

The interaction between microplastics and suspended particulate matter

A.J. Wijdeveld¹, M. J.W. Blok², A. Markus¹, T. van Kessel¹, D. Vethaak¹

¹ Deltares, Boussinesqweg 1, 2629 HV Delft, The Netherlands

Arjan.Wijdeveld@deltares.nl / Arjen.Markus@deltares.nl / Thijs.van.Kessel@deltares.nl / Dick.Vethaak@deltares.nl

² Hogeschool Rotterdam, G.J. de Jonghweg 4 – 6, 3015 GG Rotterdam, michieltjw.blok@kpnmail.nl

Introduction: There is a large amount of plastics with particle sizes smaller than 1 mm (microplastics (MP's)) present in rivers flowing into the sea. In ports suspended particulate matter (SPM) carried by the river tends to settle, including the finer (<64 μm) fraction. The focus of this study was to study if the presence of MP's impacts the settling properties of SPM.

Methods: To study the impact of MP's on the SPM flocculation and settling, column tests were carried out for 48 hours on sediment from the port of Rotterdam. One of the more inland docking ports, the Maashaven (river sediments) was chosen. The Maashaven has a relative high (>70%) fraction with a grain size <64 μm . Two types of MP's were added (with a size of 10-20 μm and with a size of 63-75 μm). Since we could not exclude the presence of MP's in relative recent (last 5-10 years) sediment, older (estimated sedimentation age 10-20 years) sediment was also collected. All tests were done on both the recent and old sediment.

Results: Adding MP's to the sediment impacts the settling rate. Figure 1 gives an impression by looking at the amount of MP's that floated at the top of the settling column after 48 hours. The impact of MP's on settling was most pronounced in the old sediment. This is also reflected in the particle size distribution (Figure 2).

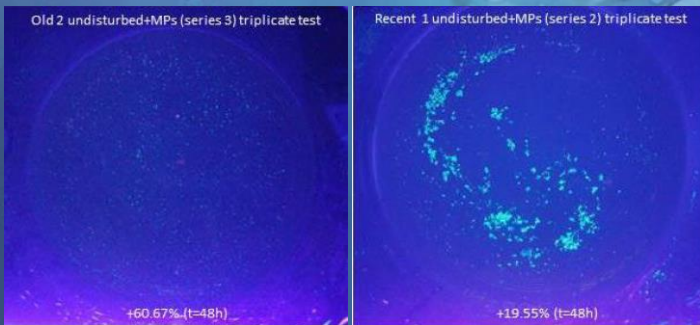


Figure 1 An overview of the floating MPs after 48 hours settling tests, left older sediment with MP, right recent sediment with MP

Discussion: MP's seem to enhance the settling rate of SPM, causing an increase in the sediment volumes to be dredged for harbors. Using the enhanced settling rate for SPM in a numerical model shows an increase in the settling volume in the main navigation channel, and a minimal impact on the sediment volume in the docking ports (Figure 3).

Most likely there is a balance between the MP concentration, the SPM load, the flow velocity and the bottom shear stress. This balance needs to be researched in more detail.

References: Michiel J.W. Blok (2018), The interaction between microplastics and suspended particulate matter, Method development and analysis to quantify the effects of microplastics on the sedimentation process in the Port of Rotterdam, Hogeschool Rotterdam.

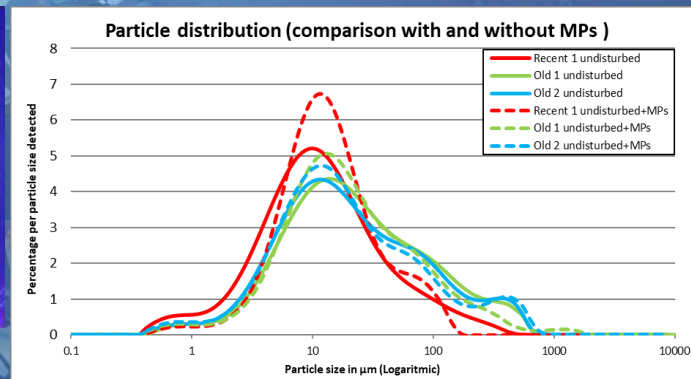


Figure 2 Impact of MP's on the particle size distribution

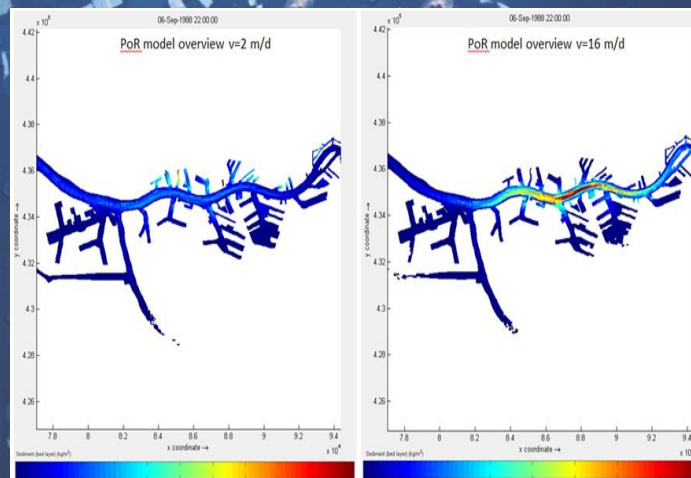


Figure 3 Translation of the impact of MP's on SMP settling in Port of Rotterdam, left without and right with MP's