PHOTOCATALYTIC PROPERTIES OF POLYSULFONIC MEMBRANES MODIFIED WITH SnO_2 NANOPARTICLES

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Membranes with photocatalytic properties are becoming widespread in the processes of the wastewater treatment, since they allow not only concentrating but also decompositing of toxic substances. Moreover, the immobilization of nanoparticles with photocatalytic properties on the membrane surface suppresses the phenomenon of concentration polarization in the processes of ultra- and nanofiltration due to photodegradation of substances in the boundary layer. The main disadvantage of such processes is the usage of UV radiation, which is not always compatible with polymeric membranes. Therefore, it is important to develop systems that exhibit photoactivity in the visible light.

Immobilization of SnO_2 nanoparticles on polyethersulfone membranes, covered with polyelectrolyte complexes, was proposed. Such systems exhibit activity in the decomposition of dyes, proteins, fats and polysaccharides in the daylight. It was studied that the highest photocatalytic activity of such membranes was achieved by the usage of complexes of weak polyelectrolytes, such as polyethylenimine-carboxymethyl cellulose and polyethyleneimine-sodium alginate.

Polyethylenesulfone membranes with a cut-off of 20 kDa (Microdyn Nadir, Germany) were used for modification. Polyelectrolyte layers were deposited by “layer-by-layer” method. The SnO_2 nanoparticles were adsorbed as the last layer. Their presence on the surface of the membrane was confirmed by SEM-EDS (Fig. 1, 2) and AFM.

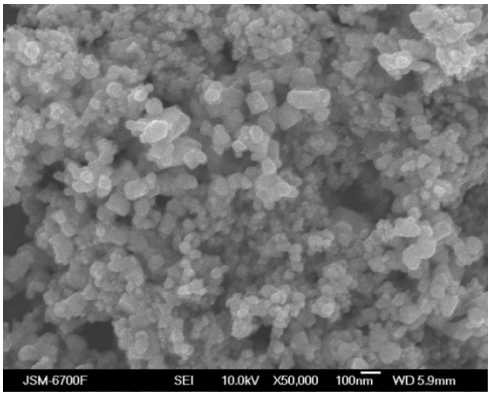

Fig. 1. SEM image of surface of PES membrane modified with SnO_2 nanoparticles

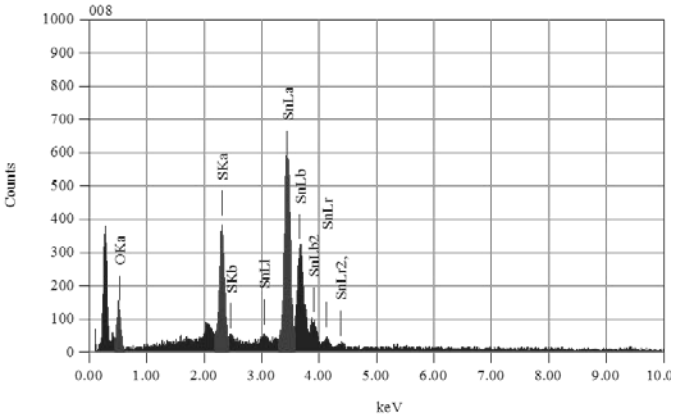

Fig. 2. EDS spectrum of surface of PES membrane modified with SnO_2 nanoparticles

It was analyzed that after SnO_2 adsorption the surface roughness was doubled. Thus, the roughness of the unmodified membrane was 6 nm, and the modified one was 12 nm.

Photocatalytic activity of membranes, modified with SnO_2 nanoparticles, was evaluated in the process of Rhodamine G decomposition. Modified membranes were characterized by a high degree of dye decomposition (40-50 %) during 1.5 hours at an initial concentration of dye $1.2 \cdot 10^{-3}$ %. It was shown that the highest photocatalytic activity of membranes was at pH 3.1.