

Summary Report of Batch Experiments Investigating the Sorption of TCE onto PT-1

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August 14, 2006**

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This report presents data from batch experiments studying the sorptive capacity of PT-1 sorbent to TCE solutions. Batch sorption experiments were performed by combining sorbent, aqueous TCE solution, and organic-free deionized (DI) water in 15-mL glass tubes. Sorbent mass used in each isotherm experiment was 0.3 g. The aqueous TCE solution was prepared at a concentration of 442 mg/L TCE. The aqueous TCE solution was mixed with DI water prior to contacting the sorbent materials in the following ratios: 100% (v/v) TCE solution; 80% TCE solution/20% DI water; 60% TCE solution/40% DI water; 40% TCE solution/60% DI water; 20% TCE solution/80% DI water.

The tubes were capped and shaken for 1 day at 23 ± 1 °C to allow sufficient time to reach equilibrium. The difference between the initial and final (equilibrium) TCE mass in the aqueous phase was considered equal to the mass sorbed to the solid phase. Samples were analyzed using gas chromatography.

The results of sorption experiments were fit to Langmuir, Freundlich or linear isotherm, as described by equations 1 to 3 respectively:

$$C_s = \frac{bC_e Q}{1 + bC_e} \quad (\text{eq.1})$$

$$C_s = K_f C_e^n \quad (\text{eq.2})$$

$$C_s = K_d \cdot C_e \quad (\text{eq.3})$$

where C_s = equilibrium sorbed metal concentration (mg/g), b (1/mg) and Q (mg/g) are fitted isotherm parameters, C_e (mg/L) is the equilibrium aqueous solute concentration and K_d = sorption distribution coefficient (L/g), K_f = Freundlich coefficient.

Results in this report are presented below.

Table 1. Estimated mass of TCE sorbed per mass of sorbent in mg/g, and percent basis.

	Initial Concentration (mg/L)	Equilibrium aqueous concentration (mg/L)	Equilibrium sorbed concentration (mg/g)	Percentage Sorbed (%)
PT-1_0	0.00	0.00	0.00	0.00
PT-1_1	93.61	9.81	3.64	0.36
PT-1_2	193.14	24.73	6.55	0.65
PT-1_3	278.68	50.79	11.22	1.12
PT-1_4	375.38	61.43	15.31	1.53
PT-1_5	470.74	77.35	19.12	1.91

Table 2. Estimated values for the sorption distribution coefficients for PT-1

Sorbent	Linear		Langmuir			Freundlich		
	K_d (L/g)	R²	Q (mg/g)	b (1/mg)	R²	K_f	1/n	R²
PT-1	0.244	0.989	4473	0.00005	0.989	0.310	0.941	0.989

The results obtained fit with high regression coefficients all the isotherm models tested. However, the linear tendency of the data agrees with previous research. Linear isotherms for non-polar compounds indicate that the sorption is caused by TCE partitioning between water and the organic matter phase formed by the long chain of quaternary ammonium cations

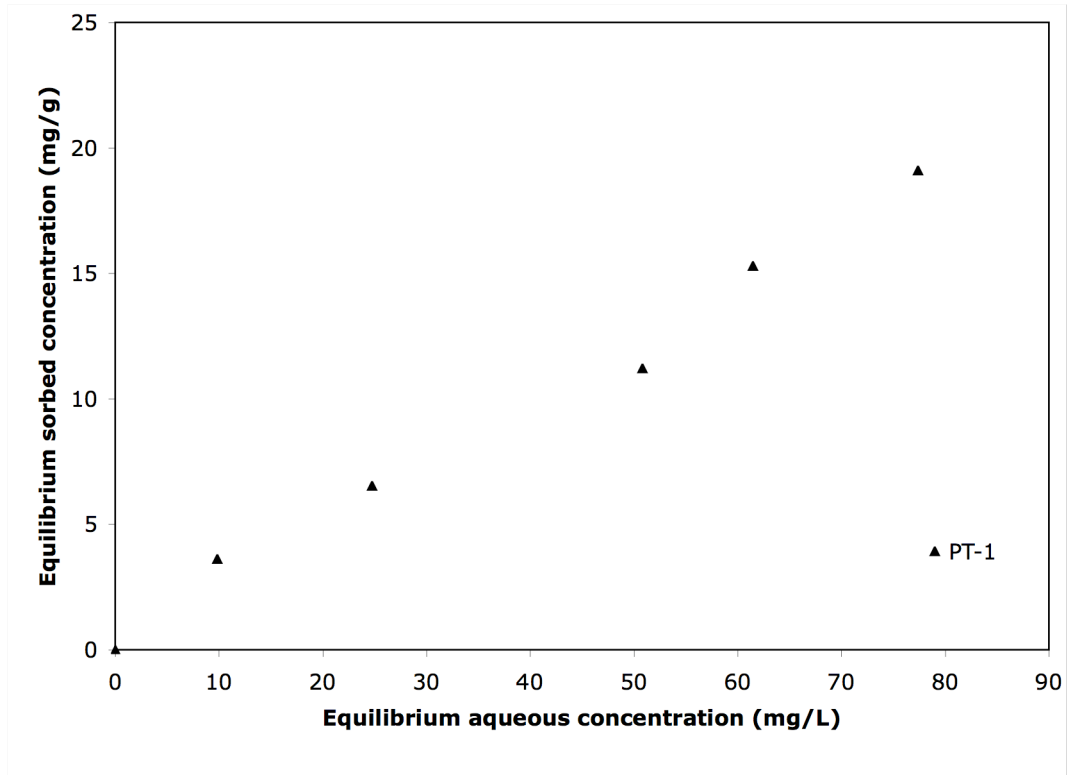


Figure 1. Sorption of TCE onto PT-1