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Experimental study of Human Adenoviruses interactions with clays

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Clays are used to establish low permeability liners in landfills, sewage lagoons, water retention ponds, golf course ponds, and hazardous waste sites. Human adenoviruses (HAdVs) are waterborne viruses which have been used as viral indicators of fecal pollution. The objective of this study was to investigate the survival of HAdV in static and dynamic clay systems. The clays used as a model were crystalline aluminosilicates: kaolinite and bentonite. The adsorption and survival of HAdVs onto these clays were characterized at two different controlled temperatures (4 and 25^o C) under static and dynamic batch conditions. Control tubes, in the absence of clay, were used to monitor virus inactivation due to factors other than adsorption to clays (e.g. inactivation or sorption onto the tubes walls). For both static and dynamic batch experiments, samples were collected for a maximum period of seven days. This seven day time – period was determined to be sufficient for the virus-clay systems to reach equilibrium. To infer the presence of infectious HAdV particles, all samples were treated with Dnase and the extraction of viral nucleid acid was performed using a commercial viral RNA kit. All samples were analyzed by Real – Time PCR which was used to quantify viral particles in clays. Samples were also tested for virus infectivity by A549 cell cultures. Exposure time intervals in the range of seven days (0.50-144 hours) resulted in a load reduction of 0.74 to 2.96 logs for kaolinite and a reduction of 0.89 to 2.92 for bentonite. Furthermore, virus survival was higher onto bentonite than kaolinite ($p<0.005$). The experimental results of this work indicate that viruses were systematically more persistent at 4^o C than at 25^o C onto both clays ($p<0.005$). The adsorption of HAdV onto both clays increase with increasing time and it is higher in dynamic experiments ($P<0.005$). The increased reduction of waterborne viruses by their contact with clays systems could play an important role in the prevention of viral waterborne diseases.