CURCUMIN

Prepared at the 61st JECFA (2003) and published in FNP 52 Add 11 (2003), superseding specifications prepared at 57th JECFA (2001) and published in FNP 52 Add 9 (2001). An ADI of 0-3 mg/kg body weight was established at the 61st JECFA in 2003.

SYNONYMS Turmeric yellow, Kurkum, INS No. 100(i)

DEFINITION Curcumin is obtained by solvent extraction of turmeric i.e., the ground rhizomes of *Curcuma longa* L. (*Curcuma domestica* Valeton). In order to obtain a concentrated curcumin powder, the extract is purified by crystallization. The product consists essentially of curcumins; i.e. the colouring principle 1,7-bis-(4-hydroxy-3-methoxy-phenyl)-hepta-1,6-diene-3,5-dione (synonyms: Curcumin, Diferuloylmethane, CI Natural Yellow 3, CI (1975) 75300) and its desmethoxy- and bis-desmethoxy-derivatives in varying proportions. Minor amounts of oils and resins naturally occurring in turmeric may be present. Only the following solvents may be used in the extraction and purification: acetone, methanol, ethanol, isopropanol, hexane and ethyl acetate. Supercritical carbon dioxide may also be used in the extraction.

Chemical names

Principal colouring components:

I. 1,7-Bis-(4-hydroxy-3-methoxyphenyl)-hepta-1,6-diene-3,5-dione
II. 1-(4-Hydroxyphenyl)-7-(4-hydroxy-3-methoxyphenyl)-hepta-1,6-diene-3,5-dione
III. 1,7-Bis-(4-hydroxyphenyl)-hepta-1,6-diene-3,5-dione

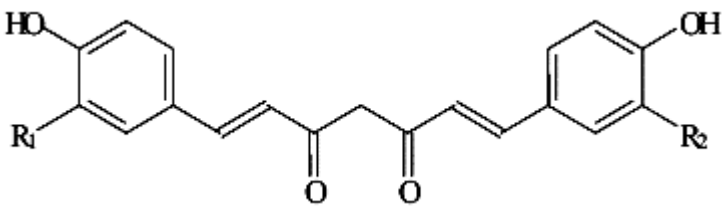
C.A.S. number

I. 458-37-7
II. 33171-16-3
III. 33171-05-0

Chemical formula

I. $C_{21}H_{20}O_6$
II. $C_{20}H_{18}O_5$
III. $C_{19}H_{16}O_4$

Structural formula



I. $R_1 = R_2 = OCH_3$
II. $R_1 = OCH_3$, $R_2 = H$
III. $R_1 = R_2 = H$

Formula weight

I. 368.39
II. 338.39
III. 308.39

Assay

Not less than 90 % total colouring matters

DESCRIPTION Orange-yellow crystalline powder

FUNCTIONAL USES Colour

CHARACTERISTICS

IDENTIFICATION

Solubility (Vol. 4): Insoluble in water and in diethyl ether; soluble in ethanol and in glacial acetic acid.

Colour reactions: A solution of the sample in ethanol is characterized by a pure yellow colour and a light green fluorescence; addition of this ethanol extract to concentrated sulfuric acid produces a deep crimson colour.

Treat an aqueous or dilute ethanolic solution of the sample with hydrochloric acid until a slightly orange colour begins to appear. Divide the mixture into 2 parts and add some boric acid powder or crystals to one portion. A marked reddening will be quickly apparent, best seen by comparison with the portion to which the boric acid has not been added. The test may also be made by dipping pieces of filter paper in an ethanolic solution of colouring matter, drying at 100º, and then moistening with a weak solution of boric acid to which a few drops of hydrochloric acid have been added. On drying, a cherry-red colour will develop.

Thin Layer Chromatography: Spot 5 µl of test solution (0.01 g of sample in 1 ml of 95% ethanol) on a TLC (Microcrystalline cellulose, 0.1 mm) plate. Develop the plate in a chamber containing a mixture of 3-methyl-1-butanol/ethanol/ water/ammonia (4:4:2:1) as solvent and allow the solvent front to ascend 10-15 cm. Examine under daylight and under UV-light and observe:

- Two or three yellow spots with R_f between 0.2 and 0.4 under daylight and UV-light
- Spots with R_f about 0.6 and 0.8 under UV-light

All spots show distinct yellow fluorescence under UV-light.

PURITY

Residual solvents (Vol. 4):

Acetone:	Not more than 30 mg/kg
Hexane:	Not more than 25 mg/kg
Methanol:	}
Ethanol:	Not more than 50 mg/kg
Isopropanol:	
Ethyl acetate:	

See description in Volume 4

Lead (Vol. 4): Not more than 2 mg/kg
Determine using an atomic absorption technique appropriate to the specified level. The selection of sample size and method of sample preparation may be based on the principles of the method described in Volume 4 , “Instrumental Methods.”

METHOD OF ASSAY

Accurately weigh about 0.08 g of the sample in a 200-ml volumetric flask and dissolve by shaking with ethanol. Make up to volume with ethanol and mix. Pipette 1.0 ml of solution into a 100-ml volumetric flask and make up to volume with ethanol.

Determine the absorbance (A) at 425 nm in a 1-cm cell. Calculate the total colouring matters content of the sample using the following equation.
% Total Colouring matters:

$$\frac{A \times 200 \times 100}{W \times 1607}$$

where

A = absorbance of sample
W = weight of sample (g)
1607 = specific absorbance of the curcumin standard in ethanol at 425 nm

The determination must be performed without delay, because the colour fades.