γ-CYCLODEXTRIN

Prepared at the 53rd JECFA (1999) and published in FNP 52 Add 7 (1999), superseding specifications prepared at the 51st JECFA (1998), published in FNP 52 Add 6 (1998). ADI "not specified", established at the 53rd JECFA in 1999.

SYNONYMS gamma-cyclodextrin, gamma-CD, cyclooctaamylose, cyclomaltooctaose

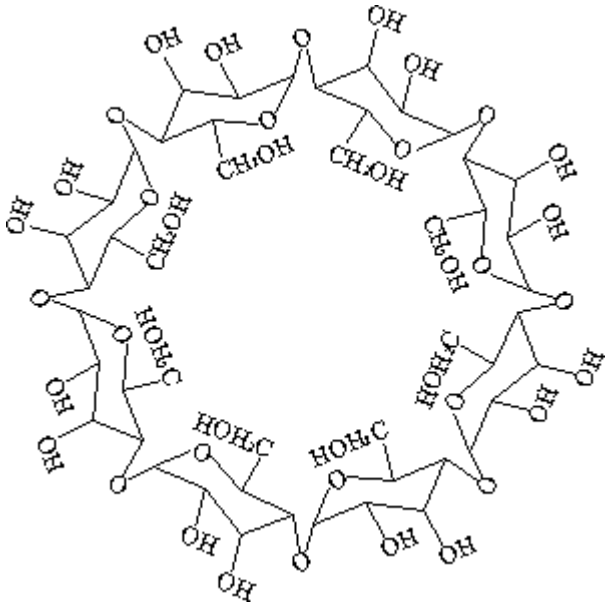
DEFINITION A non-reducing cyclic saccharide consisting of eight alpha-1,4-linked D-glucopyranosyl units manufactured by the action of cyclomaltodextrin glucanotransferase (CGTase, EC 2.4.1.19) on hydrolysed starch followed by purification of the gamma -cyclodextrin. Purification is carried out using one of the following procedures: precipitation of a complex of gamma-cyclodextrin with a macrocyclic compound and subsequent extraction with n-decane followed by steam-stripping of the solvent; crystallization from the purified mother liquor containing gamma-cyclodextrin obtained by chromatographic methods with ion exchange or gel filtration; membrane separation methods such as ultra filtration and reverse osmosis.

Chemical names Cyclooctaamylose

C.A.S. number 17465-86-0

Chemical formula $(C_6H_{10}O_5)_8$

Structural formula



Formula weight 1297

Assay Not less than 98% on an anhydrous basis

DESCRIPTION Virtually odourless, white or almost white crystalline solid

FUNCTIONAL USES Carrier, flavour modifier, stabilizer

CHARACTERISTICS

IDENTIFICATION

Solubility (Vol. 4)	Freely soluble in water; very slightly soluble in ethanol
Specific rotation (Vol. 4)	$[\alpha]^{25}_{D}$: Between +173 and +180° (1% solution)
Reaction with iodine	To 0.2 g of the sample in a test-tube add 2 ml of a 0.1 N iodine solution. Heat the mixture in a water bath and allow to cool at room temperature. A clear brown solution is formed.
Chromatography	The retention time for the major peak in a liquid chromatogram of the sample corresponds to that for gamma-cyclodextrin in a chromatogram of reference gamma-cyclodextrin (available from Consortium für Elektrochemische Industrie GmbH, München, Germany or Wacker Biochem Group, Adrian, MI, USA) using the conditions described in the METHOD OF ASSAY.

PURITY

Water (Vol. 4)	Not more than 11% (Karl Fischer Method)
Volatile organic compounds	Not more than 20 mg/kg See description under TESTS
Reducing substances (Vol.4)	Not more than 0.5% (as glucose)
Sulfated ash (Vol. 4)	Not more than 0.1%
Lead (Vol. 4)	Not more than 1 mg/kg Reflux about 5 g of the sample, accurately weighed, with 30 ml nitric acid for 1 h. Remove the reflux condenser and attach a condenser to the flask. Continue to heat and collect the distilled nitric acid. Allow the residue to cool, add 20 ml of water and again allow to cool. Add 2 ml of orthophosphoric acid, dilute to 100 ml and determine the lead content of the solution by atomic absorption spectroscopy (FNP 5).

TESTS

PURITY TESTS

Volatile organic compounds	Dissolve 50 g of the sample in about 700 ml distilled water in a 1-litre round bottom flask and add a magnetic stirrer. Attach the flask to the lower part of a Bleidner apparatus (see Figure 1) and connect a 100-ml round bottom flask containing about 70 ml hexane and a few boiling stones to the other side of the apparatus. Fill the Bleidner apparatus with equal amounts of water and hexane and place a reflux condenser on the top. Heat both flasks with heating mantels to boiling. Stir the 1-litre flask well by the magnetic stirrer. Keep the content of the two flasks boiling for 8 h. After cooling remove the 100-ml flask and transfer the content to a 100 ml volumetric flask and fill to the mark with hexane.

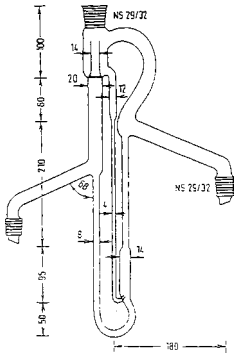


Figure 1

Analyze the hexane solution by *gas chromatography* using the following conditions:

Column
- length: 30 m
- diameter: 0.32 mm
- stationary phase: 95% dimethyl, 5% diphenyl polysiloxane, 0.25 µm
Injector: 280°
Temperature: 70° (4 min) - 250°, 10°/min
Carrier
- gas: nitrogen
- flow: 70 ml/min
Detection: FID, 280°

Calculate the area(s) under the peak for each volatile organic compound and convert it to mg/kg gamma-cyclodextrin using the response factor of 8-cyclohexadecen-1-one. The response factor is determined from a calibration curve using 8-cyclohexadecen-1-one concentrations of 0.1-6 mg/100 ml hexane.

METHOD OF ASSAY

Determine by *liquid chromatography* using the following condition:

Column
- length: 30 cm
- diameter: 7.8 mm i.d.
- packing: Silver bonded to sulfonated divinyl benzene-styrene copolymer (Aminex HPX-42A (Bio-Rad Laboratories) or equivalent
- particle size: 25 µm
Solvent: water
Flow rate: 0.3 - 1.0 ml/min
Temperature: 65 ± 10°
Injection volume: 20 - 100 µl
Detector: differential refractometer
Sample solution: weigh 1.0 g of the sample and dissolve in 100 ml of water.

Calculation
Calculate the content of gamma-cyclodextrin in the sample by the peak area percentage method using the following formula:

$$A = \frac{B}{C} \times 100$$

where
A = percentage of gamma-cyclodextrin in the sample
B = peak area of gamma-cyclodextrin in the chromatogram
C = the sum of the peak area of every peak recorded in the chromatogram