ProductInformation

Cell Culture Tested Water-Soluble Complexes

CHLORAMPHENICOL - WATER SOLUBLE

Product Number: C3175

With approx. 100 mg chloramphenicol per gram; balance 2 - hydroxypropyl - β- cyclodextrin. Sold on the basis of mg of chloramphenicol.

CHOLESTEROL - WATER SOLUBLE

Product Number: C4951

With approx. 40 mg of cholesterol per gram; balance methyl - β - cyclodextrin.

Sold on the basis of mg of cholesterol.

DEXAMETHASONE - WATER SOLUBLE

Product Number: D2915

(Cyclodextrin encapsulated dexamethasone)

With approx. 65 mg dexamethasone per gram; balance 2 - hydroxypropyl - β - cyclodextrin.

Sold on the basis of mg of dexamethasone.

ERGOCALCIFEROL - WATER SOLUBLE

Product Number: E8014

(Vitamin D2)

With approx. 7 mg ergocalciferol per gram; balance methyl - β - cyclodextrin. Sold on the basis of mg of ergocalciferol.

β - ESTRADIOL - WATER SOLUBLE

Product Number: E4389

(Cyclodextrin - encapsulated 17β - estradiol)

With approx. 45 mg estradiol per gram; balance 2 - hydroxypropyl - β - cyclodextrin.

Sold on the basis of mg of estradiol.

HYDROCORTISONE - WATER SOLUBLE

Product Number: H0396

(Cyclodextrin - encapsulated hydrocortisone)

With approx. 100 mg hydrocortisone per gram; balance 2 - hydroxypropyl - β - cyclodextrin.

Sold on the basis of mg of hydrocortisone

LINOLEIC ACID - WATER SOLUBLE

Product Number: L5900

With approx. 30 mg of linoleic acid per gram; balance methyl - β - cyclodextrin.

OLEIC ACID - WATER SOLUBLE

Product Number: O1257

With approx. 30 mg oleic acid per gram; balance methyl - β - cyclodextrin

PROGESTERONE - WATER SOLUBLE

Product Number: P7556

(Cyclodextrin - encapsulated progesterone)

With approx. 70 mg progesterone per gram; balance 2 - hydroxypropyl - β - cyclodextrin.

Sold on the basis of mg of progesterone.

RETINOL ACETATE - WATER SOLUBLE

Product Number: R0635

(Vitamin A)

With a minimum of 5 mg retinol acetate per gram; balance methyl - β - cyclodextrin. Sold on the basis of mg of retinol acetate.

TESTOSTERONE - WATER SOLUBLE

Product Number: T5035

(Cyclodextrin - encapsulated testosterone)

With approx. 109 mg testosterone per gram; balance 2 - hydroxypropyl - β - cyclodextrin.

Sold on the basis of mg of testosterone.

DEA CLASS III

PRODUCT SOLUBILITY

Water-soluble complexes are soluble in water; difficulty may be encountered when attempting to solubilize in salt solutions or buffers. Typical stock solutions can be prepared at concentrations of 50 – 500 mg solid (powder) in 1 ml water. Solutions can be sterile filtered using a 0.2 μm membrane; the powders are not sterile. Solutions should be stored in working aliquots at -20ºC. When calculating molar (e.g., μM, mM, etc.) solutions, the molecular weight of the cyclodextrin component of the complex is typically disregarded and the solution is prepared considering the amount of the hormone in the preparation and its respective molecular weight (printed in the alphabetical listings of the Sigma catalog).

CYCLODEXTRINS - WHAT ARE THEY?

Many metabolically important compounds, such as, fat-soluble vitamins and hormones have very low solubilities in aqueous solutions. Various approaches have been taken to utilize these compounds in tissue and cell culture applications. Two most frequently used approaches are: (1) predissolving the compounds in organic solvents and (2) using ''carrier'' molecules to facilitate the dissolution of these compounds. One such class of ''carrier'' molecules is the **cyclodextrins** or cycloamyloses.

Cyclodextrins are cyclic oligosaccharides consisting of 6, 7, or 8 glucopyranose units, usually referred to as α-, ß-, or γ-cyclodextrins, respectively. These naturally occurring compounds have relatively rigid doughnut-shaped structures, and have attracted interest as possible natural complexing agents. The unique structures of these compounds owe their stability to intramolecular hydrogen bonding between the C2- and C3-hydroxyl groups of neighboring glucopyranose units. The molecule takes on the shape of a torus with the C2- and C3-hydroxyls located around the larger opening and the more reactive C6-hydroxyl aligned around the smaller opening. The arrangement of C6-hydroxyls opposite the hydrogen bonded C2- and C3-hydroxyls forces the oxygen bonds into close proximity within the cavity, leading to an electron rich, hydrophobic interior. The size of this hydrophobic cavity is a function of the number of glucopyranose units forming the cyclodextrin.

The solubility of natural cyclodextrins is very poor and initially this prevented cyclodextrins from becoming effective complexing agents. In the late 1960's, it was discovered that chemical substitutions at the 2,3, and 6 hydroxyl sites would greatly increase solubility. The degree of chemical substitution, as well as, the nature of the groups used for substitution, determine the final maximum concentration of cyclodextrin in an aqueous medium. Most chemically modified cyclodextrins are able to achieve a 50% (w/v) concentration in water.

Cavity size is the major determinant as to which cyclodextrin is used in complexation. ''Fit'' is critical to achieving good incorporation of cyclodextrins. Six-glucopyranose unit compounds or α-cyclodextrins have small cavities which are not capable of accepting many molecules. Eight-glucopyranose unit compounds or γ-cyclodextrins have much larger cavities than many molecules to be incorporated and cyclodextrin hydrophobic charges can't effectively interact to facilitate complexation. The cavity diameter of b-cyclodextrins or ß-glucopyranose unit compounds is well-suited for use with molecules the size of hormones, vitamins and many compounds frequently used in tissue and cell culture applications. For this reason, ß-cyclodextrin is most commonly used as a complexing agent.

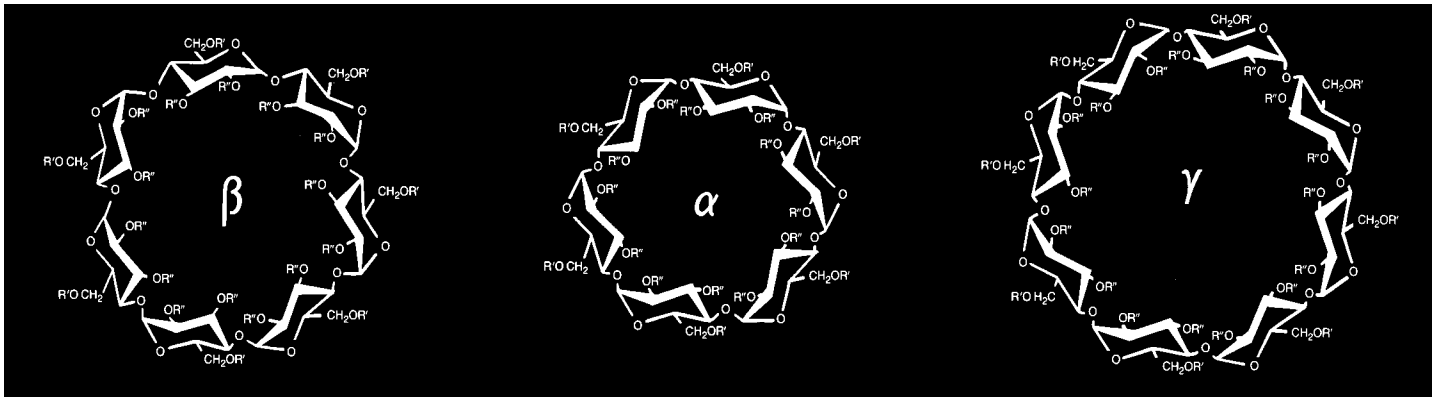
Hydrophobic molecules are incorporated into the cavity of cyclodextrins by displacing water. This reaction is favored by the repulsion of the molecule by water. This effectively encapsulates the molecule of interest within the cyclodextrin, rendering the molecule water soluble. When the water soluble complex is diluted in a much larger volume of aqueous solvent, the process is reversed, thereby releasing the molecule of interest into the solution.

SIGMA'S product line of water-soluble complexes includes host cyclodextrins and cyclodextrin-encapsulated forms of many components commonly used in tissue and cell culture applications. For product listings, see the **REAGENTS** section of this catalog.

REFERENCES

1. The Source. (1991). Water-Soluble Complexes, Part 1: Cyclodextrins—What are they? Vol. 7 No. 3.

2. The Source. (1992). Water-Soluble Complexes, Part 2: Cyclodextrins and Cell Culture. Vol. 8 No. 1.



CYCLODEXTRINS

α- CYCLODEXTRIN
Product Number: C4680
(Schardinger α - Dextrin; Cyclohexaamylose)
Crystalline
Molecular Formula: C36 H60 O30
Formula Weight: 972.87
CAS Number: 10016-20-3
Solubility: 50 mg/ ml in water

β - CYCLODEXTRIN
Product Number: C4805
(Schardinger β- Dextrin; Cycloheptaamylose)
Crystalline
Molecular Formula: C42 H70 O35
Formula Weight: 1135.0
CAS Number: 7585-39-9
Solubility: 50 mg/ml in 1N NaOH

γ - CYCLODEXTRIN
Product Number: C4930
(Schardinger γ- Dextrin; Cyclooctaamylose)
Molecular Formula: C48 H80 O40
Formula Weight: 1297.1
CAS Number: 17465-86-0
Solubility: 50 mg/ml in 1N NaOH

2 - HYDROXYPROPYL - β - CYCLODEXTRIN
Product Number: C0926
Mean degree of substitution: 4 - 10 determined by NMR
Crystalline
Formula Weight: Approx. 1576
CAS Number: 128446-35-5
Solubility: 50 mg/ ml in water

METHYL - β- CYCLODEXTRIN
Product Number: C4555
Mean degree of substitution: 10.5 - 14.7
Crystalline
Formula Weight: Approx. 1320
CAS Number: 128446-36-6
Solubility: 50 mg/ ml in water