

ADSORPTIVE REMOVAL OF MERCURY(II) BY GIBBSITE

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Adsorption of Hg(II) on gibbsite was studied under different experimental conditions in order to find optimum conditions to remove Hg from water samples. Effects of solution pH, ionic strength, contact time and background electrolyte on the adsorption were investigated. Atomic Absorption spectrometry was used to determine the concentration of Hg(II).

Adsorption of Hg(II) on gibbsite reached an optimum value after a 24 hour equilibrium period. Ionic strength effect was significant and it was inversely proportional to the adsorption density. This effect was stronger in NaCl electrolyte than in other two (NaNO₃ and NaClO₄) confirming the formation of both inner- and outer- sphere surface complexes.

The linearity in the plot of adsorption density of Hg (Γ_{Hg}) vs. initial concentration of Hg [Hg(II)_{initial}] revealed that the adsorption occurred on a homogeneous surface. The average percentage of adsorbed Hg(II) was about 94 % at pH 8, and 80 % at pH 4 when the ionic strength was 0.01 mol dm⁻³. This was found to be common for both electrolytes NaNO₃ and NaClO₄. However, the maximum amount of adsorption was 0% at pH 4 and 98% at pH 8 in 0.01 mol dm⁻³ NaCl electrolyte. Amount of adsorbed Hg²⁺ was maximum at pH 6.4, 6.5 and 7.5 and the Γ_{Hg} values were 5.91×10^{-6} , 5.42×10^{-6} and 2.32×10^{-6} mol m⁻² in three different electrolytes NaNO₃, NaClO₄ and NaCl, respectively. The nature of electrolyte effect and Cl⁻ ions influenced the amount of adsorption of Hg(II). In the presence of NO₃⁻ and ClO₄⁻ ions adsorption densities were high when the pH of the medium was greater than 4 and low when the pH of the medium was less than 8 indicating competition among counter ions of OH⁻, H⁺ and Hg(II) influenced the amount of adsorption. Visual-MINTEQ calculations shown that identical species were present in NO₃⁻ and ClO₄⁻ electrolytes and HgCl species was formed to be in the presence of Cl⁻ and it minimized the interactions of Hg(II) with Gibbsite.

The surface of gibbsite in the absence and presence of the Hg(II) was examined using FTIR-spectroscopy confirming that the hydroxyl groups on the surface of gibbsite had been replaced by Hg(II), indicating the adsorption of Hg(II) species.