World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:11, No:10, 2017

Comparison of Adsorbents for Ammonia Removal from Mining Wastewater

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Abstract : Ammonia in mining wastewater is a significant problem, and treatment can be especially difficult in cold climates where biological treatment is not feasible. An adsorption process is one of the alternative processes that can be used to reduce ammonia concentrations to acceptable limits, and therefore a LEWATIT resin strongly acidic H+ form ion exchange resin and a Bowie Chabazite Na form AZLB-Na zeolite were tested to assess their effectiveness. For these adsorption tests, two packed bed columns (a mini-column constructed from a 32-cm long x 1-cm diameter piece of glass tubing, and a 60-cm long x 2.5-cm diameter Ace Glass chromatography column) were used containing varying quantities of the adsorbents. A mining wastewater with ammonia concentrations of 22.7 mg/L was fed through the columns at controlled flowrates. In the experimental work, maximum capacities of the LEWATIT ion exchange resin were 0.438, 0.448, and 1.472 mg/g for 3, 6, and 9 g respectively in a mini column and 1.739 mg/g for 141.5 g in a larger Ace column while the capacities for the AZLB-Na zeolite were 0.424, and 0.784 mg/g for 3, and 6 g respectively in the mini column and 1.1636 mg/g for 38.5 g in the Ace column. In the theoretical work, Thomas, Adams-Bohart, and Yoon-Nelson models were constructed to describe a breakthrough curve of the adsorption process and find the constants of the above-mentioned models. In the regeneration tests, 5% hydrochloric acid, HCl (v/v) and 10% sodium hydroxide, NaOH (w/v) were used to regenerate the LEWATIT resin and AZLB-Na zeolite with 44 and 63.8% recovery, respectively. In conclusion, continuous flow adsorption using a LEWATIT ion exchange resin and an AZLB-Na zeolite is efficient when using a co-flow technique for removal of the ammonia from wastewater. Thomas, Adams-Bohart, and Yoon-Nelson models satisfactorily fit the data with R² closer to 1 in all cases.

Keywords : AZLB-Na zeolite, continuous adsorption, Lewatit resin, models, regeneration
Conference Title : ICCET 2017 : International Conference on Chemical Engineering and Technology
Conference Location : New York, United States
Conference Dates : October 05-06, 2017