



Removal of bacteria and *Cryptosporidium* from water by micelle–montmorillonite complexes

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ABSTRACT

This study aimed at testing the application of nano-composites of micelle–montmorillonite for removal of bacteria and parasites from water. The suitability of these complexes for efficient adsorption of microorganisms was expected on account of their large surface areas, large excess of positive charge, and existence of large hydrophobic domains. Tests included removal from water of bacteria: Gram negative (*Escherichia coli* K-12), Gram positive (*Bacillus megaterium*), and a protozoan parasite, *Cryptosporidium parvum*. Micelles of the organic cations Benzyldimethylhexadecylammonium (BDMHDA), or Octadecyltrimethylammonium complexed with the clay-mineral montmorillonite were shown to reduce by 3–6 orders of magnitude the numbers of microorganisms in water as tested in suspension and by filters (20 cm in length) packed with the complexes mixed with excess sand (100:1, w/w). Respiration tests demonstrated that *E. coli* K-12 cells adsorbed to micelle (BDMHDA)–montmorillonite complex lost their viability. Kinetics of filtration of *E. coli* by two filters in series was adequately simulated by a model which considers convection, adsorption, and desorption. Filtration of *E. coli* K-12 cells demonstrated that they stayed adsorbed and inactivated by the complex within the column filter without re-growth in water. These results suggest that filters including micelle–montmorillonite composites can secure the safety of drinking water in case of threatening increases in the number of pathogenic microorganisms in the water.

Keywords: Water treatment; Micelle-montmorillonite; Bacteria; *Cryptosporidium*; Adsorption; Filtration

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