Sorption and Transport Parameters of a Biosurfactant Solution in a Clayey Soil

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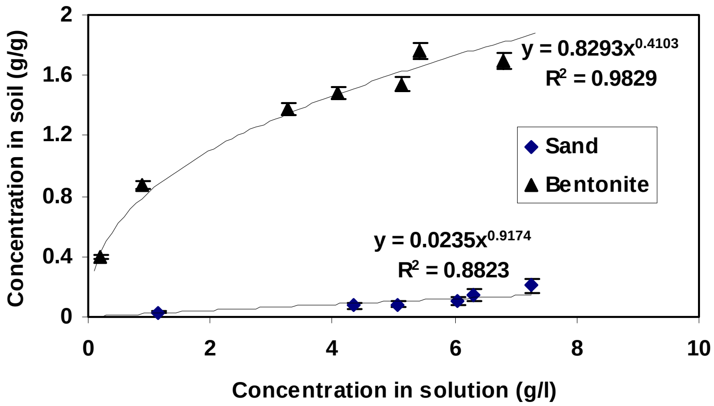
Abstract:
In this study, transport parameters of biosurfactant were determined from breakthrough curves in sand (95%) with bentonite (5%) mixture. The sorption parameters of the surfactants on soil constituents were determined from batch studies. Advection-Diffusion equation was used to model the transport of surfactants through the soil column.

1. Introduction:
The understanding of surfactant adsorption is of importance for the application of surfactants for enhanced contaminated soil remediation. Adsorption of surfactants is detrimental for these applications as it results in surfactant loss and reduced surfactant mobility. Furthermore, adsorption of surfactants may create new adsorption sites for hydrophobic compounds.

The transport processes of dissolved chemicals and colloidal particles in stratified or layered soils have been studied for several decades (Shamir et al., 1967).Solute transport in soils can be investigated using numerical models as well as analytical models. Initial approach was proposed by Shamir and Harlesman (1967) who used a system's analysis approach. Colloid facilated transport is a potentially significant contaminant transport mechanism for strongly sorbing contaminants in groundwater aquifers and soils. The primary mechanisms controlling the transport of colloidal particles in subsurface porous media are particle advection, dispersion and deposition (filtration). These are influenced by surface chemical characteristics of the soil and colloids, size and morphology of colloidal particles and solution chemistry.

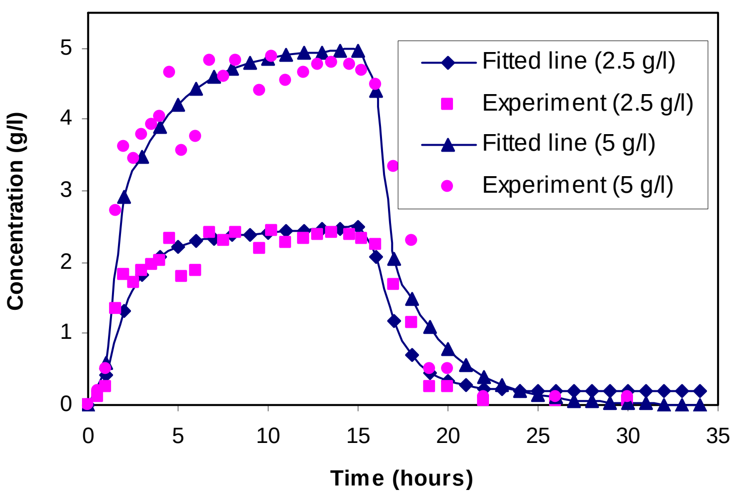
2. Objective:
The overall objective of this study was to quantify the transport parameters such as advection, dispersion and retardation factors for the UH biosurfactant through the soil with 5% bentonite soil with permeability of 10^{-4} cm/s.

3. Materials and methods:
In this study, UH biosurfactant was used. The biosurfactant had a CMC of 0.7 g/L and a molecular weight of 282. Adsorption of the biosurfactant to the soil constituents were studied in continuous stirred batch reactors. Soil was packed in the column with the height of 21 cm and diameter of 5.1 cm. Then breakthrough curve for UH biosurfactant was determined from the effluents of the column study in order to determine the transport parameters. The permeability of the soil was 10^{-4}cm/s. STANMOD, modified and updated version of the CXTFIT code (*Toride et al* [1995]) was used for estimating solute transport parameters using nonlinear least squares parameter optimization method.



Kd=2.12 from initial slope

FIG 1: UH biosurfactant adsorption to soil constituents



	R	Kd
5 g/L	1.12	0.11
2.5 g/L	4.11	2.94

FIG 2: Breakthrough curve of UH biosurfactant in sand (95%) and bentonite (5%)

4. Discussion:

It was determined that the adsorption of biosurfactant to clay followed the freundlich isotherm. The seepage velocity, diffusion coefficient and retardation factor for the UH biosurfactant were 8.456 cm/hr, 0.794 cm^2/hr, and 1.122 respectively for soil with sand (95%) and bentonite (5%) mixture. If the effluent concentration was half of the actual experimental values, the R increased from 1.12 to 4.11 (FIG 2).

5. Conclusions:

It has been shown that batch studies partition coefficient (Kd) is much greater than column studies partition coefficient and the retardation factor play a major role in transportation of UH biosurfactant.

6. Acknowledgement:

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7. References:

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