Summary Report of Experiments Investigating the Sorption of Mercury (II) to Two Sorbents

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For

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This report presents data summarizing the results from one column and one batch experiment studying the sorptive capacity of TC-75 and PT-1, respectively, to an aqueous-mercury (II) solution. A 13-inch long (33.1 cm) by 1.5-inch diameter (3.8 cm) glass column was used and filled with the sorbent material to be studied. A peristaltic pump forced an aqueous solution containing in the range of 380-395 mg/L mercury (II) up through the column to displace void-space air and ensure maximum contact with the sorbent material. Samples were collected periodically at the outflow of the column and analyzed by atomic absorption spectroscopy.

Batch sorption experiments were performed by combining sorbent, aqueous mercury (II) solution, and organic-free deionized (DI) water in 15-mL polypropylene tubes. Sorbent mass used in each isotherm experiment was 0.1 g. The aqueous metal solutions were prepared at concentrations of 1000 mg/L mercury (II). The aqueous mercury (II) solution was mixed with DI water prior to contacting the sorbent materials in the following ratios: 100% (v/v) mercury (II) solution; 90% metal solution/10% DI water; 80% metal solution/20% DI water; 70% mercury (II) solution/30% DI water; 60% mercury (II) solution/40% DI water; 50% mercury (II) solution/50% DI water; 40% mercury (II) solution/60% DI water; 30% mercury (II) solution/70% DI water; 20% mercury (II) solution/10% DI water; 2% mercury (II) solution/98% DI water. The tubes were capped and shaken for 1 day at 23 ± 1 ºC to allow sufficient time to reach equilibrium. The difference between the initial and final (equilibrium) mercury mass in the aqueous phase was considered equal to the mass sorbed to the solid phase. Samples were analyzed by atomic absorption spectroscopy.

Results in this report are presented in Tables 1 and 2 and in Figures 1 to 3 as identified on the following pages.

Table 1. Sorbent mass, porosity, flow rate and residence time information for the TC-75 column experiment and sorbent mass for the PT-1 batch experiment.

Sorbent	Mass Sorbent		Porosity	Flow Rate		Residence
	(kg)	(lb)		(mL/min)	(gal/hr)	(min)
TC-75	0.105	0.232	0.32	6.0	0.097	20
PT-1	0.00012	0.00024	N.A	N.A	N.A	N.A

N.A: not applicable, the experiment was carried out in batch mode

Table 2. 95% breakthrough for the TC-75 column experiment given in pore volumes and minutes along with estimated mass of mercury sorbed per mass of sorbent in mg/kg, lb/lb and percent basis and mass of mercury sorbed per mass of sorbent for PT-1 batch experiments in mg/kg, lb/lb, and percent basis.

Sorbent	Breakthrough			Mass sorbed		Mass Sorbed/Mass Sorbent		
	PV	BV	min	(mg)	(lb)	(mg/kg)	(lb/lb)	(% by sorbent)
TC-75	102.5	32.8	2049	2567	0.0056	23334	0.0233	2.33
PT-1	N.A	N.A	N.A	4.65*	0.000001*	38750*	0.0388*	3.88*

N.A: not applicable, the experiment was carried out in batch mode.

***** Calculated from isotherm data.

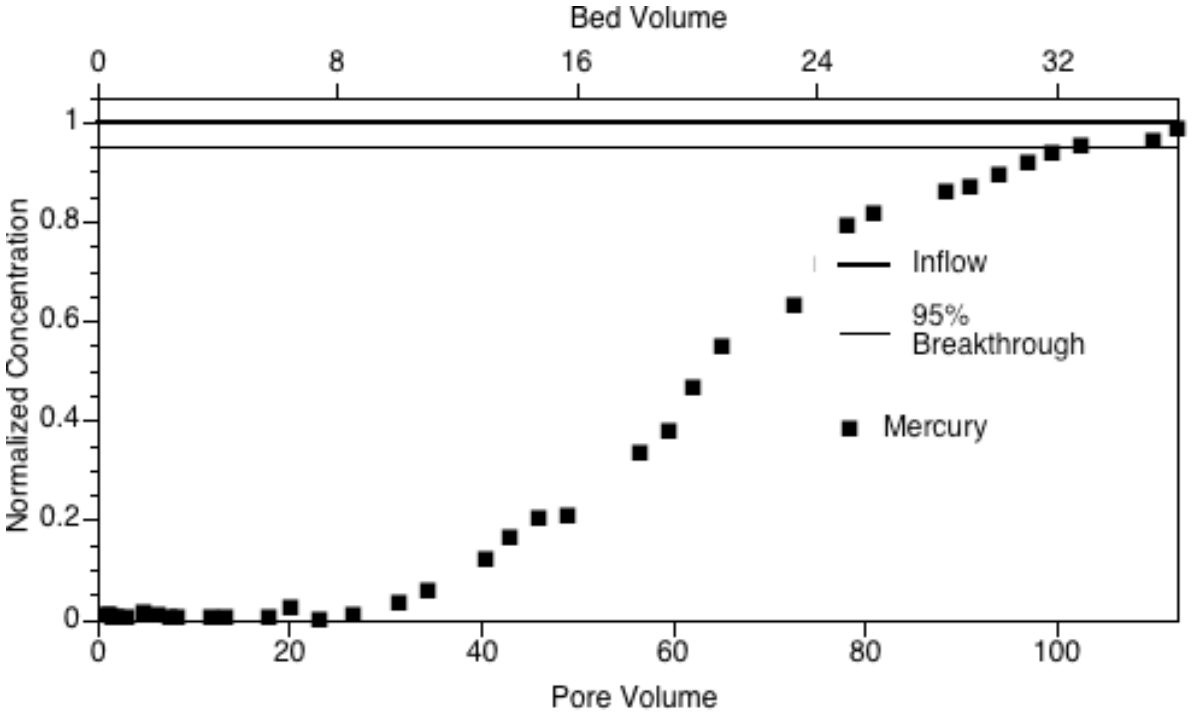

Figure 1. Breakthrough curve of mercury (II) through a column of TC-75

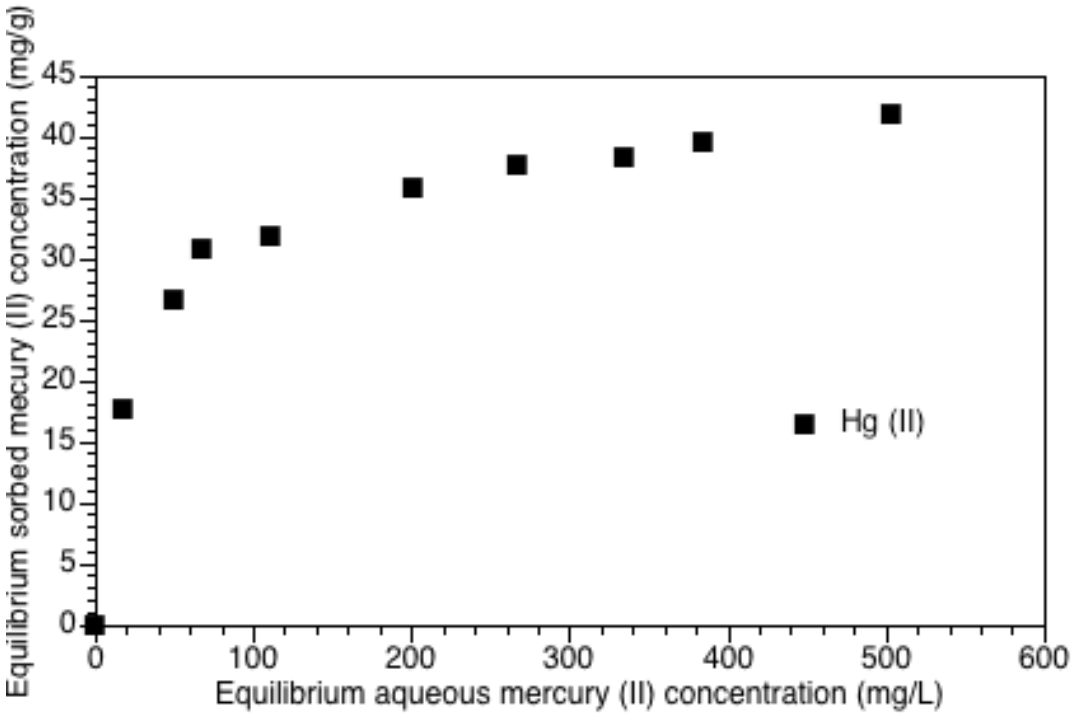

Figure 2. Isotherm for the sorption of mercury (II) to PT-1 (in terms of concentration.)

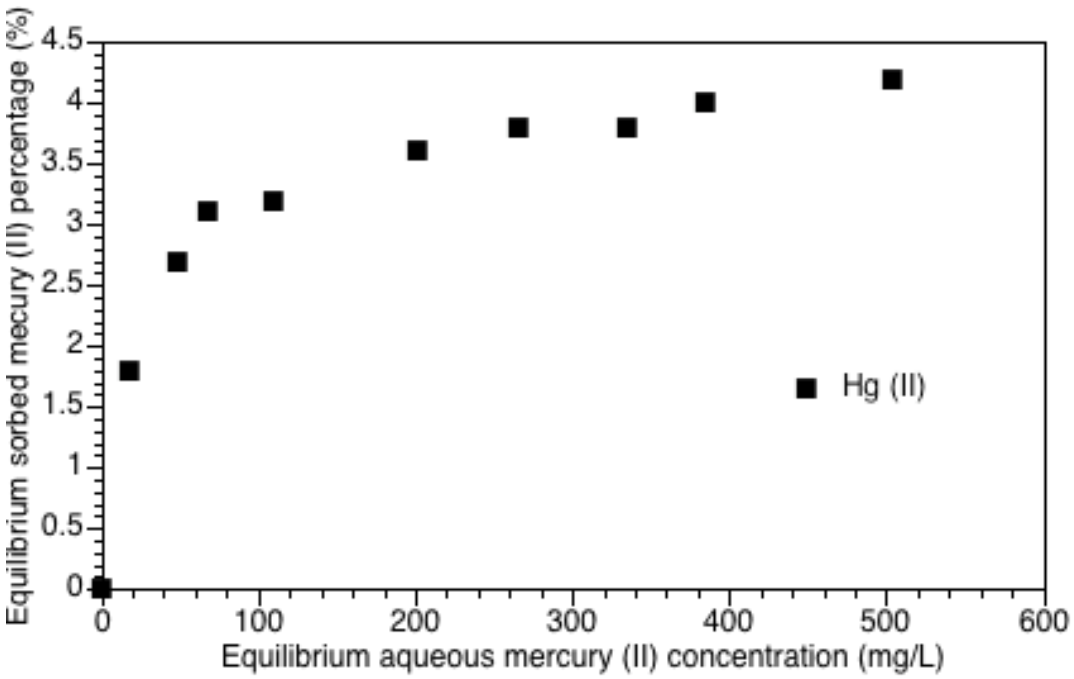

Figure 3. Isotherm for the sorption of mercury (II) to PT-1 (in terms of percentage.)