

Chapter 4. Compounds derived from alkoxyacetic acids

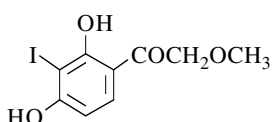
4.1. Compounds derived from methoxyacetic acids

1-(2,4-Dihydroxy-3-iodophenyl)-2-methoxyethanone

[72511-78-5]

C₉H₉IO₄

mol.wt. 308.07



Synthesis

-Obtained by iodination of 2,4-dihydroxy- α -methoxyacetophenone with iodine and periodic acid in ethanol for 2 h at r.t. (74%) [21].

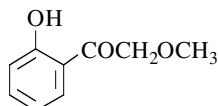
m.p. 157-158° [21].

1-(2-Hydroxyphenyl)-2-methoxyethanone

[138206-45-8]

C₉H₁₀O₃

mol.wt. 166.18



Syntheses

-Preparation by hydrogenolysis of 2-(benzyloxy)- α -methoxyacetophenone (SM) in the presence of Pd/C in ethanol for 1 h in hydrogen atmosphere (96%). SM was obtained by treatment of 2-(benzyloxy)phenylmagnesium

bromide with methoxyacetonitrile in THF, first in an ice bath, then stirred for 2 h at r.t. (56%, colourless oil) [1113].

-Also obtained by decomposition of 1-(2-acetoxyphenyl)-2-diazoethanone in methanol with copper bronze (54%). The diazoketone (deep red thick oil) was prepared by reaction of diazomethane with 2-acetoxybenzoyl chloride in ethyl ether [1251].

colourless oil [1113], pale yellow liquid [1251]; b.p._{0.6-0.8} 76-77° [1251];

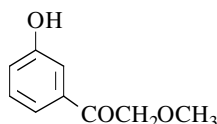
¹H NMR [1113], IR [1113], MS [1113].

1-(3-Hydroxyphenyl)-2-methoxyethanone

[54794-31-9]

C₉H₁₀O₃

mol.wt. 166.18



Syntheses

-Refer to: [621] and [1276] (Polish patent).

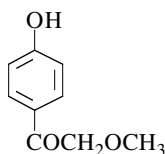
N.B.: K salt [622].

1-(4-Hydroxyphenyl)-2-methoxyethanone

[32136-81-5]

C₉H₁₀O₃

mol.wt. 166.18



Syntheses

-Obtained by scission of 5-hydroxy-4-(4-hydroxyphenyl) 5H-furan-2-one with potassium hydroxide in methanol at 20° for 24 h (85%) [443].

-Also obtained by catalytic debenzilation of 1-(4-benzyl-oxyphenyl)-2-methoxyethanone in methanol under hydrogen (5 bars) in the presence of 5% Pd/C for 24 h (81%) [443].

- Also obtained by methoxylation of the trimethylsilyl enol ether of 4-acetoxyacetophenone (SM) according to the procedure [1034], iodosobenzenediacetate replaced iodosobenzene, followed by hydrolysis of the ester complex formed (40%). SM was prepared in two steps from p-hydroxyacetophenone, namely acetylation, then trimethylsilylation (80%) [360].
- Also obtained by reaction of 2-chloro-1-(4-hydroxyphenyl)ethanone (m.p. 151°) with methanolic sodium methoxide at r.t. for 24 h (90%) [602].
- Also refer to: [3] [403] [473] [665] [1344] [1372].

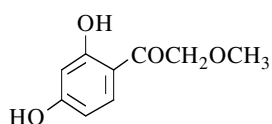
m.p. 133-135° [602], 128-130° [443];
¹H NMR [443] [602], ¹³C NMR [443], IR [443] [602],
 MS [443] [602].

1-(2,4-Dihydroxyphenyl)-2-methoxyethanone

[57280-75-8]

C₉H₁₀O₄

mol.wt. 182.18



Syntheses

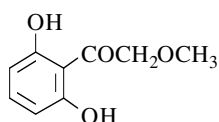
- Obtained by reaction of methoxyacetonitrile with resorcinol and subsequent hydrolysis of the ketimine hydrochloride (m.p. 205-207°) formed (Hoesch reaction) [34] [303] [378] [1371].
- Also obtained by decomposition of 1-(2,4-diacetoxyphenyl)-2-diazoethanone in methanol with copper bronze (43%). The diazoketone (brownish yellow glassy solid) was prepared by reaction of diazomethane with 2,4-diacetoxybenzoyl chloride in ethyl ether [1251].
- Also obtained by alkaline degradation of 7-acetoxy-3,4-dimethoxycoumarin (m.p. 123-124°) with sodium hydroxide or sodium carbonate [16].
- Also refer to: [17] [18] [21] [33] [123] [379] [592] [801] [803] [1123] [1154] [1253].

m.p. 138-139° [378], 136-138° [1251], 136° [1371];
¹H NMR [378], ¹³C NMR [378], MS [378].

1-(2,6-Dihydroxyphenyl)-2-methoxyethanone

C₉H₁₀O₄

mol.wt. 182.18



Synthesis

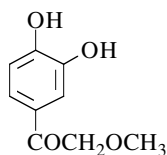
- Obtained by Fries rearrangement of 4-methylumbelliferone methoxyacetate, followed by alkaline hydrolysis of the resulting 8-(2-methoxyacetyl)-4-methylumbelliferone [726].

1-(3,4-Dihydroxyphenyl)-2-methoxyethanone

[64349-40-2]

C₉H₁₀O₄

mol.wt. 182.18



Syntheses

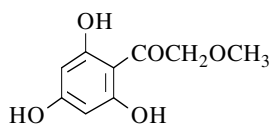
- Obtained by methoxylation of the trimethylsilyl enol ether of 3,4-diacetoxyacetophenone (SM) according to the procedure [1034], iodosobenzenediacetate replaced iodosobenzene, followed by hydrolysis of the ester complex formed (40%). SM was prepared in two steps from 3,4-dihydroxyacetophenone, namely acetylation (70%), then trimethylsilylation (88%) [361].
- Also refer to: [3] [450].

2-Methoxy-1-(2,4,6-trihydroxyphenyl)ethanone

[55317-02-7]

C₉H₁₀O₅

mol.wt. 198.18

**Syntheses**

-Preparation by reaction of methoxyacetonitrile with phloroglucinol (Hoesch reaction) [34] [141] [215] [368] [470] [957] [1371], (80%) [192], (79%) [168], (77%) [378], (75-80%) [1240], (50%) [550].

-Also refer to: [15] [17] [18] [123] [234] [371] [372] [379] [464] [728] [789] [800] [801] [863] [933] [1050] [1078] [1126] [1222] [1230] [1255] [1362] [1460].

monohydrate [328074-83-5]: [957] [1371]; Crystal data [957];

m.p. 195-196° [368], 192-194° [192] [378], 192° [847] [1371], 191-194° [550];

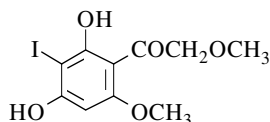
¹H NMR [192] [378], ¹³C NMR [192] [378] [1156], MS [192] [378].

1-(2,4-Dihydroxy-3-iodo-6-methoxyphenyl)-2-methoxyethanone

[74047-42-0]

C₁₀H₁₁IO₅

mol.wt. 338.10

**Synthesis**

-Preparation by iodination of 2,4-dihydroxy-6,α-dimethoxyacetophenone with iodine and periodic acid in dilute ethanol for 2 h at 60-70° (78%) [22].

m.p. 191-193° [22];

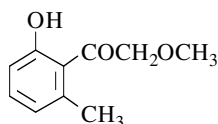
N.B.: This ketone was characterized by its corresponding diacetate: m.p. 112-114° and ¹H NMR [22].

1-(2-Hydroxy-6-methylphenyl)-2-methoxyethanone

[75278-05-6]

C₁₀H₁₂O₃

mol.wt. 180.20

**Synthesis**

-Obtained by fission of 3-methoxy-5-methylflavone (m.p. 113-115°) with ethanolic potash (50%) [20].

N.B.: This compound could not be prepared by Hoesch condensation of m-cresol with methoxyacetonitrile [20].

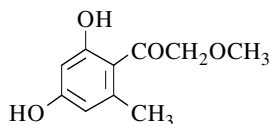
oil [20]; ¹H NMR [20].

1-(2,4-Dihydroxy-6-methylphenyl)-2-methoxyethanone

[75278-00-1]

C₁₀H₁₂O₄

mol.wt. 196.20

**Syntheses**

-Preparation by Hoesch condensation of orcinol with methoxyacetonitrile (53%) [20].

-Also refer to: [371].

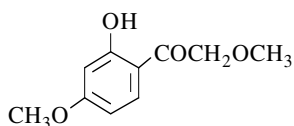
m.p. 182-183° [20]; ¹H NMR [20].

1-(2-Hydroxy-4-methoxyphenyl)-2-methoxyethanone (*Fisetol dimethyl ether*)

[4940-44-7]

C₁₀H₁₂O₄

mol.wt. 196.20

**Syntheses**

- Preparation by reaction of methoxyacetonitrile with resorcinol monomethyl ether (Hoesch reaction) [1371], (80%) [479].
- Also obtained by decomposition of 1-(2-acetoxy-4-methoxyphenyl)-2-diazoethanone in methanol with copper bronze for 30 min at 50-55°, followed by hydrolysis of the acetyl derivative (57%). The diazoketone (m.p. 102-105°) was prepared by reaction of diazomethane with 2-acetoxy-4-methoxybenzoyl chloride in ethyl ether for 12 h at -5° [1251].
- Obtained by alkaline degradation of different polymethoxyflavones with potassium hydroxide,
- *From *fisetin tetramethyl ether* (3,7,3',4'-tetramethoxyflavone) [636] [637] [638] [639] [828] [1172] [1296] [1371];
- *From 3,7,3',4',5'-pentamethoxyflavone (SM) (m.p. 149°) [223], (81%) [1296]. SM was prepared by methylation of 3,7,3',4',5'-pentahydroxyflavone, itself isolated from *Robinia pseudacacia* [1296];
- *From *kanugin* (3,7,3'-trimethoxy-4',5'-methylenedioxyflavone) (m.p. 203-205°), isolated from the root bark of *Pongamia glabra* [1210];
- *From *demethoxykanugin* (3,7-dimethoxy-3',4'-methylenedioxyflavone) (SM) (m.p. 142°), [1015], (86%) [1061]. SM was isolated from the seed oil of karanja (*Pongamia glabra*) [1061] or from fresh root bark and the stem bark of *Pongamia glabra* [1015].
- Also obtained by alkaline degradation of 3,7-dimethoxychromone with sodium ethoxide [488].
- Also obtained by alkaline degradation of 3,4,7-trimethoxycoumarin (m.p. 113-115°) with refluxing 5% aqueous sodium hydroxide for 1 h (60%) [16].
- Also obtained by partial methylation of α -methoxyresacetophenone with dimethyl sulfate,
- *in the presence of potassium carbonate in refluxing benzene for 12 h (83%) [1253] or for 10 h (78%) [1123];
- *in 5% aqueous sodium hydroxide [277] [1371], (70%) [303].
- Also refer to: [123] [592] [1022].

m.p. 132° [479], 69-70° [1251] [1253], 68-69° [1015], 67-68° [16], 67° [1061] [1296], 66° [223] [1123] [1371], 65-67° [1210], 65-66° [303]. One of the reported melting points is obviously wrong.

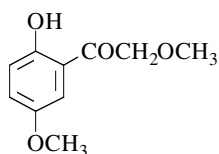
¹H NMR [479]; TLC [16].

1-(2-Hydroxy-5-methoxyphenyl)-2-methoxyethanone

[103323-12-2]

C₁₀H₁₂O₄

mol.wt. 196.20

**Synthesis**

- Obtained by decomposition of 1-(2-acetoxy-5-methoxyphenyl)-2-diazoethanone in methanol with copper bronze (57%). The diazoketone (dark reddish liquid) was prepared by reaction of diazomethane with 2-acetoxy-5-methoxybenzoyl chloride in ethyl ether [1251].

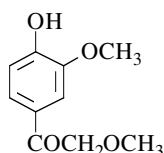
reddish liquid [1251]; b.p._{0.3-0.4} 98-100° [1251].

1-(4-Hydroxy-3-methoxyphenyl)-2-methoxyethanone

[64349-38-8]

C₁₀H₁₂O₄

mol.wt. 196.20



Synthesis

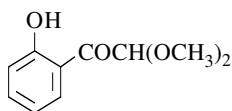
-Refer to: [3] (Japanese paper).

1-(2-Hydroxyphenyl)-2,2-dimethoxyethanone

[127255-97-4]

C₁₀H₁₂O₄

mol.wt. 196.20



Synthesis

-Preparation by reaction of o-hydroxyacetophenone with catalytic amounts of diphenyl diselenide and excess of ammonium peroxydisulfate in refluxing methanol for 1.5 h (72%) [1458].

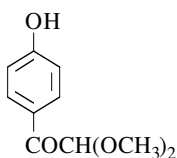
oil [1458]; TLC [1458]; GLC [1458];
¹H NMR [1458], ¹³C NMR [1458], MS [1458].

1-(4-Hydroxyphenyl)-2,2-dimethoxyethanone

[144757-78-8]

C₁₀H₁₂O₄

mol.wt. 196.20



Syntheses

-Obtained by oxidation of p-hydroxyacetophenone with methyl nitrite gas in methanolic hydrogen chloride [1042], at 0 to 5° over 4 h (57%) [429].

N.B.: The reaction involves oxidation with a source of nitrosonium ion (NO⁺) in the presence of an alcohol and a source of H⁺ to give a phenylglyoxal acetal.

Experimental procedure: Preparation by reaction of methyl nitrite with p-hydroxyacetophenone in 1.25 N methanolic hydrogen chloride between 0 to 5° for 4 h (72%). The methyl nitrite source was supplied by adding gradually 33% aqueous sulfuric acid to a sodium nitrite solution in aqueous methanol (1:1) under nitrogen. **N.B.:** During the course of the reaction, the bath was maintained at about -20°. The methyl nitrite generator was not cooled [428].

-Also obtained from electrosynthesis by a selenium catalyzed transformation of p-hydroxyacetophenone in methanol at r.t. (22%) [1373].

-Also refer to: [983] [1042].

white solid [983];

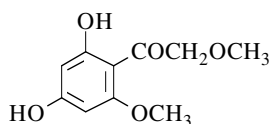
¹H NMR [428] [1373], ¹³C NMR [428], MS [428] [1373].

1-(2,4-Dihydroxy-6-methoxyphenyl)-2-methoxyethanone

[62330-14-7]

C₁₀H₁₂O₅

mol.wt. 212.20

**Syntheses**

-Preparation by condensation of methoxyacetonitrile with phloroglucinol monomethyl ether (Hoesch reaction) (60%) [847].

-Preparation by a three-step synthesis: first, tosylation of α -methoxyphloroacetophenone with p-toluenesulfonyl chloride in the presence of potassium carbonate in refluxing acetone for 4 h. Dimethyl sulfate and potassium carbonate were then added and the mixture refluxed for 36 h more. Finally, saponification of the residue isolated by distillation with refluxing 5% methanolic potassium hydroxide for 4 h (42%) [15].
-Also refer to: [17] [18] [22] [49].

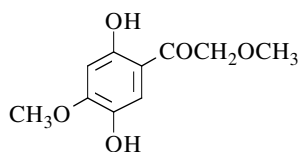
m.p. 208° [847], 190-192° [15].

1-(2,5-Dihydroxy-4-methoxyphenyl)-2-methoxyethanone

[35930-51-9]

C₁₀H₁₂O₅

mol.wt. 212.20

**Syntheses**

-Obtained on oxidation of 2-hydroxy-4, α -dimethoxyacetophenone with potassium persulfate in aqueous sodium hydroxide at 30-40° for 90 min and at r.t. for 36 h [532] (18%) [1253] (Elbs reaction).

-Also obtained by reaction of methoxyacetonitrile with 1,4-dihydroxy-2-methoxybenzene (Hoesch reaction) (13%) [410].
-Also refer to: [563] [721].

trihydrate [1253];

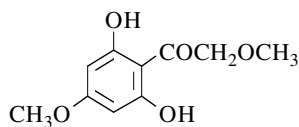
m.p. 150° [410], 148-149° [532], 145-146° [1253].

1-(2,6-Dihydroxy-4-methoxyphenyl)-2-methoxyethanone

[70390-87-3]

C₁₀H₁₂O₅

mol.wt. 212.20

**Syntheses**

-Obtained by alkaline degradation of quercetin 3,7,3',4'-tetramethyl ether (m.p. 159-160°) (5-hydroxy-3,7,3',4'-tetramethoxyflavone) (SM) with potassium hydroxide. SM was isolated from *citrus reticulata* Blanco (Rutaceae) [1292].

-Also obtained by partial methylation of α -methoxyphloroacetophenone with diazomethane in a methanol/ethyl ether mixture at 0° for 2 h (< 8%) [847].
-Also refer to: [674] [680] [1050].

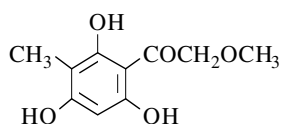
m.p. 161-162° [847]; MS [1292].

2-Methoxy-1-(2,4,6-trihydroxy-3-methylphenyl)ethanone

[110333-13-6]

C₁₀H₁₂O₅

mol.wt. 212.20

**Syntheses**

- Preparation by condensation of 2-methylphloroglucinol with methoxyacetic acid-boron trifluoride complex at 28-30° for 24 h (50%) [961].
- Preparation by reaction of methoxyacetonitrile with 2-methylphloroglucinol (28%) (Hoesch reaction) [708].

-Also refer to: [709].

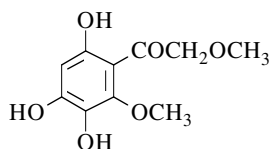
m.p. 207° [961], 206-207° [708]; sesquihydrate [708].

2-Methoxy-1-(6-methoxy-2,4,5-trihydroxyphenyl)ethanone

[65039-95-4]

C₁₀H₁₂O₆

mol.wt. 228.20

**Syntheses**

- Obtained by reaction of potassium persulfate with 2,4-dihydroxy-6,α-dimethoxyacetophenone in aqueous sodium hydroxide at r.t. under nitrogen for 38 h (11%) [49] (Elbs reaction).
- Also refer to: [1513] [1514].

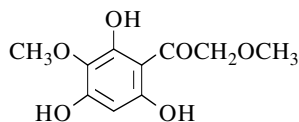
m.p. 163° [49]; IR [49], UV [49].

2-Methoxy-1-(2,4,6-trihydroxy-3-methoxyphenyl)ethanone

[16297-02-2]

C₁₀H₁₂O₆

mol.wt. 228.20

**Synthesis**

- Preparation by reaction of methoxyacetonitrile with iretol (Hoesch reaction) [535], (59%) [534].

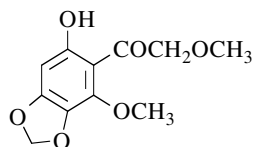
m.p. 157-158° (anhydrous) [534] [535], 82-84° [1175], 79-80° (dihydrate) [534].

1-[6-Hydroxy-2-methoxy-3,4-(methylenedioxy)phenyl]-2-methoxyethanone

[91144-13-7]

C₁₁H₁₂O₆

mol.wt. 240.21

**Syntheses**

- Obtained by reaction of methoxyacetonitrile with 3-methoxy-4,5-(methylenedioxy)phenol (Hoesch reaction) [532], (41%) [527], (29%) [49].
- Also obtained (trace) by reaction of methylene iodide with 3,4,6-trihydroxy-2,α-dimethoxyacetophenone in the presence of potassium carbonate in refluxing acetone for 30 h (1%) [49].

-Also obtained by alkaline degradation of *meliternatin* with boiling alcoholic potassium hydroxide [234], for 7 h (65%) [233]. *Meliternatin* —3,5-dimethoxy-6,7,3',4'-bis(methylenedioxy)flavone— (m.p. 198-198°5) was first isolated from *Melicope ternata* (Rutaceae) [233], then from *Melicope mantelli* Buch [261].

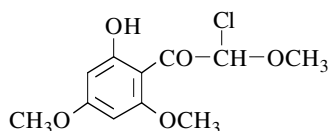
m.p. 142-144° [233] [234], 140-142° [49] [527]; IR [49] [527].

2-Chloro-1-(2-hydroxy-4,6-dimethoxyphenyl)-2-methoxyethanone

[88092-53-9]

C₁₁H₁₃ClO₅

mol.wt. 260.67



Synthesis

-Obtained (by-product) by reaction of 1-(2-hydroxy-4,6-dimethoxyphenyl)-2-methoxyethanone with iron complex [Fe(DMF)₃Cl₂] [FeCl₄] in refluxing dilute methanol for 4 h (< 3%) [1495].

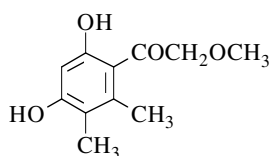
semi-solid [1495]; column chromatography [1495];
¹H NMR [1495], UV [1495].

1-(4,6-Dihydroxy-2,3-dimethylphenyl)-2-methoxyethanone

[132020-84-9]

C₁₁H₁₄O₄

mol.wt. 210.23



Syntheses

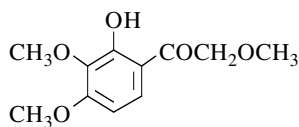
-Preparation by reaction of methoxyacetonitrile with 1,3-dihydroxy-4,5-dimethylbenzene (Hoesch reaction) (71%) [168].
 -Also refer to: [371] [372].

1-(2-Hydroxy-3,4-dimethoxyphenyl)-2-methoxyethanone

[21417-76-5]

C₁₁H₁₄O₅

mol.wt. 226.23



Syntheses

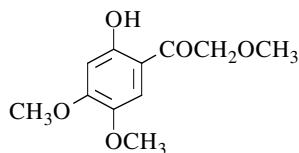
-Obtained by alkaline hydrolysis of 3,7,8,3',4'-pentamethoxyflavone (m.p. 153°) with 10% potassium hydroxide solution in boiling ethanol for 4 h (58%) [312].
 -Also obtained by alkaline hydrolysis of O-pentamethyl-dihydromelanoxetin (3,7,8,3',4'-pentamethoxyflavanone) (m.p. 146-148°) with 8% potassium hydroxide solution in refluxing ethanol for 30 min [1252].

m.p. 85-86° [312], 82-84° [1252]; ¹H NMR [312].

1-(2-Hydroxy-4,5-dimethoxyphenyl)-2-methoxyethanone

C₁₁H₁₄O₅

mol.wt. 226.23



Synthesis

-Preparation by partial methylation of 4,α-dimethoxy-2,5-dihydroxyacetophenone with dimethyl sulfate in the presence of potassium carbonate in refluxing benzene for 12 h (38%) [1253].

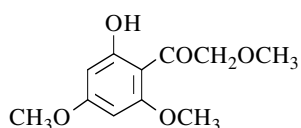
m.p. 90-91° [1253].

1-(2-Hydroxy-4,6-dimethoxyphenyl)-2-methoxyethanone

[17874-42-9]

C₁₁H₁₄O₅

mol.wt. 226.23

**Syntheses**

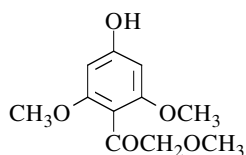
- Preparation by partial methylation of α -methoxyphloroacetophenone [1222],
- *with dimethyl sulfate in the presence of potassium carbonate in refluxing acetone/benzene mixture for 12 h (60%) [1255], (38%) [1050];
- *with methyl iodide in the presence of potassium carbonate in refluxing acetone for 3 h [708];
- *with diazomethane (1 mol) in a methanol/ethyl ether mixture at 0° for 2 h [847].
- Also obtained by condensation of phloroglucinol dimethyl ether with methoxyacetonitrile (Hoesch reaction) (45%) [168], (25%) [1255].
- Also obtained by alkaline degradation of various polymethoxyflavones,
- *From *izalpinin* dimethyl ether (m.p. 194°) (3,5,7-trimethoxyflavone) on boiling with 10% ethanolic potassium hydroxide for 3 h (52%) [793];
- *From *kaempferide* trimethyl ether (m.p. 153-154°) (SM) (3,5,7,4'-tetramethoxyflavone) with potassium hydroxide. SM was isolated from *Citrus reticulata* Blanco (Rutaceae) [1292];
- *From *populnetin* tetramethyl ether, so called *kaempferol* tetramethyl ether (m.p. 165-166°) (3,5,7,4'-tetramethoxyflavone) by refluxing with 8% ethanolic potassium hydroxide for 6 h [1222];
- *From *morin* pentamethyl ether (m.p. 154-157°) (3,5,7,2',4'-pentamethoxyflavone) by heating at reflux with 20% ethanolic potassium hydroxide for 8-10 h [636];
- *From *quercetin* pentamethyl ether (m.p. 148-150°) (3,5,7,3',4'-pentamethoxyflavone) with ethanolic potassium hydroxide [636] [1172] or with boiling dilute ethanolic sodium hydroxide (54%) [662];
- *From *oxyayanin-A* trimethyl ether (m.p. 190-193°) (3,5,7,2',4',5'-hexamethoxyflavone) [951], with potassium hydroxide in boiling ethanol for 8 h (57%) [800];
- *From *myricetin* hexamethyl ether (m.p. 153°) (3,5,7,3',4',5'-hexamethoxyflavone) with boiling 10% ethanolic potassium hydroxide [791] [1172].
- Also obtained by alkaline degradation of 3,4,5,7-tetramethoxycoumarin with refluxing 5% aqueous sodium hydroxide for 1 h [16].
- Also refer to: [68] [123] [157] [234] [464] [592] [792] [794] [795] [1076] [1078] [1371] [1495].

m.p. 104-106° [1222], 104-105° [708], 103-104° [800] [1255],
102-104° [16] [636] [951] [1172], 102° [662] [791] [793],
98-100° [1050], 98° [847];

¹H NMR [1050], ¹³C NMR [1156], IR [662] [1050], MS [1292];
TLC [16]; GLC [151].

1-(4-Hydroxy-2,6-dimethoxyphenyl)-2-methoxyethanoneC₁₁H₁₄O₅

mol.wt. 226.23

**Synthesis**

- Obtained (by-product) by condensation of phloroglucinol dimethyl ether with methoxyacetonitrile (Hoesch reaction) (< 2%) [1255].

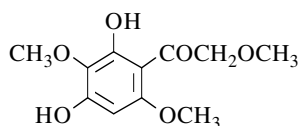
m.p. 259-260° [1255].

1-(2,4-Dihydroxy-3,6-dimethoxyphenyl)-2-methoxyethanone

[42923-40-0]

C₁₁H₁₄O₆

mol.wt. 242.23

**Syntheses**

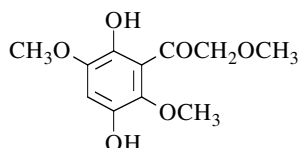
-Obtained by reaction of methoxyacetonitrile with 2,5-dimethoxyresorcinol (Hoesch reaction) [1223], (82%) [120], (62%) [1058] [1225].

-Also obtained by debenzoylation of 4-benzyloxy-2-hydroxy-3,6,α-trimethoxyacetophenone in acetic acid in the presence of hydrochloric acid (d = 1.16) on a boiling water bath for 1 h [1288].
-Also refer to: [531] [649] [1142].

m.p. 150-151° [120] [1058] [1225], 149-150° [1288].

1-(2,5-Dihydroxy-3,6-dimethoxyphenyl)-2-methoxyethanoneC₁₁H₁₄O₆

mol.wt. 242.23

**Synthesis**

-Obtained by reduction of 2-(2-methoxyacetyl)-3,6-dimethoxy-1,4-benzoquinone (m.p. 222-224°) with sulfur dioxide in ethanol (40%). This quinone was prepared by oxidation of 2-hydroxy-3,5,6,α-tetramethoxyacetophenone with fuming nitric acid in ethyl ether [122].

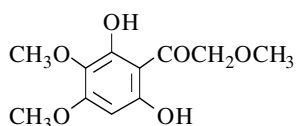
m.p. 175-177° [122].

1-(2,6-Dihydroxy-3,4-dimethoxyphenyl)-2-methoxyethanone

[100059-77-6]

C₁₁H₁₄O₆

mol.wt. 242.23

**Synthesis**

-Preparation by reaction of methoxyacetonitrile with 4,5-dimethoxyresorcinol (Hoesch reaction) [120] [286] [566].

Isolation from natural sources

-Preparation by hydrolysis of *Casticin* (m.p. 186-187°) (5,3'-dihydroxy-3,6,7,4'-tetramethoxyflavone) with potassium hydroxide in refluxing ethanol for 4 h under nitrogen (66%) [155].
-Also by degradation of *Gnaphaliin* monomethyl ether (SM) (m.p. 176-178°) (5-hydroxy-3,7,8-trimethoxyflavone) with 10% ethanolic potassium hydroxide for 2 h under nitrogen. SM was prepared by partial methylation of *Gnaphaliin* (m.p. 174-175°) (3,5-dihydroxy-7,8-dimethoxyflavone), itself isolated from the aerial parts of *Gnaphalium obtusifolium* [610].
-Also refer to: [1255].

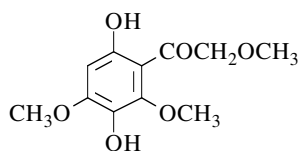
m.p. 129-130° [155] [286].

1-(3,6-Dihydroxy-2,4-dimethoxyphenyl)-2-methoxyethanone

[14639-73-7]

C₁₁H₁₄O₆

mol.wt. 242.23

**Syntheses**

-Preparation from 2-hydroxy-4,6,α-trimethoxyacetophenone by Elbs reaction (22%) [168],
 *with sodium persulfate in aqueous sodium hydroxide at 15-20° for 23 h [800] [1336], (23%) [1255], (32%) [1362];
 *with potassium persulfate in aqueous sodium hydroxide at 15-20° for 20 h (26%) [951].

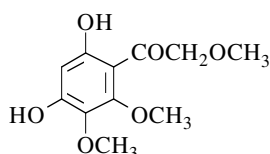
-Also refer to: [175] [176] [563] [647] [721] [1078] [1513] [1514] [1515].

m.p. 139-140° [1362], 135-136° [951] [1255];

sublimation at 115-130°/0.2 mm [1362]; ¹H NMR [1336], ¹³C NMR [1156].

1-(4,6-Dihydroxy-2,3-dimethoxyphenyl)-2-methoxyethanoneC₁₁H₁₄O₆

mol.wt. 242.23

**Synthesis**

-Preparation by reaction of methoxyacetonitrile with 4,5-dimethoxyresorcinol, according to the Hoesch method [286].

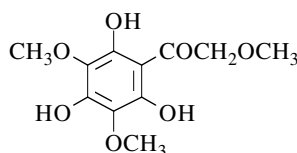
m.p. 129-130° [286].

2-Methoxy-1-(2,4,6-trihydroxy-3,5-dimethoxyphenyl)ethanone

[85950-49-8]

C₁₁H₁₄O₇

mol.wt. 258.23

**Synthesis**

-Obtained by condensation of methoxyacetonitrile with 1,3,5-trihydroxy-2,4-dimethoxybenzene (m.p. 98°) (Hoesch reaction) [1157], (85%) [431].

m.p. 152-153° [1157];

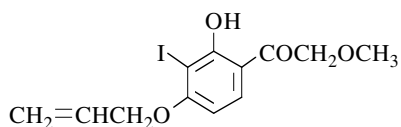
IR [431], UV [431], MS [431].

1-[2-Hydroxy-3-iodo-4-(2-propenyloxy)phenyl]-2-methoxyethanone

[72511-79-6]

C₁₂H₁₃IO₄

mol.wt. 348.14

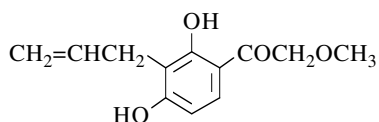
**Synthesis**

-Obtained by allylation of 2,4-dihydroxy-3-iodo-α-methoxyacetophenone with allyl bromide in the presence of potassium carbonate in refluxing acetone for 4-5 h (53%) [21].

m.p. 88-90° [21]; ¹H NMR [21].

1-[2,4-Dihydroxy-3-(2-propenyl)phenyl]-2-methoxyethanoneC₁₂H₁₄O₄

mol.wt. 222.24



Synthesis

-Obtained by Claisen rearrangement of 2-hydroxy-4-allyloxy- α -methoxyacetophenone by heating for 2 h at 190-195° under reduced pressure (67%) [51].

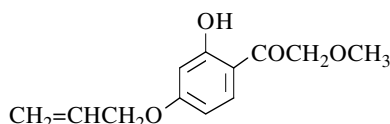
m.p. 139-139°5 [51].

1-[2-Hydroxy-4-(2-propenyloxy)phenyl]-2-methoxyethanone

[57280-73-6]

C₁₂H₁₄O₄

mol.wt. 222.24



Syntheses

-Obtained by reaction of allyl bromide with α -methoxyresacetophenone in the presence of potassium carbonate in refluxing acetone for 5 h (52%) [51].
-Also refer to: [16].

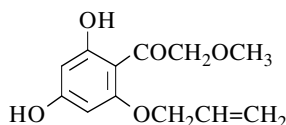
pale yellow viscous liquid [51].

1-[2,4-Dihydroxy-6-(2-propenyloxy)phenyl]-2-methoxyethanone

[62330-10-3]

C₁₂H₁₄O₅

mol.wt. 238.24



Synthesis

-Preparation by a three-step synthesis: first, tosylation of α -methoxyphloracetophenone with p-toluenesulfonyl chloride in the presence of potassium carbonate in refluxing acetone for 4 h. Allyl bromide and potassium carbonate were then added to the reaction mixture and refluxed for 30 h. Finally, saponification of the residue, isolated by distillation, with refluxing 5% methanolic potassium hydroxide for 4 h (38%) [15].

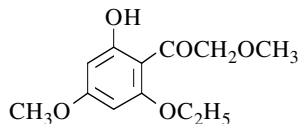
m.p. 184-186° [15].

1-(2-Ethoxy-6-hydroxy-4-methoxyphenyl)-2-methoxyethanone

[21587-55-3]

C₁₂H₁₆O₅

mol.wt. 240.26



Syntheses

-Obtained by alkaline degradation of various flavones,
-with *potassium hydroxide* in boiling ethanol for 8 h,
*From 5-ethoxy-3,7,3',4'-tetramethoxyflavone (20%) [662];
*From 5-ethoxy-3,7,2',4',5'-pentamethoxyflavone [951];
*From 5,2'-diethoxy-3,7,4',5'-tetramethoxyflavone [951];
*From 5,2',5'-triethoxy-3,7,4'-trimethoxyflavone (*oxyanin-A triethyl ether*) (57%) [800];
-with *sodium hydroxide* in boiling ethanol for 1 h,
*From 5,3',5'-triethoxy-3,7,4'-trimethoxyflavone (33%) [284]. This flavone (m.p. 139°) was prepared from *myricetin*, first by selective methylation, then ethylation of the obtained *myricetin* 3,7,4'-trimethyl ether (m.p. 207-208°) [284];

*From 5,3'-diethoxy-3,7,4'-trimethoxyflavone. This flavone was prepared from *quercetin*, first by selective methylation, then ethylation of the obtained *quercetin* 3,7,4'-trimethyl ether (m.p. 174°) [284].

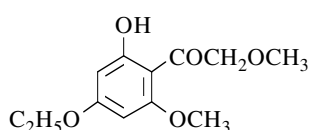
m.p. 110° [951], 109-110° [800], 106-107° [662], 95° [284];
¹H NMR [284], MS [284].

1-(4-Ethoxy-2-hydroxy-6-methoxyphenyl)-2-methoxyethanone

[91555-84-9]

C₁₂H₁₆O₅

mol.wt. 240.26



Syntheses

-Obtained by alkaline degradation of various polysubstituted flavones with potassium hydroxide in refluxing ethanol,
 *From 7-ethoxy-3,5-dimethoxyflavone (m.p. 128-129°) (81%) [1212];
 *From 7-ethoxy-3,5,4'-trimethoxyflavone [1222];

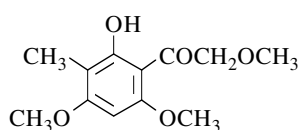
*From 7-ethoxy-3,5,3',4'-tetramethoxyflavone (m.p. 158-160°) (81%) [1212].

m.p. 108-110° [1222], 105-106° [1212].

1-(2-Hydroxy-4,6-dimethoxy-3-methylphenyl)-2-methoxyethanone

C₁₂H₁₆O₅

mol.wt. 240.26



Syntheses

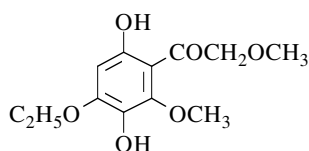
-Obtained by treatment of α-methoxyphloracetophenone with methyl iodide in the presence of potassium carbonate in refluxing acetone for 3 h [708] [1501], (18%) [930].
 -Also obtained by condensation of methoxyacetonitrile with 2-hydroxy-4,6-dimethoxytoluene (Hoesch reaction) [930].
 -Also obtained (by-product) by treatment of α-methoxyphloracetophenone with dimethyl sulfate in the presence of potassium carbonate by refluxing in an acetone and benzene mixture (1:3, v/v) for 12 h (< 3%) [1050].
 -Also obtained by alkaline degradation of 8-methylquercetin pentamethyl ether (m.p. 213-215°) with boiling ethanolic potash [1174].
 -Also refer to: [709].

m.p. 176-177° [708] [1501] (anhydrous); 148-149° [930] [1174],
 141-142° [708] [1501], 140-142° [1050] (hydrate);
¹H NMR [1050], IR [1050].

1-(4-Ethoxy-3,6-dihydroxy-2-methoxyphenyl)-2-methoxyethanone

C₁₂H₁₆O₆

mol.wt. 256.26



Synthesis

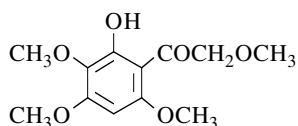
-Obtained by reaction of potassium persulfate with 4-ethoxy-2-hydroxy-6,α-dimethoxyacetophenone in aqueous sodium hydroxide at r.t. for 24 h (23%) (Elbs reaction) [1212].

1-(2-Hydroxy-3,4,6-trimethoxyphenyl)-2-methoxyethanone (*Gossypetol tetramethyl ether*)

[7741-43-7]

C₁₂H₁₆O₆

mol.wt. 256.26

**Syntheses**

- Preparation by partial methylation of 2,4-dihydroxy-3,6,α-trimethoxyacetophenone,
- *with dimethyl sulfate in the presence of potassium carbonate in refluxing acetone for 12 h (63%) [1058];
- *with diazomethane in acetone (82%) [531].

Isolation from natural sources

- Also obtained by alkaline degradation of various polymethoxyflavones with potassium hydroxide,
- *From *chlorflavonin dimethyl ether* (3'-chloro-3,5,7,8,2'-pentamethoxyflavone) (m.p. 114-115°) (SM), (35%). SM was obtained by methylation of *chlorflavonin* (3'-chloro-5,2'-dihydroxy-3,7,8-trimethoxyflavone) (m.p. 212°), itself isolated from cultures of *Aspergillus candidus* [184];
- *From *Herbacetin pentamethyl ether* (3,5,7,8,4'-pentamethoxyflavone) (m.p. 156-158°) [1223];
- *From *Gossypetin hexamethyl ether* (3,5,7,8,3',4'-hexamethoxyflavone) (m.p. 170-172°) [1173]; [123] [1058], (85%) [634], (63%) [1058];
- *From 3,5,7,8,3',4',5'-heptamethoxyflavone (m.p. 194-194°5) (SM), (51%) [1314]. SM was prepared according to different methods:
- by methylation of 5,7,3'-trihydroxy-3,8,4',5'-tetramethoxyflavone (m.p. 214-216°), itself isolated from *Beyeria brevifolia* (Muell. Arg.) Benth. [305];
- by methylation of 5,7-dihydroxy-3,8,3',4',5'-pentamethoxyflavone (m.p. 204-205°), itself isolated from the whole plant of *Conyza stricta* Willd. (Compositae) [1314];
- from *hibiscetin heptamethyl ether* (m.p. 194-196°). *Hibiscetin* is an aglycone of *Hibiscitrin* (3,5,7,8,3',4',5'-heptahydroxyflavone). It was isolated from the flowers of *Hibiscus sabdariffa* [1224].
- Also refer to: [470].

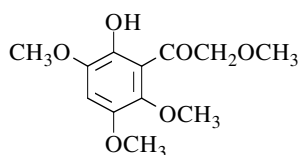
m.p. 116-118° [1058], 115-116° [184] [305] [531] [634] [1223] [1224] [1314];
 UV [531]; GLC [151].

1-(2-Hydroxy-3,5,6-trimethoxyphenyl)-2-methoxyethanone

[62953-05-3]

C₁₂H₁₆O₆

mol.wt. 256.26

**Syntheses**

- Preparation in numerous steps starting from 2,6-dihydroxy-α-methoxyacetophenone. No data [726].
- Also obtained by alkaline degradation of some flavones with refluxing ethanolic potassium hydroxide,
- *From 3,5,6,8,4'-pentamethoxyflavone (m.p. 158-159°) (SM). SM was prepared by methylation of 5,6-dihydroxy-3,8,4'-trimethoxyflavone (m.p. 178-179°), itself isolated from the whole plant of *Conyza stricta* Willd. (Compositae) [1314];
- *From *methyl gardenin* (3,5,6,8,3',4',5'-heptamethoxyflavone) (m.p. 116-117°) (SM) [123], (84%) [122]. SM was prepared by methylation of *gardenin* (m.p. 163-164°), itself isolated from Dikamali gum (gum of *Gardenia lucida*) [122].

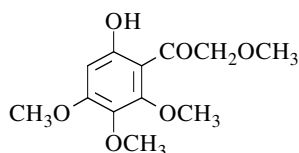
m.p. 110-112° [1314], 88-89° [122]. One of the reported melting points is obviously wrong.

1-(6-Hydroxy-2,3,4-trimethoxyphenyl)-2-methoxyethanone (*Quercetagetol tetramethyl ether*)

[14290-59-6]

C₁₂H₁₆O₆

mol.wt. 256.26

**Syntheses**

-Obtained by partial methylation of 2,5-dihydroxy- α ,4,6-trimethoxyacetophenone with dimethyl sulfate [1336], in the presence of potassium carbonate,
 *in boiling acetone/benzene (1:1) for 8.5 h (53%) [1362];
 *in refluxing benzene for 10 h (47%) [1255].

-Also obtained by alkaline degradation of various polymethoxyflavones,

*From *mikanin dimethyl ether* so-called *Tangeretin* [1236] (3,5,6,7,4'-pentamethoxyflavone) (SM) (m.p. 157-158°) [789], (m.p. 155-156°) [199] with potassium hydroxide in refluxing ethanol for 6.5 h (29%) [789] or for 8 h [199]; SM was isolated from oil of the bark of bitter orange [199];

*From *alnusin trimethyl ether* (3,5,6,7-tetramethoxyflavone) (m.p. 112-112°5) (SM) refluxing in a mixture of 50% potassium hydroxide solution and ethanol for 20 h under nitrogen (50%). SM was prepared by methylation of *alnusin* (6-methoxy-3,5,7-trihydroxyflavone) (m.p. 239-241°). *Alnus* was the main flavonoid isolated from *Alnus sieboldiana* (Betulaceae) [88];

*From *vogetin tetramethyl ether* with potassium hydroxide in refluxing ethanol for 6 h (81%) [1216], (98%) [1315];

N.B.: The *mikanin dimethyl ether* is identical with *penduletin dimethyl ether* and *vogetin tetramethyl ether*.

*From *apulein* (2',5'-dihydroxy-3,5,6,7,4'-pentamethoxyflavone) (m.p. 211-213°) with 20% sodium hydroxide in refluxing dilute methanol (1:1) for 4 h [489]. The *apulein* was isolated from the wood of *Apuleia leiocarpa* (Vog.) Macbr. (= *Apuleia praecox* Mart.) (Leguminosae, subfamily Caesalpinioideae);

*From *apulein diethyl ether* (2',5'-diethoxy-3,5,6,7,4'-pentamethoxyflavone) (m.p. 129-131°) with 10% ethanolic potassium hydroxide at reflux for 10 h under nitrogen [489];

*From *quercetagetin* hexamethyl ether (3,5,6,7,3',4'-hexamethoxyflavone) (m.p. 141-142°) [1255];

*From *patuletin* hexamethyl ether (3,5,6,7,3',4'-hexamethoxyflavone) (m.p. 141-142°) [1254],

-with refluxing (150-155°) 50% aqueous potash for 8 h (21%);

-with refluxing 7% ethanolic potash for 6 h (94%);

*From methyl 3,5,6,7,3',4'-hexamethoxyflavone-2'-carboxylate (m.p. 151-152°) (SM1) with potassium hydroxide in refluxing dilute ethanol for 8 h (78%) [801]. SM1 was obtained by prolonged methylation of *distemonanthin*, itself isolated from the wood of *distemonanthus benthamianus*;

*From (3,5,6,7,2',3',4'-heptamethoxyflavone) (m.p. 191-192°) [951];

*From *apulein dimethyl ether* (3,5,6,7,2',4',5'-heptamethoxyflavone) (m.p. 159-160°) with 50% aqueous potassium hydroxide in refluxing ethanol for 8 h [489];

*From 3,5,6,7,3',4',5'-heptamethoxyflavone (m.p. 155-156°) (SM2) with potassium hydroxide in boiling ethanol for 7 h, under nitrogen [728]. SM2 was isolated from *Eremophila fraseri* F. Muell.

oil [199];

m.p. 77-78° [1255], 75-76° [951] [1254], 72-73° [1315],

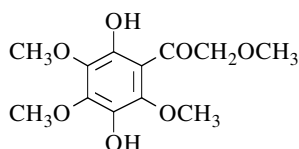
71-72° [497] [801] [1216] [1362], 70-71° [728] [789], 69-71° [88] [489];

¹H NMR [88] [1336], IR [88] [489] [1362], UV [88] [489], MS [489];

TLC [489]; GLC [151].

1-(2,5-Dihydroxy-3,4,6-trimethoxyphenyl)-2-methoxyethanoneC₁₂H₁₆O₇

mol.wt. 272.25

**Syntheses**

-Obtained by oxidation of 2-hydroxy-3,4,6,α-tetramethoxyacetophenone with alkali persulfate (Elbs reaction) (14%) [1058].

-Also refer to: [468] [469].

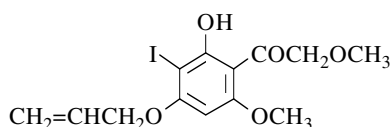
m.p. 102-103° [1058].

1-[2-Hydroxy-3-iodo-6-methoxy-4-(2-propenyloxy)phenyl]-2-methoxyethanone

[74047-41-9]

C₁₃H₁₅IO₅

mol.wt. 378.16

**Synthesis**

-Obtained by treatment of 2,4-dihydroxy-3-iodo-6,α-dimethoxyacetophenone with allyl bromide in the presence of potassium carbonate in refluxing acetone for 4-5 h (54%) [22].

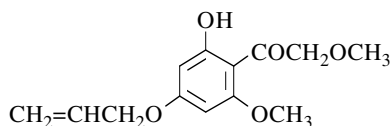
m.p. 167-168° [22]; ¹H NMR [22].

1-[2-Hydroxy-6-methoxy-4-(2-propenyloxy)phenyl]-2-methoxyethanone

[62330-15-8]

C₁₃H₁₆O₅

mol.wt. 238.24

**Synthesis**

-Preparation by partial alkylation of 2,4-dihydroxy-6,α-dimethoxyacetophenone with allyl bromide in the presence of potassium carbonate in refluxing acetone for 4 h (80%) [15].

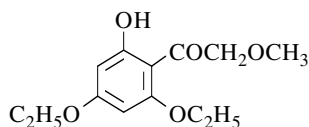
m.p. 87-89° [15].

1-(2,4-Diethoxy-6-hydroxyphenyl)-2-methoxyethanone

[2495-77-4]

C₁₃H₁₈O₅

mol.wt. 254.28

**Syntheses**

-Obtained by partial ethylation of 2,4,6-trihydroxy-α-methoxyacetophenone,

*with diethyl sulfate in the presence of potassium carbonate in boiling acetone for 5 h (78%) [789] or for 16 h [368];

*with ethyl iodide in the presence of potassium carbonate in refluxing acetone for 6 h [1222].

-Also obtained by alkaline degradation of some polysubstituted flavones with potassium hydroxide,

*From 3,4'-dimethoxy-5,7,3'-triethoxyflavone (m.p. 108-109°) (SM). SM was prepared by total ethylation of 3,4'-dimethoxy-5,7,3'-triethoxyflavone (m.p. 235-236°), itself isolated from *Baccharis sarothroides* A. Gray (Compositae) [860];

*From 3-methoxy-5,7,3',4'-tetraethoxyflavone (m.p. 146-148°) (SM) in boiling ethanol for 6 h (35%). SM was prepared by total ethylation of *quercetin 3-methyl ether* (m.p. 261-263°), itself obtained by hydrolysis of its glycoside (m.p. 165-167°). This one (*stizolose*) was isolated from

the aerial parts of *Stizolophus balsamita* (Lam.) A. Takht, so-called *Centaurea balsamita* Lam. (Compositae) [1488].

m.p. 111-112° [789], 110-112° [1222], 110-111° [1488], 109-111° [368], 109-110° [860];

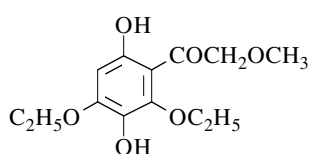
¹H NMR [860], IR [860], UV [860].

1-(2,4-Diethoxy-3,6-dihydroxyphenyl)-2-methoxyethanone

[4324-58-7]

C₁₃H₁₈O₆

mol.wt. 270.28



Synthesis

-Obtained by reaction of potassium persulfate with 2,4-diethoxy-6-hydroxy- α -methoxyacetophenone in the presence of aqueous sodium hydroxide (Elbs reaction), (33%) [789], (25%) [368].

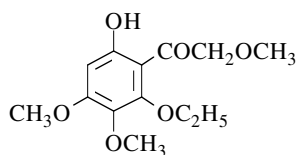
m.p. 102-103° [368], 101-103° [789]; ¹H NMR [368].

1-(2-Ethoxy-6-hydroxy-3,4-dimethoxyphenyl)-2-methoxyethanone

[14965-23-2]

C₁₃H₁₈O₆

mol.wt. 270.28



Syntheses

-Obtained by alkaline degradation of two flavones with potassium hydroxide in refluxing ethanol for 12 h under nitrogen,

*From 5,3',4'-triethoxy-3,6,7-trimethoxyflavone (m.p. 96-97°) (98%) [558];

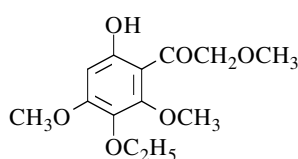
*From 5,3',5'-triethoxy-3,6,7,4'-tetramethoxyflavone (m.p. 120-121°) [728].

m.p. 82-83° [558] [728].

1-(3-Ethoxy-6-hydroxy-2,4-dimethoxyphenyl)-2-methoxyethanone

C₁₃H₁₈O₆

mol.wt. 270.28



Syntheses

-Obtained by alkaline degradation of two flavones with potassium hydroxide in boiling ethanol for 7 h,

*From 6,3'-diethoxy-3,5,7,4'-tetramethoxyflavone (di-O-ethyl-O-methyl oxyyanin-B) (73%) [800];

*From 6,2'-diethoxy-3,5,7,4',5'-pentamethoxyflavone (m.p. 136-137°) [951].

-Also obtained by reaction of ethyl iodide with 3,6-dihydroxy-2,4-dimethoxy- α -methoxyacetophenone in the presence of potassium carbonate in refluxing acetone for 18 h [800].

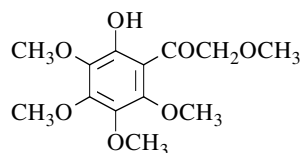
m.p. 78-79° [800], 78° [951].

1-(2-Hydroxy-3,4,5,6-tetramethoxyphenyl)-2-methoxyethanone
(*Calycopterol pentamethyl ether*)

[5071-47-6]

C₁₃H₁₈O₇

mol.wt. 286.28



Syntheses

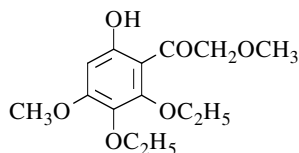
- Obtained by alkaline degradation of *Calycopterin dimethyl ether* or *Thapsin dimethyl ether* (SM) both 3,5,6,7,8,4'-hexamethoxyflavone (m.p. 133-134°) [123] [1323], (89%) [769], (54%) [1322]. SM was prepared by total methylation of *Thapsin*, itself isolated from *Digitalis Thapsi*, L. [769].
- Also obtained by alkaline degradation of *purpurascenin* (3,5,6,7,8,2',4',5'-octamethoxyflavone) (m.p. 132-133°) with refluxing ethanolic potassium hydroxide for 15 h (24%) [1158]. *Purpurascenin* was isolated from the roots, stem, leaves and flowers of *Pogostemon purpurascens* (Labiatae).
- Also obtained by alkaline degradation of *Digicitrine dimethyl ether* (3,5,6,7,8,3',4',5'-octamethoxyflavone) (m.p. 126°) with potassium hydroxide in refluxing 80% ethanol for 4 h (ca. 115°) (75%) [990]. The *Digicitrine dimethyl ether* was prepared by methylation of *Digicitrine* (5,3'-dihydroxy-3,6,7,8,4',5'-hexamethoxyflavone) (m.p. 178-179°), itself isolated from the leaves of *Digitalis purpurea* L.
- Also obtained by alkaline degradation of *Melibentin* with potassium hydroxide in refluxing dilute ethanol for 5 h (73%) [1237]. *Melibentin* (3,5,6,7,8-pentamethoxy-3',4'-methylenedioxyflavone) (m.p. 134-135°) was isolated from the bark and the wood of *Melicope broadbentiana* F. M. Bail (Rutaceae).
- Also obtained by alkaline degradation of *Natsudaiddain methyl ether* (3,5,6,7,8,3',4'-heptamethoxyflavone) (SM) (m.p. 130-131°) [199], (m.p. 128°) [808] with potassium hydroxide in refluxing ethanol [199], (75%) [808]. SM was isolated from oil of the bark of bitter orange [199] or was prepared by methylation of *Natsudaiddain* (3-hydroxy-5,6,7,8,3',4'-hexamethoxyflavone) (m.p. 146°), itself isolated from the peel oil of *Citrus natsudaiddai* HAYATA [808].
- Also obtained by partial methylation of 2,5-dihydroxy-3,4,6,α-tetramethoxyacetophenone with dimethyl sulfate in the presence of potassium carbonate in refluxing acetone for 1 h [110] [469], (29%) [468].
- Also refer to: [1143] [1211] [1324].

gum [1158]; sublimation at 40°/0.01 mm [990];
 m.p. 85-87° [1237], 66-67° [769], 65-67° [1322], 65-66° [990], 64-66° [199],
 64° [808], 62-64° [468]. One of the described melting points is obviously wrong.
 GLC [151]; TLC [990] [1158].
¹H NMR [1158] [1237], IR [1237], UV [990] [1237], MS [1158].

1-(2,3-Diethoxy-6-hydroxy-4-methoxyphenyl)-2-methoxyethanone

C₁₄H₂₀O₆

mol.wt. 284.31



Syntheses

- Obtained by alkaline degradation of various polyalkylated flavones with potassium hydroxide in refluxing ethanol,
- *From (5,6,3'-triethoxy-3,7,4'-trimethoxyflavone) *oxyayanin-B* triethyl ether (72%) [800];
- *From 5,6-diethoxy-3,7,3',4'-tetramethoxyflavone (SM). SM was prepared by ethylation of 5,6-dihydroxy-3,7,3',4'-tetramethoxyflavone (m.p. 211-213°), itself isolated from the heartwood of *Distemonanthus benthamianus* Baillon [951];
- *From 5,6-diethoxy-3,7,2',4',5'-pentamethoxyflavone (m.p. 97-99°) (SM1). SM1 was prepared by ethylation of 5,6-dihydroxy-3,7,2',4',5'-pentamethoxyflavone (m.p. 142-145°), itself isolated from

the heartwood of *Distemonanthus benthamianus* (Leguminosae) [950].

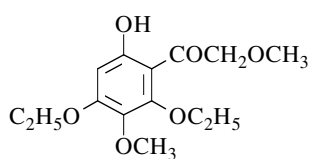
m.p. 80° [951], 79-80° [800] [950]; ¹H NMR [950].

1-(2,4-Diethoxy-6-hydroxy-3-methoxyphenyl)-2-methoxyethanone

[4324-59-8]

C₁₄H₂₀O₆

mol.wt. 284.31



Syntheses

-Obtained by reaction of dimethyl sulfate with 2,4-diethoxy-3,6-dihydroxy- α -methoxyacetophenone in the presence of potassium carbonate in refluxing acetone for 2.5 h [950], (27%) [789] or for 12 h [368].

-Preparation by Friedel-Crafts acylation of 3,5-diethoxy-4-methoxyphenol with methoxyacetyl chloride in ethyl ether in the presence of aluminium chloride, first at 10°, then at 20° for 3 h (72%) [534].

-Also obtained by reaction of methoxyacetoneitrile with 3,5-diethoxy-4-methoxyphenol (Hoesch reaction) [535], (7%) [534].

-Also obtained by alkaline degradation of 5,7-diethoxy-3,6,4'-trimethoxyflavone (SM) (m.p. 123-124°) with sodium hydroxide in refluxing dilute ethanol for 20 h under nitrogen (71%). SM was prepared by ethylation of 5,7-dihydroxy-3,6,4'-trimethoxyflavone (m.p. 164-165°), itself isolated from the leaves and terminal branches of *Dodonaea attenuata* var. *linearis* [1163].

m.p. 65-66° [1163], 60-62° [368], 57-58° [789], 56-57° [950];

b.p._{0.2} 145-146° [534] [535];

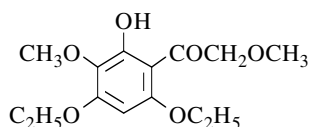
¹H NMR [368] [950], IR [534].

1-(4,6-Diethoxy-2-hydroxy-3-methoxyphenyl)-2-methoxyethanone

[5128-46-1]

C₁₄H₂₀O₆

mol.wt. 284.31



Syntheses

-Obtained by alkaline degradation of some polyalcoxyflavones with potassium hydroxide,

*From 5,7-diethoxy-3,8,4'-trimethoxyflavone (m.p. 106-108°) (SM) (91%). SM was obtained by ethylation of

5,7-dihydroxy-3,8,4'-trimethoxyflavone (m.p. 173-175°), itself isolated from *Beyeria* sp [368];

*From 5,7,3'-triethoxy-3,8,4',5'-tetramethoxyflavone (m.p. 138-139°) (89%) [305];

*From 5,7,4'-triethoxy-3,8-dimethoxyflavone (m.p. 128-129°) (71%) [558];

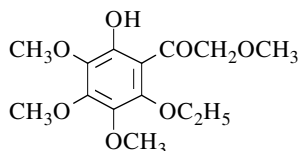
*From 5,7,4'-triethoxy-3,8,3'-trimethoxyflavone (m.p. 110-111°) (23%) [558].

m.p. 125-126° [558], 124-125° [305] [368]; ¹H NMR [368].

1-(2-Ethoxy-6-hydroxy-3,4,5-trimethoxyphenyl)-2-methoxyethanone

C₁₄H₂₀O₇

mol.wt. 300.31



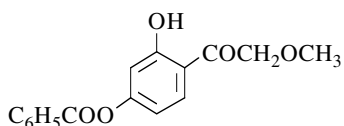
Synthesis

-Obtained by alkaline degradation of *Calycopteris diethyl ether* (m.p. 131-132°) [1323], so called *Thapsin diethyl ether* (m.p. 130°) [769] (5,4'-diethoxy-3,6,7,8-tetramethoxyflavone) with refluxing ethanolic potash [1323], (86%) [769].

m.p. 75-77° [1323], 63-64° [769].

1-[(4-Benzoyloxy)-2-hydroxyphenyl]-2-methoxyethanoneC₁₆H₁₄O₅

mol.wt. 286.28

**Synthesis**

-Formed (by-product) by simple hydrolysis of 2,4-di-benzoyloxy- α -methoxyacetophenone with potassium ethoxide in pyridine at r.t. for 1 min (11%) [1123].

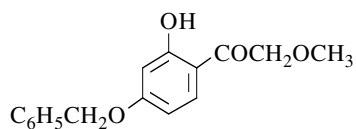
m.p. 122° [1123].

1-[2-Hydroxy-4-(phenylmethoxy)phenyl]-2-methoxyethanone

[62952-90-3]

C₁₆H₁₆O₄

mol.wt. 272.30

**Synthesis**

-Obtained by partial benzylation of α -methoxy-resacetophenone with benzyl chloride in the presence of potassium carbonate and potassium iodide in refluxing acetone for 5 h (47%) [17].

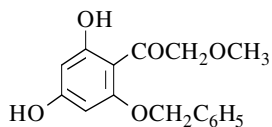
m.p. 67-68° [17].

1-[2,4-Dihydroxy-(6-phenylmethoxy)phenyl]-2-methoxyethanone

[62952-93-6]

C₁₆H₁₆O₅

mol.wt. 288.30

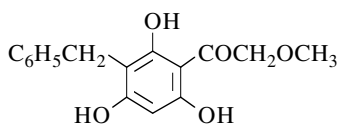
**Synthesis**

-Preparation in one pot by tosylation of α -methoxy-phloracetophenone with 2 mol of p-toluenesulfonyl chloride, subsequent benzylation and final detosylation (35%) [17].

m.p. 227-228° [17].

1-[2,4,6-Trihydroxy-3-(phenylmethyl)phenyl]-2-methoxyethanoneC₁₆H₁₆O₅

mol.wt. 288.30

**Synthesis**

-Obtained by total hydrogenolysis of 1-[2-hydroxy-4,6-bis(phenylmethoxy)-3-(phenylmethyl)phenyl]-2-methoxyethanone in methanol in the presence of Pd/C under hydrogen atmosphere [302].

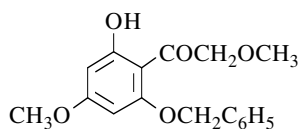
m.p. 98° (monohydrate) [302]; IR [302], UV [302].

1-[2-Hydroxy-4-methoxy-6-(phenylmethoxy)phenyl]-2-methoxyethanone

[62952-92-5]

C₁₇H₁₈O₅

mol.wt. 302.33

**Synthesis**

-Preparation by partial methylation of 6-(benzyloxy)-2,4-dihydroxy- α -methoxyacetophenone with dimethyl sulfate in the presence of potassium carbonate in refluxing acetone for 4 h (86%) [17].

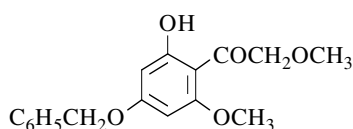
m.p. 122-124° [17].

1-[2-Hydroxy-6-methoxy-4-(phenylmethoxy)phenyl]-2-methoxyethanone

[62952-91-4]

C₁₇H₁₈O₅

mol.wt. 302.33

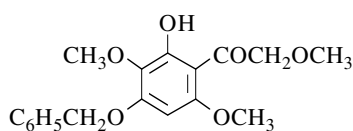
**Synthesis**

-Obtained by reaction of benzyl chloride with 2,4-dihydroxy-6, α -dimethoxyacetophenone in the presence of potassium carbonate and potassium iodide in refluxing acetone for 5 h [17].

m.p. 101-102° [17].

1-[2-Hydroxy-3,6-dimethoxy-4-(phenylmethoxy)phenyl]-2-methoxyethanoneC₁₈H₂₀O₆

mol.wt. 332.35

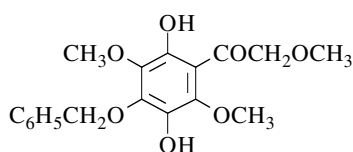
**Syntheses**

-Obtained (by-product) during the condensation of methoxyacetonitrile with 1,3-bis(benzyloxy)-2,5-dimethoxybenzene (Hoesch reaction) (32%) [1288].
-Also refer to: [460] [464] [531].

m.p. 109-110° [1288].

1-[2,5-Dihydroxy-3,6-dimethoxy-4-(phenylmethoxy)phenyl]-2-methoxyethanoneC₁₈H₂₀O₇

mol.wt. 348.35

**Syntheses**

-Obtained by oxidation of 4-(benzyloxy)-2-hydroxy-3,6, α -trimethoxyacetophenone in alkaline solution with potassium persulfate (Elbs reaction) (10%) [1288].
-Also refer to: [611].

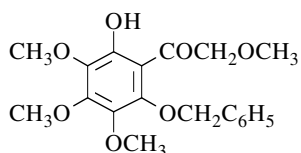
deep yellow viscous oil [1288].

1-[2-Hydroxy-6-(phenylmethoxy)-3,4,5-trimethoxyphenyl]-2-methoxyethanone

[94385-86-1]

C₁₉H₂₂O₇

mol.wt. 362.38

**Synthesis**

-Obtained by alkaline degradation of *Digicitrine dibenzyl ether* [5,3'-bis(benzyloxy)-3,6,7,8,4',5'-hexamethoxyflavone] (m.p. 75-76°) with potassium hydroxide in refluxing 80% ethanol for 3 h (85%) [990].

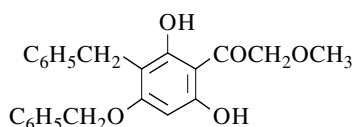
m.p. 64°5-65° [990]; UV [990].

1-[2,6-Dihydroxy-4-(phenylmethoxy)-3-(phenylmethyl)phenyl]-2-methoxyethanone

[18074-51-6]

C₂₃H₂₂O₅

mol.wt. 378.42

**Synthesis**

-Obtained from 1-[2-hydroxy-4,6-bis(phenylmethoxy)-3-(phenylmethyl)phenyl]-2-methoxyethanone by partial hydrogenolysis in methanol in the presence of Pd/C [302].

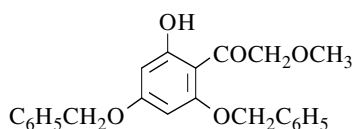
m.p. 203-205° [302]; IR [302], UV [302].

1-[2-Hydroxy-4,6-bis(phenylmethoxy)phenyl]-2-methoxyethanone

[18074-53-8]

C₂₃H₂₂O₅

mol.wt. 378.42

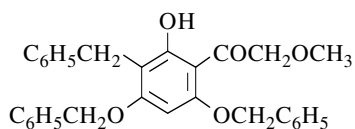
**Synthesis**

-Obtained (poor yield) by reaction of benzyl chloride with α -methoxyphloracetophenone in the presence of potassium carbonate in refluxing acetone (5%) [302].

m.p. 124° [302]; IR [302], UV [302].

1-[2-Hydroxy-4,6-bis(phenylmethoxy)-3-(phenylmethyl)phenyl]-2-methoxyethanoneC₃₀H₂₈O₅

mol.wt. 468.55

**Synthesis**

-Preparation by benzylation of α -methoxyphloracetophenone with benzyl chloride in the presence of sodium iodide and potassium carbonate in boiling acetone for 3 h (34%) [302].

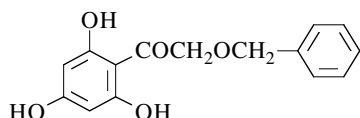
m.p. 147-148° [302]; IR [302], UV [302].

4.2. *Compounds derived from phenylmethoxyacetic acids***2-(Phenylmethoxy)-1-(2,4,6-trihydroxyphenyl)ethanone**

[322405-72-1]

C₁₅H₁₄O₅

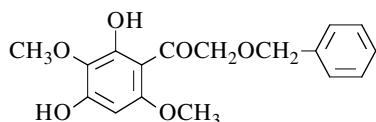
mol.wt. 274.27

**Synthesis**

-Preparation by reaction of benzyloxyacetonitrile with phloroglucinol (Hoesch reaction) (91%) [1440].

1-(2,4-Dihydroxy-3,6-dimethoxyphenyl)-2-(phenylmethoxy)ethanoneC₁₇H₁₈O₆

mol.wt. 318.33

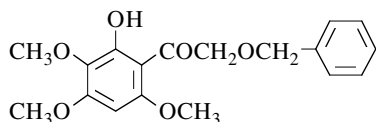
**Synthesis**

-Obtained by hydrogenation of 2-(benzyloxy)-1-[4-(benzyloxy)-2-hydroxy-3,6-dimethoxyphenyl]ethanone in ethyl acetate over Pd/C [531].

m.p. 175-176° [531].

1-(2-Hydroxy-3,4,6-trimethoxyphenyl)-2-(phenylmethoxy)ethanoneC₁₈H₂₀O₆

mol.wt. 332.35

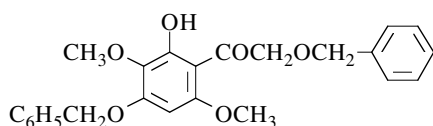
**Synthesis**

-Obtained by partial methylation of 2-(benzyloxy)-1-(2,4-dihydroxy-3,6-dimethoxyphenyl)ethanone with diazomethane [531].

m.p. 172-174° [531].

1-[2-Hydroxy-3,6-dimethoxy-4-(phenylmethoxy)phenyl]-2-(phenylmethoxy)ethanoneC₂₄H₂₄O₆

mol.wt. 408.45

**Synthesis**

-Obtained by reaction of (benzyloxy)-acetonitrile with 2,5-dimethoxyresorcinol dibenzyl ether (Hoesch reaction) (33%) [531].

m.p. 150-151° [531].

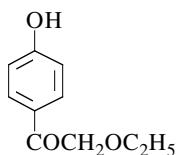
4.3. Compounds derived from ethoxyacetic acids

2-Ethoxy-1-(4-hydroxyphenyl)ethanone

[91061-33-5]

C₁₀H₁₂O₃

mol.wt. 180.20



Synthesis

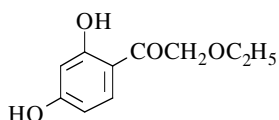
-Obtained by adding ethanol (0.1 ml) and boron trifluoride etherate to a suspension of resin **6** (52 mg) in methylene chloride, and stirring the mixture at r.t. for 1 h. The compound was isolated by usual method and purified by preparative TLC (52%) [682].

N.B.: Resin **6** (resin-bound α -TMS diazoketone **6**) (preparation given).

¹H NMR [682], ¹³C NMR [682], IR [682], MS [682].

1-(2,4-Dihydroxyphenyl)-2-ethoxyethanoneC₁₀H₁₂O₄

mol.wt. 196.20



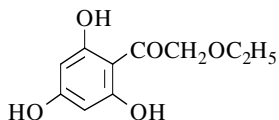
Synthesis

-Obtained by reaction of ethoxyacetonitrile with resorcinol [310], (97%) [1382], (28%) (Hoesch reaction) [1257].

m.p. 136-137° [1382], 135-136° [1257], 132-133° [310];
b.p.₁₀ 195-200° [1257].

2-Ethoxy-1-(2,4,6-trihydroxyphenyl)ethanoneC₁₀H₁₂O₅

mol.wt. 212.201



Syntheses

-Preparation by reaction of ethoxyacetonitrile with phloroglucinol (Hoesch reaction) (64%) [1256].
-Also refer to: [600] [1257].

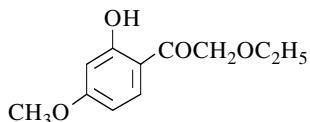
m.p. 197-198° [1256].

2-Ethoxy-1-(2-hydroxy-4-methoxyphenyl)ethanone

[34811-99-9]

C₁₁H₁₄O₄

mol.wt. 210.23



Synthesis

-Obtained by partial methylation of α -ethoxy-2,4-dihydroxyacetophenone (SM) with diazomethane in ethyl ether [311], (18%) [310]. SM was prepared by reaction of ethoxyacetonitrile with resorcinol (Hoesch reaction) [311].

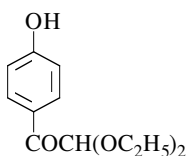
oil [311]; m.p. 30-31° [310]; b.p._{0.02} 80-85° [310]; ¹H NMR [310], IR [310].

2,2-Diethoxy-1-(4-hydroxyphenyl)ethanone

[200420-28-6]

C₁₂H₁₆O₄

mol.wt. 224.26

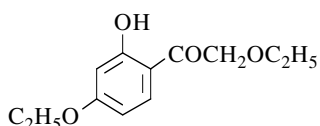


Synthesis

-Refer to: [941] (Japanese patent).

2-Ethoxy-1-(4-ethoxy-2-hydroxyphenyl)ethanoneC₁₂H₁₆O₄

mol.wt. 224.26



Synthesis

-Obtained by treatment of *fisetin* tetraethyl ether (3,7,3',4'-tetraethoxyflavone) with boiling alcoholic potassium hydroxide solution [637] [638] [828] [1371].

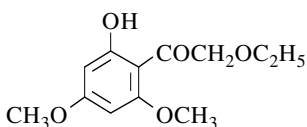
m.p. 42-44° [638].

2-Ethoxy-1-(2-hydroxy-4,6-dimethoxyphenyl)ethanone

[21587-57-5]

C₁₂H₁₆O₅

mol.wt. 240.26



Syntheses

-Obtained by partial methylation of α -ethoxyphloroacetophenone with dimethyl sulfate in the presence of potassium carbonate in refluxing acetone for 12 h (62%) [1257].

-Also obtained by degradation of 3-ethoxy-5,7,3',4'-tetramethoxyflavone with sodium hydroxide in boiling dilute ethanol for 16 h (9%) [662].

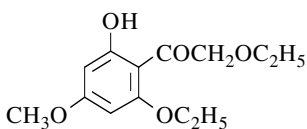
m.p. 103-104° [1257], 99-100° [662].

2-Ethoxy-1-(2-ethoxy-6-hydroxy-4-methoxyphenyl)ethanone

[21587-58-6]

C₁₃H₁₈O₅

mol.wt. 254.28



Synthesis

-Obtained (poor yield) by degradation of 3,5-diethoxy-7,3',4'-trimethoxyflavone (m.p. 164-165°) with sodium hydroxide in refluxing ethanol (3%) [662].

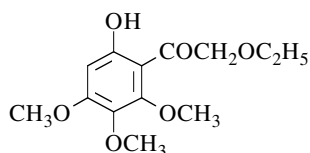
m.p. 82-83° [662]; IR [662].

2-Ethoxy-1-(6-hydroxy-2,3,4-trimethoxyphenyl)ethanone

[19598-24-4]

C₁₃H₁₈O₆

mol.wt. 270.28

**Synthesis**

-Obtained by alkaline degradation of *Eupatoretin* diethyl ether (m.p. 119-120°) (3,3'-diethoxy-5,6,7,4'-tetramethoxyflavone) with potassium hydroxide in refluxing ethanol under nitrogen for 17 h (46%) [861].

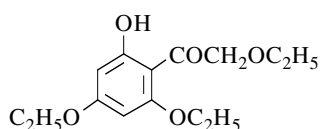
m.p. 60-61° [861];

¹H NMR [861], IR [861], UV [861], MS [861].**1-(2,4-Diethoxy-6-hydroxyphenyl)-2-ethoxyethanone**

[64184-96-9]

C₁₄H₂₀O₅

mol.wt. 268.31

**Syntheses**

-Obtained by partial ethylation of α -ethoxyphloroacetophenone with ethyl iodide in the presence of potassium carbonate in refluxing acetone for 12 h (53%) [1256].

-Also obtained by degradation of various polyethoxyflavones with boiling ethanolic potash,

*From 3,5,7,3'-tetraethoxy-4'-methoxyflavone (m.p. 136-137°) (8% potassium hydroxide, reflux 6 h) [600];

*From 3,5,7,3',4'-pentaethoxyflavone (*quercetin* pentaethyl ether) (7% potassium hydroxide, reflux 6 h) (good yield) [1256];

*From 3,5,7,3',5'-pentaethoxy-4'-methoxyflavone (m.p. 160°) (*4'-methylmyricetin* pentaethyl ether) (SM). SM was obtained by total ethylation of *4'-methylmyricetin*, itself isolated from the leaves of *Elaeocarpus lanceifolius* Roxb. (Elaeocarpaceae) [365] [1228];

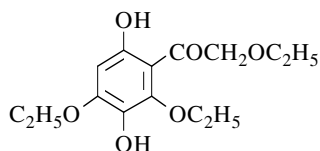
*From 3,5,7,3',4',5'-hexaethoxyflavone (m.p. 149-151°) (*myricetin* hexaethyl ether) [365] [1172]. *Myricetin* is the 3,5,7,3',4',5'-hexahydroxyflavone.

N.B.: Na salt [1256].

m.p. 97-98° [600], 96-97° [1172] [1256], 96° [365];

¹H NMR [365], UV [365], MS [365].**1-(2,4-Diethoxy-3,6-dihydroxyphenyl)-2-ethoxyethanone**C₁₄H₂₀O₆

mol.wt. 284.31

**Synthesis**

-Obtained by reaction of potassium persulfate with 2-hydroxy-4,6, α -triethoxyacetophenone in 5% aqueous sodium hydroxide, first at 15°, then at r.t. for 20 h (30%) (Elbs reaction) [1256].

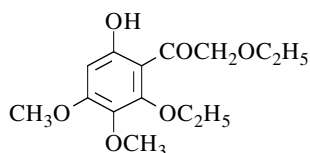
m.p. 103-104° [1256].

2-Ethoxy-1-(2-ethoxy-6-hydroxy-3,4-dimethoxyphenyl)ethanone

[4324-56-5]

C₁₄H₂₀O₆

mol.wt. 284.31

**Syntheses**

-Obtained by alkaline degradation of various substituted flavones with potassium hydroxide in refluxing ethanol,
 *From *Mikanin* diethyl ether (m.p. 94-95°) (3,5-diethoxy-6,7,4'-trimethoxyflavone) [789];

*From *Eupatin* triethyl ether (m.p. 105-106°) (3,5,3'-triethoxy-6,7,4'-trimethoxyflavone) (26%) [861];

*From *Eupalitin* triethyl ether (m.p. 80-81°) (3,5,4'-triethoxy-6,7-dimethoxyflavone) (88%) [1204];

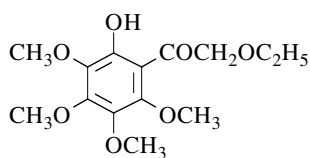
*From *Eupatolitin* tetraethyl ether (m.p. 120-121°) (3,5,3',4'-tetraethoxy-6,7-dimethoxyflavone) (97%) [1204].

m.p. 61-62° [789], 59-60° [861] [1204];

¹H NMR [861], IR [1204], UV [861], MS [861] [1204].

2-Ethoxy-1-(2-hydroxy-3,4,5,6-tetramethoxyphenyl)ethanoneC₁₄H₂₀O₇

mol.wt. 300.31

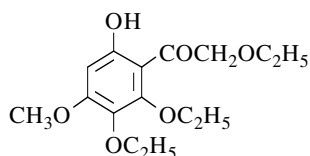
**Synthesis**

-Obtained by alkaline degradation of *Natsudaiddain ethyl ether* (3-ethoxy-5,6,7,8,3',4'-hexamethoxyflavone) (m.p. 118°) with potassium hydroxide in refluxing ethanol [808].

m.p. 47° [808]; ¹H NMR [808], IR [808], MS [808].

2-Ethoxy-1-(2,3-diethoxy-6-hydroxy-4-methoxyphenyl)ethanoneC₁₅H₂₂O₆

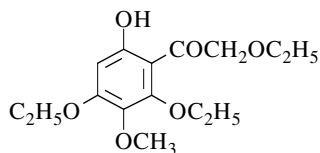
mol.wt. 298.34

**Synthesis**

-Refer to: [1256].

2-Ethoxy-1-(2,4-diethoxy-6-hydroxy-3-methoxyphenyl)ethanoneC₁₅H₂₂O₆

mol.wt. 298.34

**Syntheses**

-Obtained from ethyl 3,5,7,3',4'-pentaethoxy-6-methoxyflavone-2'-carboxylate (m.p. 111-112°) (SM) by hydrolysis with 20% ethanolic potassium hydroxide at reflux for 8 h (73%). SM was obtained by ethylation of *distemonanthin*, itself isolated from the wood of *distemonanthus benthamianus* [801].

-Also obtained by alkaline degradation of *patuletin* pentaethyl ether (3,5,7,3',4'-pentaethoxy-6-methoxyflavone) (m.p. 127-128°) with refluxing 7% ethanolic potash on a water bath for 6 h (40%) [1256].

-Also obtained by partial methylation of α ,4,6-triethoxy-2,5-dihydroxyacetophenone with dimethyl sulfate in the presence of potassium carbonate in refluxing benzene for 12 h (38%) [1256].

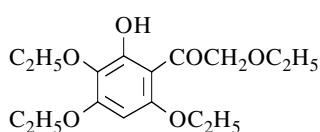
m.p. 88-89° [801], 86-87° [1256].

2-Ethoxy-1-(2-hydroxy-3,4,6-triethoxyphenyl)ethanone (*Gossypitol tetraethyl ether*)

C₁₆H₂₄O₆

mol.wt. 312.36

Synthesis



-Obtained by alkaline degradation of *Gossypetin* hexaethyl ether (m.p. 144-146°) (3,5,7,8,3',4'-hexaethoxyflavone) with potassium hydroxide in refluxing dilute ethanol for 6 h (84%) [1173].

m.p. 110-111° [1173].

4.4. Miscellaneous

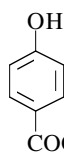
2-(β -D-Glucopyranosyloxy)-1-(4-hydroxyphenyl)ethanone

[167638-61-1]

C₁₄H₁₈O₈

mol.wt. 314.29

Isolation from natural sources



-From the fresh root bark of *Picea abies* (Pinaceae) (compound 4) [1131].

(α)_D = -33° (c = 0.2 methanol) [1131];

¹H NMR [1131], ¹³C NMR [1131], UV [1131].

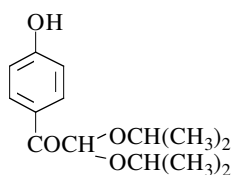
1-(4-Hydroxyphenyl)-2,2-bis(1-methylethoxy)ethanone

[144757-80-2]

C₁₄H₂₀O₄

mol.wt. 252.31

Syntheses



-Obtained by gradually adding a 33% hydrogen chloride solution in isopropanol to a solution of p-hydroxyphenylglyoxal and isopropyl nitrite in isopropanol cooled to 0°.

Hydrogen chloride solution was added at such a speed to maintain a temperature of less than 25° [428].

-Also refer to: [429].

solid [428]; ¹H NMR [428], ¹³C NMR [428], MS [428].

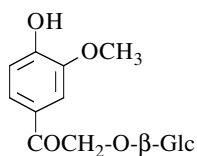
2-(β -D-Glucopyranosyloxy)-1-(4-hydroxy-3-methoxyphenyl)ethanone

[178959-37-0]

C₁₅H₂₀O₉

mol.wt. 344.32

Isolation from natural sources

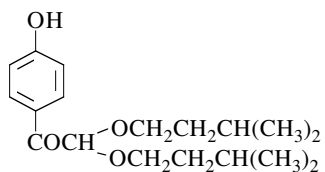
-From inner bark of *Pinus sylvestris* (compound 4) [1132].**1-(4-Hydroxyphenyl)-2,2-bis(3-methylbutoxy)ethanone**

[144757-79-9]

C₁₈H₂₈O₄

mol.wt. 308.42

Syntheses



-Obtained by slowly adding isoamyl nitrite to a solution of p-hydroxyacetophenone in isoamyl alcohol acidified with anhydrous hydrogen chloride at temperature < 25° (62%) [428].
-Also refer to: [429].

¹H NMR [428], ¹³C NMR [428], MS [428].