Microplastic Retention by Integrated Constructed Wetlands

Richard Warren*†[1], Richard Cooper[1], Andrew Mayes[1], Kevin Hiscock[1], and Stefanie Nolte[1]

[1]University of East Anglia – Norwich Research Park Norwich NR4 7TJ, United Kingdom

Abstract

Despite complex technologies, conventional wastewater treatment processes do not remove 100 % of microplastics. Integrated constructed wetlands (ICWs) are a promising nature-based solution to cost-effectively enhance wastewater treatment and improve water quality while simultaneously providing wider biodiversity benefits. ICWs receive effluent from wastewater treatment plants, and thus act as an additional treatment layer. However, there is little knowledge concerning the ability of ICWs to retain microplastics, especially over a long duration.

To assess the microplastic retention efficiency of two ICWs (Ingoldisthorpe and Northrepps) in Norfolk, England, a 12-month field sampling campaign is underway. Water samples have been collected from the inlet and outlet of each wetland monthly for three months. At the Northrepps ICW, average microfiber concentrations at the inlet pipe (i.e., WWTP effluent) are 3.67 (SD 1.2) fibres/litre and 0.05 (SD 0.03) fibres/litre at the outlet. Current data therefore shows a 98.9 % microfiber retention rate at the Northrepps ICW. Of the 1108 microfibers identified so far, the composition of 218 have been confirmed by micro-ATR-FTIR: 53 % are plastic (89 % PET), 33 % are cellulosic, and 14 % are unknown. Most suspected plastics identified have been fibres, and all suspected microplastic fragments have been confirmed to be not of plastic origin by ATR-FTIR.

Future sampling will assess where in the wetlands microplastics are stored and the extent to which the subsurface vegetation 'net' traps plastics. Further, by sampling around heavy rainfall events, the extent of plastic resuspension and impacts of preferential flow pathways will be assessed. Currently 26 ICWs are planned for construction across the East of England as part of a £50 million project. The results of the present study are therefore intended to be of use to water companies responsible for this, and so far show that ICWs successfully retain microplastic fibres.

Keywords: Integrated Constructed Wetlands, Wastewater, Microfibers

*Speaker

†Corresponding author: richard.j.warren@uea.ac.uk