INACTIVATION RATES OF COLIPHAGES ISOLATED FROM WASTE WATER TREATMENT PLANT EFFLUENTS IN GEORGIA

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Coliphages are a type of host-specific bacteriophages that infect E. coli and are found abundantly in the gut of animals, including humans. Coliphages share many structural similarities with viruses and are being evaluated as indicators for the presence of enteric viral contamination of water sources. Many studies have looked at solar inactivation rates of coliphages as one of the most significant factors affecting their fate in surface waters. Direct inactivation by solar irradiation of MS2 (an fRNA, male-specific coliphage) and Phi-X 174 (a somatic coliphage) have been well-documented; however, these surrogate indicators are not always present in all sources of fecal contamination or may not behave the same as a mixed community. The objective of our study is to obtain accurate inactivation rates for community coliphages to be able to model the transport of these alternative indicators from point sources into surface waters. Community somatic and fRNA coliphages were isolated from primary waste water treatment plant (WWTP) effluents discharging in a tributary of the South Fork Broad River in Comer, Georgia and irradiated using a full sun solar simulator. Photoinactivation was described using first order rate constants that were calculated using the enumerated phage decay rates (Log Ct/C0). MS2, Phi-X 174, community somatic and fRNA coliphage decayed at -0.88, -4.57, -3.90, and -3.06 logs/hour, respectively. Phi-X 174 exhibited the greatest rate of decay, with community somatic exhibiting a similar decay rate ($p = 0.009$). Community fRNA decayed approximately 3 times as fast as MS2 in the solar simulator, indicating that MS2 may not be a good surrogate indicator ($p<0.001$) for this community. Samples from Comer WWTP contained 720 PFU/mL somatic and 166 PFU/mL fRNA community coliphage, with respective die off of 0.73 hours and 0.85 hours at the surface. Although both community somatic and fRNA show similar inactivation rates, fRNA coliphages are more resistant to solar inactivation indicating the potential for longer survival times in rivers impacted by WWTP effluents.

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