Production and characteristics of cyclodextrin crystalforms

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Degradation of starch using specific enzymes leads to the formation of cyclic starch oligosaccharides called cyclodextrins. Cyclodextrins are non-toxic annular molecules and are like starch build from α-D-(1→4)-linked glycosyl units of varying numbers. The most common and commercially successful cyclodextrins are the α-, β-, and γ-cyclodextrins consisting of 6, 7, and 8 glucose molecules, respectively.

The large interest in this range of molecules, which includes a vast amount of modified forms, takes origin in their general ability to form inclusion complexes with a large range of primarily hydrophobic or partly hydrophobic molecules. Aqueous solutions are the preferred media for the formation of inclusion complexes, but they may also be formed between cyclodextrins and volatile molecules directly from gas phase. This requires that the cavities of the cyclodextrins are available and often mono-layers of cyclodextrins grafted to highly porous materials are used for this purpose. Normal dry from-the-box α-, β-, and γ-cyclodextrin powders display rather limited abilities as absorbent for volatile compounds. This is due to their preferred crystal structure, termed cage-type, where the cyclodextrins are packed as to block each other's cavities and only cyclodextrins positioned at the surface of the crystals are available for inclusion complex formation. By careful recrystallization of the cyclodextrins, channel-type crystals may be achieved. This crystal form allows for full accessibility of the cyclodextrin cavities throughout the crystal.

This talk presents our work on developing production methods for channel-type cyclodextrin crystals, as well as, selected studies of their characteristics with focus on their use as highly efficient absorbents.