AMPHIPHILIC SORBENTS FOR SELECTIVE SORPTION OF CHOLESTEROL

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The accumulation of cholesterol (CS) in an organism and its level in human blood exceeding 6 mM/L promotes development of atherosclerosis, which is one of the main causes of morbidity and mortality in developed countries. A high level of triglycerides, very low-density lipoproteins, and low-density lipoproteins (LDLs), known as atherogenic lipoproteins, as well as a low level of antiatherogenic high-density lipoproteins, is attributed, together with cholesterol, to main atherosclerosis factors. The level of cholesterol in blood can be substantially reduced by diet and pharmacotherapy with hypolipidemic preparations (e.g., statins). However, there exists a particular category of medical cases with a homozygotic form of familiar hyperlipoproteidemia or hyper cholesterolemia, in which an extremely high level of cholesterol and LDLs is preserved in blood even after a special-purpose medicinal therapy. In these cases, the most efficient methods are those of efferent therapy, in which cholesterol and LDLs are selectively removed from the blood of an ill person in the extracorporeal mode. The method of LDL-apheresis on expensive immunoaffine sorbents is the most widely used [1, 2]. A possible alternative to these sorbents are those simulating the natural receptors, the so-called molecularly imprinted polymers (MIPs) synthesized in the presence of a biologically active target molecule serving as a template [3]. Simultaneously, the development of MIPs will solve the problem of biocompatibility of hemosorbents because the contact of blood with animal antibodies serving as affine ligands in immunosorbents is unsafe for humans [4].

Molecularly imprinted polymers (MIPs) are crosslinked polymers obtained in the presence of a target molecule as a template. After the template is removed by washing, cavities with molecular recognition sites that can bind selectively to the original template are stored in the polymer networks. MIPs are highly selective to capture the target analyte as the antibody. But as artificial receptors, MIPs are easy and rapid to prepare, very stable in harsh conditions, and allow the usage of a great variety of binding/eluting conditions without the risk of losing binding activity.

The aim of our study was to prepare cholestrol-imprinted polymers (Ch-MIPs) by the block and emulsion copolymerization. The block Ch-MIPs were prepared by the Ch-imprinting in copolymerized hydroxyethyl methacrylate (HEMA) as an amphiphilic monomer and ethyleneglycol dimethacrylate (EGDMA) as a crosslinker in *n*-propanol. The Ch-imprinted core–shell particles were prepared by emulsion copolymerization. In this method, imprint-cavities were formed in the HEMA-EGDMA copolymer layer at the surface of nanocomposites (NCs) of selen(Se) stabilzed with polyvinylpyrrolidone (PVP). An excess amount of Se/PVP-NCs in processes, which involved contact of comonomers and water, and then contact of water and butanol resulted in the formation of stabilized Pickering emulsions of oil/water/oil type. It is remarkable that the copolymerization was carried out in aqueous microdroplets in conditions close to bioseparation medium. More over, PVP made the hybrid polymer prominantly amphiphilic [5].

The size and surface morphologies of the formed block and hybrid polymer particles were studied using the scanning electron microscopy (SEM). The block sorbents had the dense homogeneous porous structure with meso- and micropores, whereas the surface of the hybrid particles consisted of microglobules ranging from 0,5 to 1 μm cross-linked together. It is obvious that in that case, the obtained composite microparticles acquired a well-defined spherical shape indicative of a successful emulsification using Se/PVP-NCs as a Pickering stabilizer.

In the process of plasma sorption *in vitro*, it was shown that the sorption selectivty increased on the Ch-imprinted polymers if compare with the corresponding non-imprinted polymers. At the same time, hydrodynamics of sorption on the hybrid polymers were better than on the bulk polymers due to more prominent amphiphilicity and narrow surface sorption layer in the hybrid networks.

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