Optimization of Gold Adsorption from Aqua-Regia Gold Leachate Using Baggase Nanoparticles

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Abstract : To establish an economical and efficient process for the recovery of gold metal from refractory gold ore obtained from Esperando axis of Osun state Nigeria, the adsorption of gold (III) from aqua reqia leached solution of the ore using bagasse nanoparticles has been studied under various experimental variables using batch technique. The extraction percentage of gold (III) on the prepared bagasse nanoparticles was determined from its distribution coefficients as a function of solution pH, contact time, adsorbent, adsorbate concentrations, and temperature. The rate of adsorption of gold (III) on the prepared bagasse nanoparticles is dependent on pH, metal concentration, amount of adsorbate, stirring rate, and temperature. The adsorption data obtained fit into the Langmuir and Freundlich equations. Three different temperatures were used to determine the thermodynamic parameters of the adsorption of gold (III) on bagasse nanoparticles. The heat of adsorption was measured to be a positive value ΔH_o = +51.23kJ/mol, which serves as an indication that the adsorption of gold (III) on bagasse nanoparticles is endothermic. Also, the negative value of ΔG_o = -0.6205 kJ/mol at 318K shows the spontaneity of the process. As the temperature was increased, the value of ΔG_o becomes more negative, indicating that an increase in temperature favors the adsorption process. With the application of optimal adsorption variables, the adsorption capacity of gold was 0.78 mg/g of the adsorbent, out of which 0.70 mg of gold was desorbed with 0.1 % thiourea solution.

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