

Cyclodextrins: Introduction

Cyclodextrins are seductive molecules, appealing to investigators in both pure research and applied technologies. They are most unusual in that they transcend traditional barriers separating many sub-disciplines of the chemical sciences. Biological chemists, physical chemists, and synthetic chemists all work shoulder to shoulder in their pursuits of the creation, analyses, and uses of these captivating molecules, and they do so while admitting that their common interests are held together only by a very thin thread of circularly linked sugar monomers. Why is this so? What is so significant about these cyclic oligomers that they have drawn together such a diverse set of people for such a long time? This special issue of *Chemical Reviews* that focuses on both the scientific and technological aspects of cyclodextrins explores the answers to these questions and presents some of the fascinating advances made in this field.

The idea for this special issue came about when the guest editors were each looking for certain information for their own research and realized that it was not available in one place in a form that could be used conveniently. It became clear that if this information could be put together in a concise and convenient way, it might be useful for others in similar situations. Moreover, it was evident that despite several authoritative reviews already published on cyclodextrins, certain areas were not adequately represented. The guest editors contacted experts in these areas and they were willing to contribute to this thematic issue. The resulting issue ranges in scope from computational chemistry to industrial uses of cyclodextrins. The only limitations placed on the authors were those imposed by the journal, namely that the articles should be comprehensive, authoritative, and give weight to all investigations according to their importance rather than the laboratory of origin. We are grateful to the referees who have conscientiously ensured that these standards were adhered to.

Guidelines for cyclodextrin nomenclature are now available, but they have not been enforced for this issue; different areas within the cyclodextrin community have varied traditions of nomenclature, parlances and idiomatic expression, and it was our opinion that the flow of information, which is the

main emphasis of this issue, would be best served by allowing this freedom rather than insisting on strict adherence to a set of nomenclature rules.

A lengthy introduction for this special issue by the guest editors might have been warranted because of the enormous size that the field of cyclodextrin research has attained. This role has however been taken over by the authoritative overview written by József Szejtli, a leading figure in many aspects of cyclodextrins, and one who may legitimately be called a "godfather" of cyclodextrins. This is a definitive and sometimes cutting assessment of how far the field has come and the direction in which it is going. A chapter by Hans-Jörg Schneider and his collaborators focuses on the various uses of NMR spectroscopy for understanding the structural, dynamical, and host-guest complexing abilities of cyclodextrins. Two chapters concern X-ray studies, one of which is a compilation and assessment by Wolfram Saenger and his collaborators. In the other, Kazuaki Harata describes the stereoselective nature of cyclodextrins in the solid state. The chapter on computational chemistry by Kenny Lipkowitz provides a mini tutorial on computational methods. This chapter also offers a comprehensive analysis of the literature along with a set of pitfalls to avoid. Yoshihisa Inoue and Mikhail Rekharsky evaluate complexation thermodynamics as studied by calorimetry.

Two chapters by Fraser Stoddart and co-workers elaborate the synthesis of new cyclodextrin systems. In one, de novo synthesis of cyclic oligosaccharides starting from natural and synthetic synthons is described. The other reviews the use of cyclodextrin to create catenanes and rotaxanes. The chapter by Valerian D'Souza and co-workers discusses the synthesis of novel cyclodextrin systems by selective modifications of native cyclodextrins.

Finally, there are four chapters that deal with applications of cyclodextrin systems. The chapter on biomimetic reactions by Ronald Breslow and Steve Dong describes advances made in the field of artificial enzymes based on cyclodextrins. Whereas these systems use modified cyclodextrins, the chapter on mediated organic reactions by Keiko Takahashi reviews reactions that are accelerated by native cyclodextrins. One of the reasons that cyclodextrins are so valuable is their industrial applications, and

these are surveyed by Allan Hedges. Also, the predominant industrial use of cyclodextrins in formulations as drug carriers is covered by Kaneto Uekama and co-workers.

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