Sorption of Antibacterial Compounds, Penicillin and Triclosan, to Clays: Implications for Removal of Pharmaceuticals from Aqueous Systems

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The effect of TCS contamination in the environment is not understood. TCS sorption between antibiotic contamination and the proliferation of antibiotic-resistant bacteria. Triclosan (TCS) (SIGMA 72779, CAS 3380-34-5; FW =289.54) solutions of four concentrations, 8000ppm serially diluted to ~1000ppm, were prepared in a buffered mixture of pH 7.4 (HHepes+NaOH; I= 0.005M) and 0.2M Sodium Lauryl Sulfate (SLS) to create a solution in standard batch mixing experiments with montmorillonite (MM) (Wards #26), illite (IL) (Wards #36) and kaolinite (KA) (Wards #9). Sorption results are given in Figure 6.

Ampicillin sorption to Montmorillonite (MM) and Illite (IL) Six concentrations of AMP, ranging from 8000ppm to ~1000ppm, were prepared in a mixture of pH 7.4 (HHepes+NaOH; I= 0.005M) and 0.2M Sodium Lauryl Sulfate (SLS) to create a standard batch mixing experiment with MM, IL and KA. Sorption results are given in Figure 4.

Figure 4: Ampicillin Sorption to Illite (IL)

Figure 5: Ampicillin Sorption to Montmorillonite (MM)

The results reported in this poster are part of a larger investigation to determine if the soil absorption of β-diketones and the antibiotic triclosan is enhanced, inhibited, or unaffected by the presence of clay. The data will be important input parameters for future studies of the fate of these compounds in the environment.

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References


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3. Sorption is pH dependent with most sorption occurring at pH 2, 4 and 6 (cationic and zwitterionic AMP). The amount of AMP sorption to MM and IL is similar for both clays, and if the data are linearized for pH 2, 4 and 6, the isotherms are parallel to each other.

Isotherms generated from the experimental data show some preliminary observations regarding AMP sorption to MM and IL:

2. The amount of sorption of AMP to MM and IL is similar for both clays, and if the data are linearized for pH 2, 4 and 6, the isotherms are parallel to each other.

1. Buffered TCS solutions containing sodium lauryl sulfate appear to expand the average d-spacing of montmorillonite’s repetitive spacing due to ethylene glycol treatment. Less expansion was observed for the sample of TCS+SLS that was not treated with ethylene glycol.

The batch isotherm and mixing experiments performed to date support the following preliminary conclusions:

1. Buffer TCS solutions containing sodium lauryl sulfate appear to expand the average d-spacing of montmorillonite’s repetitive spacing due to ethylene glycol treatment. Less expansion was observed for the sample of TCS+SLS that was not treated with ethylene glycol.

2. The amount of sorption of AMP to MM and IL is similar for both clays, and if the data are linearized for pH 2, 4 and 6, the isotherms are parallel to each other.

3. Sorption is pH dependent with most sorption occurring at pH 2, 4 and 6 (cationic and zwitterionic AMP). The amount of AMP sorption to MM and IL is similar for both clays, and if the data are linearized for pH 2, 4 and 6, the isotherms are parallel to each other.

4. Sorption of AMP to MM and IL catalyzes the hydrolysis of AMP, while KA has a negligible effect in comparison to standard and control experiments.