SPECTROPHOTOMETRIC AND LUMINESCENT PROPERTIES OF CATIONIC POLYMETHINE DYES ON THE SURFACE OF HYBRID FILMS

Hybrid silica films contained cation exchange polyelectrolytes were examined as optical sensor elements for sorption-luminescent detection of oxidants. The adsorption of polymethine cationic dyes (indopolycarbocyanines) 1–3 with different length of polymethine chain onto hybrid silica films was studied for this purpose. The sol-gel synthesis of hybrid silica films performed in the presence of structure directed compounds, nonionic surfactans Tween 20 and Pluronic F127, and a mixture of poly sulfonates: polyvinyl and polystyrenesulfonic acids.The adsorption capacity of hybrid films was a function of the length of polymethine chain of the dyes and the surfactants content in silica sol. The highest adsorption capacity (5.0 μmol/g) was observed for the dye with the shortest methine chain onto the films obtained in the presence of mixture of non-ionic surfactants (Tween20 : Pluronic F127= 14 : 1, molar ratio). The obtained results correlate with the highest pore diameter of the studied films. The luminescent properties of the polymethine dye on the surface of the films are a function of surfactant content in silica sol. The luminescent intensity of the dye on the surface of hybrid film obtained in the presence of mixture of surfactants increases 30 times compare to the films without surfactant. That makes such dyes perspective luminescent probes for the testing of the surface hydrophobicity and porosity.

The absorption and luminescent intensities the hybrid films modified with polymethine dye decreased after their contact with the solution of oxidants. The highest discoloration (50–55%) was observed for chlorine solution, time of contact 10 minutes at pH 2.5–3.0. The calibration graph for sorption-spectrophotometric determination of chlorine using hybrid silica films modified with polymethine dye was obtained. The range of linearity is 0.1–1.0 mg/l, the LOD = 0,1 mg/l, which allow to determine chlorine in the tap water.

Keywords: sol-gel synthesis, hybrid films, silica, polymethine dyes.