

tent searching not enough attention is paid to studying of a composition and structure of the iron-polymer complexes used as catalysts.

In this work, results on establishment of regularities and the nature of interaction in aqueous solutions of iron (III) chloride with PVP, a number of physical and chemical methods as IR-spectroscopy, scanning electron microscopy, conductometry, potentiometry are presented.

Experimental

Iron (III) chloride hexahydrate ($\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$), polyvinylpyrrolidone (molecular mass 40000, AppliChem, Germany), distilled water, hydrochloric acid were used without purification. Complexing processes of iron (III) ions with PVP were investigated by potentiometric and conductometric methods [14]. Potentiometric measurements were conducted on an ionomer pX-150MI with using silver chloride and glass electrodes. Conductometric studies were performed on a device ConductivityMeter 13701/93 (PHYWE, Germany) in thermostated conditions. All experiments have been carried out under temperature control with an accuracy of $\text{pH} \pm 2$. IR spectra of PVP and the Fe-PVP complex were recorded on the FT IR-4100 type A JASCO device in the range of $4000\text{--}450\text{ cm}^{-1}$. SEM images were produced on the device JSM-6490LA of Jeol. IR-spectra and SEM images were taken in analytical laboratories at the Technical University of Kaiserslautern (TUK, Germany).

Synthesis of the FeCl_3 -PVP complex was carried out as follows. The salt $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ (2.70 g, 0.01 mol) and PVP polymer (4.44 g, 0.04 mol) were placed in 50 mL round-bottom flask and dissolved in 10 mL of distilled water. The obtained solution was mixed on a magnetic stirrer within 20–30 minutes before the complete linking of polymer with Fe (III) ions at ambient temperature. The synthesized complex of orange color was dried and stored on air at ambient temperature. Yield is 6.23 g (97 %).

Results and Discussion

Interaction between PVP and Fe^{3+} ions has been investigated by potentiometric and conductometric methods, which allowed establishing the structure, concentration and stability constants of the polymer/metal complex [15]. The high tendency to complexation, non-toxicity, good solubility in various solvents, including high solubility in aqueous mediums, provides to PVP broad application in textile, food, pharmaceutical industry and in medicine [16]. Curves of potentiometric and conductometric titration of PVP by iron (III) chloride are presented in Figures 1 and 2.

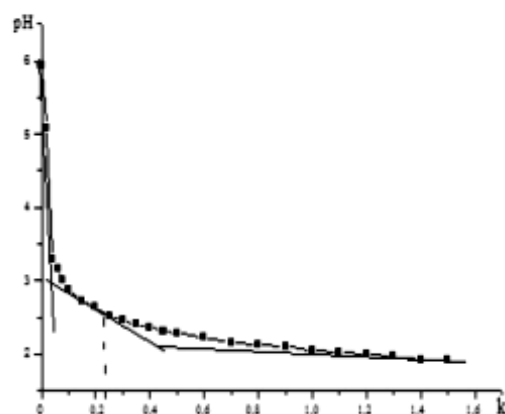


Figure 1. Curve of potentiometric titration of PVP (10^{-2} M) with iron chloride solution (10^{-2} M) $k = [\text{Fe}^{3+}]/[\text{PVP}]$

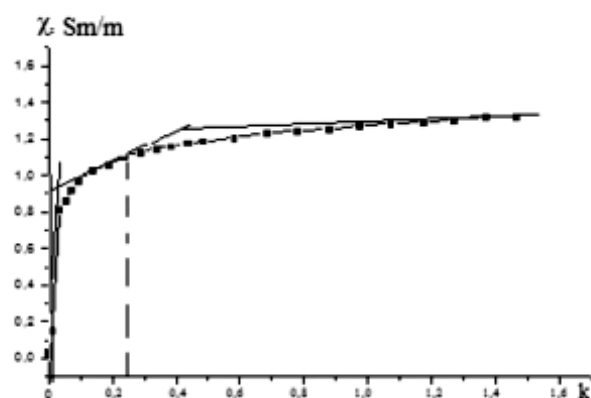


Figure 2. Curve of conductometric titration of PVP (10^{-2} M) with iron chloride solution (10^{-2} M) $k = [\text{Fe}^{3+}]/[\text{PVP}]$

Mixing of aqueous solution of polymer with solution of salt, apparently from Figures 1 and 2, is accompanied by pH decrease of medium that is explained by formation of protons of hydroxyl groups of the protonated PVP during complexing. The experimental data confirm formation of a polymer-metal complex with an optimum molar ratio of the components $k = [\text{Fe}^{3+}]/[\text{PVP}] = 0.24$. It means that one metal ion contacts with four compound mono-links of a polymeric ligand. Coordinative saturation of metal ion is probably realized at the expense of molecules of solvent or anion of iron salt. To confirm the composition of the formed