

Research and Development Projects

ECF Project:	ECF 2020-76
Project Title:	Identification, characterisation, and process modification for enhancing removal efficiency of microplastics in sewage treatment works with different designs in Hong Kong
Principal Investigator:	Dr Tsang Yiu Fai, Department of Science and Environmental Studies, The Education University of Hong Kong
Total Approved Grant:	\$1,000,000
Duration:	30/04/2021 to 30/10/2023
Project Status/Remarks:	Completed
Project Scope:	<p>In recent years, microplastics (MPs) have frequently been detected in the raw sewage and treated effluent from sewage treatment works (STWs), which have been identified as one of the largest sources of MPs in the water environment. Due to the continuous discharge of treated effluent and the increasing application of waste sludge, MPs have reached different ecosystems. In this project, reliable and rapid MP analytical protocols will be developed and validated to investigate the removal efficiency of MPs in local STWs with different designs. The findings will –</p> <ol style="list-style-type: none"> (a). Clarify the mechanisms of efficiency deterioration and microbial inhibition in various wastewater treatment systems due to the presence of MP; (b). Evaluate the potential environmental risks of the associated toxic chemicals and adsorbed contaminants of MPs; and (c). Modify the existing designs of wastewater treatment systems for enhancing MP removal performance and mitigating MP-induced inhibition for potential real applications. <p>This understanding will provide a reference for developing cost-effective wastewater treatment processes for realising stable and efficient MP removal in full-scale STWs. The research outputs will also enable wastewater engineers and policy regulators to gain a better understanding of the overall impact of the MP presence in STWs and their environmental risks.</p>
Summary of the Findings/Outcomes:	<p>This study aimed to identify and characterise microplastics (MPs) in three local sewage treatment works (STWs) with different treatment levels and process designs. Rapid quantification of MPs was developed and validated to obtain a reliable MP mass in wastewater. The developed method saved 75% of time and 60% of cost to quantify the MPs in samples, compared to conventional methods. This is first comprehensive study to examine MP mass and MP particle concentrations simultaneously. The MP abundance in screened effluent ranged from 16.5 to 69.6 items/L, and 4.0 to 19.3 items/L of MPs were found in treated effluent, representing an overall removal efficiency of 61.0% in Stonecutters Island STWs. In Shew Wu Hui STWs, the MP abundance in screened effluent ranged from 36.8 to 119.3 items/L,</p>

	<p>and 1.0 to 5.8 items/L of MPs were found in treated effluent, representing an overall removal efficiency of 94.5%. In Ngong Ping STWs, the MP abundance in screened effluent ranged from 15.5 to 70.0 items/L, and 0.8 to 4.5 items/L of MPs were found in treated effluent, representing an overall removal efficiency of 86.9%. Based on MP abundance in each treated effluent, the potential ecological risks of MPs to the aquatic environment is low.</p>
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