

Chapter 4

Systems Based on Calixarenes as the Basis for the Creation of Catalysts and Nanocontainers

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1 INTRODUCTION

An increase in the rate of chemical reactions has recently become a topic of research activity. In this direction, nanoreactors in which reactants are concentrated in small volumes of about several nanometers to be involved in appropriate reactions are considered as promising solutions. Micellar systems and emulsions can be mentioned as examples of such nanoreactors.

2 SYNTHESIS AND STRUCTURE OF CALIXARENES

Among the large number of macrocyclic compounds related to supramolecular chemistry, calixarenes offer unique possibilities for selectively forming, transporting, and catalyzing complexes, and also for serving as biomimetic and building blocks for the synthesis of supramolecular architectures. The cup-shaped structure of calixarenes (“calix” in Greek means “cup, vase”) is a convenient platform for molecular design of the three-dimensional structures with a wide range of cavity sizes, different numbers and types of binding sites, and diverse spatial arrangement of binding groups, as well as the possibility of asymmetric cavity formation and the control of a balance between rigidity and flexibility of a receptor.

On this basis, calix[4]arene **1**, thiacalix[4]arene **2**, calix[4]resorcinarene **3**, and calix[4]pirogallolarene **4** (Scheme 4.1), which are cyclocondensation products of *p*-alkylphenols with formaldehyde or sulfur in alkaline medium and of acid-catalyzed reaction of resorcinol or pyrogallol with aldehydes, are used as basic blocks for the construction of host molecules.