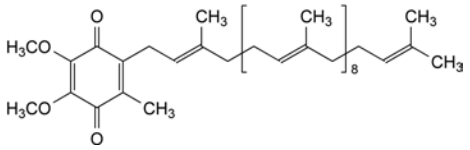
01/2008:1578
corrected 6.0

UBIDECARENONE

Ubidecarenonum



$C_{59}H_{90}O_4$ M_r 863
[303-98-0]

DEFINITION

2-[(all-*E*)-3,7,11,15,19,23,27,31,35,39-Decamethyltetraconta-2,6,10,14,18,22,26,30,34,38-decaenyl]-5,6-dimethoxy-3-methylbenzene-1,4-dione.

Content: 97.0 per cent to 103.0 per cent.

CHARACTERS

Appearance: yellow or orange, crystalline powder.

Solubility: practically insoluble in water, soluble in acetone, very slightly soluble in ethanol.

It gradually decomposes and darkens on exposure to light.

mp: about 48 °C.

Carry out all operations avoiding exposure to light.

IDENTIFICATION

A. Infrared absorption spectrophotometry (*2.2.24*).

Preparation: discs.

Comparison: *ubidecarenone CRS*.

B. Examine the chromatograms obtained in the test for related substances.

Results: the retention time of the principal peak in the chromatogram obtained with the test solution is similar to that of the principal peak in the chromatogram obtained with reference solution (a).

TESTS

Related substances. Liquid chromatography (*2.2.29*).

Test solution. Dissolve 25.0 mg of the substance to be examined in 25.0 mL of *ethanol R* by heating at about 50 °C for 2 min. Allow to cool.

Reference solution (a). Dissolve 5 mg of *ubidecarenone CRS* in 5 mL of *ethanol R* by heating at about 50 °C for 2 min. Allow to cool.

Reference solution (b). Dissolve 2 mg of *ubidecarenone impurity D CRS* in 2 mL of the test solution by heating at about 50 °C for 2 min. Allow to cool. Dilute 1 mL to 50 mL with *ethanol R*.

Reference solution (c). Dilute 1.0 mL of the test solution to 100.0 mL with *ethanol R*.

Column:

– *size*: *l* = 0.15 m, Ø = 4.6 mm,

– *stationary phase*: *octadecylsilyl silica gel for chromatography R* (5 µm).

Mobile phase: *ethanol R, methanol R2* (20:80 *V/V*).

Flow rate: 2 mL/min.

Detection: spectrophotometer at 275 nm.

Injection: 10 µL.

Run time: 2 times the retention time of ubidecarenone.

Relative retention with reference to ubidecarenone (retention time = about 12 min): impurity D = about 0.67.

System suitability: reference solution (b):

– *resolution*: minimum 6.5 between the peaks due to impurity D and to ubidecarenone.

Limits:

– *any impurity*: not more than half the area of the principal peak in the chromatogram obtained with reference solution (c) (0.5 per cent),

– *total*: not more than the area of the principal peak in the chromatogram obtained with reference solution (c) (1.0 per cent),

– *disregard limit*: 0.05 times the area of the principal peak in the chromatogram obtained with reference solution (c) (0.05 per cent).

Impurity F. Liquid chromatography (*2.2.29*).

Test solution. Dissolve 25.0 mg of the substance to be examined in 25.0 mL of *hexane R*.

Reference solution (a). Dissolve the contents of a vial of *ubidecarenone for system suitability CRS* in 1 mL of *hexane R*.

Reference solution (b). Dilute 1.0 mL of the test solution to 100.0 mL with *hexane R*.

Column:

– *size*: *l* = 0.25 m, Ø = 4.0 mm,

– *stationary phase*: *silica gel for chromatography R* (7 µm).

Mobile phase: *ethyl acetate R, hexane R* (3:97 *V/V*).

Flow rate: 2 mL/min.

Detection: spectrophotometer at 275 nm.

Injection: 20 µL.

Run time: 1.2 times the retention time of ubidecarenone.

Relative retention with reference to ubidecarenone (retention time = about 10 min): impurity F = about 0.85.

System suitability: reference solution (a):

– *resolution*: minimum 1.5 between the peaks due to impurity F and to ubidecarenone.

Limit:

– *impurity F*: not more than 0.5 times the area of the principal peak in the chromatogram obtained with reference solution (b) (0.5 per cent).

Sulfated ash (*2.4.14*): maximum 0.1 per cent, determined on 1.0 g.

ASSAY

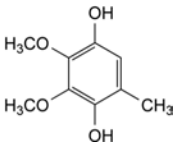
Dissolve 50.0 mg in 1.0 mL of *hexane R* and dilute to 50.0 mL with *ethanol R*. Dilute 2.0 mL of the solution to 50.0 mL with *ethanol R*. Measure the absorbance (*2.2.25*) at the maximum at 275 nm. Calculate the content of $C_{59}H_{90}O_4$ taking the specific absorbance to be 169.

STORAGE

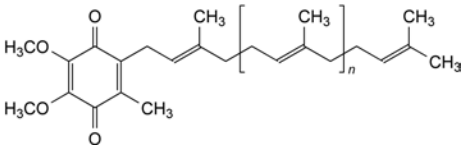
Store in an airtight container, protected from light.

IMPURITIES

Specified impurities: A, B, C, D, E, F.



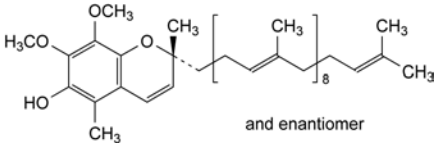
A. 2,3-dimethoxy-5-methylbenzene-1,4-diol,



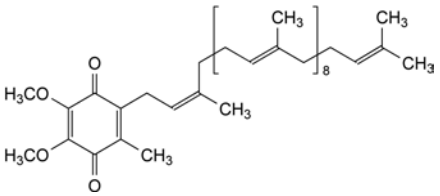
B. *n* = 5: 2-[(all-*E*)-3,7,11,15,19,23,27-heptamethyloctadocosa-2,6,10,14,18,22,26-heptaenyl]-5,6-dimethoxy-3-methylbenzene-1,4-dione (ubiquinone-7),

C. *n* = 6: 5,6-dimethoxy-3-methyl-2-[(all-*E*)-3,7,11,15,19,23,27,31-octamethyldotriaconta-2,6,10,14,18,22,26,30-octaenyl]benzene-1,4-dione (ubiquinone-8),

D. *n* = 7: 5,6-dimethoxy-3-methyl-2-[(all-*E*)-3,7,11,15,19,23,27,31,35-nonamethylhexatriaconta-2,6,10,14,18,22,26,30,34-nonaenyl]benzene-1,4-dione (ubiquinone-9),



E. (2*RS*)-7,8-dimethoxy-2,5-dimethyl-2-[(all-*E*)-4,8,12,16,20,24,28,32,36-nonamethylheptatriaconta-3,7,11,15,19,23,27,31,35-nonaenyl]-2*H*-1-benzopyran-6-ol (ubicromenol),



F. 2-[(2*Z*,6*E*,10*E*,14*E*,18*E*,22*E*,26*E*,30*E*,34*E*,38*E*)-3,7,11,15,19,23,27,31,35,39-decamethyl-2,6,10,14,18,22,26,30,34,38-tetracontadecaenyl]-5,6-dimethoxy-3-methylbenzene-1,4-dione (ubidecarenone (*Z*)-isomer).

B. Freezing point (*2.2.18*): 21 °C to 24 °C.

C. To 2.0 g add 2 mL of freshly distilled *aniline R* and boil under a reflux condenser for 10 min. Allow to cool and add 30 mL of *ether R*. Shake with 3 quantities, each of 20 mL, of *dilute hydrochloric acid R* and then with 20 mL of *water R*. Evaporate the organic layer to dryness on a water-bath. After recrystallising twice from *ethanol (70 per cent V/V) R* and drying *in vacuo* for 3 h, the residue melts (*2.2.14*) at 66 °C to 68 °C.

D. Dissolve 0.1 g in a mixture of 2 mL of *dilute sulfuric acid R* and 5 mL of *glacial acetic acid R*. Add dropwise 0.25 mL of *potassium permanganate solution R*. The colour of the potassium permanganate is discharged.

TESTS

Peroxide value (*2.5.5, Method A*): maximum 10.

Fixed and mineral oils. To 1.0 g add 5 mL of *sodium carbonate solution R* and 25 mL of *water R* and boil for 3 min. The hot solution is not more opalescent than reference suspension II (*2.2.1*).

Water-soluble acids. To 1.0 g add 20 mL of *water R* heated to 35-45 °C and shake for 2 min. Cool and filter the aqueous layer through a moistened filter. To 10 mL of the filtrate add 0.1 mL of *phenolphthalein solution R*. Not more than 0.1 mL of *0.1 M sodium hydroxide* is required to change the colour of the indicator.

Degree of unsaturation. Dissolve 85.0 mg in a mixture of 5 mL of *dilute hydrochloric acid R* and 30 mL of *glacial acetic acid R*. Using 0.05 mL of *indigo carmine solution R1* as indicator, added towards the end of the titration, titrate with *0.0167 M bromide-bromate* until the colour changes from blue to yellow. 8.9 mL to 9.4 mL of *0.0167 M bromide-bromate* is required. Carry out a blank titration.

Sulfated ash (*2.4.14*): maximum 0.1 per cent, determined on 0.50 g.

ASSAY

Dissolve 0.750 g in 10 mL of *ethanol (96 per cent) R*. Titrate with *0.5 M sodium hydroxide* using 0.1 mL of *phenolphthalein solution R* as indicator, until a pink colour is obtained.

1 mL of *0.5 M sodium hydroxide* is equivalent to 92.14 mg of $C_{11}H_{20}O_2$.

STORAGE

In a non-metallic container, protected from light.

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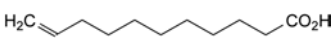
UNDECYLENIC ACID

Acidum undecylenicum



$C_{11}H_{20}O_2$ M_r 184.3
[112-38-9]

DEFINITION

Undec-10-enoic acid.

Content: 97.0 per cent to 102.0 per cent.

CHARACTERS

Appearance: white or very pale yellow, crystalline mass or colourless or pale yellow liquid.

Solubility: practically insoluble in water, freely soluble in ethanol (96 per cent) and in fatty and essential oils.

IDENTIFICATION

A. Refractive index (*2.2.6*): 1.447 to 1.450, determined at 25 ± 0.5 °C.

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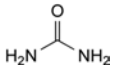
corrected 6.0

UREA

Ureum



CH_4N_2O M_r 60.1
[57-13-6]

DEFINITION

Carbamide.

Content: 98.5 per cent to 101.5 per cent (dried substance).

CHARACTERS

Appearance: white or almost white, crystalline powder or transparent crystals, slightly hygroscopic.

Solubility: very soluble in water, soluble in alcohol, practically insoluble in methylene chloride.

IDENTIFICATION

First identification: A, B.