\gamma\text{-CYCLODEXTRIN}


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 
\((\text{C}_6\text{H}_{10}\text{O}_5)_8\)

Structural formula

![Structural formula of \gamma\text{-CYCLODEXTRIN}]

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.
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