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Presentation of combined model for Adsorption Processes from the aqueous Solution

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For more than 100 years, absorption isotherm models have been used to determine the equilibrium absorption behavior of materials. Some of these models are not able to calculate the absorbent capacity. Among of these model just Langmuir's model is theoretical and able to calculate the absorbing capacity. In the year 2017, a model is proposed that we called it a "combined" model. This model can calculate the absorption capacity including equilibrium and initial absorption and fit well with absorption data. The purpose of this research is to introduce the combined isotherm model and determination of activated carbon adsorbent capacity (AC) for absorption of Fe, Pb, Ni, Zn and Cd elements using the combined model.

For this aim activated carbon with concentrations of 20 to 200 mg / l was used to remove selected heavy elements from solution. The results of pH experiments showed that the maximum adsorption value was obtained at pH: 6-7. Kinetics experiments showed that the maximum time of equilibrium in the concentration of 20 mg / L for selected elements is between 75 and 120 minutes.

The results of fitting the isotherm models showed that for all elements, the "combined model", Freundlich and Langmuir model has the lowest RMSE and the highest regression coefficient respectively.

Absorbent capacity by the combined model for adsorption of Fe, Pb, Ni, Zn, and Cd was calculated 26.29, 30.93, 27.99, 23.85 and 21.84 mg / g, respectively.

Also, the initial adsorption rate (Fe, Pb, Ni, Zn, and Cd) was 8.5, 6.35, 5.49, 6.33 and 4.01 mg / g, respectively.

Results showed that the combined model has the best fitting with the adsorption data of heavy metals and also a large part of the absorption is carried out in the initial absorption (chemical absorption). While Langmuir and Freundlich equilibrium isotherms are not able to calculate it.

Keywords: Combined isotherm model; Absorption; Heavy elements; Primary adsorption