



USEPA Region 9 Progress Toward Standardized Method Development

Measuring Microplastics: Building Best Practices & Methods for Sampling, Extraction and Analysis

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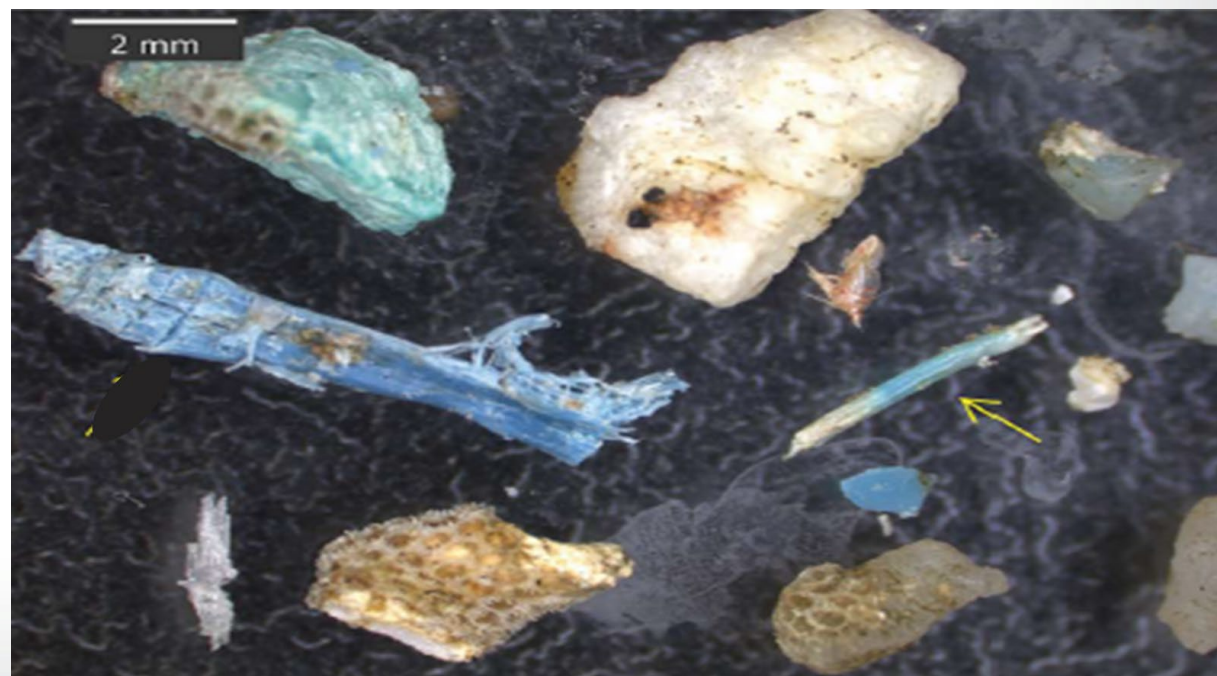
Partners:

California Department of Public Health – EHL

Amergent Techs

Pima County Regional Wastewater Reclamation Department

University of Arizona





Considerations when reporting microplastics sampling and analysis data.

- Particle sizes, including dimensions
- Particle shapes, recognizing the need for standardized terminology
- Polymer types
- Particle quantity, taking into account the choice of units (e.g., mass/volume, mass/area, particles/volume, particles/area)
- Detection limits for the sampling and analysis methods used.



Justin Keogh, University of Arizona



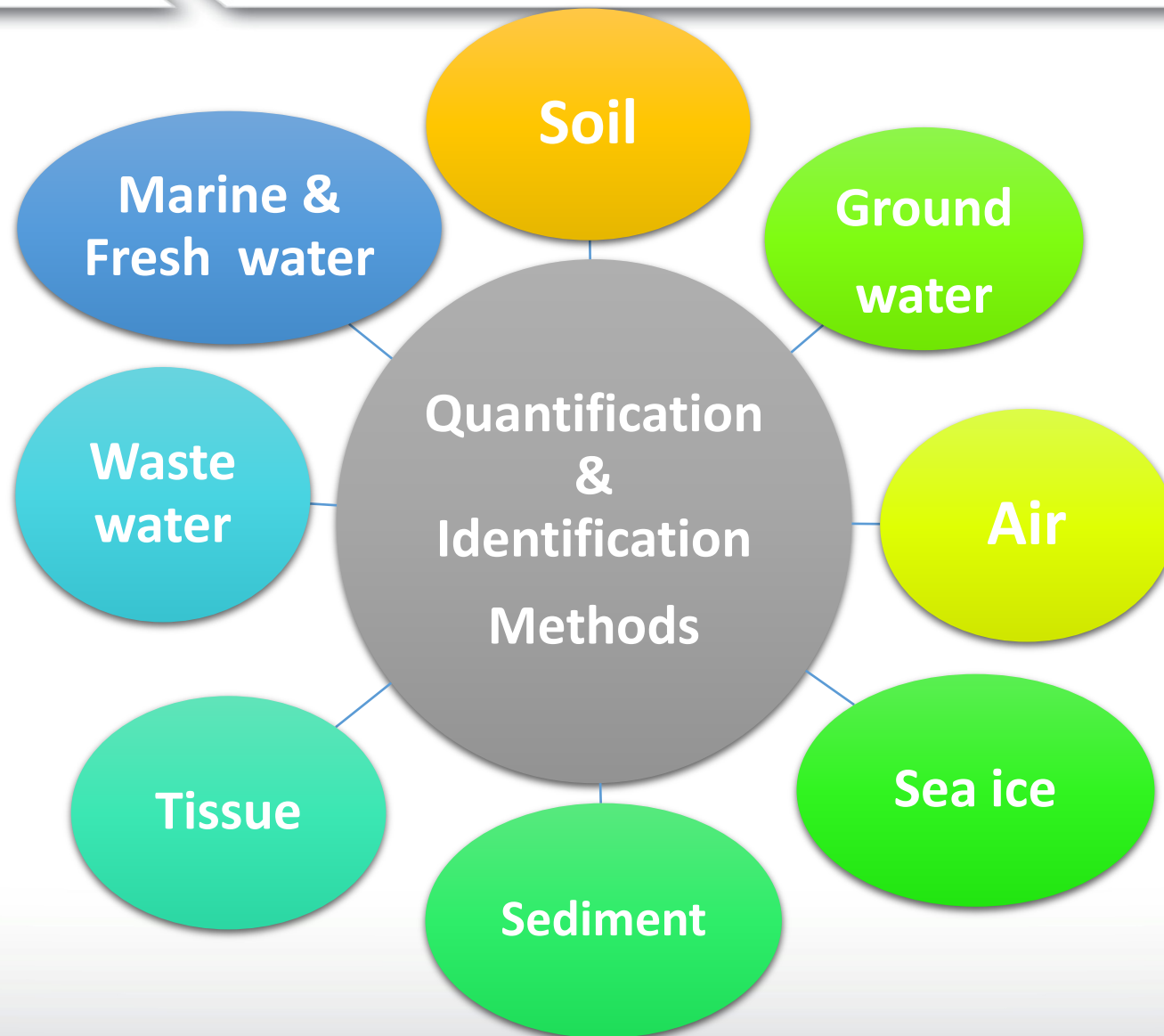
Environmental Media Harboring Microplastics

- **Air:** Limited studies worldwide report microplastics in indoor and outdoor dust samples and atmospheric fallout
- **Groundwater:** Generally a potential result of discharged wastewater treatment plant effluent into subterranean aquifers.
- **Marine and Fresh Water:** Majority of information on quantity and distribution gleaned from marine and surface water plankton nets for particles >333 µm.
- **Organism Tissue:** Microplastics have been found in stomachs and other parts of organism bodies.
- **Sea ice:** Limited studies report the occurrence and release of microplastics from Arctic sea ice.
- **Sediment:** Evidence of microplastic occurrence reported in limited studies.
- **Soils:** Limited studies show presence of microplastic from agricultural plastic and biosolids application.
- **Wastewater:** Concern and some evidence regarding the release of microfibers from clothes washing, lack of removal by typical secondary wastewater treatment and effluent discharge into domestic water supplies.
- Link: https://www.epa.gov/sites/production/files/2018-03/documents/microplastics_expert_workshop_report_final_12-4-17.pdf



Each environmental medium requires specific collection and preparation practices

Practices developed for collection and preparation of microplastics from surface water sources may be transferrable for drinking water assessment. Like air, drinking water may harbor nano-sized particles.



Air, perhaps more than other media, may harbor nano-sized particles necessitating additional new preparation practices and quantification & identification methods.

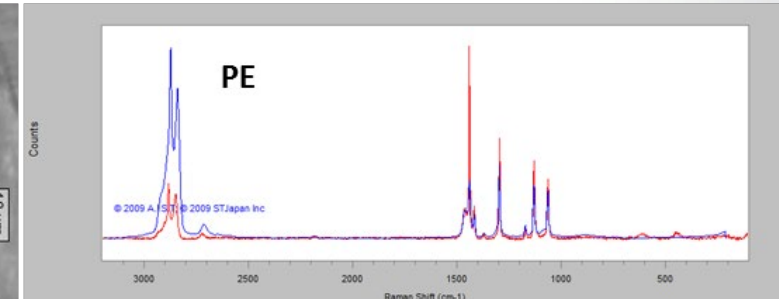
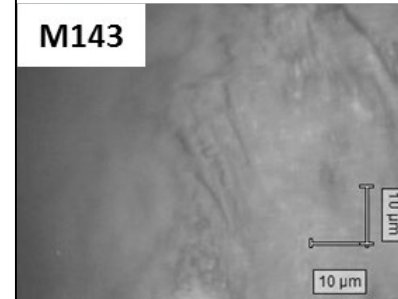
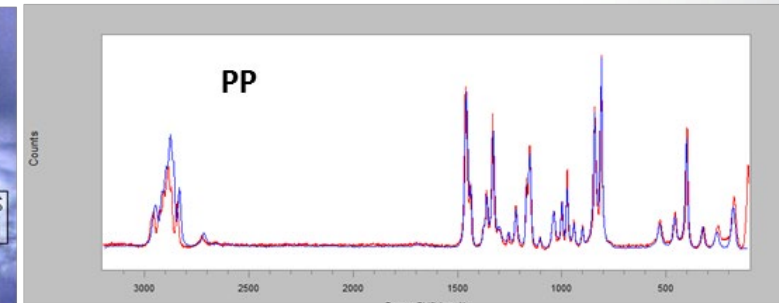
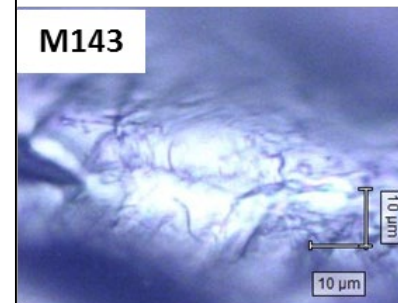
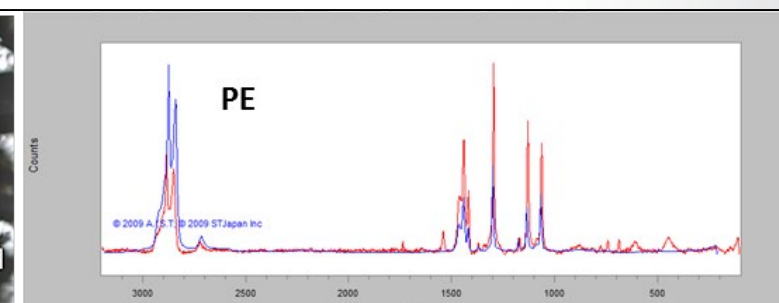
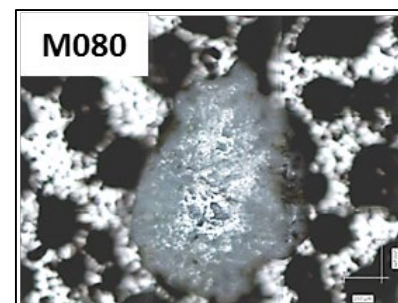
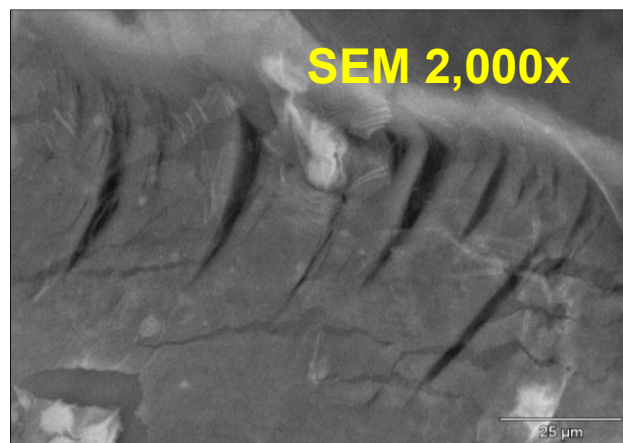
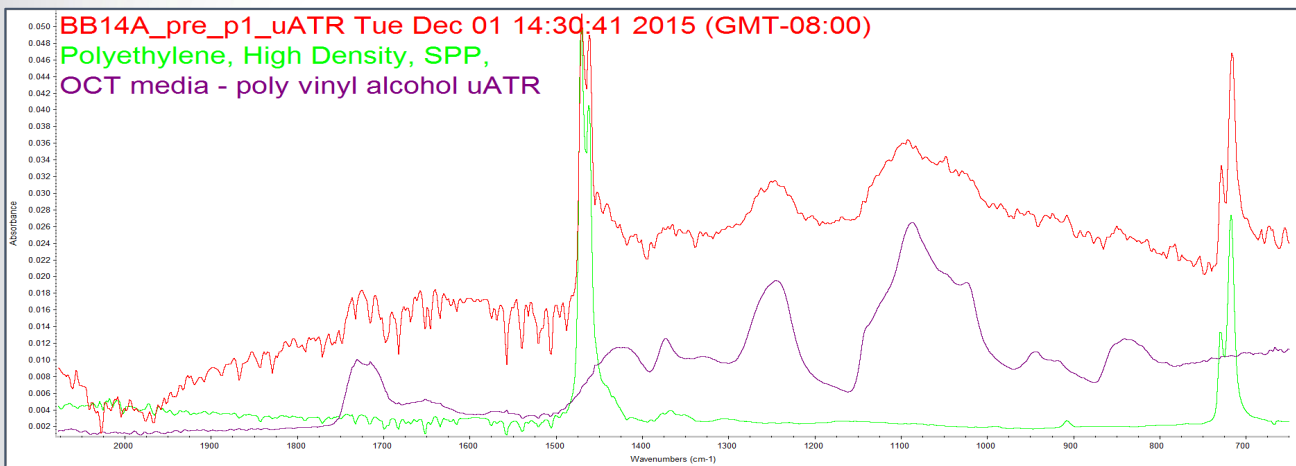


EPA Initial Standards Development: Lab Analytical Practices & Methods

- **Organism: microplastics in fish gut – non-destructive preparation practice completed by CDPH for EPA in January 2017**
- **Water Column: in process**
- **Waste Water: in process for 3 ASTM Practices and 1 ASTM Method**
 - **Influent**
 - **Effluent**
 - **Primary**
 - **Secondary**
 - **Tertiary**
- **Sediment: in process - completion of evaluation of current practices by October 2019**
- **Reference Samples: in process**



SEM, FTIR & Raman Images and Spectra of Microplastics in N. Pacific and S. Atlantic Myctophids

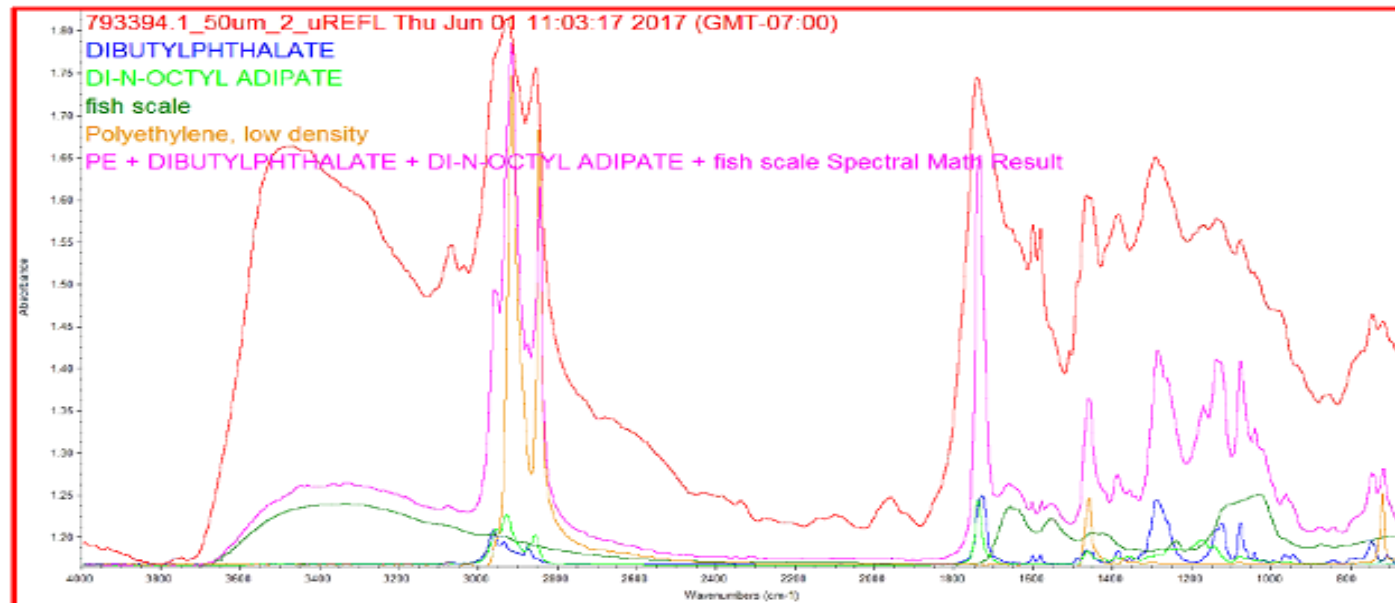
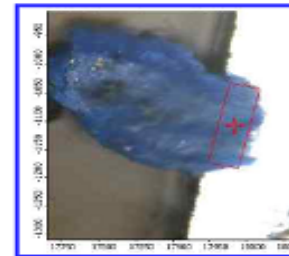


Sutapa Ghosal, Jeff Wagner, Zhong-Min Wang, and Stephen Wall
California Department of Public Health

Multi-trophic level study: Microplastic particles and prey identified in the stomach of Great Lakes sport fish

FTIR uREFL of microplastics in 50um-1mm fraction of GL fish #793394.1 smallmouth bass

- 300um PE + plasticizers (DBP + DOA) + fish proteins
- 75um PE + plasticizers (DBP + DOA) + fish proteins



Undigested prey items saved from stomachs of sport fish for later analysis of microplastic particles

Best Practice and Method Development

Collection:
Practice

Preparation:
Practice

Identification:
Method
(FTIR/Raman)

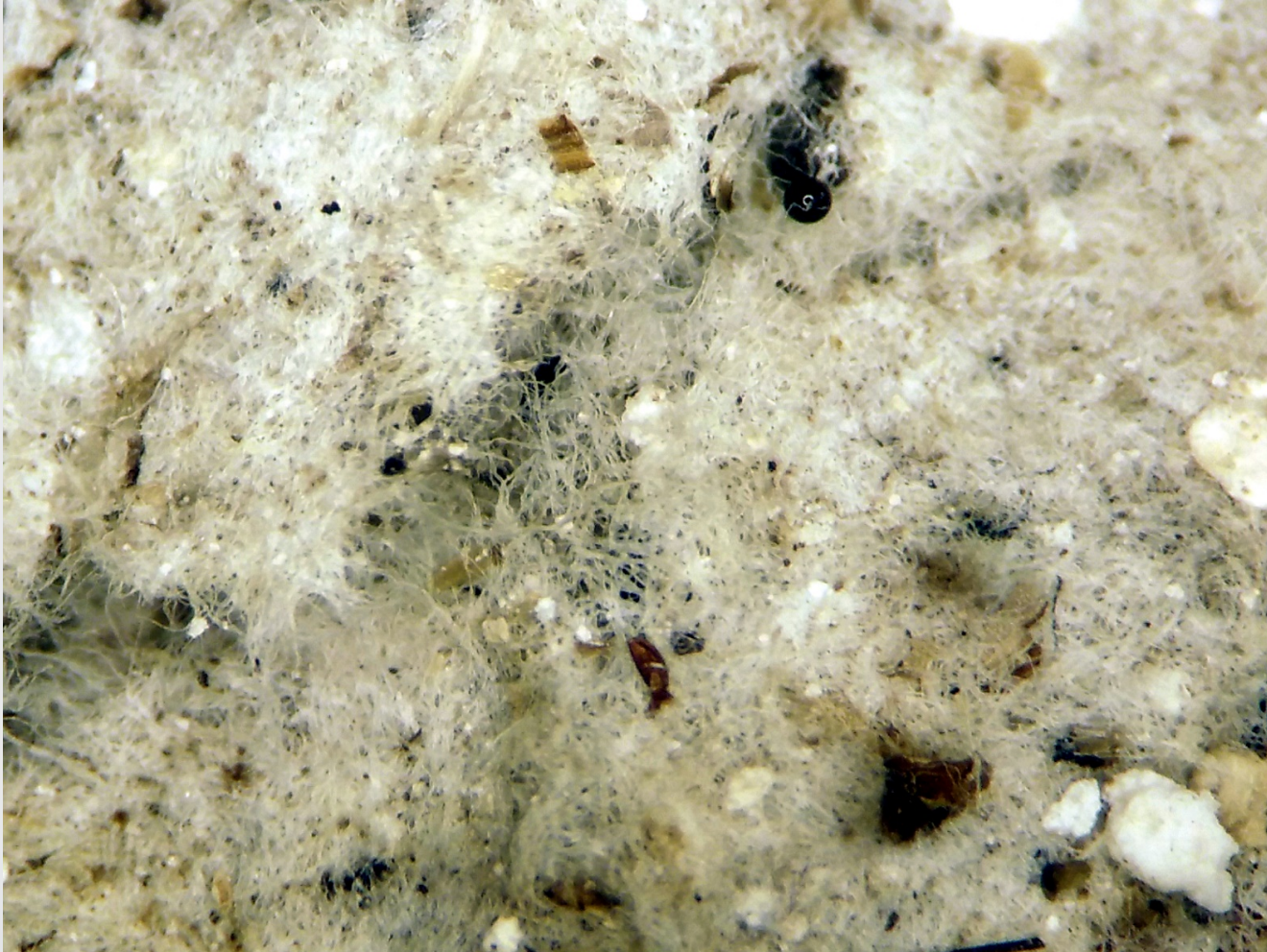
Reference
Samples:
Practice

***“You can’t manage what
you can’t measure”***

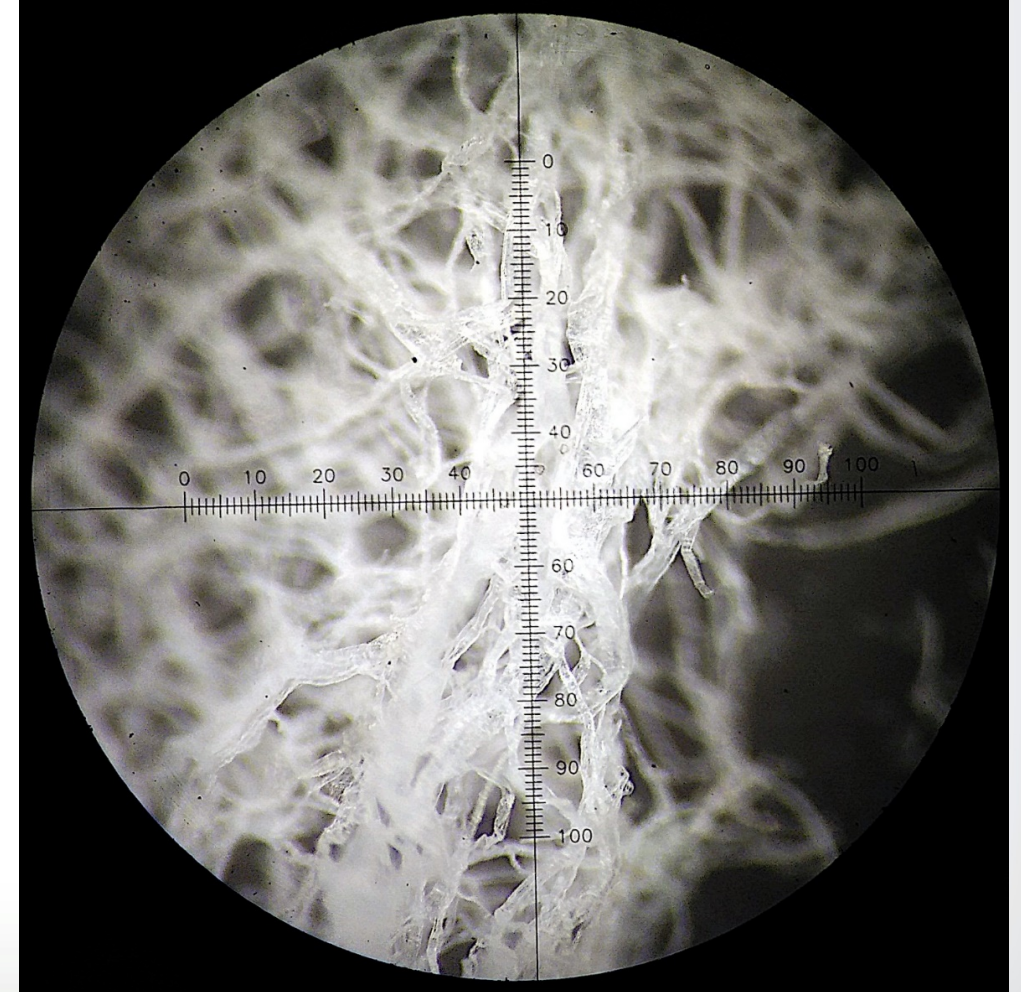
Standardized identification methods and solid baseline measurements are needed to assist international, national, regional, State and local scientists and organizations answer increasing public concerns associated with microplastics.

What's in there?

20x magnification

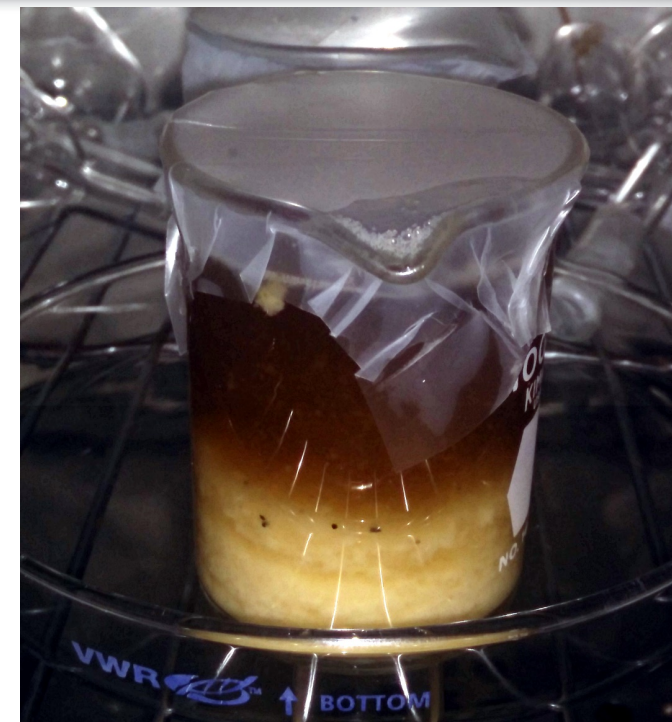
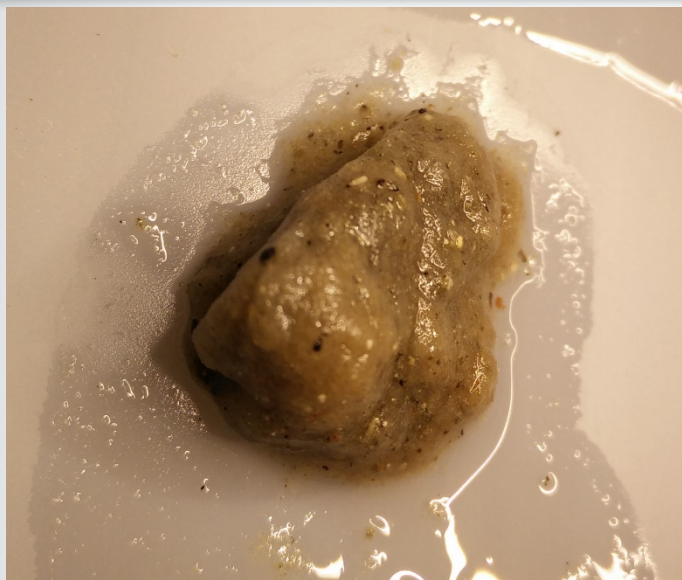


150x magnification

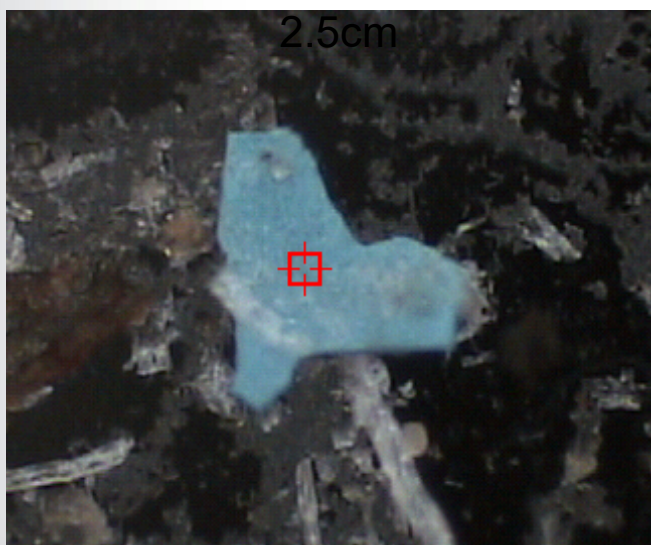




Microplastics in Wastewater Preparation Practice



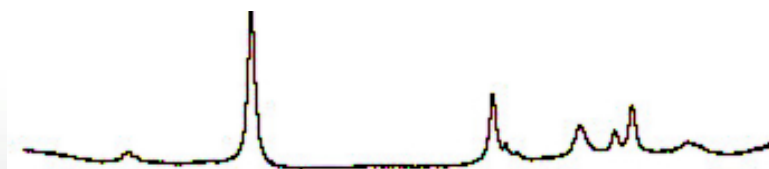
The large increase in the apparent volume of suspended solids is due to the comparatively dense cellulose being hydrolyzed into polysaccharides, starch, etc.



150um



>90% cellulose





Ideal Scenario

1. Obtain a sample
2. Filter sample to retain particulates
3. Induce absorption or emission
4. Identify targets
5. Isolate individual particles
6. Positive identification
7. Quantify

