Sampling, Extraction and Analysis of Microplastics
Challenges for Wastewater Treatment Plants

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TYPES OF PLASTICS

Most popular / commonly used plastics

- Polyethylene (PE)
- Acrylic Polymethyl methacrylate (PMMA nylon)
- Polyethylene Terephthalate (PET polyester)
- Polyvinyl Chloride (PVC)
- Polycarbonate (PC)
- Polypropylene (PP)
- Acrylonitrile-Butadiene-Styrene (ABS)
PLASTICS CAN BE SEPARATED INTO TWO BROAD GROUPS

**THERMOPLASTICS**
- Can be re-melted
- Recycled into new products
- Examples - polyvinyl chloride, polyethylene, polypropylene, nylon, polystyrene, polycarbonate etc.

**THERMOSETS**
- Are usually formed and cured as a final product in a single step
- Cannot be re-melted or returned to their pre-synthetic state.
- Examples - vulcanized rubber, acrylics, melamines, polyurethanes, epoxies, silicone etc.
Identification of Microplastics

- Visual sorting (microscope, magnifying glass etc.)
- Tactile probing using micro-spatulas
- Morphology (spheres, geometric features)
- Physical / chemical properties (density, deformity)
- Acidic Digestion / Enzyme digestion, and Oxidative cleanups
- FT-IR / Raman / GC-MS / Pyrolysis / NMR
Cospheric Microspheres
Microsphere Distribution in H₂O
Mixed Liquor Imhoff
Imhoff ML Settling Test (10 min)
Imhoff Settling (1 hour)
Microplastic Dispersion
Microspheres 300 µm on 246 µm mesh
Microspheres (45, 63, 106, 150) µm on 246 µm Mesh
Microplastic Spheres in H₂O
Microplastic Spheres in H₂O
Microplastic from toothpaste
Biofilm
Surface biofouling

L=429.55 µm

L=399.32 µm
MPPs - Fats – Oil - Grease
Fiber Residues

(a) Bio-residues collected in the 45 μm sieve at WRP 6 when viewed under high magnification, I: Testate Amoebae, II: filamentous bacteria, III: rotifer. (b) Filamentous bacteria in 45 μm sieve residues at WRP 6. (c) Comparative fabric fibers (lint type taken from domestic washing machines) using similar magnification for (b).
Conclusions

- Field blanks must be utilized throughout sampling and associative processes
- Commercial standard sources be available (NIST)
- Consensus on reporting units: count, mass
- Preparative manipulations could change counts
- Fibers and particulate residues will likely require separate cleanup / enumeration methods
- Methods should not be bounded by preconceived notions
- Orthodox analytical routines may not be transferable
Thank You

QUESTIONS ?