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Modelling inactivation rates of indicator microorganisms based on laboratory determinations of T_{90} for different temperature and salinity levels

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ABSTRACT

In coastal areas, treated or pre-treated domestic wastewaters are commonly discharged into marine environment through outfall systems as a final disposal application. The main parameters used to design a marine outfall system are; treatment level, length of outfall manifold and discharge depth. One major aim is to preserve seawater quality especially in sensitive areas where aquaculture and recreational activities take place. It is vital to comply with the bathing water quality standards in such areas to protect public health against water borne diseases originated from pathogens. In this manner, it is very important to define the case specific bacterial inactivation rates and/or the time needed to inactive 90% of bacteria (T_{90}) in design of marine outfall systems. In this study, T_{90} values have been determined for four different temperatures to represent different seasonal conditions in the Mediterranean Sea. The experiments were conducted in dark at 16 °C, 20 °C, 24 °C and 28 °C with wastewater inoculated seawater samples with different salinity levels between 20 ppt and 40 ppt. The selected temperatures represent the mean seasonal seawater temperatures in the bay of Antalya, located on the Turkish Mediterranean coast. The dark conditions represent a common case of submerged wastewater field below Secchi depth that is commonly observed in many deep sea outfall systems located along the coastal area. The seawater samples were taken from an offshore location in Antalya Bay and the inoculated wastewater was from a domestic wastewater treatment plant. T_{90} values have been determined for faecal coliform (FC) bacteria which are commonly used as bacteriological indicators in seawater. Multiple linear regression analysis was applied to develop a model to predict T_{90} values for different salinity and temperature levels.

Keywords: Bacterial inactivation; Marine outfall; Salinity; T_{90}; Temperature

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