A NEW, HIGHLY EFFICIENT METHOD FOR THE SEPARATION & QUANTIFICATION OF PLASTIC PARTICLES IN SEDIMENTS OF AQUATIC ECOSYSTEMS

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Introduction
Although plastic debris is constantly accumulating in aquatic environments, the impact on aquatic ecosystems is not yet fully understood. A first important step in order to assess the consequences of plastic debris in aquatic ecosystems is the establishment of a reliable, verified and standardized method to quantify the amount of plastic particles of ecologically relevant size classes.

Aims:
- Improvement of density separation methods regarding small microplastic particles (S-MPP, <1 mm)
- Successful separation and identification of mesoplatic particles (20 - 500 µm), large microplastic particles (L-MPP, 5 - 1 mm) and small microplastic particles (S-MPP, < 1 mm) down to 1 µm with respect to possible density alterations due to biodegrading and fouling.

Separated - Workflow

1. Sediment Samples
2. Particle Separation
   - Separation liquid in the MPSS (ZnCl₂, 1.6 - 1.7 kg/l)
   - Introduction of Sediment-sample
   - Mounting of dividing chamber
   - Introduction of fresh separation fluid
   - Plastic particles are carried with the rising fluid
3. Filtration
   - Attachment of filter holder with appropriate filter
   - Close Ball Valve
   - Detachment of Dividing chamber
   - Switch to Filter Mode
   - Vacuum filtration on a quartzfilter paper (0.3 µm)
4. Identification with Raman Microspectroscopy
   - Chemical oxidation of organic compounds (e.g. hydrogen peroxide in combination with sulfuric acid) on the filter.

Experimental Design & Results
Clean sediment samples, inoculated with plastic particles, separation with ZnCl₂

Recovery rates for Classical Density Separation (recent studies1,2)
A L-MPP (5 - 1 mm, numbers, N=3)
B S-MPP (1 mm - 1 µm, weight, N=3)

Recovery rates for the new Munich Plastic Sediment Separator - MPSS
A L-MPP (5 - 1 mm, numbers, N=3)
B S-MPP (1 mm - 1 µm, weight, N=3)

Summary
- Effective density separation of particles down to the µm range is achieved using the new MPSS with a ZnCl₂-solution (density 1.6 - 1.7 kg/l)
- For the first time: Verification with recovery rates for S-MPP & L-MPP including PVC & POM with highest specific density
- Reliable and rapid identification of different plastic particles and other micron sized particles

References

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Endnotes
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