

Qualitative Identification of Microplastics: A Preliminary Study Using Fourier-transform Infrared (FTIR) Spectroscopy

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Abstract

The prevailing of microplastics draws a great deal of concern due to their negative impacts to the environment. The environmental microplastics usually consist of several chemical constituents, and classifying these constituents is important for subsequent pollution control and risk management. In the literature the environmental microplastics were often analyzed as a whole by measuring their total weight and particle number. In contrast, this study employed Fourier-transform infrared (FTIR) spectroscopy to identify the polymer constituents of the tested microplastics, using polyethylene terephthalate (PET), polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC) and nylon (NY) as the model plastic polymers. Mixtures containing different tested microplastics were analyzed. For a given tested plastic in a plastic mixture, its apparent signals may be interfered or masked by the reflection of another coexisting plastics. Therefore, uniqueness in FTIR signal for each tested plastic becomes critical if each plastic constituent shall be identified. By comparing the FTIR signals from the plastic sample containing multi-component polymers, the characteristic wave number of each test sample was established according to its obtained FTIR spectrum. The FTIR spectra enabled the identification of their respective plastic constituents. In



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addition, real samples obtained from a selected industry and the ambience were employed to examine the applicability of the proposed identification procedure. This study demonstrated the FTIR application to identifying microplastic constituents by proposing a systematic operating procedure.

Keywords: Microplastics, FTIR, Analytical procedure, Qualitative analysis

Biography

Dr. Chihhao Fan is a professor of the Department of Bioenvironmental Systems Engineering, National Taiwan University. He received his Ph. D. in Civil Engineering from Purdue University in 1997. He was a postdoctoral fellow at the Hydrotech Research Institute of National Taiwan University right after receiving his Ph. D. degree. After working one year with Nation Taiwan University, he decided to work with the Taiwan Environmental Protection Administration as an environmental engineer. In 2000, Dr. Fan joined Ming Chi University of Technology as a faculty member, and he transferred to National Taiwan University in 2015. Dr. Fan's main research areas include watershed management, water/wastewater treatment, environmental chemistry, water resource management. He conducted more than 60 projects in these related areas, and currently, he has been serving as a board member of several government committees. He currently also serves as the managing editor of *Paddy and Water Environment*.