APPENDIX C. BATCH EQUILIBRIUM TESTS

Batch equilibrium tests were performed to determine whether or not the sodium chloride used in tracer experiments, such as the breakthrough experiment described in Chapter 7, would adsorb to the solids in the soil-bentonite. Since the predominant cation in the exchange complex of the bentonite was sodium, cation exchange was not a concern. The anticipated result of the batch equilibrium tests was that the chloride ions would not adsorb to the soil-bentonite; evidence from the literature (e.g., Shackelford, 1988) indicates that chloride ions do not adsorb to soil solids.

The main idea of a batch equilibrium test is as follows. A number of solutions of the chemical to be tested are prepared at varying concentrations. The solutions are then mixed with soil solids until the equilibrium degree of adsorption, if any, occurs. The concentrations of the chemical in the solutions are then measured and any decrease in mass of the chemicals in the solutions is assumed to be due to adsorption onto the soil solids, and sorbed concentrations can be calculated. A relationship is then established between the equilibrium aqueous concentration of the chemical and the sorbed concentration of the chemical.

For the batch equilibrium tests performed in this study, solutions of sodium chloride and Price's Fork water (PFW) were mixed at six different concentrations. Samples of 200 g were taken of each solution, and the electrical conductivity of each sample was measured. The linear relationship between concentration and electrical conductivity is shown in Figure C-1. Then, 50 g of oven-dried soil bentonite (1% bentonite) was added to each sample and the samples were mixed in a mechanical shaker for a period of 48 hours. Finally, the samples were centrifuged to separate the solids, and the electrical conductivity of the supernatant was measured.

If chloride adsorbs to the soil-bentonite solids, then the specific conductance in aqueous solution would change from its initial value. In Figure C-1, the specific conductance of the solutions is shown both before and after addition of the soil-bentonite and mixing. The specific conductance measured at zero sodium chloride concentration was due to other ions in the PFW. There is no change in specific conductance, indicating that the aqueous concentration of sodium chloride does not change. This indicates that no adsorption of sodium chloride occurred.

The batch equilibrium tests confirmed that adsorption of sodium chloride would not occur in tracer experiments with the soil-bentonite.

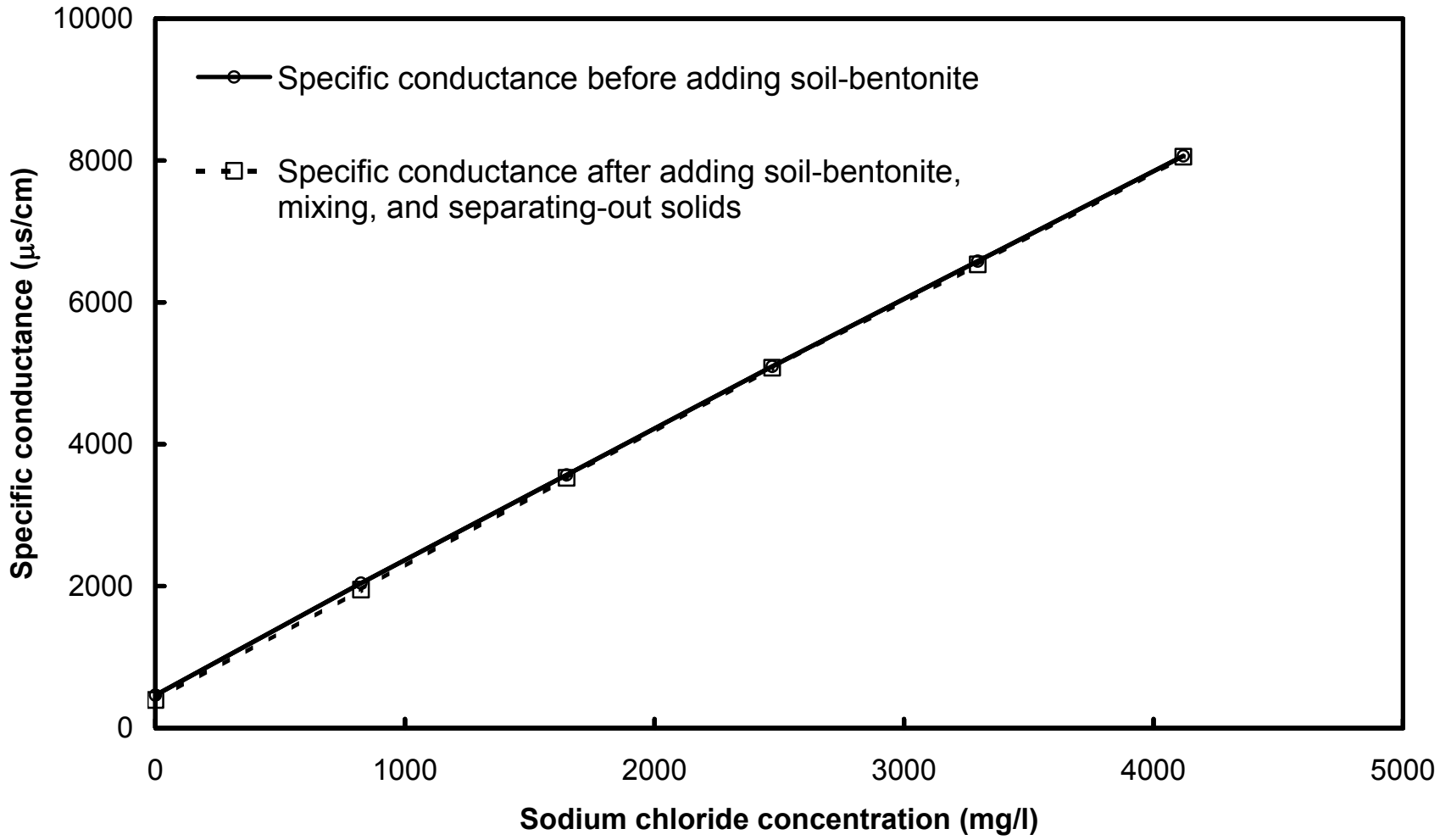

Figure C-1. Batch equilibrium tests