

The tools for designing chemical disinfection solutions of combined sewer overflows - DesiCSO

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The tools for designing chemical disinfection solutions of combined sewer overflows - DesiCSO

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Abstract

Combined sewer overflows (CSOs) occur when it rains heavily and the hydraulic capacity of either the wastewater treatment plant or the collection of system that transports the combined flow of rain water and raw sewage to the wastewater treatment plant exceed. The excess flows tend to be discharged into receiving bodies nearby like sea, lake and river. CSOs contains a variable mixture of raw sewage, watershed runoff pollutants consists of variable pathogenic microorganisms, suspended solids, chemicals and floatable materials which adversely impacts on the quality of receiving water bodies and cannot used for recreational activities e.g. bathing. Namely the frequent loss of bathing water quality (blue flag) has a significant economic impact.

The existing solutions to loss of bathing water quality are capital intensive solutions either to constructing retention basins, very long seawater outlet pipes or UV disinfection systems at the point of CSO release. With increasing recreational use of surface waters close to cities and increased frequencies of substantial CSO releases from intensive rain events the very capital intensive solutions are difficult to apply due to the high number of installations which are required. Alternative solution which requires a low initial investment could be chemical disinfections which are known from treatment of many other types of water. However, general design parameters for the use of disinfection chemical in CSO are not available.

In this work we determined the main parameters needed to design disinfection systems for CSO overflows for four disinfectants (peracetic acid, performic acid, chlorine dioxide, sodium hypochlorite) that may potentially be applied for CSO.

Model CSO water for experiments was created by diluting raw sewage (5, 15 and 40 %) with demineralised water based on the correlation of the ammonium concentration in the CSOs profile described on literature.

Analytical methods were either adopted or developed for the chemicals used in CSO water. With the analytical methods concentration profiles (with time) of each chemical in different qualities of CSO and pH were recorded.

The efficiency of each chemical in removing the indicator organisms mentioned the EU bathing water directive were determined. Finally the risk of toxic effects from the use of the chemicals and ecotoxicity analysis of treated effluents were evaluated.

The influences of initial concentrations and contact times on the removal of indicator organisms, on residual biocide and on by-products formation were compared among four disinfectants. The disinfection effect of Performic acid (PFA) on indicator organisms was superior to rest of the disinfectants and this chemical also appeared to less toxic among other chemicals.

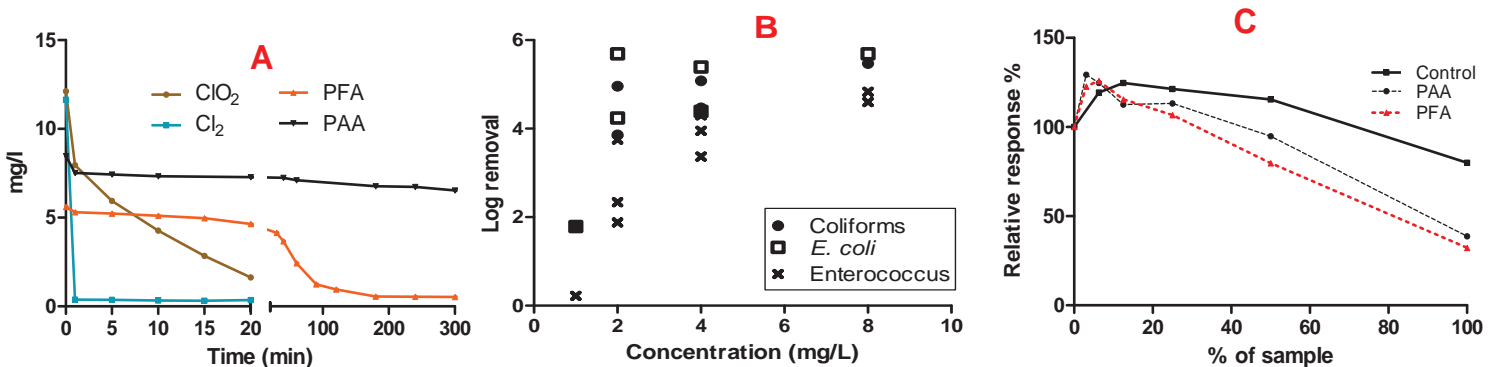


Figure 1: A) Concentration profiles (with time) effect of four chemicals in model CSO (15% raw wastewater). B) Disinfection by performic acid of indicator organisms. C) Toxicity to *Vibrio fischeri* after chemical treatment of model CSO (15% raw wastewater).

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