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# DISCUSSION ON "COMPETITIVE SORPTION OF MULTIPLE COMPONENT HEAVY METALS FROM GOLD MINING LEACHATE ONTO LATERITE SOIL" LOWLAND TECHNOLOGY INTERNATIONAL, 10(1), 54-64

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## DISCUSSIONS:

After going through the paper written by A. Putthividhya published in Lowland Technology International 10(1) 54-64, we found that there are some points in the methodology and analysis of results necessary to be clarified. Whilst essentially the experimental approach was straightforward and sound, beyond this, however, the analysis and the interpretations drawn are far from satisfactory.

The sorption behavior of metals on soil determined by Batch adsorption method has been reported significantly deviated from that predicted by column diffusion test which proved more applicable to solute transport simulations (Khandelwal and Rabideau, 2000; Do and Lee, 2006). We have compared the sorption behaviors of potassium (K(I)) on pure Kaolinite mineral which was determined by different method and the adsorption isotherms are shown in Fig. 1. It is obvious that the sorption affinity ($K_d$) obtained from Batch method is 71.4 L $g^{-1}$, much larger than 0.679 L $g^{-1}$ that obtained from soil column method (Li et al., 2008). Similarly, this characteristic also exists in the sorption of heavy metals on clay minerals. Batch adsorption researches revealed that the solid-solution ratio has an obvious influence on the adsorption capacity of solute on the sorbent (Tang et al., 2008a; Tang et al., 2008b). In compacted soil, the solid-solution ratio is significantly greater than the dilute slurry used in Batch adsorption studies, which will inevitably affect the sorption behavior of solute. Therefore, those parameters determined by Batch method are not applicable in solute migration predictions in subsurface environment.

As indicated, this work intended to "predict or estimate migration of these contaminants in the environment" and to investigate "the transport and migration of the multiple species heavy metals under various soil moisture contents", as a result, it needs more reasonable test method to determine the sorption parameters required in the numerical simulation. Shackelford et al. has reported many works regarding the determination of transport parameters based on soil column test, either in form of diffusion cell or break through curve (Shackelford and Daniel, 1989; Shackelford and Daniel, 1991). This work could refer to these papers to make some calibrations.

1. The diffusion coefficients and effective diffusion coefficients of heavy metals in the studied soil should be determined using column diffusion test or at least be noted with the relevant references. Although the physical meanings of $D_e$, $D^*$ and $\tau$ have been shown in Eqs. (3, 4), there is no information about how these parameters were obtained.
2. Eq. (4) has no contribution to the paper since the effective diffusion coefficient is directly given in Table 5.
3. There is an error in Eq. (8) where the notation "p" should be "ρ" based on the following explanations to this equation.
4. In Fig. 5, the captions and legends should be clearly made. It is difficult to identify which dot or curve is related to the specific species of metal. The second figure in Fig. 5 should have information about the depth.
5. In Fig. 5, the definition of the water content should be indicated to be whether the initial water content or the final water content after flux of mining leachate? According to the conceptual model in Fig. 3, the upper boundary is saturated and the infiltration of water will give rise to the bulk water content of the sublayer soil. It is difficult to understand the results in Fig. 5 if this point is obscure.
6. In Fig. 6, the notations of different saturations should differ from each other. In the current form, it is hard to distinguish each other.

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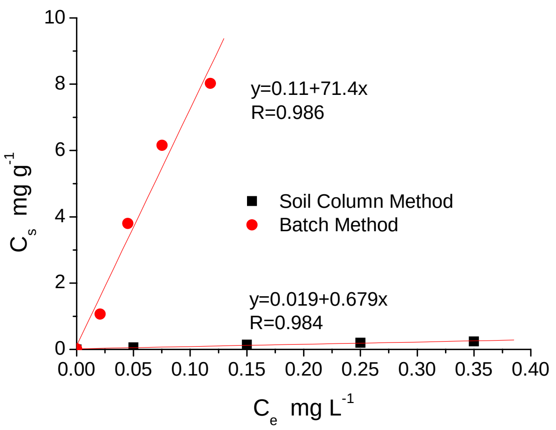


Fig. 1 Isotherm of K(I) adsorption on Kaolinite determined by Batch Method and Soil Column Method

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