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Complexes of amylose with diols: polymorphism and factors affecting the crystal structure

Amylose forms crystallosolvates with a large variety of small molecules [1]. This so-called "V-amylose" occurs as single helices and the guest molecules can be located inside the helices, in-between or both [2]. We have studied the morphology (TEM) and crystal structure (X-ray and electron diffraction) of V-amylose complexed with a series of diols with different chemical structures (i.e. 1,3-butanediol, 1,4-butanediol and 1,6-hexanediol). The complexes were prepared from 0.1 wt% aqueous amylose solutions in the form of lamellar single crystals using various concentrations of diols and crystallization temperatures. In the wet state, four allomorphs were identified, containing 6- or 7-fold amylose single helices organized into hexagonal or orthorhombic unit cells. Upon drying, a structural transition was observed for each allomorph, resulting in the formation of three other pseudo-hexagonal or pseudo-tetragonal crystalline forms. A transition from a 7- to a 6-fold helical conformation was also observed. Some features of the complexing diols were shown to be decisive in controlling the resulting crystal structures, such as the geometry of the carbon chain (branched or linear, chain length) and the position of the hydroxyl groups. By adequately controlling the crystallization temperature and diol concentration, a given diol could induce the formation of several distinct allomorphs.

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Preferred topic

Solid state - crystallosolvates

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