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Supramolecular systems based on amidoammonium and amidoaminocalix[4]resorcinarenes and polyacrylic acid

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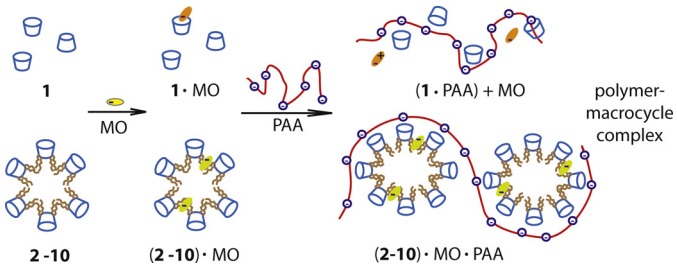
HIGHLIGHTS

- Amphiphilic calixresorcinarenes form polymer-colloid systems with polyacrylic acid.
- Size and properties of colloids depends from amine and alkyl groups of macrocycle.
- Triple systems are formed by interaction of polymer with macrocycle-dye aggregates.

GRAPHICAL ABSTRACT



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ABSTRACT

In the solutions of polyacrylic acid (PAA) the amphiphilic calix[4]resorcinarenes **1**–**10** and their complexes with Methyl Orange (MO) form binary (**1**–**10**)-PAA and tertiary (**2**–**10**)-MO-PAA supramolecular complexes which are water-soluble in the case of amidoammonium (**1**–**5**) and water-insoluble in the case of amidoamino (**6**, **7**) or amido(dimethylamino) (**8**–**10**) calixresorcinarenes. Almost 90% of removal of MO from the aqueous solution is achieved by the formation of the water-insoluble systems (**6**–**10**)-MO-PAA. In aqueous solution the particles of the (**1**–**5**)-PAA systems have average hydrodynamic diameters which values vary depending on the length of the alkyl substituents of macrocycles.

1. Introduction

One of the approaches for creating nanoscale materials is the formation of the supramolecular polymer-colloid systems. They represent the supramolecular complexes formed by the water-soluble polymer and the molecules such as surfactants and the water-soluble macrocycles due to the noncovalent interactions such as electrostatic, H-bonding, hydrophobic effect etc. [1,2]. A lot of scientific articles on the polymer-containing supramolecular systems relate to a surfactant-polymer complexes, in which the surfactant' micelles are immobilized on the polymer surface. Such systems are widely used in biomedicine, catalysis, cosmetics, oil industry, etc. [3].

The separate part of the polymer-colloid systems is related to the macrocycle-polymer complexes. The aim of the study of the noncovalent macrocycle-polymer systems is to provide novel supramolecular catalysts [4–6], polymers with controlled rheology or thermal properties [7,8], drug delivery systems [9] etc. Known macrocycles, which are non-covalently bound with polymers, are the amphiphilic calixarenes [4–6,10], pillararenes [7] and cyclodextrins [8,9,11]. These macrocycles are primarily known as

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