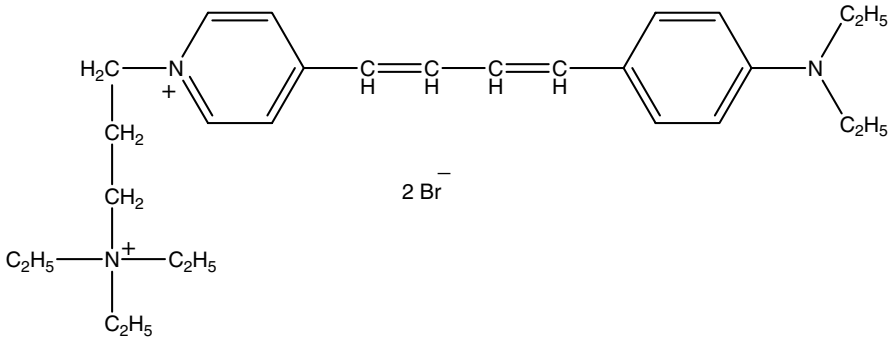
RH 414

CAS Registry Number 161433-30-3

Chemical Structure



CA Index Name Pyridinium, 4-[4-[4-(diethylamino) phenyl]-1,3-butadien-1-yl]-1-[3-(triethylammonio)propyl]-, bromide (1:2)

Other Names Pyridinium, 4-[4-[4-(diethylamino)phenyl]-1,3-butadienyl]-1-[3-(triethylammonio)propyl]-, dibromide; RH 414

Merck Index Number Not listed

Chemical/Dye Class Styryl

Molecular Formula $C_{28}H_{43}Br_2N_3$

Molecular Weight 581.48

Physical Form Solid

Solubility Soluble in water, ethanol, methanol, dimethyl sulfoxide

Melting Point >200 °C

Absorption (λ_{max}) 532 nm

Emission (λ_{max}) 716 nm

Synthesis Synthetic method[1]

Staining Applications Clostridial toxin substrate;[2] membranes;[3] flavoproteins;[4] neurons[5,6]

Biological Applications Measuring membrane potential;[7,8] detecting Clostridia toxin activity;[2] probes for Na, K-ATPase reaction mechanism;[9] examining activity of ion channels[10]

Industrial Applications Not reported

Safety/Toxicity No data available

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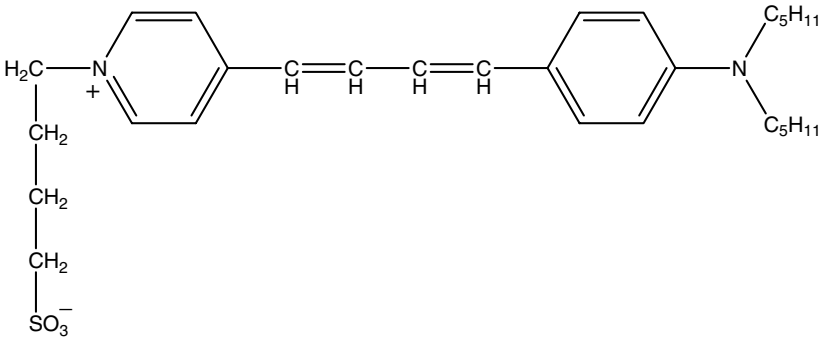
RH 421

CAS Registry Number 107610-19-5

Chemical Structure



CA Index Name Pyridinium, 4-[4-[4-(dipentylamino) phenyl]-1,3-butadienyl]-1-(4-sulfobutyl)-, inner salt

Other Names 4-{4-[4-(Dipentylamino)phenyl]-1,3-butadienyl}-1-(4-sulfobutyl)pyridinium hydroxide; RH 421

Merck Index Number Not listed

Chemical/Dye Class Styryl

Molecular Formula $C_{29}H_{42}N_2O_3S$

Molecular Weight 498.72

Physical Form Red powder

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide, *N*,*N*-dimethylformamide

Melting Point >200 °C

Absorption (λ_{max}) 515 nm

Emission (λ_{max}) 704 nm

Synthesis Synthetic method[1]

Staining Applications Cardiac tissues;[2,3] lipid membranes;[4–6,8] proteins;[7,8] neurons[9]

Biological Applications Measuring membrane potential[10–12]

Industrial Applications Photoresists[13]

Safety/Toxicity No data available

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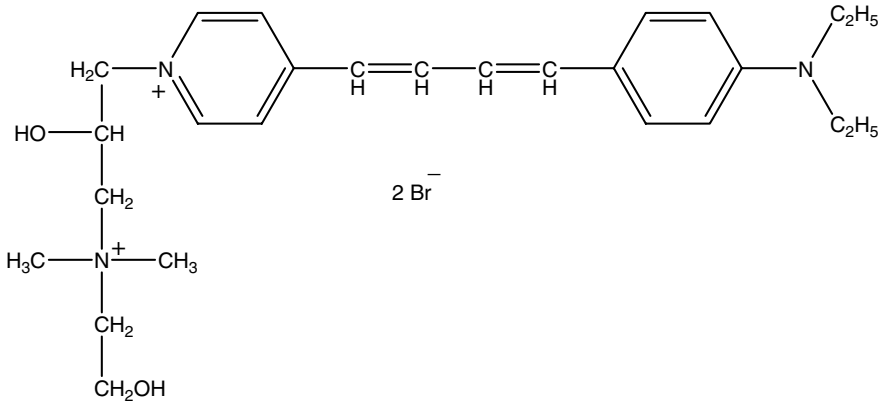
RH 795

CAS Registry Number 172807-13-5

Chemical Structure



CA Index Name Pyridinium, 4-[4-[4-(diethylamino) phenyl]-1,3-butadienyl]-1-[2-hydroxy-3-[(2-hydroxyethyl)dimethylammonio]propyl]-, dibromide

Other Names RH 795

Merck Index Number Not listed

Chemical/Dye Class Styryl

Molecular Formula $C_{26}H_{39}Br_2N_3O_2$

Molecular Weight 585.42

Physical Form Solid

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide

Melting Point >200 °C

Absorption (λ_{max}) 530 nm

Emission (λ_{max}) 712 nm

Synthesis Synthetic method[1]

Staining Applications Brainstem;[2] cortex;[3] neurons[4]

Biological Applications Measuring membrane potential;[4,5] probes for Na, K-ATPase reaction mechanism;[6] examining activity of ion channels[7]

Industrial Applications Not reported

Safety/Toxicity No data available

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1. Haugland, R. P. *The Handbook: A Guide to Fluorescent Probes and Labeling Technologies*; Molecular Probes Inc.: Eugene, **2005**; pp 976–978.
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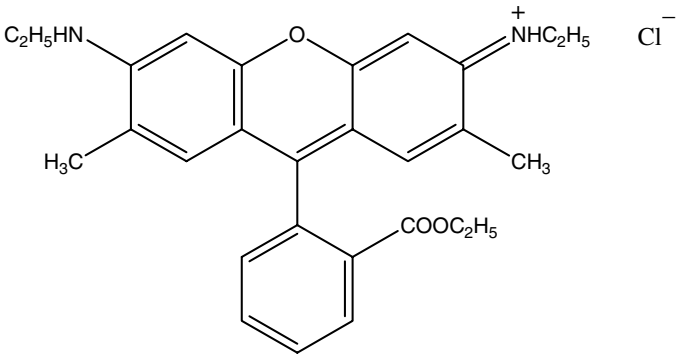
RHODAMINE 6G

CAS Registry Number 989-38-8

Chemical Structure



CA Index Name Xanthylium, 9-[2-(ethoxycarbonyl) phenyl]-3,6-bis(ethylamino)-2,7-dimethyl-, chloride (1:1)

Other Names Benzoic acid, *o*-[6-(ethylamino)-3-(ethylimino)-2,7-dimethyl-3*H*-xanthen-9-yl]-, ethyl ester, monohydrochloride; Rhodamine 6GCP; Xanthylium, 9-[2-(ethoxycarbonyl)phenyl]-3,6-bis(ethylamino)-2,7-dimethyl, chloride; Aizen Rhodamine 6GCP; Basic Red 1; Basonyl Red 482; Basonyl Red 483; C.I. 45160; C.I. Basic Red 1; Calcozine Red 6G; Calcozine Rhodamine 6GX; Eljon Pink Toner; Exciton 590; Fanal Pink B; Fanal Pink GFK; Fanal Red 25532; Flexo Red 482; Heliostable Brilliant Pink B extra; Mitsui Rhodamine 6GCP; NSC 36345; Nyco Liquid Red GF; R 634; R 6G; Rh 6G; Rhodamin 6G; Rhodamine 4GD; Rhodamine 4GH; Rhodamine 590 Chloride; Rhodamine 5GDN; Rhodamine 5GDN Extra; Rhodamine 5GL; Rhodamine 6G; Rhodamine 6G Extra; Rhodamine 6G Extra Base; Rhodamine 6G chloride; Rhodamine 6GB; Rhodamine 6GBN; Rhodamine 6GD; Rhodamine 6GDN; Rhodamine 6GDN Extra; Rhodamine 6GEx ethyl ester; Rhodamine 6GH; Rhodamine 6GO; Rhodamine 6GX; Rhodamine 6JH; Rhodamine 6JH-SA; Rhodamine 6JH-SA Extra 1150; Rhodamine 6Zh-DN; Rhodamine F 5G; Rhodamine F 5GL; Rhodamine GDN; Rhodamine GDN Extra; Rhodamine Y 20-7425; Rhodamine Zh; Silosuper Pink B; Vali Fast Red 1308

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{28}H_{31}ClN_2O_3$

Molecular Weight 479.02

Physical Form Red-brown or maroon powder or crystals

Solubility Soluble in water, ethanol, methanol

Melting Point 290 °C

Absorption (λ_{max}) 528 nm

Emission (λ_{max}) 551 nm

Synthesis Synthetic methods[1–11]

Staining Applications Mitochondria;[12–14,23] internal limiting membrane;[15] vitreous;[15] lens capsule of eye;[15] serum albumin;[16] hairs[17]

Biological Applications Detecting nucleic acids,[18] prostate cancer,[19] stress biomarkers,[20] protease activity,[21] urogenital infection;[22] measuring membrane potential;[23] photodynamic therapy;[24] apoptosis assays;[25] stents[26]

Industrial Applications Paints;[27] inks;[28] color filters;[29] dye lasers;[30,31] electroluminescent displays;[32] laser devices;[33] light-emitting devices;[34] liquid crystals;[35] photovoltaic device;[36] thin films;[37] waveguides[38]

Safety/Toxicity Carcinogenicity;[39,40] DNA damage;[41] ecotoxicity;[42] genotoxicity;[43] mutagenicity[44,45]

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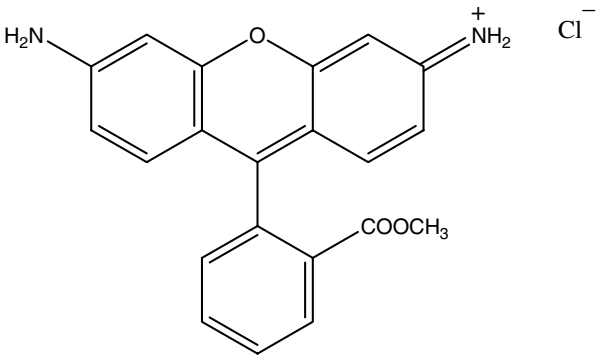
RHODAMINE 123

CAS Registry Number 62669-70-9

Chemical Structure



CA Index Name Xanthylium, 3,6-diamino-9-[2-(methoxycarbonyl)phenyl]-, chloride (1:1)

Other Names 2-(6-Amino-3-imino-3*H*-xanthen-9-yl) benzoic acid methyl ester; Benzoic acid, 2-(6-amino-3-imino-3*H*-xanthen-9-yl), methyl ester, monohydrochloride; 3,6-Diamino-9-[2-(methoxycarbonyl)phenyl]xanthylium chloride; Xanthylium, 3,6-diamino-9-[2-(methoxycarbonyl)phenyl]-, chloride; R 22420; R 302; RH 123; Rhodamine 123

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{21}H_{17}ClN_2O_3$

Molecular Weight 380.83

Physical Form Brownish-red crystals or powder

Solubility Slightly soluble in water; soluble in methanol, ethanol, ether, *N*,*N*-dimethylformamide

Melting Point 235 °C

Absorption (λ_{max}) 501 nm, 507 nm

Emission (λ_{max}) 529 nm

Synthesis Synthetic methods[1–6]

Staining Applications Mitochondria;[7–9] cells;[10,11] P-glycoprotein;[12–14] sperms[15]

Biological Applications Measuring membrane potential;[16] detecting cancer cells,[17] spores,[17] prostate cancer,[18] stress biomarkers;[19] treating disc degenerative disease,[20] epilepsy,[21] erectile dysfunction;[22] apoptosis assays;[23] tumor cell multidrug resistance assay;[24] implantable medical devices[25]

Industrial Applications Colored bubbles;[26] paints[27]

Safety/Toxicity Acute toxicity;[28] carcinogenicity;[29,30] cytotoxocity;[31,32] metabolic toxicity;[33] mutagenicity;[34] neurotoxicity;[35] ocular toxicity[36]

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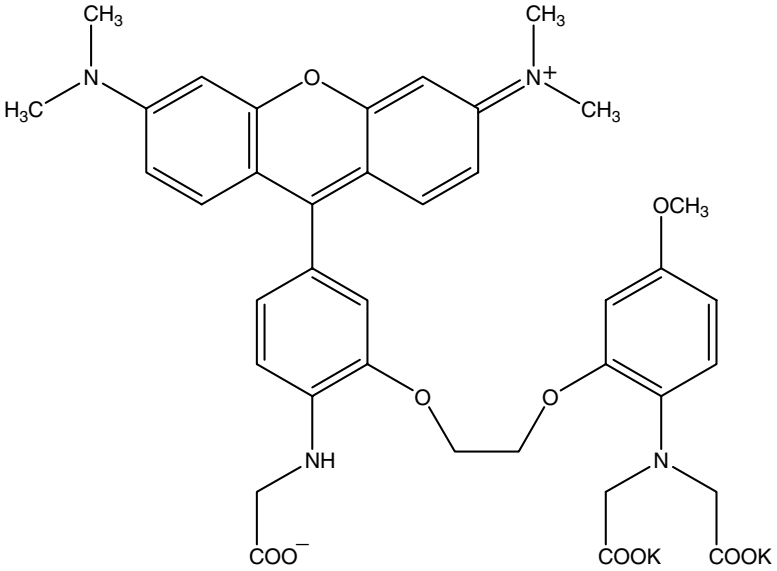
RHODZIN 3

CAS Registry Number 677716-65-3

Chemical Structure



Molecular Formula $C_{38}H_{38}K_2N_4O_{10}$

Molecular Weight 788.94

Physical Form Solid

Solubility Soluble in water

CA Index Name Xanthylium, 9-[3-[2-[2-[bis(carboxymethyl)amino]-5-methoxyphenoxy]ethoxy]-4-[(carboxymethyl)amino]phenyl]-3,6-bis(dimethylamino)-, inner salt, potassium salt (1:2)

Other Names Xanthylium, 9-[3-[2-[2-[bis(carboxymethyl)amino]-5-methoxyphenoxy]ethoxy]-4-[(carboxymethyl)amino]phenyl]-3,6-bis(dimethylamino)-, inner salt, dipotassium salt; RhodZin 3; RhodZin 3 dipotassium salt

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Melting Point >250 °C

Absorption (λ_{max}) 549 nm

Emission (λ_{max}) 576 nm

Synthesis Synthetic methods[1,2]

Staining Applications Zinc ions[1–3]

Biological Applications Zinc indicator[1–3]

Industrial Applications Not reported

Safety/Toxicity No data available

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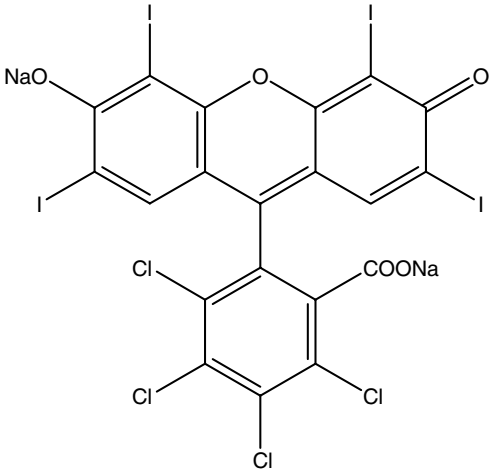
ROSE BENGAL

CAS Registry Number 632-69-9

Chemical Structure



CA Index Name Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-3-one, 4,5,6,7-tetrachloro-3′,6′-dihydroxy-2′,4′,5′,7′-tetraiodo-, sodium salt (1:2)

Other Names C.I. 45440; C.I. Acid Red 94; Bengal Rose B sodium salt; Fluorescein, 4,5,6,7-tetrachloro-2′,4′,5′,7′-tetraiodo-, disodium salt; Spiro[isobenzofuran-1(3*H*),9′-[9*H*]xanthen]-3-one, 4,5,6,7-tetrachloro-3′,6′-dihydroxy-2′,4′,5′,7′-tetraiodo-, disodium salt; 2′,4′,5′,7′-Tetraiodo-3,4,5,6-tetrachlorofluorescein disodium salt; 3′,4′,5′,6′-Tetrachloro-2,4,5,7-tetraiodofluorescein disodium salt; Japan Red 105-1; Rose Bengal Extra; Rose Bengal disodium salt; Rose Bengal extra; Rose Bengal sodium; Rose Bengal sodium salt; Sodium tetraiodotetrachlorofluorescein

Merck Index Number 8262

Chemical/Dye Class Xanthene

Molecular Formula $C_{20}H_2Cl_4I_4Na_2O_5$

Molecular Weight 1017.64

Physical Form Red-brown powder

Solubility Soluble in water, ethanol

Melting Point >200 °C

pK_a 3.9, 4.7

Absorption (λ_{max}) 548 nm

Emission (λ_{max}) 567 nm

Synthesis Synthetic methods[1–4]

Staining Applications Bacteria;[5] apoptotic cells;[9] bacterial spores;[17] proteins;[6] hairs[7,8]

Biological Applications Apoptosis assay;[9,10] diagnosis of diseases related to amyloid accumulation;[11] controlling plant diseases;[12] identifying fungi;[12,13] treating skin,[14] mouth,[14] digestive tract,[14] urinary tract,[14] reproductive tract,[14] respiratory tract,[14] circulatory system,[14] head and neck,[14] endocrine system,[14] lymphoreticular system,[14] rhinitis,[15] asthma,[15] urticaria,[15] atopic dermatitis,[15] anaphylactic shock;[15] photodynamic therapy;[16,17] pesticides;[18] insecticides;[19] fungicides[20]

Industrial Applications Organic photodetectors;[21] memory devices;[22] solar cells;[23] semiconductor film;[24] imaging method;[25] optical filters;[26] antireflection films;[26] as polymerization photoinitiators;[27] recording materials;[28] thermoplastics;[29] cements;[30] photographic materials[31]

Safety/Toxicity Genotoxicity;[32] microbial toxicity[33]

Certification/Approval Certified by Biological Stain Commission (BSC)

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PCT Int. Appl. WO 2005071420, 2005; *Chem. Abstr*. **2005**, *143*, 188838.

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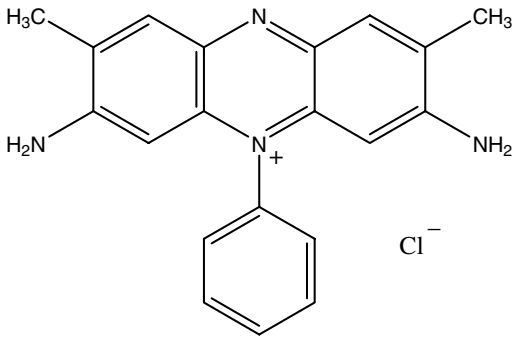
SAFRANIN O

CAS Registry Number 477-73-6

Chemical Structure



CA Index Name Phenazinium, 3,7-diamino-2,8-dimethyl-5-phenyl-, chloride (1 : 1)

Other Names C.I. Basic Red 2; Phenazinium, 3,7-diamino-2,8-dimethyl-5-phenyl-, chloride; Safranine O; 2,8-Dimethylphenosafranine; 3,7-Diamino-2,8-dimethyl-5-phenylphenazinium chloride; Basic Pink; Basic Red 2; Brilliant Safranine BR; Brilliant Safranine G; Brilliant Safranine GR; C.I. 50240; Calcozine Red Y; Cotton Red; Duasyn Basic Red TH; Gossypimine; Hidaco Safranine; Leather Red HT; Lowacryl Red 2; Lowacryl Red 2 Conc; Mitsui Safranine T; Nippon Kagaku Safranine GK; Nippon Kagaku Safranine T; Safranin; Safranin O; Safranin T; Safranine; Safranine A; Safranine B; Safranine G; Safranine GF; Safranine J; Safranine OK; Safranine OK 70:100; Safranine Superfine G; Safranine T; Safranine TH; Safranine TN; Safranine TS; Safranine Y; Safranine YN; Safranine Zh; Tolusafranine

Merck Index Number Not listed

Chemical/Dye Class Phenazine

Molecular Formula $C_{20}H_{19}ClN_4$

Molecular Weight 350.84

Physical Form Dark red to dark green powder

Solubility Soluble in water, ethanol, ethylene glycol, methyl cellosolve, pyridine

Melting Point >240 °C (decompose)

pK_a 6.4

Absorption (λ_{max}) 530 nm

Synthesis Synthetic methods[1–16]

Staining Applications Antigen;[17] bacteria;[18] brain;[19] cellulose;[20] lignin;[20] mitochondria;[21,22] nucleated and non-nucleated blood cells;[28] nucleic acids;[23,24] proteins;[25] spinal cord;[19] hairs[26,27]

Biological Applications Hematotoxicity assays;[28] measuring membrane potential;[21,22,29] detecting microorganisms;[30] treating diabetes-associated pain,[31] mechanical allodynia,[32] oncological diseases;[33] food packaging materials[34]

Industrial Applications Photogalvanic cells;[35] polymeric electro-mechanic devices;[36] recording material;[37] inks;[38,39] textiles[40]

Safety/Toxicity Bacterial toxicity;[41] carcinogenicity;[42–44] environmental toxicity;[45] microbial toxicity;[46] mitochondrial toxicity;[47] mutagenicity;[48] nucleic acid damage[49,50]

Certification/Approval Certified by Biological Stain Commission (BSC)

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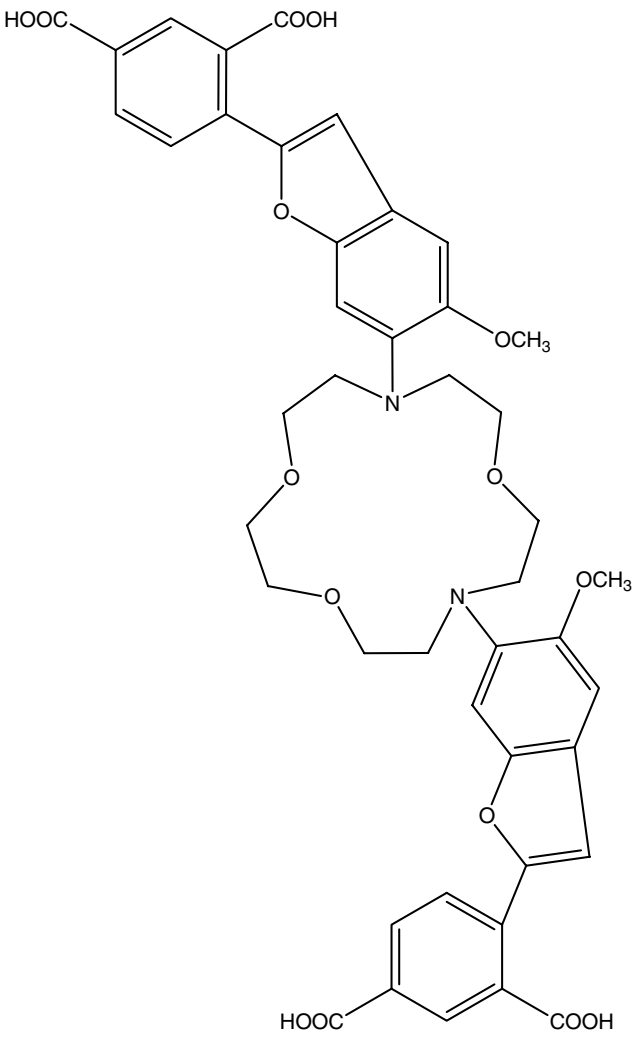
SBFI

CAS Registry Number 124549-08-2

Chemical Structure



CA Index Name 1,3-Benzenedicarboxylic acid, 4,4′-[1,4,10-trioxa-7,13-diazacyclopentadecane-7,13-diylbis (5-methoxy-6,2-benzofurandiyl)]bis-

Other Names 1,4,10-Trioxa-7,13-diazacyclopentadecane, 1,3-benzenedicarboxylic acid derivative; SBFI

Merck Index Number Not listed

Chemical/Dye Class Benzofuran

Molecular Formula $C_{44}H_{42}N_2O_{15}$

Molecular Weight 838.81

Physical Form Solid

Solubility Soluble in methanol, dimethyl sulfoxide

Melting Point >200 °C

Boiling Point (Calcd.) 1034.1 ± 65.0 °C, pressure: 760 Torr

pK_a (Calcd.) 2.96 ± 0.36, most acidic, temperature: 25 °C; 4.09 ± 0.40, most basic, temperature: 25 °C

Absorption (λ_{max}) 339 nm

Emission (λ_{max}) 565 nm

Synthesis Synthetic methods[1,2]

Staining Applications Sodium ions;[1–32] cells[34]

Biological Applications Sodium indicator;[1–32] identifying genes;[33] monitoring cellular processes;[34] K^+-channel openers[35]

Industrial Applications Not reported

Safety/Toxicity Cardiotoxicity;[36] copper toxicity[37]

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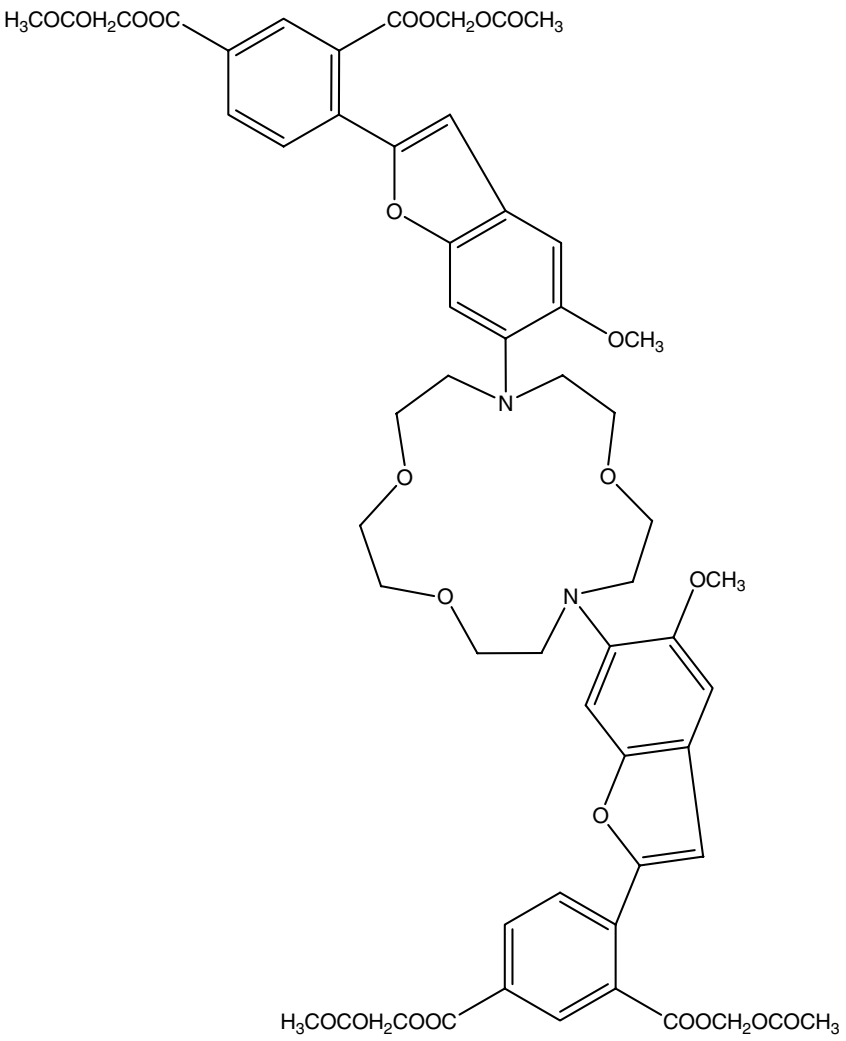
SBFI AM

CAS Registry Number 129423-53-6

Chemical Structure



Merck Index Number Not listed

Chemical/Dye Class Benzofuran

Molecular Formula $C_{56}H_{58}N_2O_{23}$

Molecular Weight 1127.06

CA Index Name 1,3-Benzenedicarboxylic acid, 4,4′-[1,4,10-trioxa-7,13-diazacyclopentadecane-7,13-diylbis (5-methoxy-6,2-benzofurandiyl)]bis-, 1,1′,3,3′-tetrakis [(acetyloxy)methyl]ester

Other Names 1,3-Benzenedicarboxylic acid, 4,4′-[1,4,10-trioxa-7,13-diazacyclopentadecane-7,13-diylbis (5-methoxy-6,2-benzofurandiyl)]bis-,tetrakis[(acetyloxy)methyl]ester; 1,4,10-Trioxa-7,13-diazacyclopentadecane, 1,3-benzenedicarboxylic acid derivative; SBFI-AM, Sodium-binding benzofuran isophthalate-AM

Physical Form Orange powder

Solubility Soluble in methanol, dimethyl sulfoxide

Melting Point >200 °C

Boiling Point (Calcd.) 1110.3 ± 65.0 °C, pressure: 760 Torr

pK_a (Calcd.) 3.82 ± 0.40, most basic, temperature: 25 °C

Absorption (λ_{max}) 379 nm

Emission (λ_{max}) Fluorescence is very weak

Synthesis Synthetic methods[1,2]

Staining Applications Sodium ions[1–15]

Biological Applications Sodium indicator;[1–15] assays for identifying taste-specific genes;[16,17] treating depression[6]

Industrial Applications Not reported

Safety/Toxicity No data available

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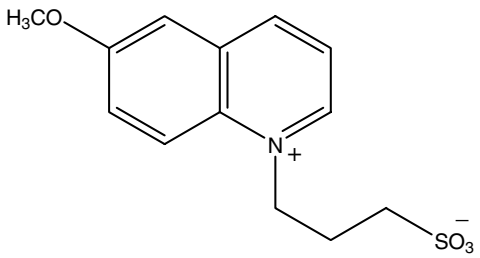
SPQ

CAS Registry Number 83907-40-8

Chemical Structure



CA Index Name Quinolinium, 6-methoxy-1-(3-sulfopropyl)-, inner salt

Other Names 6-Methoxy-*N*-(3-sulfopropyl)quinolinium, inner salt; SPQ

Merck Index Number Not listed

Chemical/Dye Class Quinoline

Molecular Formula $C_{13}H_{15}NO_4S$

Molecular Weight 281.33

Physical Form White powder

Solubility Soluble in water, dimethyl sulfoxide

Melting Point >299 °C (decompose)

Absorption (λ_{max}) 344 nm

Emission (λ_{max}) 443 nm

Synthesis Synthetic methods[1,2]

Staining Applications Chloride ions;[3–31] nitrite ions[32]

Biological Applications Chloride indicator;[3–31] nitrite indicator;[32] diagnosis of diseases caused by elemental imbalances;[35] detecting cancer cells,[36] spores,[36] stress biomarkers;[37] identifying genes;[38] studying chloride–bicarbonate exchange[33,34]

Industrial Applications Not reported

Safety/Toxicity No data available

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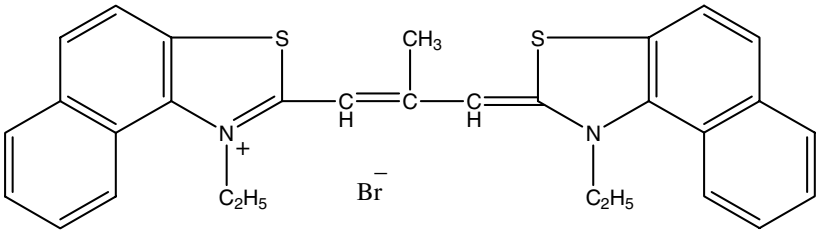
STAINS-ALL

CAS Registry Number 7423-31-6

Chemical Structure



Chemical/Dye Class Naphthothiazole

Molecular Formula $C_{30}H_{27}BrN_2S_2$

Molecular Weight 559.58

Physical Form Dark green to dark grey powder

CA Index Name Naphtho[1,2-*d*]thiazolium, 1-ethyl-2-[3-(1-ethylnaphtho[1,2-*d*]thiazol-2(1*H*)-ylidene)-2-methyl-1-propen-1-yl]-, bromide (1 : 1)

Other Names 1-Ethyl-2-[3-(1-ethylnaphtho[1,2-*d*]thiazolin-2-ylidene)-2-methylpropenyl]naphtho[1,2-*d*]thiazolium bromide; Naphtho[1,2-*d*]thiazolium, 1-ethyl-2-[3-(1-ethylnaphtho[1,2-*d*]thiazol-2(1*H*)-ylidene)-2-methyl-1-propenyl]-, bromide; Naphtho[1,2-*d*]thiazolium, 1-ethyl-2-[3-(1-ethylnaphtho[1,2-*d*]thiazolin-2-ylidene)-2-methylpropenyl]-, bromide; 4,5,4′,5′-Dibenzothiacarbocyanine bromide, 3,3′-diethyl-9-methyl-; 3,3′-Diethyl-9-methyl-4,5,4′,5′-dibenzothiacarbocyanine bromide; 3,3′-Diethyl-9-methyl-4,5,4′,5′-naphthothiacarbocyanine bromide; 4,5,4′,5′-Dibenzo-3,3′-diethyl-9-methylthiacarbocyanine bromide; Carbocyanin DBTC; DBTC; Stains-all

Merck Index Number Not listed

Solubility Soluble in water, ethanol, chloroform

Melting Point >200 °C

Absorption (λ_{max}) 575 nm

Synthesis Synthetic methods[1–5]

Staining Applications Axonemal tubulins;[6] biomolecules;[7] elastin fibers;[8] eye lens proteins crystallins;[9] fungi;[10] protozoa;[10] glycosaminoglycans;[11] neurofilaments;[12] nucleic acids;[13–15,18,19] proteins;[16–19] conjugated proteins;[18] polar lipids;[18] phosphorpoteins[20]

Biological Applications Detecting nucleic acid hybridization;[21] identifying microorganisms[22]

Industrial Applications Lithographic printing plates;[23] optical discs;[24] optical recording materials;[25] photographic materials[26–28]

Safety/Toxicity Endotoxicity[29]

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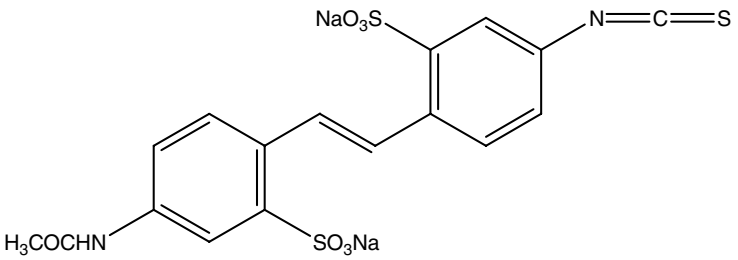
STILBENE ISOTHIOCYANATE SULFONIC ACID (SITS)

CAS Registry Number 51023-76-8

Chemical Structure



CA Index Name Benzenesulfonic acid, 5-(acetylamino)-2-[2-(4-isothiocyanato-2-sulfophenyl)ethenyl]-, sodium salt (1 : 2)

Other Names 4-Acetamido-4′-isothiocyanato-2,2′-stilbenedisulfonic acid disodium salt; Benzenesulfonic acid, 5-(acetylamino)-2-[2-(4-isothiocyanato-2-sulfophenyl) ethenyl]-, disodium salt; Disodium 4-acetamido-4′-isothiocyanatostilbene-2,2′-disulfonate; SITS

Merck Index Number Not listed

Chemical/Dye Class Stilbene

Molecular Formula $C_{17}H_{12}N_2Na_2O_7S_3$

Molecular Weight 498.46

Physical Form Yellow or tan-yellow powder

Solubility Soluble in water, methanol, dimethyl sulfoxide

Melting Point >200 °C

Absorption (λ_{max}) 336 nm

Emission (λ_{max}) 436 nm

Synthesis Synthetic methods[1–4]

Staining Applications Neuronal axons;[3] proteins;[3,4] photochromes[5]

Biological Applications Chloride channel blockers;[6–17] anion transport inhibitors;[18–20,25] treating cancer,[21] glaucoma,[22] heart diseases,[23] viral diseases[24]

Industrial Applications Not reported

Safety/Toxicity Effect on hemolysis;[25] lysosomal sulfate transport[26]

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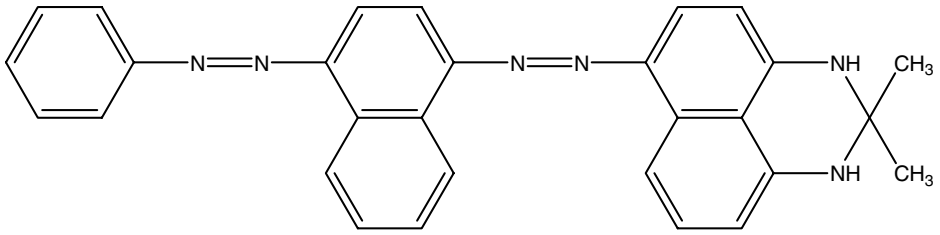
SUDAN BLACK B

CAS Registry Number 4197-25-5

Chemical Structure



CA Index Name 1*H*-Perimidine, 2,3-dihydro-2,2-dimethyl-6-[2-[4-(2-phenyldiazenyl)-1-naphthalenyl] diazenyl]-

Other Names 1*H*-Perimidine, 2,3-dihydro-2,2-dimethyl-6-[[4-(phenylazo)-1-naphthalenyl]azo]-; C.I. Solvent Black 3; Sudan Black B; 2,3-Dihydro-2,2-dimethyl-6-[(4-phenylazo-1-naphthalenyl)-azo]-1*H*-perimidine; 2,3-Dihydro-2,2-dimethyl-6-[[4-(phenylazo)-1-naphthyl] azo]perimidine; 6-(1-Phenylazo-4-naphthylazo)-2,3-dihydro-2,2-dimethylperimidine; Acetylated Sudan Black B; Aizen SOT Black 6; C.I. 26150; Ceres Black BN; Chuo Sudan Black 141; Fast Black HBN; Fat Black HB; Fat Black HB 01; Hexatype Black B; Lacquer Black S; Lacquer Black VB; NSC 11239; Neptune Black X 60; Nubian Black BT; Oil Black 860; Oil Black BT; Oil Black HBB; Oil Black HZ; Orient Oil Black 860; Orient Oil Black HBB; SOT-Black 6; Solvent Black 3; Sudan Black 141; Sudan Black X 60; Sudan Deep Black BB; Sudan Deep Black BN; Typogen Black

Merck Index Number 8885

Chemical/Dye Class Azo

Molecular Formula $C_{29}H_{24}N_6$

Molecular Weight 456.54

Physical Form Dark brown powder

Solubility Insoluble in water; soluble in ethanol, acetone, benzene, toluene, xylene, ethylene glycol

Melting Point 180–186 °C (decompose)

Boiling Point (Calcd.) 726.0 ± 60.0 °C, pressure: 760 Torr

pK_a (Calcd.) 3.57 ± 0.40, most basic, temperature: 25 °C

Absorption (λ_{max}) 598 nm, 415 nm

Synthesis Synthetic methods[1–5]

Staining Applications Glycol methacrylate embedded tissue sections;[6] blast cells;[7–9] lipids;[10–12] lipid antigens;[13] lipoproteins;[14,15] apolipoproteins;[15] neuron-specific nuclear protein NeuN;[16] liposomes;[17] myelin;[18] mutants;[19] skin;[20] tissues;[21] keratin fibers;[22] hair[23]

Biological Applications Diagnosis of acute myeloid leukemia (AML);[7–9] detecting neuron-specific nuclear protein NeuN;[16] drug screening[24]

Industrial Applications Plasma display panels;[25] inks;[26–29] toners;[30] photographic materials;[31] adhesives;[32] pesticides;[33] leather;[34] textiles[34–36]

Safety/Toxicity Acute oral toxicity,[37] carcinogenicity[7,38]

Certification/Approval Certified by Biological Stain Commission (BSC)

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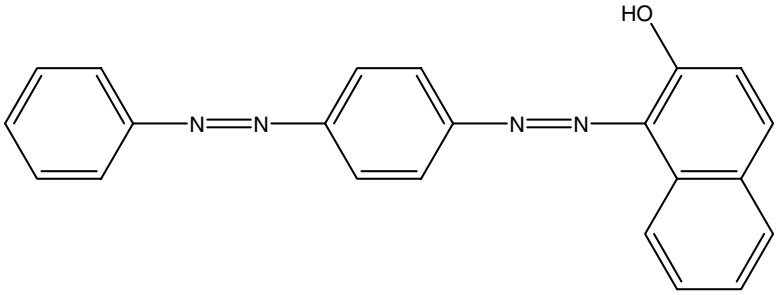
SUDAN III

CAS Registry Number 85-86-9

Chemical Structure



CA Index Name 2-Naphthalenol, 1-[2-[4-(2-phenyldiazenyl)phenyl]diazenyl]-

Other Names 2-Naphthalenol, 1-[[4-(phenylazo)phenyl]azo]-; 2-Naphthol, 1-(*p*-phenylazophenylazo)-; C.I. Solvent Red 23; 1-(*p*-Phenylazophenylazo)-2-naphthol; 111440 Red; Brasilazina Oil Scarlet; C.I. 26100; Certiqual Oil Red; D and C Red No. 17; D&C Red No. 17; FD and C Red No. 17; Fast Oil Scarlet III; Fat Red Bluish; Fat Red HRR; Fat Red R; Fat Red RS; Fat Scarlet LB; Fat Soluble Red Zh; Grasal Brilliant Red G; Grasan Brilliant Red G; Japan Red 225; Japan Red No. 225; NSC 65825; NSC 8995; Oil Red 3G; Oil Red AS; Oil Red DR 126; Oil Red Extra; Oil Scarlet G; Organol Red BS; Organol Scarlet; Red No. 225; Red Zh; Silotras Scarlet TB; Solvent Red 23; Somalia Red III; Stearix Scarlet; Sudan 3; Sudan III; Sudan P III; Sudan Red III; Sudan Red BK; Tetrazobenzene-β-naphthol; Toney Red; Tony Red

Merck Index Number 8884

Chemical/Dye Class Azo

Molecular Formula $C_{22}H_{16}N_4O$

Molecular Weight 352.39

Physical Form Brown-red powder

Solubility Insoluble in water; soluble in benzene, chloroform; moderately soluble in acetone, ether, petroleum ether; slightly soluble in ethanol, xylene

Melting Point 195 °C

Boiling Point (Calcd.) 584.6 ± 35.0 °C, pressure: 760 Torr

pK_a (Calcd.) 13.44 ± 0.50, most acidic, temperature: 25 °C

Absorption (λ_{max}) 507 nm, 354 nm

Synthesis Synthetic methods[1–6]

Staining Applications Lipids;[7–11] fats;[12] skin;[13–20] lips;[20] lipsticks;[21] contact lens;[22] eye shadow;[23] keratin fibers;[24] hairs;[25] latex particles;[26,27] nail enamel;[28] sunscreen;[29,30] spinal fluid[31]

Biological Applications Antiseptic;[32] preventing prostate cancer;[33] medical devices;[34] dental impression materials[35]

Industrial Applications Plasma display panels;[36] liquid crystal displays;[37] dielectric materials;[38] photoresists;[39,40] inks;[41] toners;[42] pesticides;[43] cleansing products;[44] textiles;[45] fabric softener;[46] oils;[47] fuel cells;[48] petroleum products[49]

Safety/Toxicity Acute cytogenetic effect;[50] carcinogenicity;[33,51,52] chromosomal aberration;[53] genotoxicity;[54,55] mutagenicity;[56] neurotoxicity;[57] skin toxicity[58]

Certification/Approval Certified by Biological Stain Commission (BSC)

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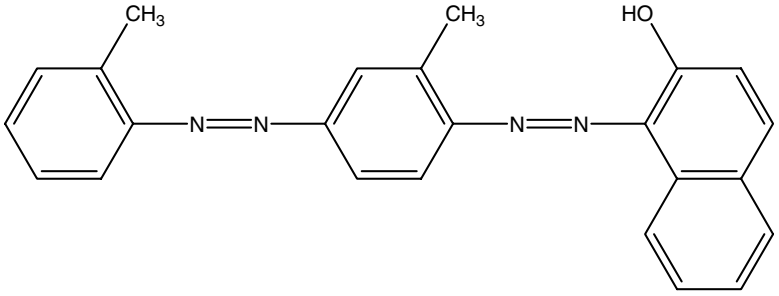
SUDAN IV

CAS Registry Number 85-83-6

Chemical Structure



CA Index Name 2-Naphthalenol, 1-[2-[2-methyl-4-[2-(2-methylphenyl)diazenyl]phenyl]diazenyl]-

Other Names 2-Naphthalenol, 1-[[2-methyl-4-[(2-methylphenyl)azo]phenyl]azo]-; 2-Naphthol, 1-(4-*o*-tolylazo-*o*-tolylazo)-; C.I. Solvent Red 24; 1-(2′-Methyl-4′-(2″-methylphenylazo)phenylazo)-2-naphthol; 1-[4-(*o*-Tolylazo)-*o*-tolylazo]-2-naphthol; 2′,3-Dimethyl-4-(2-hydroxynaphthylazo)azobenzene; Aizen SOT Red 1; Atlasol Red 4B; Biebrich Scarlet BPC; Biebrich Scarlet Red; Brasilazina Oil Red B; C.I. 26105; Candle Scarlet 2B; Candle Scarlet B; Candle Scarlet G; Ceres Red BB; Dispersol Red PP; Enial Red IV; Fast Oil Red B; Fast Red BB; Fat Ponceau R; Fat Red 2B; Fat Red B; Fat Red BB; Fat Red BS; Fat Red TS; Fat Soluble Dark Red; Grasal Brilliant Red B; Grasan Brilliant Red B; Hidaco Oil Red; Japan Red 501; Lacquer Red V; Lacquer Red VS; NSC 10472; Oil Red; Oil Red 282; Oil Red 2B; Oil Red 3; Oil Red 3B; Oil Red 47; Oil Red 7; Oil Red A; Oil Red APT; Oil Red B; Oil Red BB; Oil Red BS; Oil Red D; Oil Red ED; Oil Red F; Oil Red GO; Oil Red RC; Oil Red RR; Oil Red S; Oil Red SST Extra; Oil Red TAX; Oil Red ZD; Oil Scarlet; Oil Scarlet 48; Oleal Red BB; Oleosol Red BB; Organol Red B; Orient Oil Red RR; Plastoresin Red F; Red 3R Soluble in Grease; Resinol Red 2B; SOT Red 1; Scarlet R; Scarlet R (solvent dye); Scarlet oil; Scarlet red; Silotras Red T 3B; Solvent Red 24; Somalia Red IV; Stearix Red 4B; Stearix Red 4S; Sudan (IV) dye; Sudan 4; Sudan IV; Sudan P; Sudan Red 380; Sudan Red 4BA; Sudan Red BB; Sudan Red BBA; Sudan Red IV; TU 6-14-8780; Tertrogras Red N; Toyo Oil Red BB; Waxoline Red O; Waxoline Red OM; Waxoline Red OS; *o*-Tolueneazo-*o*-toluene-β-naphthol; *o*-Tolylazo-*o*-tolylazo-β-naphthol; *o*-Tolylazo-*o*-tolylazo-2-naphthol

Merck Index Number 8393

Chemical/Dye Class Azo

Molecular Formula $C_{24}H_{20}N_4O$

Molecular Weight 380.44

Physical Form Dark red-brown powder

Solubility Insoluble in water; soluble in benzene, methanol, acetone, isopropanol; slightly soluble in ethanol

Melting Point 184–186 °C (decompose)

Boiling Point (Calcd.) 618.8 ± 55.0 °C, pressure: 760 Torr

pK_a (Calcd.) 13.52 ± 0.50, most acidic, temperature: 25 °C

Absorption (λ_{max}) 520 nm, 357 nm

Synthesis Synthetic methods[1–4]

Staining Applications Fat globules;[5] fats;[6] lipids;[6–9,13] fish oil;[10] lipoproteins;[11] CYP1A1 proteins;[12] proteins;[13] starch;[13] nucleic acids;[12,14,15] tissues;[16,17] waxes[18]

Biological Applications Detecting atherosclerosis;[10,11] diapers;[19] skin care products;[20] shampoos;[21] hair colors;[22] stents;[23] dental impression materials[24]

Industrial Applications Plasma display panels;[25] liquid crystal display device;[26] color filters;[27] semiconductor devices;[28] photoresists;[29,30] recording materials;[31] inks;[32,33] toners;[34] lenses;[35] pesticides;[36] laundry detergents;[37] textiles;[38,39] clay;[40] gasoline;[41,42] diesel fuels;[42] petroleum products[43]

Safety/Toxicity Mutagenicity[44–46]

Certification/Approval Certified by Biological Stain Commission (BSC)

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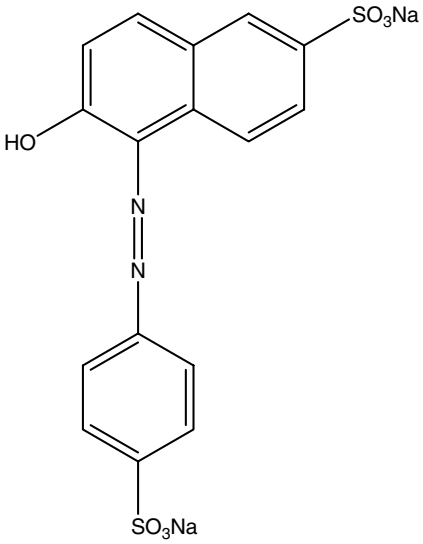
SUNSET YELLOW FCF

CAS Registry Number 2783-94-0

Chemical Structure



CA Index Name 2-Naphthalenesulfonic acid, 6-hydroxy-5-[2-(4-sulfophenyl)diazenyl]-, sodium salt (1 : 2)

Other Names 2-Naphthalenesulfonic acid, 6-hydroxy-5-[(4-sulfophenyl)azo]-, disodium salt; C.I. Food Yellow 3; C.I. Food Yellow 3, disodium salt; Sunset Yellow FCF; 1-*p*-Sulfophenylazo-2-hydroxynaphthalene-6-sulfonate disodium salt; 1351 Yellow; 1899 Yellow; Acid Food Yellow 3; Acid Yellow TRA; Aizen Food Yellow 5; Alabaster No. 3; Atul Sunset Yellow FCF; C Orange 10; C.I. 15985; Canacert Sunset Yellow FCF; Certicol Sunset Yellow CFS; Cilefa Orange S; Cogilor Orange 213.11; D and C Yellow No. 6; Dolkwal Sunset Yellow; E 110; E 110 (dye); Edicol Supra Yellow FC; Eniacid Sunset Yellow; Eurocert Orange FCF; FD & C Yellow 6; FD and C Yellow 6; FD and C Yellow No. 6; FD&C Yellow No. 6; Food Yellow 3; Food Yellow 5; Food Yellow No. 5; HD Sunset Yellow FCF; HD Sunset Yellow FCF Supra; Hexacol Sunset Yellow FCF; Hexacol Sunset Yellow FCF Supra; INS 110; Japan Food Yellow No. 5; Japan Yellow 5; Japan Yellow No. 5; KCA Foodcol Sunset Yellow FCF; L Orange Z 2010; Maple Sunset Yellow FCF; Orange G; Orange II R; Orange PAL; Orange Yellow 85; Orange Yellow S; Orange Yellow SFQ; Orient Water Yellow 2; Para Orange; Sun Orange A Geigy; Sun Yellow; Sun Yellow Extra Conc. A Export; Sun Yellow Extra Pure A; Sun Yellow FCF; Sunlight Yellow FCF; Sunset Yellow; Sunset Yellow 6; Twilight yellow; Usacert Yellow No. 6; Vitasyn Orange RGL 90; Water Yellow 2; Yellow 6; Yellow No. 5; Yellow No. 6; Yellow Orange S; Yellow S; Yellow SY; Yellow Sun

Merck Index Number 9001

Chemical/Dye Class Azo

Molecular Formula $C_{16}H_{10}N_2Na_2O_7S_2$

Molecular Weight 452.37

Physical Form Orange-red crystals

Solubility Soluble in water, ethanol

Melting Point 390 °C (decompose)

Absorption (λ_{max}) 480 nm

Synthesis Synthetic methods[1–13]

Staining Applications Cells;[14] animal feed;[15] bakery products;[16] candies;[20] beverages;[17–19] bread;[21] cereal;[21] confectionery products;[22] cough syrup;[23] dairy products;[24] dietary supplement;[25,29] drinks;[20,26,27] frozen food product;[28] grape extract;[29] meat products;[30] soft drinks;[31] soup;[32] sweeteners;[33,34] syrup;[19] capsule;[35] tablets;[22,36–38] dental bleaching gel;[39] eyebrows;[40] eye shadows;[41] lips;[42] skin;[42,43] tattoos;[44] tooth;[45] hairs;[46–48] keratin fibers[49]

Biological Applications Medical devices;[50] treating bone metabolic diseases,[51] dermatological disorders,[52] mitochondrial diseases,[53] respiratory illness[54]

Industrial Applications Inks;[55–59] paints;[60] thermoplastics;[61] batteries;[62] cleansing products;[63] colored bubbles;[64] textiles;[65] toys[66]

Safety/Toxicity Acute toxicity;[67] carcinogenicity;[68–73] childhood behavior effects;[74] chromosomal aberration;[70,75,76] cytotoxicity;[77] genotoxicity;[78–81] mutagenicity;[82–86] neurotoxicity;[87] reproductive toxicity[87]

Certification/Approval Approved by Food & Drugs Administration (FDA)

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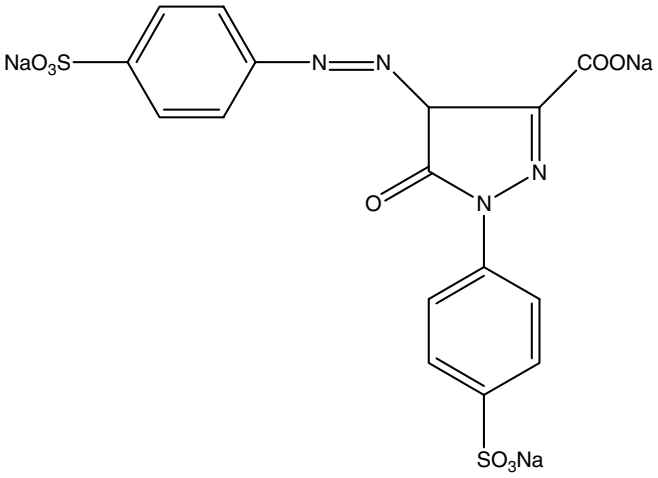
TARTRAZINE

CAS Registry Number 1934-21-0

Chemical Structure



CA Index Name 1*H*-Pyrazole-3-carboxylic acid, 4,5-dihydro-5-oxo-1-(4-sulfophenyl)-4-[2-(4-sulfophenyl) diazenyl]-, sodium salt (1 : 3)

Other Names 1*H*-Pyrazole-3-carboxylic acid, 4,5-dihydro-5-oxo-1-(4-sulfophenyl)-4-[(4-sulfophenyl)azo]-, trisodium salt; C.I. Acid Yellow 23; C.I. Acid Yellow 23, trisodium salt; Tartrazine; 1310 Yellow; 1409 Yellow; 3-Carboxy-5-hydroxy-1-*p*-sulfophenyl-4-*p*-sulfophenylazopyrazole trisodium salt; A.F. Yellow No. 4; AY 23; Acid Leather Yellow T; Acid Yellow 23; Acid Yellow N; Acid Yellow T; Acid Yellow XX-SF; Acilan Yellow GG; Airedale Yellow T; Aizen Tartrazine; Amacid Yellow T; Amacid Yellow T-EX; Apollo Acid Tartrazine; Atul Tartrazine; B 3014; Basovit Yellow 133E; Bosovit Yellow 133E; Bucacid Tartrazine; C.I. 19140; C.I. Food Yellow 4; C.I. Solvent Yellow 57; Calcocid Yellow MCG; Calcocid Yellow XX; Canacert Tartrazine; Certicol Tartrazol Yellow S; Cilefa Yellow T; Cogilor Yellow 113.11; Cogilor Yellow 113.11-90003; Concorde Acid Tartrazine; Concorde Leather Yellow TTZ; Curon Fast Yellow 5G; D and C Yellow No. 5; Dinacid Tartrazine Yellow PFD; Dolkwal Tartrazine; Duasyn Acid Yellow XX; Duasyn Acid Yellow XX-SF; Duasyn Acid Yellow XX-SF-LP 413; Durkee Yellow Food Color; Dyacid Yellow N; Dye Yellow Lake; Dynacid Yellow K; E 102; E 102 (dye); Edicol Supra Tartrazine N; Egacid Yellow T; Egg Yellow A; Eniacid Tartrazine J; Erio Tartrazine; Erio Yellow T Supra; Eurocert Tartrazine; Eurocert Tartrazine 311840; FD & C Yellow No. 5-307008; FD and C Yellow No. 5; FD&C Yellow 5; FD&C Yellow No. 5; FD&C Yellow No. 5-37000; FD&C Yellow No. 5-37009; FD&C Yellow No. 5-90123; Fenazo Yellow T; Food Dye Yellow 4; Food Yellow 4; Food Yellow No. 4; Food dye yellow number 4; HD Tartrazine; HD Tartrazine Supra; Hexacert Yellow No. 5; Hexacol Tartrazine; Hidazid Tartrazine; Hispacid Fast Yellow T; Hydrazine yellow; Hydroxine Yellow L; INS 102; Japan Food Yellow No. 4; Japan Yellow 4; Japan Yellow No. 4; KCA Foodcol Tartrazine PF; KCA Tartrazine PF; Kako Tartrazine; Kayaku Food Colour Yellow No. 4; Kayaku Tartrazine; Kemacid Tartrazine NS; Kiton Yellow T; L Yellow Z 1020; Lake Yellow; Lemon Yellow; Lemon Yellow (Chinese food dye); Lemon Yellow A; Lemon Yellow A Geigy; Maple Tartrazol Yellow; Mitsui Tartrazine; Multacid Yellow T; NSC 4760; Naphtocard Yellow O; Necol Tartrazine; Neelicol Tartrazine; Neklacid Yellow T; Orient Water Yellow 1; Oxanal Yellow T; Pacid Tartrazin; Pro-Jet Yellow OAM; PuriColor Yellow AYE 23; Ritacid Yellow NS; Romexal Yellow T; San-ei Tartrazine; Sandolan Yellow E-TZ; Sicovit Tartrazin Lake E 102; Sicovit Tartrazine Lake E 102; Solvent Yellow 57; Sugai Tartrazine; Tartar Yellow FS; Tartar Yellow N; Tartar Yellow PF; Tartar Yellow S; Tartran Yellow; Tartraphenine; Tartrazin; Tartrazine 307043; Tartrazine 36008; Tartrazine 37000; Tartrazine 37009; Tartrazine 90123; Tartrazine A; Tartrazine A Export; Tartrazine B; Tartrazine B.P.C.; Tartrazine C; Tartrazine E 102; Tartrazine Extra Pure A; Tartrazine FQ; Tartrazine G; Tartrazine GR; Tartrazine Lake; Tartrazine Lake Yellow N; Tartrazine M; Tartrazine MCGL; Tartrazine N; Tartrazine NS; Tartrazine O; Tartrazine O Specially Pure; Tartrazine T; Tartrazine XX; Tartrazine XX Specially Pure; Tartrazine XXX; Tartrazine Yellow; Tartrazine Yellow 5; Tartrazine Yellow BF; Tartrazol BPC; Tartrazol Yellow; Tartrine Yellow O; Triacid Tartrazine Yellow O; Triacid Yellow T; Trisodium 3-carboxy-5-hydroxy-1-*p*-sulfophenyl-4-*p*-sulfophenylazopyrazole; Unitertracid Yellow TE; Usacert FD&C Yellow No. 5-310122; Usacert Yellow No. 5; Vitasyn Tartrazine X 90; Vitasyn Tartrazine XX 90; Vondacid Tartrazine; Water Yellow 1; Water Yellow 176552; Water Yellow 176571; Water Yellow 178758; Water Yellow 178819; Wool Yellow; Xylene Fast Yellow GT; Yellow 5; Yellow HO 203; Yellow Lake 69; Yellow No. 5

Merck Index Number 9072

Chemical/Dye Class Pyrazolone; Azo

Molecular Formula $C_{16}H_9N_4Na_3O_9S_2$

Molecular Weight 534.36

Handbook of Biological Dyes and Stains By R. W. Sabnis

Physical Form Bright orange-yellow powder

Solubility Freely soluble in water; soluble in ethanol, cellosolve; insoluble in xylene

Melting Point 300 °C

Absorption (λ_{max}) 425 nm

Synthesis Synthetic methods[1–25]

Staining Applications Enzymes;[26] lymph nodes;[27] alcohol;[28] bakery products;[29] beverages;[30–33] candy;[34,36] cucumber pickle products;[35] drinks;[36,37] egg noodle;[38] fast food products;[38] fish;[39] ice cream;[40] meat products;[41] potato products;[42] seafood;[43] sweeteners;[44] syrup;[33] yoghurts;[45] capsules;[46] tablets;[47] mouthwash;[48] toothpastes;[49] sunscreen;[50] eyebrows;[51] eyelashes;[52] lips;[53–56] skin;[55–57] tattoos;[58] tooth;[59] hairs[60]

Biological Applications Treating hepatitis,[44,47] periodontal disease,[61] psoriasis[62]

Industrial Applications Color filters;[63,64] liquid crystal displays;[63,64] organic thin films;[65] inks;[66–68] highlighters;[69] paints;[70,71] adhesives;[72] photographic materials;[73] thermoplastics;[74] cleansing products;[75] detergents;[76] colored bubbles;[77] papers,[78] fabrics,[79] wood[80,81]

Safety/Toxicity Acute oral toxicity;[82] allergic contact dermatitis;[83] carcinogenicity;[84–88] chromosomal aberration;[89] chronic toxicity;[86,87] cytotoxicity;[90,91] dermal toxicity;[92] genotoxicity;[93–96] hyperactive behavior in children;[97] mutagenicity;[98–106] neurotoxicity;[107] pseudoallergic reactions;[108] reproductive toxicity[107]

Certification/Approval Approved by Food & Drugs Administration (FDA)

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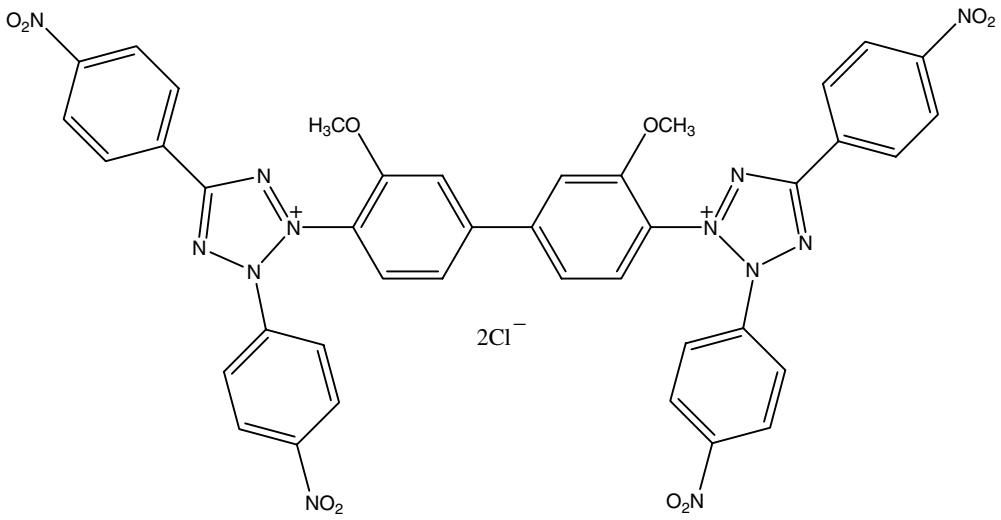
TETRANITRO BLUE TETRAZOLIUM (TNBT)

CAS Registry Number 1184-43-6

Chemical Structure



Chemical/Dye Class Tetrazolium salt

Molecular Formula $C_{40}H_{28}Cl_2N_{12}O_{10}$

Molecular Weight 907.63

Physical Form Yellow crystals or powder

CA Index Name 2*H*-Tetrazolium, 2,2′-(3,3′-dimethoxy [1,1′-biphenyl]-4,4′-diyl)bis[3,5-bis(4-nitrophenyl)-, chloride (1 : 2)

Other Names 2*H*-Tetrazolium, 2,2′-(3,3′-dimethoxy [1,1′-biphenyl]-4,4′-diyl)bis[3,5-bis(4-nitrophenyl)-, dichloride; 2*H*-Tetrazolium, 3,3′-(3,3′-dimethoxy-4,4′-biphenylylene)bis[2,5-bis(*p*-nitrophenyl)-, dichloride; [3,3′-(3,3′-Dimethoxy-4,4′-biphenylylene)bis[2,5-bis(*p*-nitrophenyl)-2*H*-tetrazolium chloride]]; 2,2′,5,5′-Tetra-*p*-nitrophenyl-3,3′-(3,3′-dimethoxy-4,4′-biphenylene)ditetrazolium chloride; 2,2′,5,5′-Tetrakis(*p*-nitrophenyl)-3,3′-(3,3′-dimethoxy-4,4′-diphenylene)ditetrazolium chloride; 2,2′,5,5′-Tetrakis-*p*-(nitrophenyl)-3,3′-bis(3,3′-dimethoxy-4,4′-diphenylene)ditetrazolium chloride; Blue *p*-nitrotetrazolium chloride; NSC 121208; Nitroblue monotetrazolium chloride; TNBT; Tetranitro Blue Tetrazolium; Tetranitro-BT; Tetranitroblue tetrazolium chloride; Tetranitrotetrazolium blue

Merck Index Number Not listed

Solubility Soluble in water, ethanol, methanol, *N,N*-dimethylformamide

Melting Point 170 °C (decompose)

Absorption (λ_{max}) 279 nm

Synthesis Synthetic methods[1–4]

Staining Applications Cancer tissues;[5] enzymes;[6] β-galactosidase;[7] glucose-6-phosphate dehydrogenase;[8,9] motor nerve terminals[10]

Biological Applications Diagnosis of bacterial vaginosis;[11] detecting alkaline phosphatase,[12] gamma-hydroxybutyric acid (GHB),[13] succinate dehydrogenase activity;[14] generating and detecting reactive oxygen species;[15,16] treating cancer[17]

Industrial Applications Recording materials;[18] steel products;[19] toner[20]

Safety/Toxicity Bacterial toxicity[21]

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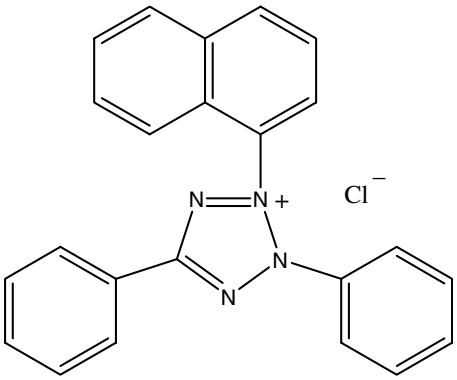
TETRAZOLIUM VIOLET (TV)

CAS Registry Number 1719-71-7

Chemical Structure



CA Index Name 2*H*-Tetrazolium, 3-(1-naphthalenyl)-2,5-diphenyl-, chloride (1 : 1)

Other Names 2*H*-Tetrazolium, 3-(1-naphthalenyl)-2,5-diphenyl-, chloride; 2*H*-Tetrazolium, 3-(1-naphthyl)-2,5-diphenyl-, chloride; 3-(1-Naphthyl)-2,5-diphenyl-2*H*-tetrazolium chloride; 2,5-Diphenyl-3-(1-naphthyl)-2*H*-tetrazolium chloride; 2,5-Diphenyl-3-(1-naphthyl)tetrazolium chloride; 2,5-Diphenyl-3-α-naphthyltetrazolium chloride; TV; Tetrazolium purple; Tetrazolium violet; Tetrazolium violet chloride; VT; Violet Tetrazolium

Merck Index Number Not listed

Chemical/Dye Class Tetrazolium salt

Molecular Formula $C_{23}H_{17}ClN_4$

Molecular Weight 384.86

Physical Form Yellow brown or tan powder

Solubility Soluble in water, ethanol, methanol

Melting Point 245–250 °C (decompose)

Absorption (λ_{max}) 244 nm

Synthesis Synthetic methods[1–3]

Staining Applications Bacteria;[4] fungi[5]

Biological Applications Analysis of microorganisms;[6] detecting anti-bacterial agent,[7] γ-hydroxybutyric acid (GHB);[8] treating cancer,[9] pain[10]

Industrial Applications Semiconductor powders;[11] photographic materials;[12] recording materials;[13] steel products[14]

Safety/Toxicity No data available

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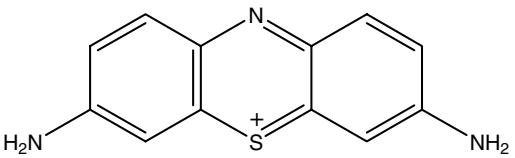
THIONIN

Note: The literature is exclusively devoted to Thionin chloride; however, Thionin acetate is certified by Biological Stain Commission (BSC).

CAS Registry Number 78338-22-4

Chemical Structure



CH_3COO^-

CA Index Name Phenothiazin-5-ium, 3,7-diamino-, acetate (1 : 1)

Other Names C.I. 52000; Lauth's violet; Phenothiazin-5-ium, 3,7-diamino-, acetate; 3,7-Diaminophenothiazin-5-ium acetate; Thionin; Thionin acetate; Thionin acetate salt; Thionine acetate

Merck Index Number Not listed (Chloride listed: 9346)

Chemical/Dye Class Phenothiazine

Molecular Formula $C_{14}H_{13}N_3O_2S$

Molecular Weight 287.34

Physical Form Dark green powder

Solubility Soluble in water, ethanol

Melting Point >200 °C

pK_a 2.5, 11.3

Absorption (λ_{max}) 598 nm

Emission (λ_{max}) 625 nm

Synthesis Synthetic methods[1,2]

Staining Applications Bacteria;[3] viruses;[4] nucleic acids;[4] glomerular deposits[5]

Biological Applications Biosensors;[6] diagnosis of diabetes;[7] detecting ascorbic acid,[8] uric acid,[8] glucose,[9] glomerular deposits[5]

Industrial Applications Batteries;[10] carbon nanotubes;[11,12] glass–polyester composite fibers;[13] magnetic composites;[14] electrochromic devices[15]

Safety/Toxicity No data available

Certification/Approval Certified by Biological Stain Commission (BSC)

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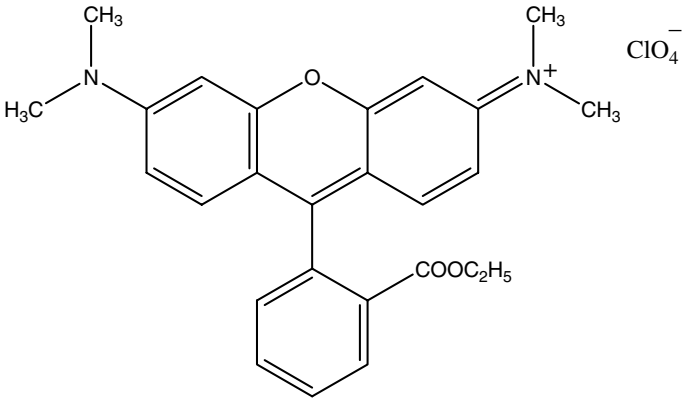
TMRE

CAS Registry Number 115532-52-0

Chemical Structure



CA Index Name Xanthylium, 3,6-bis(dimethylamino)-9-[2-(ethoxycarbonyl)phenyl]-, perchlorate

Other Names T 669; TMRE; Tetramethylrhodamine ethyl ester perchlorate

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{26}H_{27}ClN_2O_7$

Molecular Weight 514.95

Physical Form Dark green crystals

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide

Melting Point 264–266 °C

Absorption (λ_{max}) 549 nm

Emission (λ_{max}) 574 nm

Synthesis Synthetic method[1]

Staining Applications Mitochondria;[2–10] cells[3]

Biological Applications Detecting mitochondrial membrane potential;[1,11,12] apoptosis assays;[13–15] multi-drug resistance assays[16]

Industrial Applications Semi-conducting polymer nanoparticles[17]

Safety/Toxicity No data available

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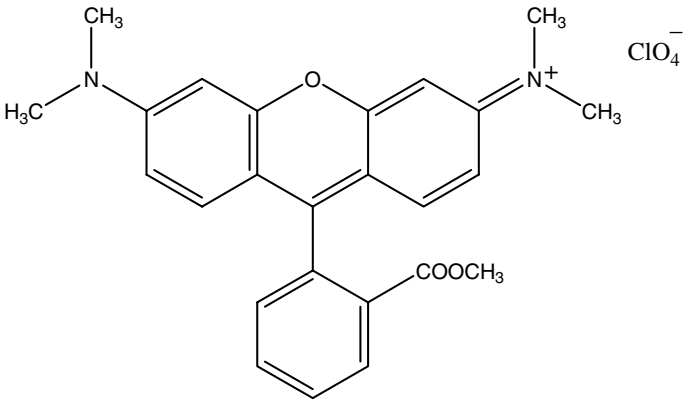
TMRM

CAS Registry Number 115532-50-8

Chemical Structure



CA Index Name Xanthylium, 3,6-bis(dimethylamino)-9-[2-(methoxycarbonyl)phenyl]-, perchlorate

Other Names T 668; TMRM; Tetramethylrhodamine methyl ester perchlorate

Merck Index Number Not listed

Chemical/Dye Class Xanthene

Molecular Formula $C_{25}H_{25}ClN_2O_7$

Molecular Weight 500.93

Physical Form Dark green crystals

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide

Melting Point 274–276 °C

Absorption (λ_{max}) 549 nm

Emission (λ_{max}) 573 nm

Synthesis Synthetic method[1]

Staining Applications Mitochondria;[2–4] cells[3]

Biological Applications Detecting mitochondrial membrane potential;[1,3,5,6] apoptosis assays;[7,8] multidrug resistance assays[9]

Industrial Applications Not reported

Safety/Toxicity No data available

REFERENCES

1. Ehrenberg, B.; Montana, V.; Wei, M. D.; Wuskell, J. P.; Loew, L. M. Membrane potential can be determined in individual cells from the Nernstian distribution of cationic dyes. *Biophys. J*. **1988**, *53*, 785–794.
2. Hattori, F.; Fukuda, K. Method for selecting myocardial cells using intracellular mitochondria labeled with fluorescent indicator. PCT Int. Appl. WO 2006022377, 2006; *Chem. Abstr*. **2006**, *144*, 270175.
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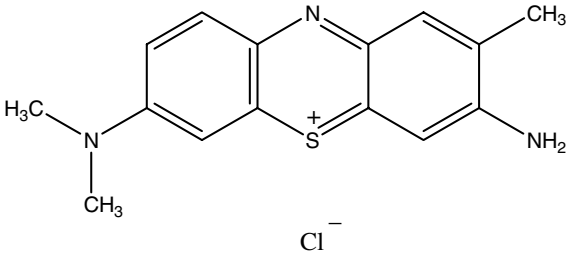
TOLUIDINE BLUE O

CAS Registry Number 92-31-9

Chemical Structure



CA Index Name Phenothiazin-5-ium, 3-amino-7-(dimethylamino)-2-methyl, chloride (1:1)

Other Names Phenothiazin-5-ium, 3-amino-7-(dimethylamino)-2-methyl, chloride; 3-Amino-7-(dimethylamino)-2-methylphenazathionium chloride; 3-Amino-7-(dimethylamino)-2-methylphenothiazin-5-ium chloride; Basic Blue 17; Blutene; Blutene chloride; C.I. 52040; C.I. Basic Blue 17; Dimethyltoluthionine chloride; F Klot; Gabilin; Klot; Menodin; NSC 36758; Schultz 1041; Tolazul; Tolonium chloride; Toluidine Blue O; Toluidine Blue OO; Toluidine blue; Toluidine blue (phenothiazine dye); *o*-Toluidine blue

Merck Index Number 9520

Chemical/Dye Class Phenothiazine

Molecular Formula $C_{15}H_{16}ClN_3S$

Molecular Weight 305.83

Physical Form Dark green powder

Solubility Soluble in water, ethanol

Melting Point >200 °C

pK_a 2.4, 11.6

Absorption (λ_{max}) 626 nm, 630 nm

Synthesis Synthetic methods[1–10]

Staining Applications Amyloid deposits;[11] cells;[12,13] gene expression;[14] glycosaminoglycans;[15] leaf cuticle;[16] Mohs' micrographic surgery;[17] neurons;[18,19] nucleic acids;[20] nuclei;[21] ocular structure;[22] oral lesions;[23–26] paraffin;[27] phenolic deposits;[28] prion protein deposits;[29] proteoglycans;[30] renal cells;[31] RNA;[32] skin lesions;[33] sperm DNA;[34] sperm chromatin;[34,35] sputum[36]

Biological Applications Bound hyaluronan assay;[37] DNA assay;[38] bioelectronic applications;[39] biofuel cells;[40,41] microbial fuel cells;[42] detecting bacteria,[43] body fluid,[44] nucleic acids,[45,46] proteins,[46] viruses;[46] identifying Gram-negative bacteria,[47] β-amyloid reducing agents;[48] photodynamic therapy;[49–56] treating eye diseases,[53] fungal infections,[54] oral lesions,[55] skin diseases,[56] nail infections,[57] neurodegenerative diseases;[58] medical devices[59]

Industrial Applications Photovoltaic cells;[60] solar cells;[60] inks;[61] toners;[62] electrorheological materials;[63] recording materials;[64] paints;[65] detergents;[66] rubber;[67] textiles;[68] analytical applications;[69] security applications[70]

Safety/Toxicity Carcinogenicity;[71,72] cytotoxicity;[73] hepatotoxicity;[74] microbial toxicity;[75] mutagenicity;[76,77] neurotoxicity;[78–80] ototoxicity;[81] photodynamic toxicity[82,83]

Certification/Approval Certified by Biological Stain Commission (BSC)

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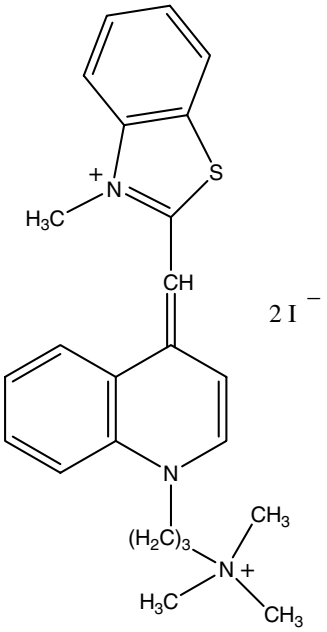
TO-PRO 1

CAS Registry Number 157199-59-2

Chemical Structure



CA Index Name Quinolinium, 4-[(3-methyl-2(3*H*)-benzothiazolylidene)methyl]-1-[3-(trimethylammonio) propyl]-, iodide (1:2)

Other Names Quinolinium, 4-[(3-methyl-2(3*H*)-benzothiazolylidene)methyl]-1-[3-(trimethylammonio)propyl]-, diiodide; TO-PRO 1; TO-PRO 1 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{24}H_{29}I_2N_3S$

Molecular Weight 645.38

Physical Form Red-brown powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250 °C

Absorption (λ_{max}) 515 nm

Emission (λ_{max}) 531 nm

Synthesis Synthetic methods[1–6]

Staining Applications Nucleic acids;[7–13] cells;[4,14,15] antibodies;[1,2] bacteria;[16] leukocytes;[17,18,27] nuclei;[27] megakaryocyte;[19] microorganisms;[20] peptides;[1,2] proteins;[1,2] reticulocytes;[21] sperms[22]

Biological Applications Nucleic acid hybridization;[23,24] nucleic acid assay;[12] nucleic acid fragment sizing;[13] nucleic acid sequencing;[11] detecting nucleic acids,[7–10] cells,[4,14,15]Human papilloma virus (HPV),[25] microstructures;[26] counting embryoblasts,[27] leukocytes;[27] monitoring cell cycle kinetics[28]

Industrial Applications Not reported

Safety/Toxicity No data available

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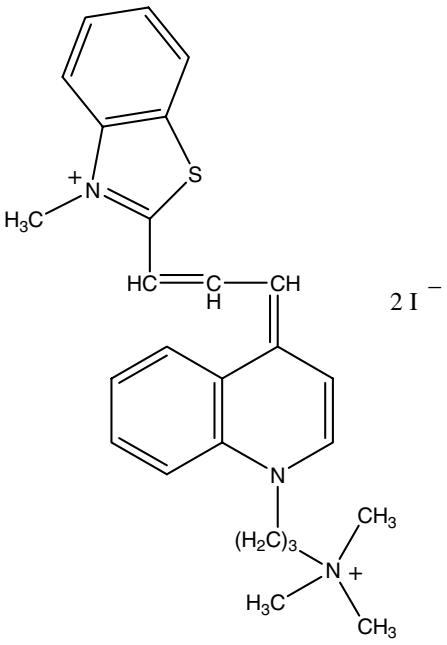
TO-PRO 3

CAS Registry Number 157199-63-8

Chemical Structure



CA Index Name Quinolinium, 4-[3-(3-methyl-2(3*H*)-benzothiazolylidene)-1-propen-1-yl]-1-[3-(trimethylammonio)propyl]-, iodide (1:2)

Other Names Quinolinium, 4-[3-(3-methyl-2(3*H*)-benzothiazolylidene)-1-propenyl]-1-[3-(trimethylammonio)propyl]-, diiodide; TO-PRO 3; TO-PRO 3 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{26}H_{31}I_2N_3S$

Molecular Weight 671.42

Physical Form Red-brown powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250 °C

Absorption (λ_{max}) 642 nm

Emission (λ_{max}) 661 nm

Synthesis Synthetic methods[1–5]

Staining Applications Nucleic acids;[5–13] cells;[4,16] bacteria;[14,15] chromatin;[17] genes;[18] leukocytes;[19] nuclei;[20] peptides;[1] proteins;[1] antibodies[1]

Biological Applications Nucleic acid hybridization;[21,22] nucleic acid assay;[9] detecting nucleic acids,[5–13] cells,[4,16] bacteria,[14,15] bromodeoxyuridine incorporation,[23] Human papilloma virus (HPV),[24] pathogens;[25] counting leukocytes[19]

Industrial Applications Microchip system and polymer waveguides[26]

Safety/Toxicity No data available

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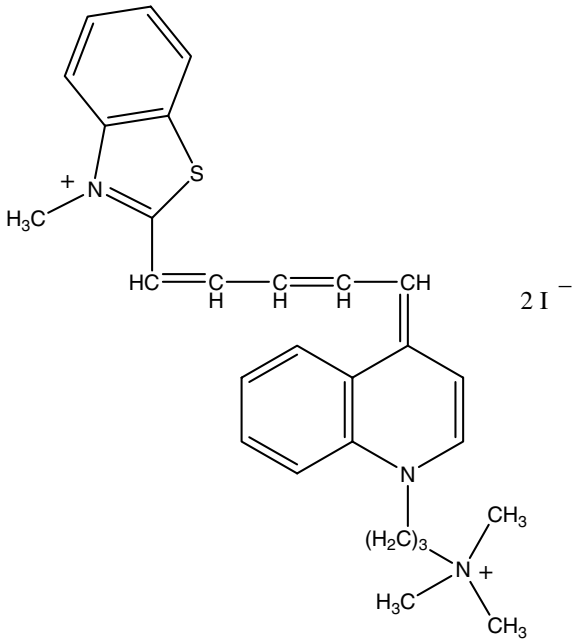
TO-PRO 5

CAS Registry Number 177027-61-1

Chemical Structure



CA Index Name Quinolinium, 4-[5-(3-methyl-2(3*H*)-benzothiazolylidene)-1,3-pentadienyl]-1-[3-(trimethylammonio)propyl]-, diiodide

Other Names 3-methyl-2-[5-[1-[3-(trimethylammonio)propyl]-4(1*H*)-quinolinylidene]-1,3-pentadienyl] benzothiazolium diiodide; TO-PRO 5; TO-PRO 5 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{28}H_{33}I_2N_3S$

Molecular Weight 697.46

Physical Form Red-brown powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250 °C

Absorption (λ_{max}) 747 nm

Emission (λ_{max}) 770 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[2–4] cells[5]

Biological Applications Nucleic acid hybridization;[6,7] detecting nucleic acids,[2–4] Cells;[5] monitoring cell cycle kinetics[8]

Industrial Applications Not reported

Safety/Toxicity No data available

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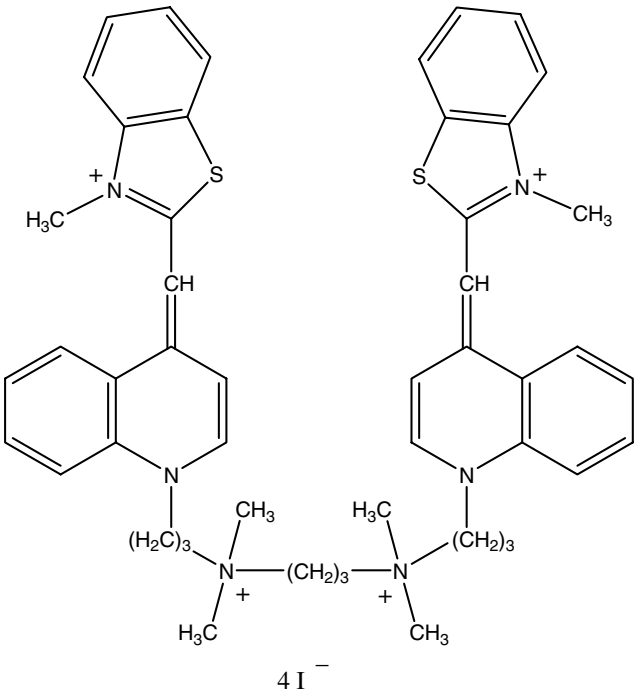
TOTO 1

CAS Registry Number 143413-84-7

Chemical Structure



CA Index Name Quinolinium, 1,1′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl]]bis[4-[(3-methyl-2(3*H*)-benzothiazolylidene)methyl]-, iodide (1:4)

Other Names Quinolinium, 1,1′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl]]bis[4-[(3-methyl-2(3*H*)-benzothiazolylidene)methyl]-, tetraiodide; TOTO 1; TOTO 1 iodide; Thiazole Orange dimer

Merck Index Number 9308

Chemical/Dye Class Cyanine

Molecular Formula $C_{49}H_{58}I_4N_6S_2$

Molecular Weight 1302.77

Physical Form Red powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250 °C

Absorption (λ_{max}) 514 nm

Emission (λ_{max}) 533 nm

Synthesis Synthetic methods[1–6]

Staining Applications Nucleic acids;[3,5–16] cells;[17,18] bacteria;[1,20] chromatin;[24] genes;[21,22] leukocytes;[23,35] nuclei;[35] micronuclei;[24] megakaryocyte;[25] microorganisms;[26] peptides;[19] proteins;[19] antibodies;[19] sperms[27]

Biological Applications Nucleic acid hybridization;[28] nucleic acid amplification assay;[15] DNA fragment sizing;[16] detecting nucleic acids,[3,5–16] cells,[17,18] cystic fibrosis mutations,[29] genes,[21,22]human papilloma virus (HPV),[30] intact recombinant viruses,[31] oncoprotein platelet-derived growth factor,[32] PCR products,[33] stress biomarkers;[34] counting embryoblasts;[35] determining nuclease activity[36]

Industrial Applications Analyzing polymers;[37] high resolution electron-beam lithography[38]

Safety/Toxicity No data available

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Publ. US 2007172836, 2007; *Chem. Abstr*. **2007**, *147*, 182489.

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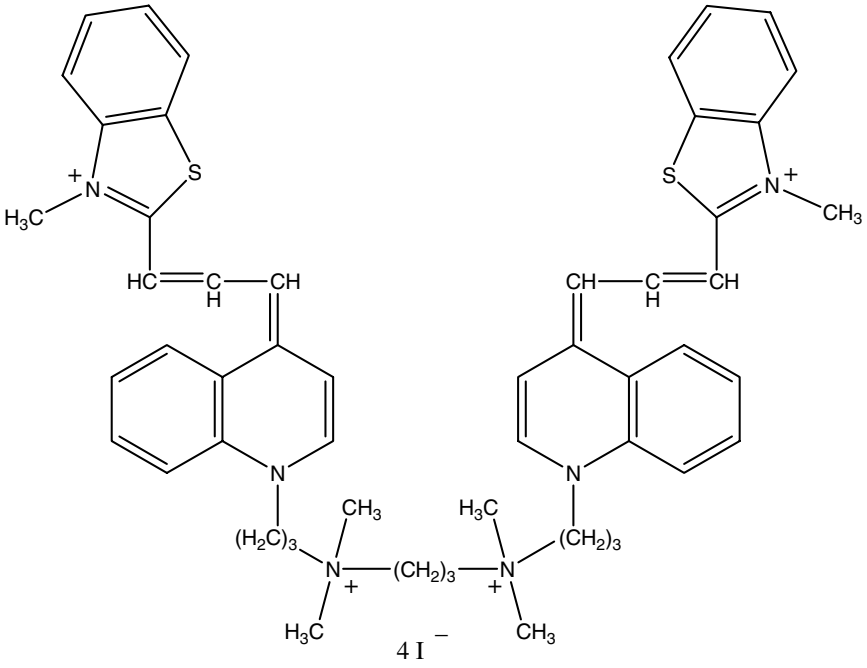
TOTO 3

CAS Registry Number 166196-17-4

Chemical Structure



CA Index Name Quinolinium, 1,1′-[1,3-propanediyl-bis[(dimethyliminio)-3,1-propanediyl]]bis[4-[3-(3-methyl-2(3*H*)-benzothiazolylidene)-1-propen-1-yl]-, iodide (1:4)

Other Names Quinolinium, 1,1′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl]]bis[4-[3-(3-methyl-2(3*H*)-benzothiazolylidene)-1-propenyl]-, tetraiodide; TOTO 3; TOTO 3 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{53}H_{62}I_4N_6S_2$

Molecular Weight 1354.85

Physical Form Red powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250 °C

Absorption (λ_{max}) 642 nm

Emission (λ_{max}) 660 nm

Synthesis Synthetic methods[1–4]

Staining Applications Nucleic acids;[5–11] cells;[12] antibodies;[1,2] bacteria;[13] leukocytes;[14,21] nuclei;[21] megakaryocyte;[15] peptides;[1,2] proteins;[1,2] sperms;[16] hairs[17]

Biological Applications Nucleic acid hybridization;[18] detecting nucleic acids,[5–11] cells,[12] human papilloma virus (HPV),[19] pathogens;[20] counting embryoblasts;[21] determining nuclease activity;[22] retinal toxicity screening methods;[23] studying cellular uptake of gene transfer complexes[24]

Industrial Applications Semiconductor devices[25]

Safety/Toxicity No data available

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5. Exner, M.; Rogers, A. Methods for identifying nucleic acids and determining melting temperature using multiple fluorophores and FRET. U.S. Pat. Appl. Publ. US 2007172836, 2007; *Chem. Abstr*. **2007**, *147*, 182489.
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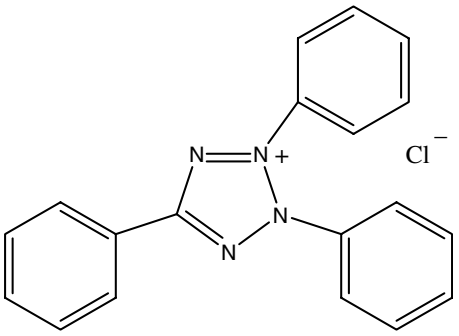
TRIPHENYL TETRAZOLIUM CHLORIDE (TTC)

CAS Registry Number 298-96-4

Chemical Structure



CA Index Name 2*H*-Tetrazolium, 2,3,5-triphenyl-, chloride (1:1)

Other Names 2,3,5-Triphenyl-2*H*-tetrazolium chloride; 2*H*-Tetrazolium, 2,3,5-triphenyl-, chloride; 1,3,5-Triphenyl-2*H*-tetrazolium chloride; 1,3,5-Triphenyltetrazolium chloride; 2,3,5-Triphenyltetrazolium chloride; PTB; RT; Red tetrazolium; TPTZ; TT; TTC; TTC (dye); Tetrazolium chloride; Tetrazolium red; Triphenyltetrazolium chloride; Urocheck; Uroscreen; Vitastain

Merck Index Number 9744

Chemical/Dye Class Tetrazolium salt

Molecular Formula $C_{19}H_{15}ClN_4$

Molecular Weight 334.80

Physical Form Colorless needles, turns yellow on exposure to light

Solubility Soluble in water, ethanol, acetone; insoluble in ether

Melting Point 243–253 °C (decompose)

Absorption (λ_{max}) 247 nm

Synthesis Synthetic methods[1–20]

Staining Applications Bacteria;[21] brain sections;[22] brain slices;[23] cells;[24] cerebral infarcts;[25] cortex;[26] infarcted hearts tissues;[27,28] neurons;[29] plant roots[30,31]

Biological Applications Algae viability assay;[32] microbial growth assays;[33] transketolase activity screening assays;[34] detecting bacteria,[35] γ-hydroxybutyric acid (GHB),[36] microorganisms,[37] myocardial infarction;[28] measuring dehydrogenase activity;[38] treating cancer[39]

Industrial Applications Photographic materials[40]

Safety/Toxicity Bacterial toxicity;[41] mutagenicity[42]

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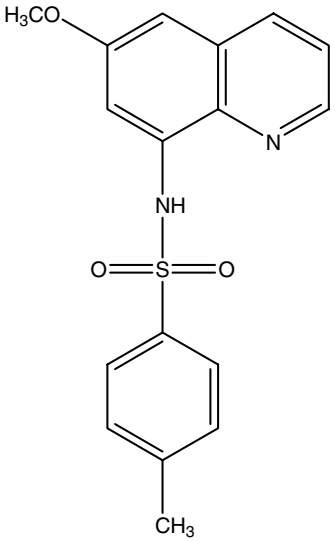
TSQ

CAS Registry Number 109628-27-5

Chemical Structure



CA Index Name Benzenesulfonamide, *N*-(6-methoxy-8-quinolinyl)-4-methyl-

Other Names *p*-Toluenesulfonamide, *N*-(6-methoxy-8-quinolyl)-; NSC 120213; TSQ

Merck Index Number 9799

Chemical/Dye Class Quinoline

Molecular Formula $C_{17}H_{16}N_2O_3S$

Molecular Weight 328.39

Physical Form White crystals

Solubility Soluble in ethanol, methanol

Melting Point 133–134 °C

Boiling Point (Calcd.) 518.8 ± 60.0 °C, pressure: 760 Torr

pK_a (calcd.) 7.40 ± 0.30, most acidic, temperature: 25 °C; 3.09 ± 0.20, most basic, temperature: 25 °C

Absorption (λ_{max}) 334 nm

Emission (λ_{max}) 385 nm

Synthesis Synthetic methods[1–6]

Staining Applications Amyloid plaques;[7] pancreatic islets;[8–10,34] neurons;[7,11–16] sperms;[17] zinc ions[1,2,7–9,11–28,33]

Biological Applications Zinc indicator;[1,2,7–9,11–28,33] early diagnosis of prostate cancer;[28] treating age-related macular degeneration (AMD),[29] amyloidosis disorders,[30] autoimmune diseases,[31] herpes virus infection[32]

Industrial Applications Not reported

Safety/Toxicity Neurotoxicity;[33] pancreatic toxicity[34]

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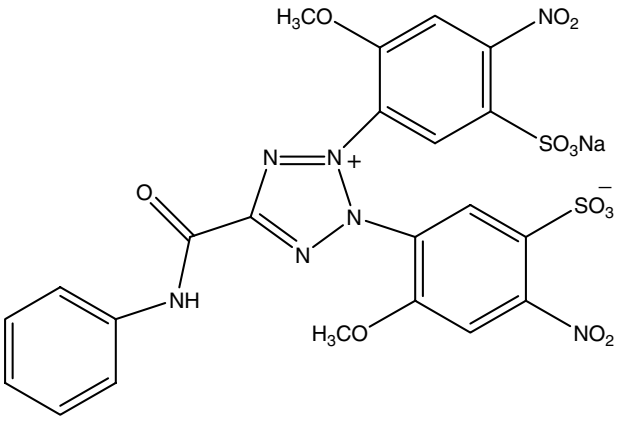
XTT

CAS Registry Number 111072-31-2

Chemical Structure



CA Index Name 2*H*-Tetrazolium, 2,3-bis(2-methoxy-4-nitro-5-sulfophenyl)-5-[(phenylamino)carbonyl]-, inner salt, sodium salt (1:1)

Other Names 2*H*-Tetrazolium, 2,3-bis(2-methoxy-4-nitro-5-sulfophenyl)-5-[(phenylamino)carbonyl]-, inner salt, monosodium salt; 2,3-Bis(2-methoxy-4-nitro-5-sulfophenyl)-2*H*-tetrazolium-5-carboxanilide inner salt; Sodium 3′-[1-(phenylaminocarbonyl)-3,4-tetrazolium]bis (4-methoxy-6-nitro)benzenesulfonic acid; XTT; XTT (tetrazolium derivative)

Merck Index Number Not listed

Chemical/Dye Class Tetrazolium salt

Molecular Formula $C_{22}H_{16}N_7NaO_{13}S_2$

Molecular Weight 673.52

Physical Form Yellow powder

Solubility Soluble in water, methanol, dimethyl sulfoxide

Melting Point 285 °C (decompose)

Absorption (λ_{max}) 286 nm

Synthesis Synthetic methods[1,2]

Staining Applications Cells[3]

Biological Applications Cell proliferation assays;[3,4] cytotoxicity assays;[5,6] ecotoxicity assays;[7] neurotoxicity assays;[8] antimicrobial susceptibility testing assays;[9,10] antifungal susceptibility testing assays;[11–15] cardiac valve viability assays;[16] cell viability assays;[17,18] bacterial viability assays;[19] fungal viability assays;[20] parasite viability assays;[21] BCG vaccines viability assays;[22] detecting DNA single strand breaks,[23] proteins;[24] generating and detecting reactive oxygen species;[25–28] treating cancer[29]

Industrial Applications Not reported

Safety/Toxicity Bacterial toxicity[30]

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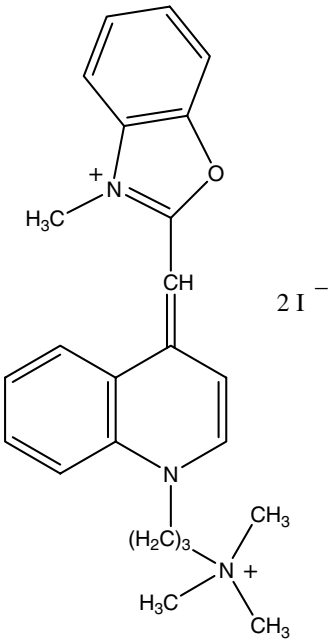
YO-PRO 1

CAS Registry Number 152068-09-2

Chemical Structure



CA Index Name Quinolinium, 4-[(3-methyl-2(3*H*)-benzoxazolylidene)methyl]-1-[3-(trimethylammonio) propyl]-, iodide (1:2)

Other Names Quinolinium, 4-[(3-methyl-2(3*H*)-benzoxazolylidene)methyl]-1-[3-(trimethylammonio)propyl]-, diiodide; Oxazole yellow; YO-PRO 1; YO-PRO 1 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{24}H_{29}I_2N_3O$

Molecular Weight 629.32

Physical Form Orange-red powder

Solubility Soluble in dimethyl sulfoxide, water

Melting Point >250 °C

Absorption (λ_{max}) 491 nm

Emission (λ_{max}) 509 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[2–7] cells;[8,9] bacteria;[18] genes;[10] islets;[11] chromatin;[13] leukocytes;[22] marine prokaryotes;[12] nuclei;[22] micronuclei;[13] megakaryocyte;[14] microorganisms;[20,21] sperms;[15] viruses[23]

Biological Applications Nucleic acid hybridization;[16,17] nucleic acid sequencing;[2–7] detecting nucleic acids,[2–7] cells,[8,9] bacteria,[18] immunodeficiency virus,[19] microorganisms;[20,21] counting embryoblasts,[22] viruses;[23] apoptosis assay;[24] white blood cell functional assay[25]

Industrial Applications Not reported

Safety/Toxicity Cytotoxicity;[26] neurotoxicity;[27] vasotoxicity[28]

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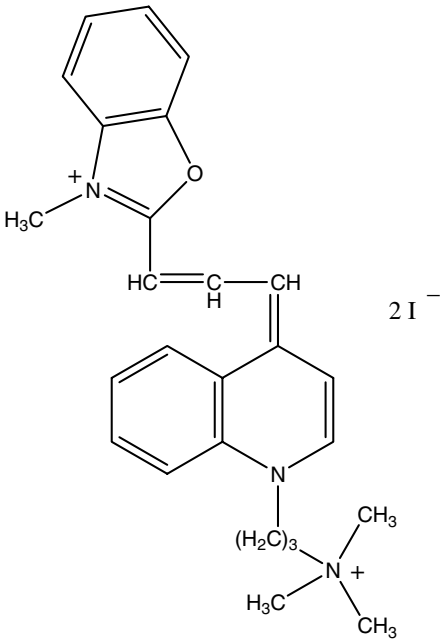
YO-PRO 3

CAS Registry Number 157199-62-7

Chemical Structure



CA Index Name Quinolinium, 4-[3-(3-methyl-2(3*H*)-benzoxazolylidene)-1-propenyl]-1-[3-(trimethylammonio)propyl]-, diiodide

Other Names YO-PRO 3; YO-PRO 3 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{26}H_{31}I_2N_3O$

Molecular Weight 655.36

Physical Form Orange-red powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250 °C

Absorption (λ_{max}) 612 nm

Emission (λ_{max}) 631 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[2–4] cells[5,6]

Biological Applications Nucleic acid hybridization;[7,8] detecting nucleic acids,[2–4] cells;[5,6] monitoring cell cycle kinetics[9]

Industrial Applications Not reported

Safety/Toxicity No data available

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1. Yue, S. T.; Johnson, I. D.; Huang, Z.; Haugland, R. P. Unsymmetrical cyanine dyes with a cationic side chain for enhanced fluorescence on binding with nucleic acids. U.S. Patent 5321130, 1994; *Chem. Abstr*. **1994**, *121*, 129393.
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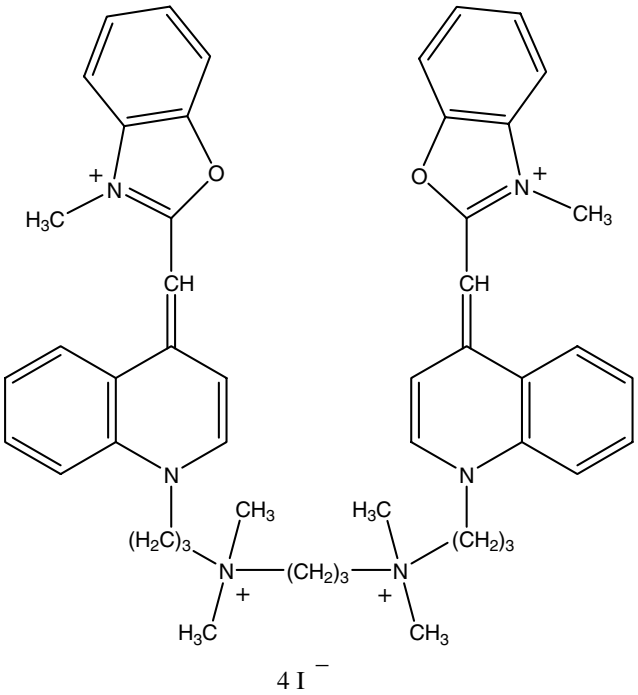
YOYO 1

CAS Registry Number 143413-85-8

Chemical Structure



CA Index Name Quinolinium, 1,1′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl]]bis[4-[(3-methyl-2(3*H*)-benzoxazolylidene)methyl]-, iodide (1:4)

Other Names Quinolinium, 1,1′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl]]bis[4-[(3-methyl-2(3*H*)-benzoxazolylidene)methyl]-, tetraiodide; YOYO 1; YOYO 1 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{49}H_{58}I_4N_6O_2$

Molecular Weight 1270.65

Physical Form Orange-red powder

Solubility Soluble in dimethyl sulfoxide, water

Melting Point >250 °C

Absorption (λ_{max}) 491 nm

Emission (λ_{max}) 509 nm

Synthesis Synthetic methods[1,2]

Staining Applications Nucleic acids;[3–8] cells;[9,10] antibodies;[15] genes;[11] chromatin;[12] micronuclei;[12] megakaryocyte;[13] microorganisms;[14] peptides;[15] proteins;[15] sperms[16]

Biological Applications Nucleic acid hybridization;[17,18] nucleic acid sequencing;[7] detecting nucleic acids,[3–8] cells,[9,10,23] human papilloma virus (HPV),[19] pathogens,[20] spores,[21] cancer cells,[21] stress biomarkers,[22] viruses[23,24]

Industrial Applications Not reported

Safety/Toxicity Double-strand breaks in reconstituted chromatin[25]

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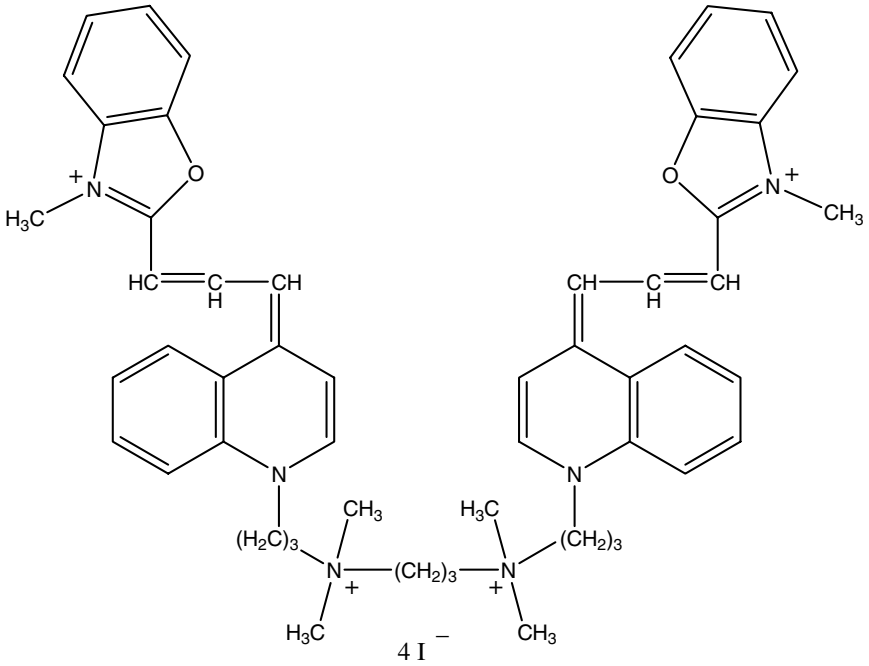
YOYO 3

CAS Registry Number 156312-20-8

Chemical Structure



Molecular Weight 1322.73

Physical Form Orange-red powder

Solubility Soluble in dimethyl sulfoxide

Melting Point >250 °C

CA Index Name Quinolinium, 1,1′-[1,3-propanediyl-bis[(dimethyliminio)-3,1-propanediyl]]bis[4-[3-(3-methyl-2(3*H*)-benzoxazolylidene)-1-propen-1-yl]-, iodide (1:4)

Other Names Quinolinium, 1,1′-[1,3-propanediylbis[(dimethyliminio)-3,1-propanediyl]]bis[4-[3-(3-methyl-2(3*H*)-benzoxazolylidene)-1-propenyl]-, tetraiodide; YO-YO 3; YOYO 3 iodide

Merck Index Number Not listed

Chemical/Dye Class Cyanine

Molecular Formula $C_{53}H_{62}I_4N_6O_2$

Absorption (λ_{max}) 612 nm

Emission (λ_{max}) 631 nm

Synthesis Synthetic method[1]

Staining Applications Nucleic acids;[2–9] cells;[10] leukocytes;[15] nuclei;[15] proteins;[9] sperms[11]

Biological Applications Nucleic acid hybridization;[12,13] detecting nucleic acids,[2–9] cells,[10] pathogens;[14] counting embryoblasts;[15] monitoring cell cycle kinetics[16]

Industrial Applications Analyzing polymers[17]

Safety/Toxicity No data available

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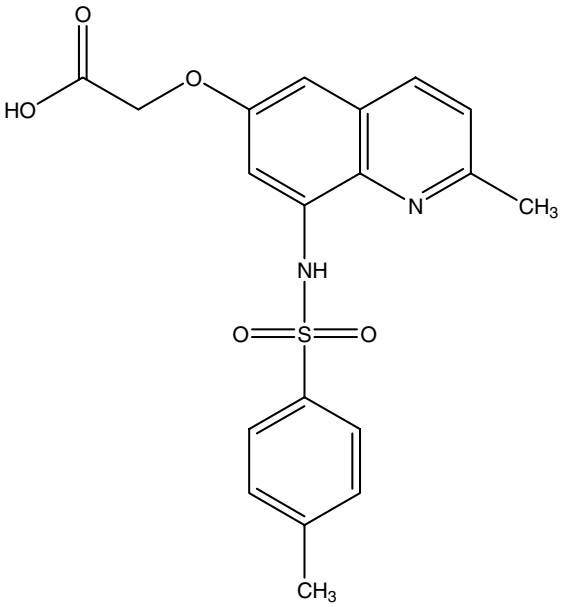
ZINQUIN

CAS Registry Number 151606-29-0

Chemical Structure



CA Index Name Acetic acid, 2-[[2-methyl-8-[[(4-methylphenyl)sulfonyl]amino]-6-quinolinyl]oxy]-

Other Names Acetic acid, [[2-methyl-8-[[(4-methylphenyl)sulfonyl]amino]-6-quinolinyl]oxy]-; Zinquin; Zinquin A; Zinquin acid

Merck Index Number 10169

Chemical/Dye Class Quinoline

Molecular Formula $C_{19}H_{18}N_2O_5S$

Molecular Weight 386.42

Physical Form Off-white crystals

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide; slightly soluble in water

Melting Point 198–200 °C

Boiling Point (Calcd.) 608.0 ± 65.0 °C, pressure: 760 Torr

pK_a (Calcd.) 2.75 ± 0.40, most acidic, temperature: 25 °C; 3.88 ± 0.50, most basic, temperature: 25 °C

Absorption (λ_{max}) 368 nm

Emission (λ_{max}) 490 nm

Synthesis Synthetic methods[1–3]

Staining Applications Zinc ions[1–35]

Biological Applications Zinc indicator;[1–35] detecting apoptosis[12,13,17,21,25,32,33]

Industrial Applications Not reported

Safety/Toxicity Zinc toxicity[34]

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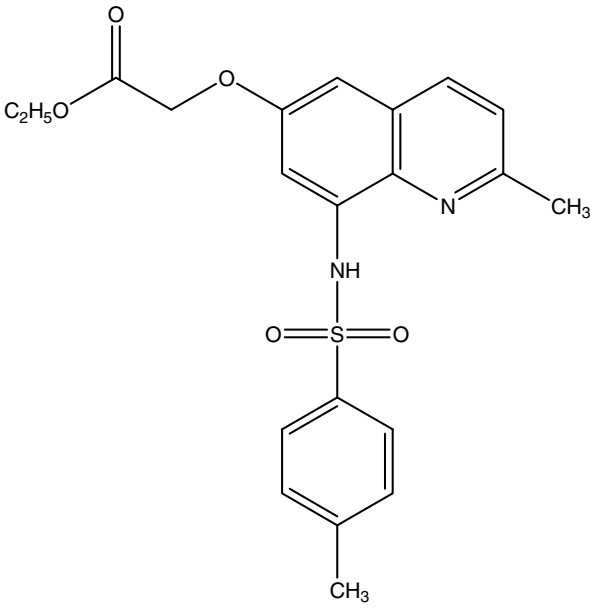
ZINQUIN ESTER

CAS Registry Number 181530-09-6

Chemical Structure



CA Index Name Acetic acid, 2-[[2-methyl-8-[[(4-methylphenyl)sulfonyl]amino]-6-quinolinyl]oxy]-, ethyl ester

Other Names Acetic acid, [[2-methyl-8-[[(4-methylphenyl)sulfonyl]amino]-6-quinolinyl]oxy]-, ethyl ester; 2-Methyl-8-[(4-methylphenyl)sulfonylamino]-6-(ethyloxycarbonylmethyloxy)quinoline; Zinquin E; Zinquin ester; Zinquin ethyl ester

Merck Index Number 10169

Chemical/Dye Class Quinoline

Molecular Formula $C_{21}H_{22}N_2O_5S$

Molecular Weight 414.47

Physical Form Colorless crystals

Solubility Soluble in ethanol, methanol, dimethyl sulfoxide; slightly soluble in water

Melting Point 111–113 °C

Boiling Point (Calcd.) 578.0 ± 60.0 °C, pressure: 760 Torr

pK_a (Calcd.) 7.38 ± 0.30, most acidic, temperature: 25 °C; 3.66 ± 0.50, most basic, temperature: 25 °C

Absorption (λ_{max}) 364 nm

Emission (λ_{max}) 385 nm

Synthesis Synthetic methods[1–3]

Staining Applications Zinc ions[1–4]

Biological Applications Zinc indicator;[1–4] detecting apoptosis[4]

Industrial Applications Not reported

Safety/Toxicity Zinc toxicity[5]

REFERENCES

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APPENDIX A
INDEX OF CAS REGISTRY NUMBERS

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CAS Registry Number	Dye	Page Number
4197-25-5	Sudan Black B	440
4548-53-2	Ponceau SX	375
5141-20-8	Light Green SF Yellowish	261
6359-05-3	Ethyl Eosin	193
7114-03-6	Methyl Green	300
7220-79-3	Methylene Blue Trihydrate	296
7423-31-6	Stains-All	436
8004-87-3	Methyl Violet 2B (Methyl Violet)	309
8005-03-6	Nigrosin	330
10114-58-6	Bismark Brown Y	46
10121-91-2	Dansyl Cadaverine	125
10510-54-0	Cresyl Violet Acetate	114
15391-59-0	Darrow Red	129
16423-68-0	Erythrosin	177
17372-87-1	Eosin Y	173
18472-87-2	Phloxine B	370
23491-45-4	Hoechst 33258	229
23491-52-3	Hoechst 33342	233
23555-00-2	Hoechst 34580	237
25535-16-4	Propidium Iodide	386
25956-17-6	Allura Red	16
28718-90-3	DAPI	127
28983-56-4	Aniline Blue (Methyl Blue)	24
33864-99-2	Alcian Blue 8GX	8
34373-76-7	MEQ	292
36536-22-8	$DiIC_1(5)$	156
38116-89-1	BSPT	64
41085-99-8	DiI	153
47623-98-3	$DiSBAC_2(3)$	167
50909-86-9	Coelenterazine h	100
51023-76-8	Stilbene Isothiocyanate Sulfonic Acid (SITS)	438
51811-82-6	Giemsa Stain	219
53213-81-3	$DiOC_5(3)$	160
53213-82-4	$DiOC_6(3)$	162
53213-83-5	$DiOC_7(3)$	166
53213-94-8	$DiSC_3(5)$	169
54375-47-2	Calcein Blue	78
55779-48-1	Coelenterazine	92
57576-49-5	Acridine Homodimer	3
58880-05-0	Ethidium Monoazide (EMA)	191
61389-30-8	Oxonol V	359
61926-22-5	Ethidium Homodimer-1 (EthD-1)	186
62669-70-9	Rhodamine 123	418
62758-13-8	Resazurin sodium salt	406
63560-89-4	$DiBAC_4(5)$	142
64724-75-0	Oxonol VI	361
67769-47-5	Lucifer Yellow CH	266
70363-83-6	$DiBAC_4(3)$	139
71231-14-6	Lucifer Yellow VS	269
71418-44-5	Monobromobimane (mBBr)	313
73630-23-6	Quin 2	400
74681-68-8	Nuclear Yellow	342
75168-11-5	Nonyl-Acridine Orange (NAO)	339
78338-22-4	Thionin	465
81029-05-2	Brilliant Cresyl Blue	60
83104-85-2	Quin 2 AM	402
83668-91-1	RH 237	408
83907-40-8	SPQ	433
85233-19-8	BAPTA	37
86701-10-2	NBD C_6-Ceramide	317
90134-00-2	Di-4-ANEPPS	135
90217-02-0	Cyanotolyl Tetrazolium Chloride (CTC)	120
104821-25-2	Dihydroethidium	146
107610-19-5	RH 421	412
108964-32-5	Fura 2 AM	215
109244-58-8	Dihydrorhodamine 123	151
109628-27-5	TSQ	488
111072-31-2	XTT	491
112926-02-0	Indo 1 AM	245
113694-64-7	Fura 2	213
115532-50-8	TMRM	469
115532-52-0	TMRE	467
121714-22-5	Fluo 3 AM	201
123437-16-1	Coelenterazine f	98
123437-22-9	Coelenterazine n	104
123437-25-2	Coelenterazine cp	96
123437-32-1	Coelenterazine hcp	102
123632-39-3	Fluo 3	198
124549-08-2	SBFI	428
124549-11-7	PBFI	366
124549-23-1	PBFI AM	368
126150-97-8	BAPTA AM	40

CAS Registry Number	Dye	Page Number
127274-91-3	DiD	144
129423-53-6	SBFI AM	431
130100-20-8	Mag-Fura 2 AM	278
130926-94-2	Mag-Indo 1 AM	283
132299-21-9	Mag-Indo 1	281
132319-56-3	Indo 1	243
132319-57-4	Mag-Fura 2 (Furaptra)	275
133867-53-5	BODIPY FL C_5-Ceramide	55
143413-84-7	TOTO 1	480
143413-85-8	YOYO 1	498
148504-34-1	Calcein AM	74
151606-29-0	Zinquin	503
152068-09-2	YO-PRO 1	495
153130-66-6	Calcium Green 5N	86
154324-80-8	BTC	66
154719-40-1	Calcium Green 1	81
154757-99-0	POPO 3	380
156312-20-8	YOYO 3	500
157134-53-7	Di-8-ANEPPS	137
157199-56-9	PO-PRO 1	382
157199-59-2	TO-PRO 1	475
157199-62-7	YO-PRO 3	497
157199-63-8	TO-PRO 3	477
160605-94-7	Di-2-ANEPEQ	134
161016-55-3	PO-PRO 3	384
161433-30-3	RH 414	410
162112-35-8	FM 4-64	211
162558-52-3	MQAE	316
166196-17-4	TOTO 3	483
168482-84-6	Calcein Blue AM	80
169454-13-1	BOBO 1	51
169454-15-3	POPO 1	378
169454-17-5	BOBO 3	53
170516-40-2	Calcium Green 2	84
170516-41-3	Magnesium Green	284
172807-13-5	RH 795	414
176767-94-5	BTC AM	68
177027-61-1	TO-PRO 5	479
180389-01-9	Ethidium Homodimer-2 (EthD-2)	189
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192140-58-2	Fura 2FF	217
211566-66-4	Hexidium Iodide	227
214147-22-5	NBD methylhydrazine	320
217176-83-5	Dihydrorhodamine 6G	149
234075-34-4	Phen Green SK	369
254109-20-1	DAF FM	123
273221-59-3	Fluo 4	203
273221-67-3	Fluo 4 AM	205
288374-37-8	Newport Green DCF	327
296277-09-3	RedoxSensor Red CC-1	405
304014-12-8	QSY 7 Carboxylic Acid, Succinimidyl Ester	393
304014-13-9	QSY 21 Carboxylic Acid, Succinimidyl Ester	398
305801-86-9	JO-PRO 1	259
305801-87-0	JOJO 1	257
305802-06-6	LOLO 1	264
404335-95-1	FluoZin 3	209
411209-53-5	FluoZin 1	207
411209-54-6	FluoZin 2	208
522592-13-8	JC 9	256
481667-01-0	CoroNa Red	112
612502-05-3	Newport Green PDX	329
677716-65-3	RhodZin 3	421
690993-66-9	CoroNa Green	110
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APPENDIX B
INDEX OF BIOLOGICAL DYES/STAINS (CERTIFIED BY BIOLOGICAL STAIN COMMISSION)

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APPENDIX C
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APPENDIX D
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APPENDIX E:
INDEX OF NUCLEIC ACID STAINS

Handbook of Biological Dyes and Stains By R. W. Sabnis

APPENDIX F:
INDEX OF ORGANELLE PROBES

Handbook of Biological Dyes and Stains By R. W. Sabnis

APPENDIX G:
INDEX OF pH INDICATORS

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