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Supramolecular architecture-controlled self-assemblies of calixarenes

Stoikov I., Yushkova E., Antipin I., Konovalov A.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The controlled self-assembly of macrocyclic molecules based on calixarenes in functional supramolecular entities is an interesting topic of research in the area of supramolecular chemistry and nanotechnology. Due to many possible applications, such molecule receptors can be useful as base elements in the development of sensors and as selective carriers in industrial membrane extraction technologies. Being highly affine and convertible effectors and catalysts, the calixarenes can be considered as building blocks for constructing nanosized structures adapted for recognition specific guest molecules. The role of calixarenes in the design, synthesis and application of nanoscale aggregates with metal cations by self-association processes is discussed. Among others, the approaches to the synthesis and modification of nanoparticles ranging from 1 nm to 1 mm are considered with particular emphasis to the areas of their possible application in nanotechnology. The discussion is focused on the establishment of the "structure-property" relationships that allow determining size, shape, and chemical properties of the nanoscale aggregates at the spatial structure level as well as their application. The aggregation of metal cations and calixarenes is of special interest due to the following reasons: (i) metal cations can participate in photon absorption or emission, electron transfer, and ion exchange and (ii) synthetic receptors are able to form molecular or supramolecular architectures of predicted spatial arrangement of the active parts, among them, due to their interaction with metal cations. This combination of above mentioned properties is favorable for the synthesis of supramolecular structures with useful chemical, physical and biological properties dependent on the size of components, i.e., the quantity of atoms or molecules forming nanoscale structures.

Keywords

Calixarenes, Molecular recognition, Self-assembly, Thiacalixarenes