Effects of Pipe Materials on Biofilm Microbial Communities in Drinking Water Distribution System

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ABSTRACT

The effects of pipe materials on biofilm accumulation and water quality were measured by heterotrophic plate count (HPC) and PCR-DGGE. The annular reactors with the sample coupons of four pipe materials (iron, copper, stainless steel, and PVC) were operated under hydraulic condition similar to real plumbing system for 14 months. HPC of biofilm was about 100 times higher on iron pipe than other pipes throughout the experiment. During the first 120 days, copper pipe showed the lowest number of HPC, but thereafter HPC increased with progression of pipe corrosion, and thus STS pipe recorded the lowest microbial number at the latter half of experiment. Analysis of the 16S rDNA sequences of 176 cultivated isolates revealed that 66.5% was *Proteobacteria* and the others included Unclassified bacteria, *Actinobacteria*, and *Bacilli*. Regardless of the pipe materials, *Sphingomonas* was the predominant species in all biofilms. *Methylobacterium* was the major species on pipes of corrosive materials, while Drinking water bacterium was predominant on pipes of noncorrosive materials. PCR-DGGE analysis showed that iron and copper pipes exhibited higher microbial diversity than STS pipe. The DGGE profile of biofilm on PVC was much different from those of the metallic materials. The results suggest that STS pipe is the best material for plumbing systems in terms of microbiological aspects of the water quality.

Keywords : Pipe materials, Biofilm, PCR-DGGE, 16S rDNA sequences, Annular reactors.