Nanostructured surfaces

Synthesis, characterization and application of glutaraldehyde-crosslinked chitosan-silica cryogels

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Nowadays materials with characteristics useful for fillers of polymers, drug carriers, pigments, and thickeners are received high interest among researchers. The properties of such materials depend not only on their composition but also on treatment conditions and the history of the materials. Recently many studies have been focused on the development of materials produced from renewable and low-cost raw materials alternative to the traditional synthetic ion exchangers. Materials of biological origin are especially interesting since they are cheap and can be used to remove toxic compounds from various wastewaters.

In current work, cryogels with chitosan-silica of various compositions were synthesized with crosslinking of amino groups of chitosan macromolecules. The influence of the cryogelation on such physicochemical properties as textural characteristics, porosity, morphology of particles, surface structure, and thermal stability of the materials is discussed.

Synthesized cryogels could be applied as adsorbents for aromatic compounds, such as pharmaceuticals, pesticides and dyes, as well as heavy metal ions that often found in the industrial and domestic wastewaters. It has been found that the cryogels have relatively high adsorption capacity with respect to levofloxacin, fluoroquinolone antibiotic. Thus, one gram of a glutaraldehyde-crosslinked chitosan-silica cryogel could adsorb up to 325 mg of levofloxacin. For the cryogels, the isotherms of antibiotic adsorption from neutral and acidic media were recorded and the values of the constants of the Langmuir and Freundlich models were estimated. The kinetic adsorption characteristics were also studied for the composites. It was shown that the pseudo-second order kinetics is well appropriate (correlation coefficient > 0.99). Theoretical calculations of adsorption capacity were compared to the experimentally obtained values.

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