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Microplastics and biogeochemical relationships in sediments from Skagerrak, Kattegat and Baltic Sea

This study is a first attempt in Denmark on assessing the presence of microplastics in our open & coastal waters from Baltic to North Sea.

The occurrence and impact of microplastics have in several national initial assessment for EU's Marine Strategy Framework Directive (MSFD)

been identified as a relevant indicator for describing "Good Environmental Status" (GES) for descriptor 10 on Marine Litter.

Microplastic particles in marine waters, which consist of synthetic polymer materials, origin mainly from secondary microplastics, i.e. fragments of litter like solid waste, fishing gear, paint flakes etc. from either sea- or land based sources.

Primary microplastics (engineered) are not expected to be as common as secondary microplastics.

Microplastics can origin from both local sources and from long-range transport with ocean or air currents.

Examples of microplastic fibres

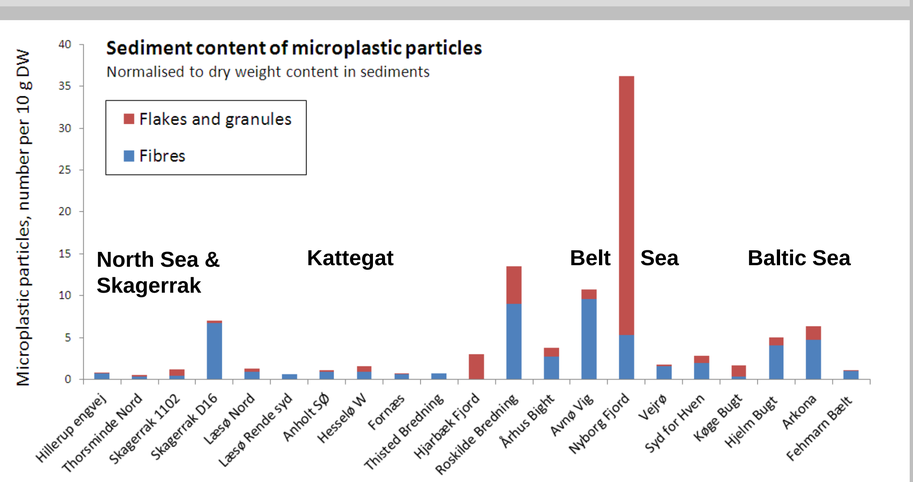
Sampling of sediments

have been coordinated with the national monitoring (NOVANA) of contaminants in Denmark in 2012 and an additional sampling campaign in 2013.

In addition to data for various contaminants groups in sediments, also data on general sediment characteristics are generated on the same samples.

Results

Microplastics were found in all samples and in the range of 0.6 – 36 particles pr 10 gram dry weight (DW) sediment.



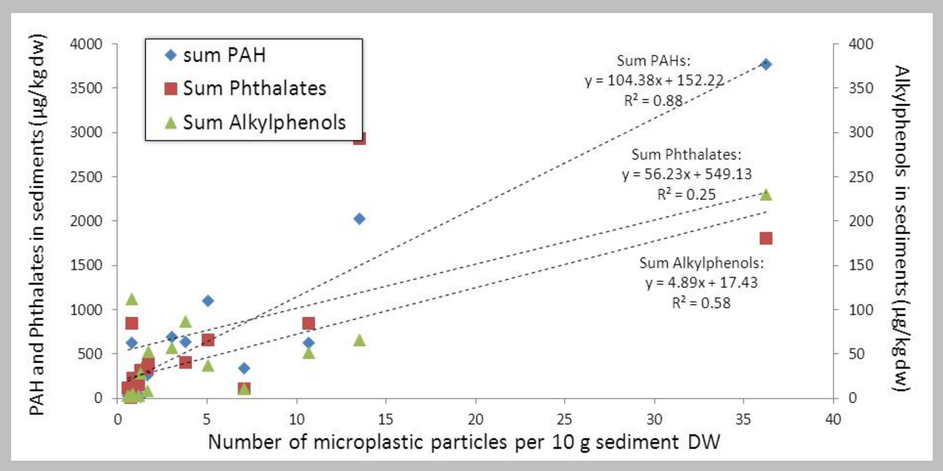
Normalisation to matter does matter !

Normalisation to adequate sediment characters can reduce the variability caused by natural heterogeneity between samples and increase the power of identifying more or less affected areas.

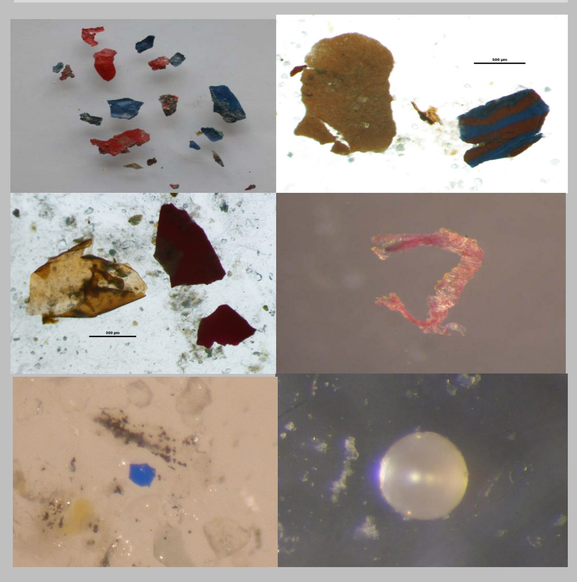
Strong relationships between the content of microplastics and both **%TOC** and fine fraction **(<63µm)** in sediments were found throughout the area

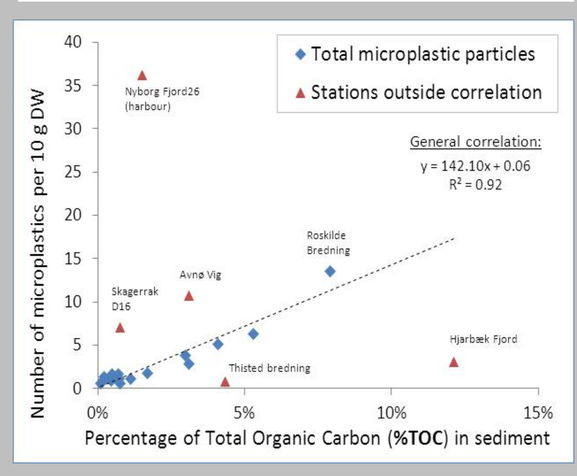
supporting that microplastic will accumulate in sedimentary depositional areas – i.e. with parallels to organic pollutants sorped to organic materials.

Strong correlations were also established to **PAH** and to lesser extent to **alkylphenols** & **phthalates** in sediments probably due to co-variation with sources and TOC.

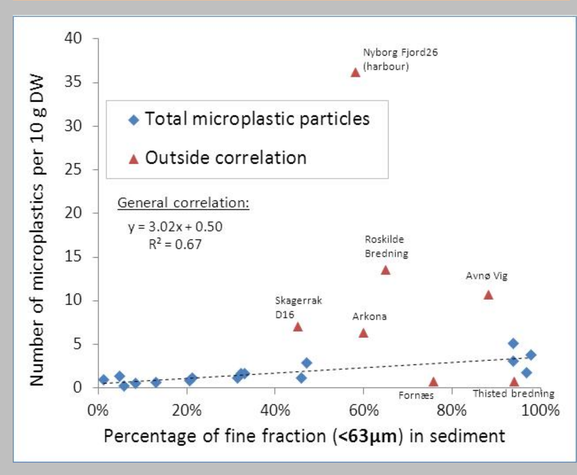


Examples of flakes/granules





Stations outside the general correlations to TOC or <63µm can better be identified as more or less affected areas



Characterisation of microplastic particles

Microplastic particles have been isolated from a100g sediment sample, which has been digested for 2 hours with 200 ml of solution with KOH and NaOCl for reducing the amounts of natural organic materials.

The remaining sample was when density-fractionated two times with saturated NaCl solution.

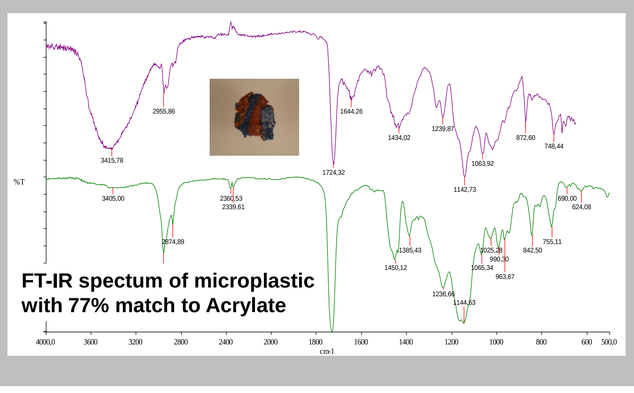
Particles were collected using sediment test sieves in following size fractions

I) 38 µm – 1 mm, II) 1 – 5 mm and **III) >5 mm**

Particles, regarded as of synthetic origin, were with microscope isolated, counted and characterized according to their colour and shape/structure, i.e. as fibres, flakes, granules or spherules.

FT-IR spectroscopy was applied to identify specific polymers in some selected flakes and granules with size larger than 0.5 x 0.5mm, i.e. fibres were too small to study. Particles of the polymers **polypropylene, acrylate**, and **polyester/alkyd** were identified.

About 50% of particles regarded as "uncertain origin" could not be matched on synthetic materials in our FT-IR database – and were probably of natural origin.



Conclusions:

Microplastic particles can be found in sediment in Danish waters and is a potential indicator for MSFD.

Normalisation to %TOC, or the <63µm fraction as a 2nd alternative, will improve spatial assessment.

Further studies are needed to identify the specific plastic polymers, sources and impact of microplastics.

This poster was presented at
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