

Discussion

Comments on “adsorption of 4-chlorophenol from aqueous solutions by xad-4 resin: Isotherm, kinetic, and thermodynamic analysis”

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Abstract

This letter reports the importance and advantages of the constraints in the Redlich Peterson isotherm exponent.
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Recently Dr. Bilgili [1] had published a paper entitled above. No doubt that above referred paper is very much useful and informative for the researchers working in this area. In addition, it is also good to know about the ability of xad-4 resin to remove the toxic compound 4-chlorophenol from the aqueous solution. However, I have few suggestions on the adsorption isotherm section discussed in the above referred paper [1]. In the adsorption isotherm section (Section 3.2 of ref. [1]), a three parameter Redlich Peterson isotherm was used to explain the experimental equilibrium data. Redlich Peterson isotherm was reported for three solution temperatures. Based on the predicted Redlich Peterson isotherms, a value of constant ‘g’ greater than unity ($g > 1$) was reported.

In 1959, the Redlich Peterson [2] isotherm was proposed by considering the limitations of Freundlich and Langmuir isotherm. The Redlich Peterson isotherm as reported in the original article is given by [2]:

$$q_e = \frac{AC_e}{1 + BC_e^g} \quad (1)$$

where A is the Redlich Peterson isotherm constant (L/g), B the Redlich Peterson isotherm constant ($L/mg^{1-1/A}$) and g is the exponent, which lies between 0 and 1. The Redlich Peterson isotherm as in Eq. (1) has two limiting cases, which can be explained as follows:

When the exponent $g = 1$, the Langmuir equation results, given by:

$$q_e = \frac{AC_e}{1 + BC_e} \quad (2)$$

When $g = 0$, Redlich Peterson isotherm equation transforms to Henry’s law equation

$$q_e = \frac{AC_e}{1 + B} \quad (3)$$

The features of Redlich Peterson isotherm following the Langmuir isotherm when the constant g equals unity was recently verified for the sorption of basic dyes onto activated carbon [3–6]. In addition the Redlich Peterson isotherm following the Freundlich isotherm for the constants A and $B \gg 1$ and $g = 1$ was verified for the sorption of auramine O onto activated carbon [7]. The Redlich Peterson isotherm following the Henry’s law equation was reported for the sorption of sodium ions onto tree fern particle [8]. Thus, anything g value out of the range from 0 to 1 may fail to explain the theory behind the Redlich Peterson isotherm. Though search for the best fit isotherm using regression methods are acceptable, care should be taken such that the regression methods should not interfere with the theory of the isotherms. In the referred paper [1], the value of the Redlich Peterson exponent greater than unity (Table 4 of ref. [1]) suggests that no constraint was fixed to the Redlich Peterson exponent ‘g’ while using the regression techniques. Irrespective of the regression method, either linear or non-linear method, the

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Redlich Peterson isotherm should be subjected under the constraints $0 < g < 1$. In addition the g value within the range from 0 to 1 will be helpful to get a more clear idea about the actual mechanism of the sorption process. In addition from Table 4 of ref. [1], it can be seen that both the Freundlich and Langmuir isotherm well represents the experimental equilibrium data with higher r^2 values. In this situation the g value will explain where the isotherm represents, either in the Freundlich or the Langmuir. Thus, I request the author to reevaluate the Redlich Peterson isotherm considering the theoretical constraints of this isotherm.

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