The investigation of electroreduction of $AuCl_4^-$ in the case of gold electrosorption using activated carbon

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Pesic and Storhok [1] investigated the kinetics of gold (III) bromide complex adsorption and observed that gold is accumulated in its original ionic form on the surface of activated carbon. This phenomenon is different from the gold (III) chloride complex behavior, where adsorption process is accompanied by the reduction of the ions [2].

In recent years, many works have been published on gold adsorption using various biosorbents [3]. However, the literature is still insufficient to cover this research area, and more work and studies are needed in this field to develop other locally available and economical adsorbents. In this research, results showing the possibility of activated carbon application in electroreduction of gold from aqueous solution are presented. The studies were performed with synthesized activated carbon based on rice husk. The influence of amount of activated carbon used, initial concentration of gold (III) chloride complex ions, temperature were investigated.

The kinetics of electroreduction of gold on platinum surface from chloride electrolytes by the cyclic voltammetry (CV) with variation of the scan rate in the range of 10-50 mV s^{-1} has been studied. Chronoamperometric (CA) measurements were performed at the potential of +0.2 V vs. Ag/AgCl with varying gold concentration and in the temperature range from 15°C to 35°C.

All electrochemical measurements were carried out in a three-electrode cell using an Autolab PGSTAT 302 N galvanostat/potentiostat (Metrohm, the Netherlands). A working electrode with surface area of 0.071 cm^2 was a platinum rotating disk. A platinum plate was used as an auxiliary electrode, and the silver-chloride electrode (Ag/AgCl) was the reference electrode. 0.1 M potassium chloride solution containing $HAuCl_4$ with a pH of 1.5 was served as the electrolyte. The gold chloride solutions ($HAuCl_4$) with a gold concentration of 0.39; 1.17; 2.30; 4.10×10^{-4} mol L^{-1} were prepared by dissolution of metallic gold in aqua regia.

Diffusion coefficient of Au^{3+} ions for the concentration of Au^{3+} 4.1×10^{-4} mol L^{-1}, at 25^{0}C determined by the CV method on the basis of the Randles-Ševcik equation is in good agreement with the value determined by the CA using the Cottrell law and the amounts of coefficient: 1.7 10^{-13} and 4.8×10^{-13} cm^2 s^{-1}, respectively. As a result of these studies, the kinetic characteristics of gold reduction at the potential of 0.4 V were determined.

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References

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