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ABSTRACT

Industrial development leads to the generation of effluents – polluted streams, which if untreated may result in water, sediment groundwater and soil pollution. The treatment of such wastewaters requires the use of many complementary technologies, allowing to achieve high extant of pollution removal, the reuse of purified water, as well as recovery of harmful compounds containing in wastewater. Consequently heavy metal ions become a valuable product.

Liquid membranes, and recently also polymer inclusion membranes (PIMs) are an alternative of the liquid-liquid extraction in the process of selective recovery and concentration of metal ions from aqueous solutions. The up to now used carriers enable the different isolation of metal ions, however their selectivity is poor; this fact shows the necessity of searching for new ion carriers, among them macrocyclic compounds. The preparation of calixpyrroles for their application as ion carriers in membrane systems is important from the scientific aspect, since up to now this theme received only little attention.

The main aim of doctoral dissertation was to determine efficiency and selectivity of five calix[4]pyrroles derivatives as the ion carriers in the transport processes of Cu(II), Zn(II), Ag(I) and Cd(II) through the polymer inclusion membrane. It has been shown that calix[4]pyrroles functionalized carboxylic and ester groups as well as sulfur analogues allow to the selective removal of Cu(II), Zn(II), Ag(I) and Cd(II) from aqueous solutions by transport through polymer inclusion membranes. The efficiency and selectivity of this process depend on the composition, the pH of the aqueous phase as well as the concentration of carrier in the organic phase. The effect both source and receiving aqueous phases composition and the temperature of the membrane system on the efficiency of Ag(I) transport across PIMs containing cellulose triacetate (CTA), *o*-nitrophenyl pentyl ether (*o*-NPPE) and calix[4]pyrrole were studied.

It was found that the separation of the Cu(II), Zn(II), Ag(I) and Cd(II) across PIMs containing functionalized calix[4]pyrrole is hampered due to the formation of stable complexes of metal / calix[4]pyrrole in the membrane phase; this fact prevent quantitative reextraction of metal ions into receiving aqueous phase. The values of the activation energy indicates the diffusion – reaction mechanism of Ag(I) transport by PIM with the investigated calix[4]pyrroles. These plasticizer membranes used in facilitated transport have thermal stability and long-term integrity. The polymer inclusion membranes with calix[4]pyrrole derivatives as ion carriers can be used for recovery of Ag(I) from industrial effluents.