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Virus inactivation in the presence of quartz sand under static and dynamic batch conditions

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Virus inactivation is one of the most important factors that controls virus fate and transport in the subsurface. In this study the inactivation of viruses in the presence of soil was examined. The bacteriophages MS2 and Φ174 were used as model viruses. Experiments were performed at 4 °C and 20 °C, under constant controlled conditions, to investigate the effect of virus type, temperature, soil particle size, and initial virus concentration on virus inactivation. The experimental virus inactivation data were satisfactorily represented by a pseudo-first order expression with time-dependent rate coefficients. Furthermore, the results indicated that virus inactivation was substantially affected by the ambient temperature and initial virus concentration. The inactivation rate of MS2 was shown to be greater than that of Φ174. However, the greatest inactivation was observed for MS2 without the presence of sand, at 20 °C. Sand surfaces offered protection against inactivation especially under static conditions. However, no obvious relationship between soil particle size and virus inactivation could be established from the experimental data. Moreover, the inactivation rates were shown to increase with decreasing virus concentration.