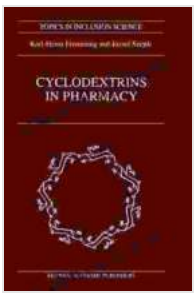
Cyclodextrins in Pharmacy: Unlocking the Power of Inclusion Science

Cyclodextrins (CDs) are cyclic oligosaccharides composed of α-D-glucopyranose units linked by α-1,4-glycosidic bonds. They are produced by the enzymatic degradation of starch by cyclodextrin glycosyltransferases (CGTases). CDs consist of a truncated cone-shaped structure with a hydrophobic cavity and a hydrophilic outer surface. This unique structure enables CDs to form inclusion complexes with various guest molecules by encapsulating them within their hydrophobic cavities.

Properties of Cyclodextrins

The properties of CDs depend on the number of glucose units in their structure. The most common CDs used in pharmacy are:



Cyclodextrins in Pharmacy (Topics in Inclusion Science Book 5) by Karl-Heinz Frömming

★★★★★ 5 out of 5

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File size	: 5149 KB
Text-to-Speech	: Enabled
Screen Reader	: Supported
Enhanced typesetting	: Enabled
Print length	: 293 pages

- α-Cyclodextrin (α-CD): 6 glucose units
- β-Cyclodextrin (β-CD): 7 glucose units

- γ-Cyclodextrin (γ-CD): 8 glucose units

α-CD has the smallest cavity and the highest affinity for guest molecules, while γ-CD has the largest cavity and the lowest affinity. CDs are water-soluble and can form inclusion complexes with both hydrophilic and hydrophobic guest molecules. They have excellent complexation abilities, which makes them valuable for various pharmaceutical applications.

Applications of Cyclodextrins in Pharmacy

CDs have gained significant interest in pharmacy due to their ability to improve drug solubility, stability, and bioavailability. They offer several advantages over traditional drug delivery systems:

1. Improved solubility: CDs can significantly increase the solubility of poorly water-soluble drugs by forming inclusion complexes. This enhanced solubility improves drug absorption and bioavailability.
2. Enhanced stability: CDs can protect drugs from degradation by forming inclusion complexes that shield them from environmental factors such as light, heat, and moisture.
3. Targeted drug delivery: CDs can be used to target drugs to specific tissues or cells by modifying their surface with ligands or antibodies.
4. Sustained drug release: CDs can be used to control drug release by forming inclusion complexes that release the drug slowly over time.

CDs have been successfully used in various pharmaceutical formulations, including tablets, capsules, injectables, and topical preparations.

Research Advancements in Cyclodextrins

Recent research has focused on developing novel cyclodextrin derivatives with improved properties and expanded applications. These derivatives include:

- Hydroxypropyl-β-cyclodextrin (HP-β-CD): HP-β-CD has increased water solubility and complexation ability compared to β-CD.
- Sulfobutylether-β-cyclodextrin (SBE-β-CD): SBE-β-CD is an anionic cyclodextrin derivative with improved solubility and complexation ability for cationic drugs.
- Randomly methylated-β-cyclodextrin (RAMEB): RAMEB has reduced complexation ability, but it is more biocompatible and can be used for targeted drug delivery.

In addition, research is ongoing to explore the use of CDs in combination with other drug delivery systems, such as nanoparticles and liposomes, to further improve drug delivery efficiency.

Case Studies

Several successful case studies demonstrate the applications of CDs in pharmacy. For example, the use of HP-β-CD in the formulation of itraconazole, an antifungal drug, significantly improved its solubility and bioavailability. In another study, SBE-β-CD was used to enhance the solubility and stability of paclitaxel, an anticancer drug.

Cyclodextrins are versatile molecules with unique properties that offer significant advantages in pharmaceutical applications. Their ability to improve drug solubility, stability, and bioavailability makes them valuable for developing more effective drug delivery systems. Ongoing research

advancements continue to expand the applications of CDs in the pharmaceutical field, making them a promising tool for improving patient outcomes.

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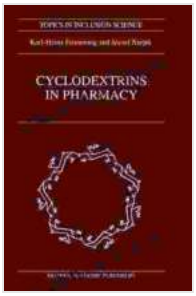

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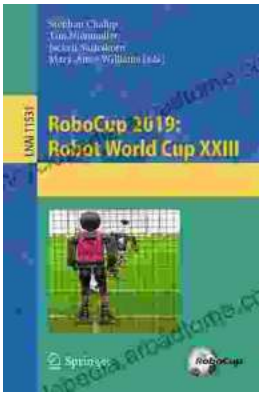

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