

# Micro- and nanoplastics in wastewater treatment systems and receiving waters

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## Introduction

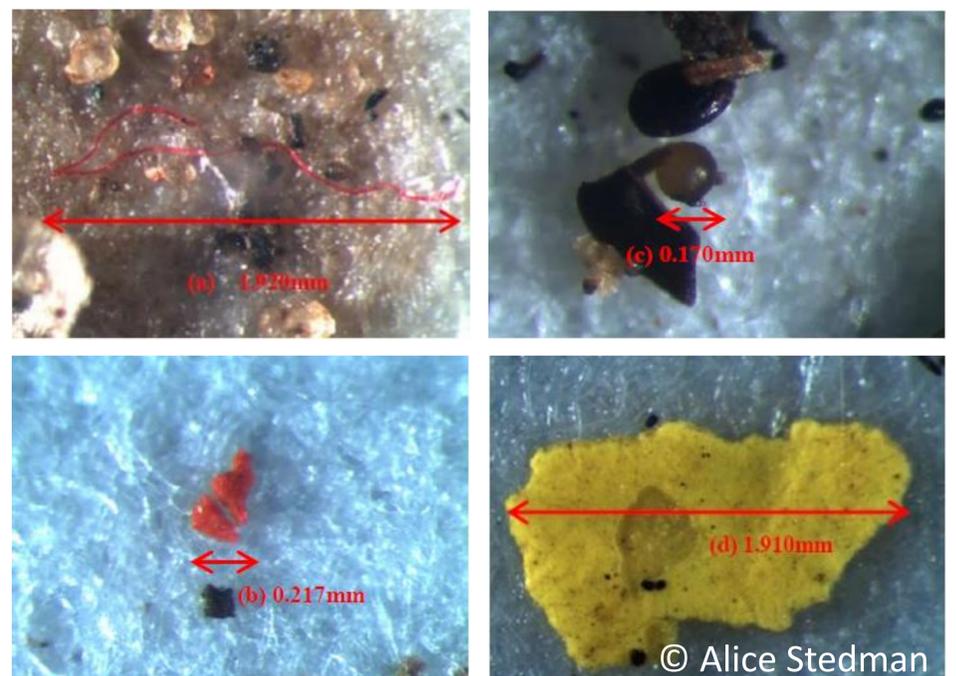
- Plastic pollution is widespread and persistent; and, of growing concern are micro- and nanoplastics (MNPs) < 5 mm in size, originating from primary and secondary sources.
- MNPs can uptake and concentrate other pollutants, and are easily ingested by aquatic organisms, causing adverse physiological effects.
- MNPs are largely documented in oceans, but there is scarce knowledge in freshwaters.
- Management of land-based inputs is key, with effective strategies depending on a comprehensive understanding of source, distribution, transport, degradation, and removal of MNPs in freshwater and wastewater treatment (WWT) systems.
- **Primary aim:** Describe and model the behaviour of MNPs in WWT and fluvial systems.

## Methods

- There are no standardised procedures to measure and detect MNPs.
- **Proposed approach:**
  - Spatial sampling: WWT inflow and effluent; spatial sampling up- or downstream of effluent discharge
  - Sorting: size fraction sieving, density separation, filtration, visual sorting
  - Analytical techniques for source characterisation: electron microscopy (**Figure 1**) for particle structure and spectroscopy for chemical composition and degradation.
  - Impact: bacterial growth (COD, direct count); blockages in WWT system (sand column experiments)
  - Fate: Predict MNPs load to recipient water through transport models based on flow (e.g. Delft 3D)

## Expected Outcome

- Generate incisive understanding of the distribution and behaviour of MNPs in WWT and freshwater environments.
- Inform stakeholders (e.g. legislators, manufacturers, industry) to develop effective mitigation strategies.
- Relevance to Hydro Nation goals:
  - Connecting research and policy.
  - Developing the economic, environmental and social values of Scotland's water resources.
  - Raising Scotland's international profile; international knowledge exchange.



**Figure 1** Electron microscopy images of microplastics collected from the River Kelvin in Scotland (unpublished work)

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