

Assessment of adsorbent for removing lead (pb) ion in an industrial-scaled packed bed column

ABSTRACT

Adsorption is becoming a prominent method to remove heavy metal ions from wastewater due to its ability to remove pollutant at extremely low concentration. In batch experimental studies, activated alumina shows a good adsorption capacity towards lead Pb(II). Subsequently, this study was conducted to simulate the performance of activated alumina in a packed bed column to remove Pb(II) presents in wastewaters, using Aspen Adsorption® based on data from batch experiments. A plug flow mathematical model, with a linear driving force (LDF) approximation was used for the simulation. A dynamic column performance was evaluated systematically at various parameters. The simulated results show that a decrease in the inlet flowrate and inlet concentration, and an increase in both bed height and bed diameter enhance the Pb(II) adsorption by the column by delaying the breakthrough time. In addition, a real activated alumina industrial packed bed column plant, namely Plant D was employed as a case study for a scale-up analysis. A sensitivity analysis of three model parameters revealed that the activated alumina column was very sensitive towards the changes in isotherm model and bed porosity, and insignificant to the changes in LDF mass transfer coefficient. The size of a packed bed column was taken to be 1.459 m and 0.6090 m, for height and diameter, respectively. The corresponding operation time was 28 days at inlet flowrate and inlet concentration of 6.31×10^{-4} m³/s and 0.1 mg/L, respectively. These figures seem to be practical and manageable for industrial wastewater treatment plant.