Abstract

Bacillus subtilis's spore and *E. coli* removal from hospital wastewater was studied by using chlorination, ultraviolet (UV)-C disinfection, and TiO_2 photocatalyst in batch and continuous – flow reactors. The photocatalyst was prepare by coating 5 wt.% Degussa P 25 TiO_2 suspension onto two 6"x 8" glass plates and irradiated with UV-A light (365 nm) at the radiation intensity of 1.72 ± 0.02 mW/cm^2 and 3.94 ± 0.03 mW/cm^2 Hydrogen peroxide in a concentration of 14, 42, 70, 110, 150, 226, or 300 mM was also added into the wastewater. For UV-C disinfection, 254 nm lamps with the radiation intensity of 2.1 ± 0.01 mW/cm^2 or 4.55 ± 0.02 mW/cm^2 were replaced and H_2O_2 was not added to the wastewater. In case of chlorination, 0.5-1 ppm of $C_3Cl_3N_3O_3$ solution was applied to the contaminated wastewater. In each set of the experiment, the wastewater was pipetted to cultivate the colony of *B. subtilis* and *E. coli* at the initial time and every 30 minutes for 3 hours using plate count technique. The efficiencies of *B. subtilis* spore and *E. coli* removals from each method were obtained by comparing the remaining colony with the initial colony.

The results showed that the chlorine residual of 1 ppm could disinfect 89.74% of *E. coli* within 30 minutes, but could not disinfect *B. subtilis* spore even though the concentration was increased to 100 ppm. However UV-C photolysis intensity of 2.1 ± 0.01 mW/cm^2 could inactivate 100% of *B. subtilis* spores within 120 minutes and using less time (60 minutes) when the UV-C intensity was increased to 4.55 ± 0.02 mW/cm^2. In TiO_2 photocatalysis, the more concentration of H_2O_2, the higher removal efficiency was obtained. When using 2.17 g/L TiO_2, UV-A intensity of 3.94 ± 0.03 mW/cm^2, and H_2O_2 concentration of 226 mM, *B. subtilis* spore was removed at 91% within 30 minutes, but at radiation intensity of 1.72 ± 0.02 mW/cm^2, *B. subtilis* spore removal was decreased to 71% .

Keywords : Titanium dioxide; Hydrogen peroxide; Ultraviolet-C; Photocatalysis; *Bacillus subtilis*; *E. coli*