

Discussion

Comments on “Removal of lead from aqueous solution using *Syzygium cumini* L.: Equilibrium and kinetic studies”

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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 King et al. [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 *Syzygium cumini* L. to remove the toxic lead ions from their aqueous solution. However, I have few suggestions on the adsorption isotherm section discussed in the above referred paper [1]. In the biosorption equilibrium section (Section 4 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 constant 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 will 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 negative value of the Redlich–Peterson exponent (Table 1 of Ref. [1]) suggests that no constraint was fixed to the Redlich–Peterson exponent ‘g’ while using the regression techniques. This was also reflected by a very poor fit of Redlich–Peterson isotherm to the experimental equilibrium data as in Figs. 8 and 10 of Ref. [1]. Irrespective of

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the regression methods, either linear or non-linear method, the Redlich–Peterson isotherm should be subjected under the constraints $0 < g < 1$. In addition the g value lying in 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 1 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 be helpful in explaining where the isotherm represents, either in the Freundlich or the Langmuir. Thus, it is suggested to the authors to predict the Redlich–Peterson isotherm by considering the theoretical constraints of this isotherm.

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