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Experimental study on the nickel (II) removal from aqueous solutions using silica fume with/without apocarbonic anhydrase

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ABSTRACT

The silica fume is a fine-grain, thin and very high surface area silica. Although the silica fume is a waste material of industrial applications, it has become the most valuable by-product among the pozzolanic materials due to its very active and high pozzolanic property. In this study, the potential use of silica fume in the remediation of polluted heavy metal water to remove nickel ions is presented. For studying metal adsorption, 1 g of silica fume has been taken as adsorbent and then it has been suspended in 50 ml of 3 mmol dm^{-3} $NiCl_2$, at pH between 3 and 9 and contacted batchwise in a thermostatic (t = 25°C ± 0.1°C) water-bath agitator for 1 h to enable equilibration of the sorbent and solution phases. The nickel concentrations in the samples taken from the silica fume treated aqueous solutions of polluted river water with/without apocarbonic anhydrase (apoCA) and $NiCl_2$ solution have been determined by spectrophotometric method using dithizone. The nickel concentration in the samples of silica fume treated leachates solutions decreased. It was determined that the adsorption of nickel ions increased with the addition of apoCA as compared with those of without apoCA. The experimental investigation results show that activated silica fume has a high level of adsorption capacity for nickel ion. Consequently, it is concluded that the silica fume can be successfully used for the removal of the nickel ions from the aqueous solutions with heavy metals.

Keywords: Waste water; Silica fume; Apocarbonic anhydrase; Aqueous solution; Nickel removal; Adsorption isotherms

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