水質分析

聚氯乙烯管釋出塑膠微粒潛勢之研究：以臭氧、自由餘氯以及熱進行加速試驗老化

Release of microplastics from poly(vinyl chloride) pipes: an accelerated aging study using ozone, chlorine and high temperature

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摘要

Microplastics are small plastic particles with a size ranging from 1 μm-5 mm. These tiny plastic fragments are typically generated from the degradation of plastic products due to complex environmental interactions. Microplastics have been detected in most aquatic systems, including ocean, river and even drinking water. In Taiwan, polyvinyl chloride (PVC) pipe that are widely used in the water treatment facility and distribution system for the drinking water system are potential sources of microplastics. Microplastics may cause adverse effects in ecological and human health. The potential hazard of microplastics release due to aging should be investigated. In this study, the effects of ozonation, chlorination and heating on the aging and release of microplastics from PVC pipes are investigated.

The release of microplastics increased with increasing exposure of ozone, chlorine and temperature. The highest release of microplastics was found to be 1,058, 1,256 and 1,303 # L^{-1} after aging in 30 mg O_3 L^{-1}, 260 mg Cl_2 L^{-1} and 80^oC, respectively. The size distribution (1-10 μm, 10-50 μm, and >50 μm) of released microplastics was investigated. The release of microplastics with a size in the range of 10-50 and >50 μm increased with increasing exposure of chlorine while those in size of 1-10 μm was not significantly changed. On the other hand, the size composition of released microplastics due to exposure of ozone and heat tended to maintain constant. The different surface morphologies were observed under different aging conditions. The carbonyl index (CI) of PVC pipes generally increased with enhanced aging with ozone, chlorine and heating. The formation of carbonyl functional groups on the surfaces may result in the surface roughness and ultimately lead to the detachments of microplastics from aged PVC pipes.

關鍵字：聚氯乙烯管、臭氧、自由餘氯、熱

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