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Mutual action of copper (II) and a nonionic surfactant (oxyethylated alcohols) on their simultaneous removal by a neutral hyper-cross-linked polystyrene adsorbent

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ABSTRACT

The mutual action of Cu(II) and nonionic surfactant Lutensol AO-10 on their sorption onto neutral hyper-cross-linked polystyrene Macronet MN-200 from mixtures has been investigated by the analysis of sorption equilibrium and kinetic data. The experimental equilibrium data were analyzed using the Langmuir and Freundlich models. The sorption mechanism of Cu(II) from one-component solutions or Cu(II) and AO-10 from their mixture corresponded to the Langmuir model rather than to the Freundlich one, whereas the sorption mechanism of AO-10 from one-component solutions proceeded according to the Freundlich rather than to the Langmuir model. The pseudo-second-order-reaction and intraparticle diffusion models (Weber–Morris plot) were used to describe the sorption kinetics, and to determine the sorption rate (k_2), intraparticle (k_i) and external diffusion (k_s) constants. The k_2 values obtained for Cu(II) sorption from solutions free from AO-10 was higher than those obtained for sorption from solutions free from Cu(II). The presence of AO-10 in the mixture results in a decrease in k_2 value for Cu(II), whereas the presence of Cu(II) leads to an increase in k_2 value determined for AO-10. The Cu(II) sorption rates from the solution free from AO-10 or Cu(II) and AO-10 from their mixture are dependent on intraparticle and external diffusion proceeding simultaneously. The sorption rate of AO-10 from one-component solution is limited only by intraparticle diffusion. Electron microscopy (SEM) images of MN 200 surface, scanned before and after AO-10 sorption, distribution of Cu(II) in the cross-section of the bead after Cu(II) sorption in the presence of AO-10 are in agreement with sorption measurements.

Keywords: Copper (II); Nonionic surfactant; Sorption; Hyper-cross-linked polystyrene; Environment protection

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