

## Adsorption of Copper, Silver, and Zinc Cations at Polarized Active Carbons

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Active carbons are well-known sorbents; however, the electrochemical properties of active carbons are studied and utilized insufficiently. It would be useful to increase the sorption activity of active carbon. Compared to the modern high-temperature methods, the electrochemical regeneration *in situ* by altering the potential is more attractive and inexpensive.

According to Frumkin *et al.*, the ability of porous active carbon, with a highly extended surface, to change adsorption properties depends on potential's value. Systematic investigation of electrosorption is achieved by the adsorption of some exo- and endo-toxic substances on active carbon from physiological solutions such as aqueous solution of 0.9% sodium chloride or biological media such as blood, plasma, and lymph. Literature supports the application of electrosorption to solve some ecological problems, particularly the removal of organic compounds from waste water, but such investigations are episodic ones.

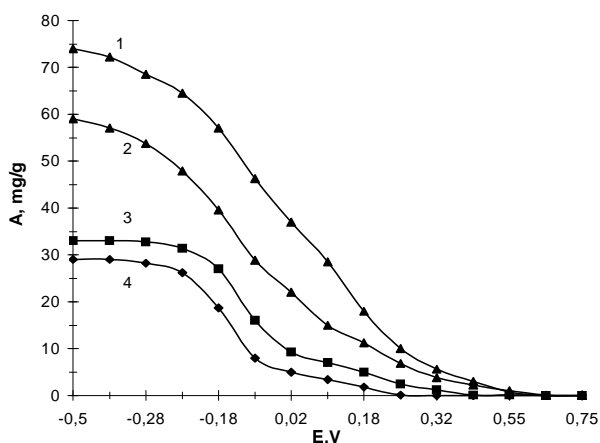


Fig.1 Adsorption of ions at SKT-6A and SIT-1 against a potential of active carbons (1 -  $\text{Ag}^+$  at SIT-1, 2 -  $\text{Ag}^+$  at SKT-6A, 3 -  $\text{Cu}^{2+}$  at SIT-1, 4 -  $\text{Cu}^{2+}$  at SKT-6A).

This work is focused on the mechanism and features of the electrosorption of copper, silver, and zinc ions from aqueous solutions at porous active carbons.

The significant difference between the adsorption activity of preliminary polarized active carbon and active carbon directly polarized by a potentiostat was not found. The shifts in the potential of the preliminary polarized active carbon to a more positive value, due to adsorption of cations, were measured. The investigation of the adsorption kinetics and the isotherms of silver, copper, and zinc cations shows the dependence of the adsorption activity on the potential of a carbon sorbent. Changing the of adsorption isotherms from Langmuir to Henry, through a row of transient and S-shaped isotherms, depending on the potential, alludes to the chemical transformations of the composition of the compound's surface of active carbon. The electrooxidation or electroreduction of a

surface compounds is quite probable.

Adsorption of  $\text{Cu}^{2+}$ ,  $\text{Ag}^+$ , and  $\text{Zn}^{2+}$  cations at preliminary polarized active carbons depends on potential. Shifts of active carbon potential during adsorption of cations to more positive values were found.

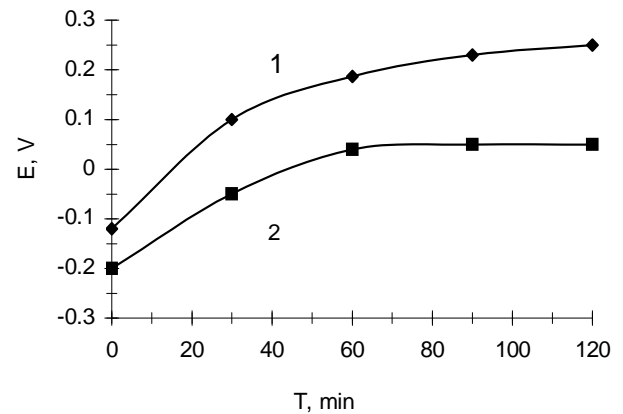


Fig. 2. Potential shifts for the adsorption process on active carbon (1 - Adsorption of  $\text{Ag}^+$  ions at SIT-1, 2 - Adsorption of  $\text{Cu}^{2+}$  ions at SKT-6A).

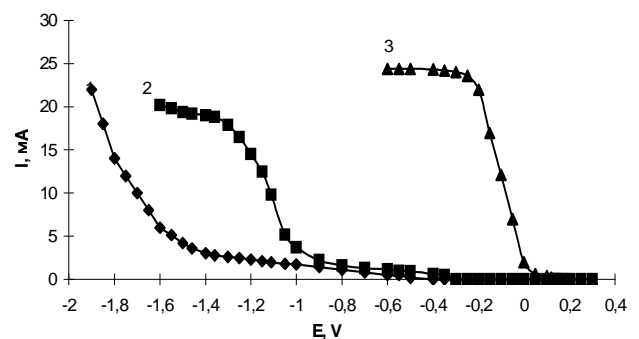


Fig. 3. Electroreduction of some adsorbates in 0.5 M sodium sulfate (curve 1) at the carbon rotating disc electrode. Adsorbates are  $\text{Zn}^{2+}$  (2) and  $\text{Cu}^{2+}$  (3).

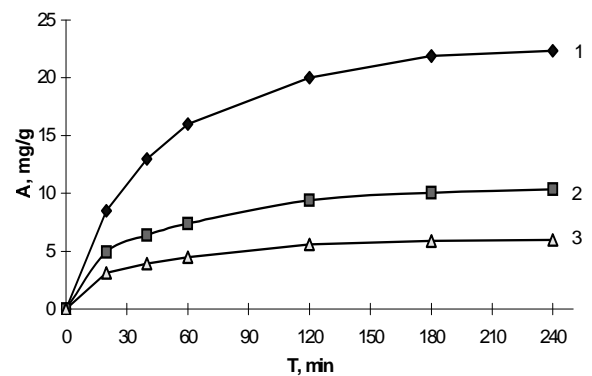


Fig. 4. Adsorption of  $\text{Cu}^{2+}$  at sintered AG-3V at different potentials. Initial concentration of  $\text{Cu}^{2+}$  is 1 g/L (1 - 0.00V, 2 - 0.10V, 3 - 0.20V).