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Thermodynamic parameters for the adsorption of chromate to the Kelani river suspended solids

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Water bodies are polluted when substances like heavy metals enter the water way and alter their functions. Depending on the solubility, these metals may eventually become associated with suspended particulate matter and/or with the bottom sediments. Kelani River, the second largest watershed in Sri Lanka, flows through the most populated and economically administrative district and a large number of industries including tanneries, which utilize chromium, are developed along its shore. The effluents of these industries discharge to the river without any treatment. Hence the distribution of heavy metals in water and suspended solids (SS) in Kelani River was studied to see the adsorption pattern of these metals at different ionic strengths and pH through the complexation process.

Concentrations of heavy metals in river SS and water collected from locations having different characteristics were determined using flame and graphite furnace atomic adsorption spectrometry. It shows that the most of the heavy metals are associated with SS.

The adsorption density of chromate on 2g of Kelani river SS examined in batch experiments as a function of time at the pH of 6.12 by varying the initial chromate concentrations at 1 x 10^{-7}, 5 x 10^{-7} and 1 x 10^{-6} mol dm^{-3}, at a background electrolyte concentration of 0.010 mol dm^{-3} NaCl showed that it increases with the initial concentration of chromate. When the amount of SS varied in the above experiment by keeping the initial concentration of chromate at 5 x 10^{-7} mol dm^{-3}, the adsorption increased but the adsorption density decreased with the amount of SS as the adsorption density is reported per unit area.

The adsorption density of chromate on 2g of SS in the acidic conditions at pH of 4.12, at 5 x 10^{-7} mol dm^{-3} initial chromate concentration and 0.010 mol dm^{-3} NaCl background electrolyte has increased in the acidic medium. The chromate adsorption to SS was very poor in the basic medium of pH 9.00.
The activation energy (*E*a), Gibbs free energy ($\Delta G^{\#}$), entropy ($\Delta S^{\#}$) and enthalpy ($\Delta H^{\#)}$ of the activation stage for chromate adsorption on Kelani river SS of Kelani estuary and upstream having different natural electrical conductivities were calculated by Arrhenius and Eyring models. Always $\Delta S^{\#}$ values approximate to zero and $-T\Delta S^{\#}$ values were positive, which indicates that the activation state of chromate adsorption process is entropy-controlled.

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