**Memorandum**

To: Deborah Sills

From: Joe Sangimino, John Aras

Date: September 24, 2013

Re: Lab 3 – Nonlinear Curve Fitting Lab

**OBJECTIVES**

The goal of this project was to assess the accuracy of two isotherm models fitted to sorption data. The engineers performed proper statistical tests to determine whether the linear or freundlich models were a more appropriate fit to the data.

**METHODS**

A sorption isotherm of chlordane was introduced to samples of chlordane in an attempt to reduce the concentrations of this insecticide. The sorption data provided consisted of three sets of dissolved oxygen measurements (mg/L) versus time. Kaleidograph was used in this assignment to efficiently plot the results of the sorption data fitted to isotherm trend lines. Three types of rate equations were fitted to the data: zero, first, and second order equations listed below respectively.

(1)

(2)

(3)

where r is the mass of adsorbed per mass of adsorbent at equilibrium (mg/g), is the concentration of adsorbate in the aqueous phase at equilibrium (mg/L), and k is the freundlich isotherm soil-water coefficient ((mg/g),(L/mg)).

In part 2 of the project, two isotherms were fitted to the sorption data to determine whether a linear or freundlich fit would more accurately describe the data trends. The linear and freundlich equations fitted to the data are below, respectively:

(4)

(5)

where in this case, q is the mass of adsorbed per mass of adsorbent at equilibrium (mg/g), C is the concentration of adsorbate in the aqueous phase at equilibrium (mg/L), K is the freundlich isotherm soil-water coefficient ((mg/g),(L/mg)), and 1/n is the Freundlich isotherm intensity parameter.

Three sets of the sorption data was analyzed, and the appropriately order equations were determined based on the root mean squared values provided by Kaleidograph. The fitted values of the reaction rate coefficient k were recorded.

**RESULTS AND DISCUSSION**

It was determined that the best fit to the sorption data was the freundlich equation which achieved a root mean squared very close to 1. The plot of this data fitted to a freundlich trendline are provided in figure 4 below. The freundlich isotherm soil-water coefficient and isotherm intensity parameter are provided in the plot.



Figure 1. Measured dissolved oxygen concentrations versus time.

The line represents a second order model fit.



Figure 2. Measured dissolved oxygen concentrations versus time.

The line represents a zero order model fit.



Figure 3. Measured dissolved oxygen concentrations versus time.

The line represents a first order model fit.



Figure 4. Measured dissolved chlordane concentration vs the adsorbed chlorade concentration. This is a Freundlich fitted curve.