REGENERATION OF CAPROLACTAM-LADEN ACTIVATED CARBON BY SUPERCRITICAL CARBON DIOXIDE: MODELING AND VARIFICATION

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Supercritical Carbon Dioxide (scCO2) is an environmental friendly solvent widely used for the extraction of thermal sensitive chemicals from plant species and as a media for chemical reactions. ScCO2 was recently proposed as a solvent suitable for the regeneration of Caprolactam laden activated carbon exhausted by wastewater treatment applications. In this work, mathematical modeling and verification of Caprolactam desorption by scCO2 under various operational conditions were studied.

Regeneration of Caprolactam-laden activated carbon was studied in a packed column at different temperature (25-70 ^{0}C) and pressure (80-285 bar) conditions. Desorption was modeled with four well known mathematical models, namely Langmuir sorption isotherm controlled desorption in resistance-less media (Langmuir Model), Freundlich sorption isotherm controlled desorption in resistance-less media (Langmuir Model), Linear Equilibrium desorption in resistance media (Recasens-I Model), and Irreversible desorption in resistance media (Recasens-II Model). A semi-empirical model (Recasens-III) was also proposed and the accuracy of prediction of desorption by all models was investigated using Newton's least square error method. The results verified that the proposed model can most accurately predict the caprolactam desorption from activated carbon at all tested conditions.

A graphical method to determine the 'Recasence III' model parameters was proposed. Examination by sensitivity analysis showed that the proposed method can accurately predict model parameters.