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Inactivation of indicator bacteria from various sources of fecal contamination in seawater and freshwater

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ABSTRACT

The survival of indicator microorganisms in aquatic systems is affected by both biotic and abiotic factors. Relatively little work in this field has been conducted on the wide variety of sources of microorganisms by using naturally occurring inoculants of microorganisms for study. Rates of inactivation of water quality indicators, total coliforms, *E. coli*, enterococci, and male-specific coliphage were studied in three week-long, factorially designed experiments using three different inoculants: sewage influent (to simulate a sewage spill), treated sewage effluent (to simulate chronic sewage discharges), and dry-weather urban runoff (to simulate non-point source discharges). Rates of inactivation were studied by examining the effects of temperature, nutrients, total suspended solids, initial bacterial load, and solar radiation in both natural fresh and seawater exposure matrices. Our results demonstrated that temperature and solar radiation had significant effects upon rates of inactivation (ANOVA, $p < 0.001$). These inactivation rates were similar, regardless of the inoculant type. Enterococci consistently degraded the slowest under dark conditions with a T90 of 115-121 h and 144-177 h at 20°C and 14°C, respectively. When incubated in sunlight, enterococci was inactivated significantly more rapidly than either *E. coli* or male-specific coliphage ($p < 0.001$). Enterococci T90s increased to 8-10 h when either low (wintertime) or high (summertime) solar radiation was applied. None of the other parameters that were examined had significant effects on inactivation rates ($p > 0.05$).

Full Text

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