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VALIDATION OF A DENSITY SEPARATION TECHNIQUE FOR THE RECOVERY OF MICROPLASTIC AND ITS USE ON MARINE & FRESHWATER SEDIMENTS.

MICRO2016, LANZAROTE

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Density Separation Validation

- Claessens et al., (2013) protocol (3:1)
- Brine solutions (4) & water
- Sediment (200-400 µm)
- MP size classes (200-600 µm)
- Different plastic types
- N=9, individually & mixture

### Plastics in validation test

<table>
<thead>
<tr>
<th>Plastic</th>
<th>Source</th>
<th>Density (g/cm-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High density Polyethelene (HDPE)</td>
<td>Air waves base</td>
<td>0.941 g/cm³</td>
</tr>
<tr>
<td>High density Polyethelene (HDPE)</td>
<td>Milk carton</td>
<td>0.941 g/cm³</td>
</tr>
<tr>
<td>Low density Polyethelene (LDPE)</td>
<td>Air waves lid</td>
<td>0.915–0.925 g/cm³</td>
</tr>
<tr>
<td>Nylon</td>
<td>Thread</td>
<td>1.13-1.15g/cm3</td>
</tr>
<tr>
<td>Polyethelene (PE)</td>
<td>Supermarket bag</td>
<td>0.926–0.940 g/cm³</td>
</tr>
<tr>
<td>Polyethelene terephthalate (PET)</td>
<td>Lucozade bottle</td>
<td>1.38 g/cm³</td>
</tr>
<tr>
<td>Polypropylene (PP)</td>
<td>Plastic container</td>
<td>0.855 -0.946g/cm3</td>
</tr>
<tr>
<td>Polystyrene (PS)</td>
<td>Coffee lid</td>
<td>0.946 g/cm3</td>
</tr>
<tr>
<td>Polystyrene (PS)</td>
<td>Plastic forks</td>
<td>0.946 g/cm3</td>
</tr>
<tr>
<td>Polyvinyl chloride (PVC) Un Plasticised</td>
<td>Window frame</td>
<td>1.35-1.45 g/cm3.</td>
</tr>
<tr>
<td>Polyvinyl chloride (PVC) Plasticised</td>
<td>Wire</td>
<td>1.35-1.45 g/cm3.</td>
</tr>
<tr>
<td>polyethylene (180µm)</td>
<td>sigma bottle</td>
<td>0.926–0.940 g/cm³</td>
</tr>
</tbody>
</table>

### Densities of Saturated Brines Solutions

<table>
<thead>
<tr>
<th>Solution</th>
<th>Density (g/cm-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>water</td>
<td>1.0032</td>
</tr>
<tr>
<td>NaCl</td>
<td>1.1708</td>
</tr>
<tr>
<td>NaBr</td>
<td>1.37</td>
</tr>
<tr>
<td>NaI</td>
<td>1.566</td>
</tr>
<tr>
<td>ZnBr2 (25%)</td>
<td>1.71</td>
</tr>
<tr>
<td>ZnBr2</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Validation results (n=9)

% MP Recovery

H2O NaCl NaBr NaI ZnBr2

PE (180um) PE PE (FW) PVC HDPE PET PS Nylon Mixed
Results: Validation Experiment

- H2O
- NaCl
- NaBr
- NaI
- ZnBr2

- % MP Recovery

- PE (180um)
- PE
- PE (FW)
- PVC
- HDPE
- PET
- PS
- Nylon

- Average Percentage
- Recovery (%)
Results: Environmental Samples

Freshwater MP / M$^3$

Marine MP / M$^3$

Map of Scotland showing locations…
Conclusion

• There are more efficient density solutions out there... ZnBr$_2$ is one of them.

• $\uparrow$ MP extraction efficiency, $\downarrow$ time

• Expensive to buy, but overall (including labour) cheaper
Other work...

• Scottish Microplastic Research Group - http://www.masts.ac.uk/research/masts-community-projects/scottish-microplastic-research-group/

• Fionn Murphy – Xlf (Thursday)

• Christopher Crawford – 1a