A New Look at the Hydrophobic Characteristics of Cyclodextrins, Cyclomannins, Cyclogalactins, Cyclofructins, and of Starch

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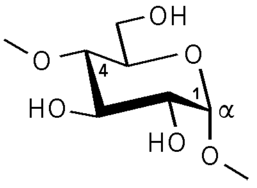
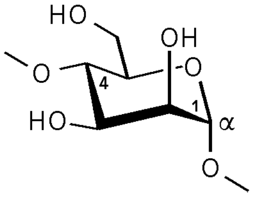
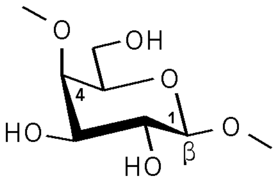
The color-coded projections of molecular lipophilicity patterns (MLP) on molecular surfaces provide a new look at the hydrophobic topographies of cyclodextrins. By comparing the non-natural small-ring cyclodextrins with three, four, and five glucose units with their starch-derived counterparts with six (e.g. a-CD, **1**) to nine glucose residues, it becomes obvious that the cycloglucopentaoside is still capable of forming inclusion complexes, whilst the smaller homologs are amenable to hydrophobic binding via a surface indentation only[1]. Isomeric CD's, such as the a(1fi4)-linked cyclomannins (e.g. **2**) exhibit narrowed, but pronouncedly hydrophobic cavities[2]. For the b(1fi4)-linked cyclogalactins ("inside-turned-out CD's") an inverse situation prevails, the central cavity in the a-cyclogalactin **3**, for example, being more hydrophilic than the outer surface areas[2].



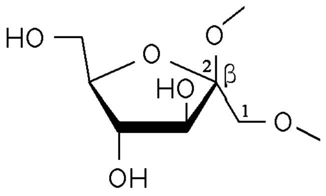
Cyclodextrins



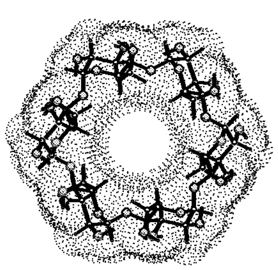
Cyclomannins



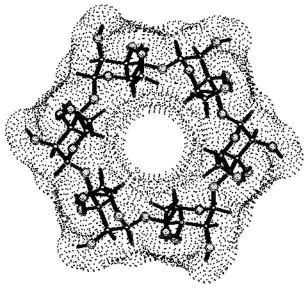
Cyclogalactins



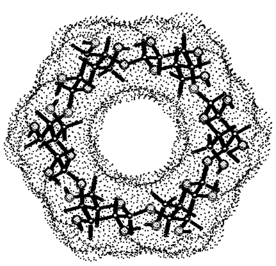
Cyclofructins



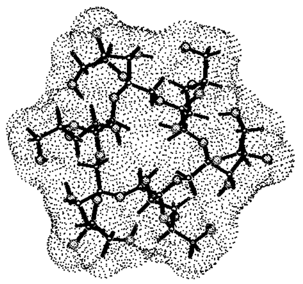
cyclo[Glc*p* a(1fi4)]$_6$
1 (a-CD)



cyclo[Man*p* a(1fi4)]$_6$
2



cyclo[Gal*p* b(1fi4)]$_6$
3



cyclo[Fru*f* b(1fi2)]$_6$
4

Distinct differences in their MLPs and the absence of a central cavity reveal that the inulin-derived a-cyclofructin **4** is devoid of similar inclusion phenomena[3]. The visualization of the hydrophobic nature of the central channel of V_H-amylose sheds further light on the complex formation properties of carbohydrate macromolecules[3].

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[1] S. Immel, J. Brickmann, and F. W. Lichtenthaler, *Liebigs Ann. Chem.* **1995**, in press.

[2] F. W. Lichtenthaler and S. Immel, *Tetrahedron Asymmetry* **1994**, *5*, 2045-2060.

[3] F. W. Lichtenthaler and S. Immel, *Int. Sugar J.* **1995**, *97*, 12-22.