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SYNTHESIS AND CHARACTERIZATION OF COPPER(II) CHLORIDE COMPLEXES WITH NON-IONIC POLYMERS PEG AND PVP

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Abstract. The compositions of polymer-metal complexes based on copper (II) chloride and polyethylene glycol (PEG) and polyvinylpyrrolidone (PVP) have been determined by the potentiometric method. Based on the experimental data, obtained to determine the composition of the complex, the titration curves have been plotted, and the optimal molar ratios of the reacting components have been found. The Bjerrum's formation functions have been calculated. The obtained data indicate the formation of the polymer copper complexes, in which there are two PEG mono-links per two copper ions-complexing agent (1:2 in the Cu^{2+}-PEG), and in the case of PVP, there are three ones (1:3 in the Cu^{2+}-PVP). On the basis of thermodynamic constants of stability, using isotherm equations and isobars of Vant Hoff and Gibbs, Gibbs' energy (Δ_rG^0), enthalpy (Δ_rH^0) and entropy (Δ_rS^0) changes have been calculated. The complexation process in the Cu^{2+}-PEG and Cu^{2+}-PEG systems is characterized by negative Gibbs' energies, which indicates a spontaneous occurrence of the polymer-metal complex (PMC) formation process in these systems. In contrast, the complexation of copper ions with PEG is accompanied by the large positive enthalpy values, which indicate that the interaction of Cu^{2+} with the functional groups of the polymer is energetically unfavorable. The entropy values are positive, which can be explained by the dehydration of ions and functional groups, acting as ligands and a chelating effect during complexation, when one ion binds to several functional groups. The structure of the synthesized complexes has been investigated by IR spectroscopy.

Keywords: polyvinylpyrrolidone, polyethylene glycol, copper, complexation, stability constants, composition.

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