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Particulate matter outflow and behavior in ultrapure water pipelines

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ABSTRACT

In the current study, the outflow and behavior of particulate matter through the operation of ultrapure water pipelines were investigated. Various ultrapure pipe materials such as Polyvinylidene fluoride(PVDF), and Chlorinated Polyvinyl Chloride (CPVC) materials as well as conventional materials such as Stainless steel (SUS), and polyvinyl chloride (CPVC) were selected for particle outflow under various aquatic conditions. For the experiments, a cylindrical glass pipe as a negative control pipe and polyvinyl chloride (PVC) as a positive control pipe were used to elute the particulate matter settling in the test water. Experiments were conducted by filling ultrapure water into each pipes and submerging them into water baths for temperature control. The migration potential (MP) experiment was used to analyze the amount of assimilated organic matter efflux through the pipe elution test, and the particulate matter efflux evaluation was analyzed using dynamic light scatter and nano particle tracking analysis system. The results showed that the highest TOC leakage was found in PVC, the drinking water pipe among the selected samples (0.3 mg TOC/cm^2), and the TOC concentration in SUS samples was 1.75 times higher than CPVC. CPVC exhibited lower TOC migration than even the selected glass control sample (<0.15 mg/cm^2), and a similar trend was observed for particle counts of particulate matter in ultrapure water pipelines, with the exception of PVC. Additionally PVDF also showed a high TOC leakage second to PVC, indicating a high potential for bacterial growth. SUS showed the highest significant particle number and the largest average particle size among the samples (186.2 nm). Aligned with the TOC leakage results, bacterial growth showed the highest results from the PVC pipelines. Additionally after cell growth occurred on the pipe surfaces, the cells were wasted off and particle outflow was tested to show that along with PVC, CPVC also showed a high particle outflow after cells inhibited the pipe surface.

REFERENCES

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