

國立臺灣海洋大學
海洋環境與生態研究所 專題討論

題目：荷蘭瓦登海的奈米塑膠和超細微塑膠—隱藏的塑膠碎片？

英文題目：Nanoplastics and ultrafine microplastic in the Dutch Wadden Sea –
The hidden plastics debris?

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Abstract

Plastic pollution in the marine environment has been identified as a global problem; different polymer types and fragment sizes have been detected across all marine regions, from sea ice to the equator and the surface to the deep sea. However, quantification of marine plastics debris in the size range of nanoplastics ($<1\ \mu\text{m}$) and ultrafine microplastics ($<10\ \mu\text{m}$) is not constrained, because such minuscule particles are challenging to measure. In this work, we applied a novel analytical assay using Thermal Desorption – Proton Transfer Reaction – Mass Spectrometry (TD-PTR-MS), which is suitable to detect and identify plastics in the nanogram range. From two stations in the Wadden Sea (the Netherlands), we measured nanoplastics directly from seawater aliquots, and from filters with different mesh sizes. Our results show the presence of Polystyrene (PS) and Polyethylene terephthalate (PET) nanoplastics as well as ultrafine microplastics in the Wadden Sea water column. The mass concentration of PS nanoplastics was $4.2\ \mu\text{g/L}$ on average, indicating a substantial contribution of nanoplastics to the Wadden Sea's total plastic budget.

中文摘要

海洋環境中的塑膠污染已被認為是一個全球性問題，在所有海洋區域如海冰到赤道，甚至從海洋表面到深海，都檢測到了不同尺寸及種類的塑膠。然而，在定量海洋中的奈米塑膠 ($<1\ \mu\text{m}$) 和超細微塑膠 ($<10\ \mu\text{m}$) 時則受到了限制，因為這種微小的顆粒很難被測量。在這篇研究中，作者結合熱脫附質子轉移反應質譜儀 (TD-PTR-MS) 開發了新的塑膠分析方法，適用於檢測及定量奈克範圍的奈米塑膠及超細微塑膠。進一步於荷蘭瓦登海的兩個測站採樣，分析未濃縮海水以及經過不同網目濃縮與分級之樣品，最後以質譜儀做奈米及超細微塑膠的鑑定及量化。此研究結果顯示，瓦登海中存在聚苯乙烯 (PS) 和聚對苯二甲酸乙二醇酯 (PET) 的奈米塑膠和超細微塑膠顆粒。平均而言，PS 奈米塑膠之質量濃度平均為 $4.2\ \mu\text{g/L}$ ，間接表明奈米塑膠佔瓦登海中塑膠總量的很大比例。