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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

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

Graph showing the % MP Recovery for PE, PE (180um), PE (FW), PVC, HDPE, PET, PS, Nylon, Mixed materials.
Results: Validation Experiment

- H2O, NaCl, NaBr, NaI, ZnBr2
- PE (180um), PE, PE (FW), PVC, HDPE, PET, PS, Nylon, Mixed

Graph showing % MP Recovery and Average Percentage Recovery (polyethylene, FFG, PVC Cable, PVC Unpl, Plastic fork, PET Strath bottle, PP Cont, Morrisons bag, Window)
Results: Environmental Samples

Freshwater MP / M³

Marine MP / M³

Map of Scotland showing locations…
Conclusion

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

• ↑ MP extraction efficiency, ↓ time

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

- Fionn Murphy – Xlf (Thursday)
- Christopher Crawford – 1a