

MJPhD

SEPARATION AND CONCENTRATION OF AQUEOUS MICRO- AND NANOPARTICLE SUSPENSIONS

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24 March 2025



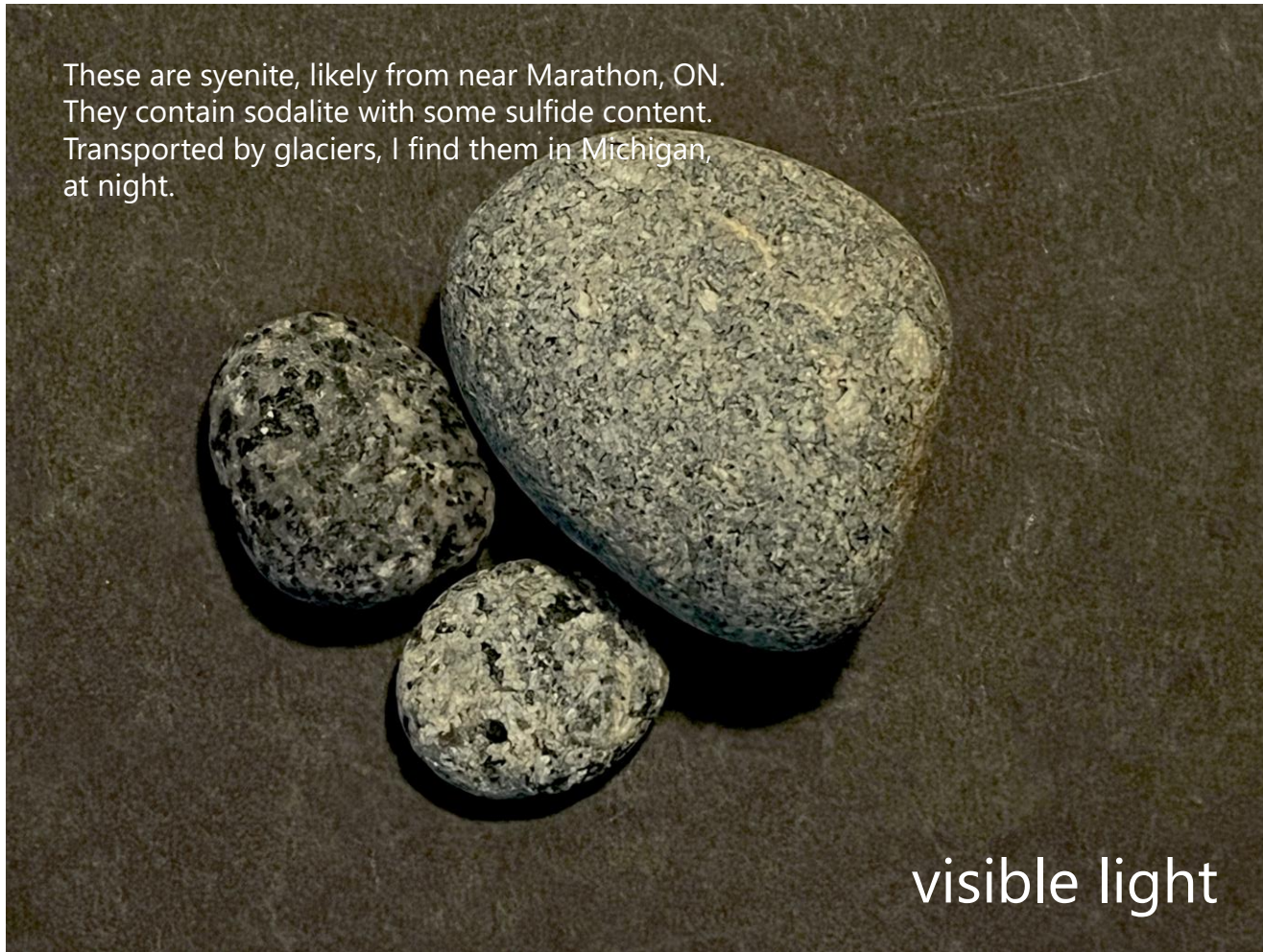


Development of options to include microplastics in testing of water quality with students.

Microplastics are lipophilic, a property that can be used in their collection and concentration.

Lipophilic solids work to remove micro- and nanoplastic particles from water.

These are syenite, likely from near Marathon, ON.
They contain sodalite with some sulfide content.
Transported by glaciers, I find them in Michigan,
at night.



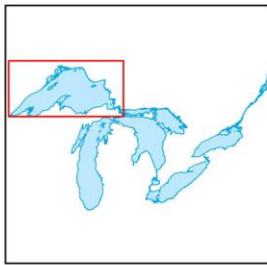
visible light

Yooperlites



UV light
(365 nm filtered)

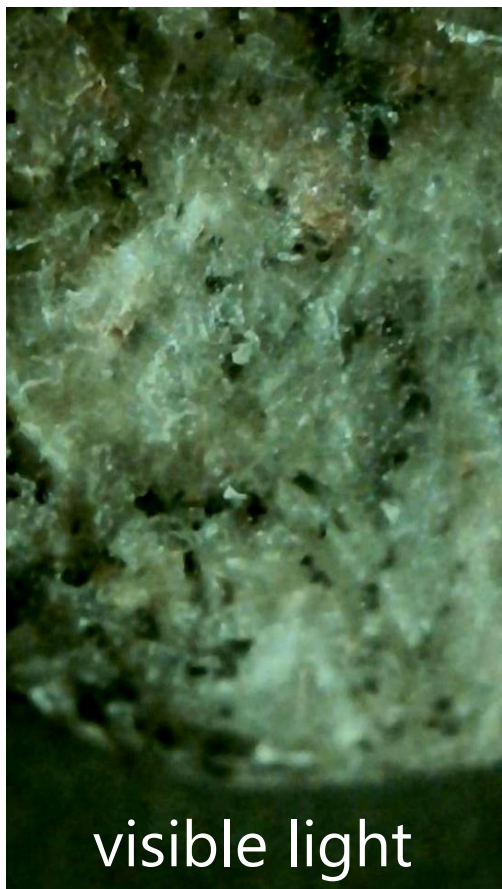
Lake Superior Watershed



Legend

- Cities/Towns
- State Borders
- Rivers
- - - International Border
- Lake Superior Watershed
- Diversions





visible light



UV light

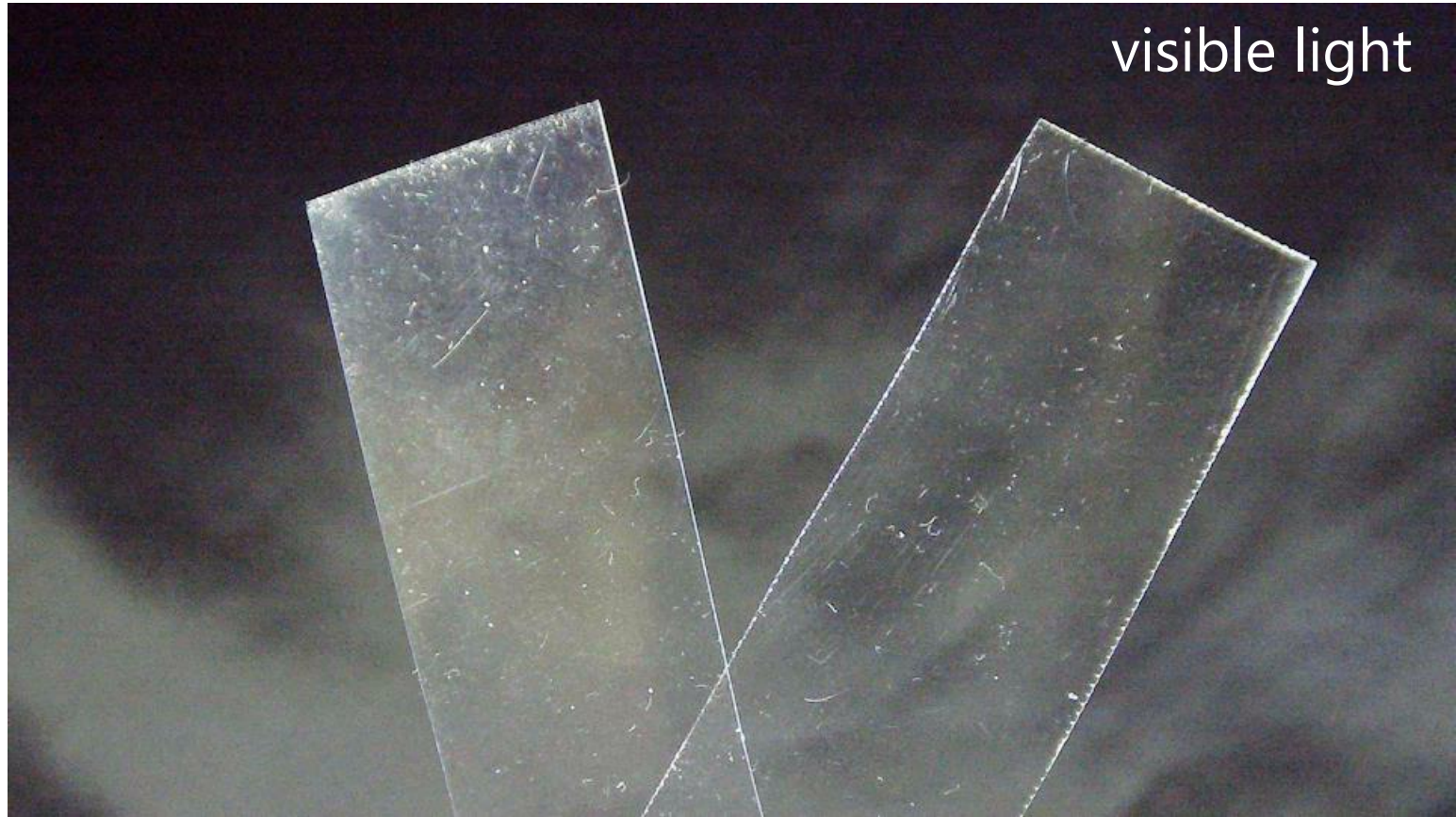
OBX BEACH SAND



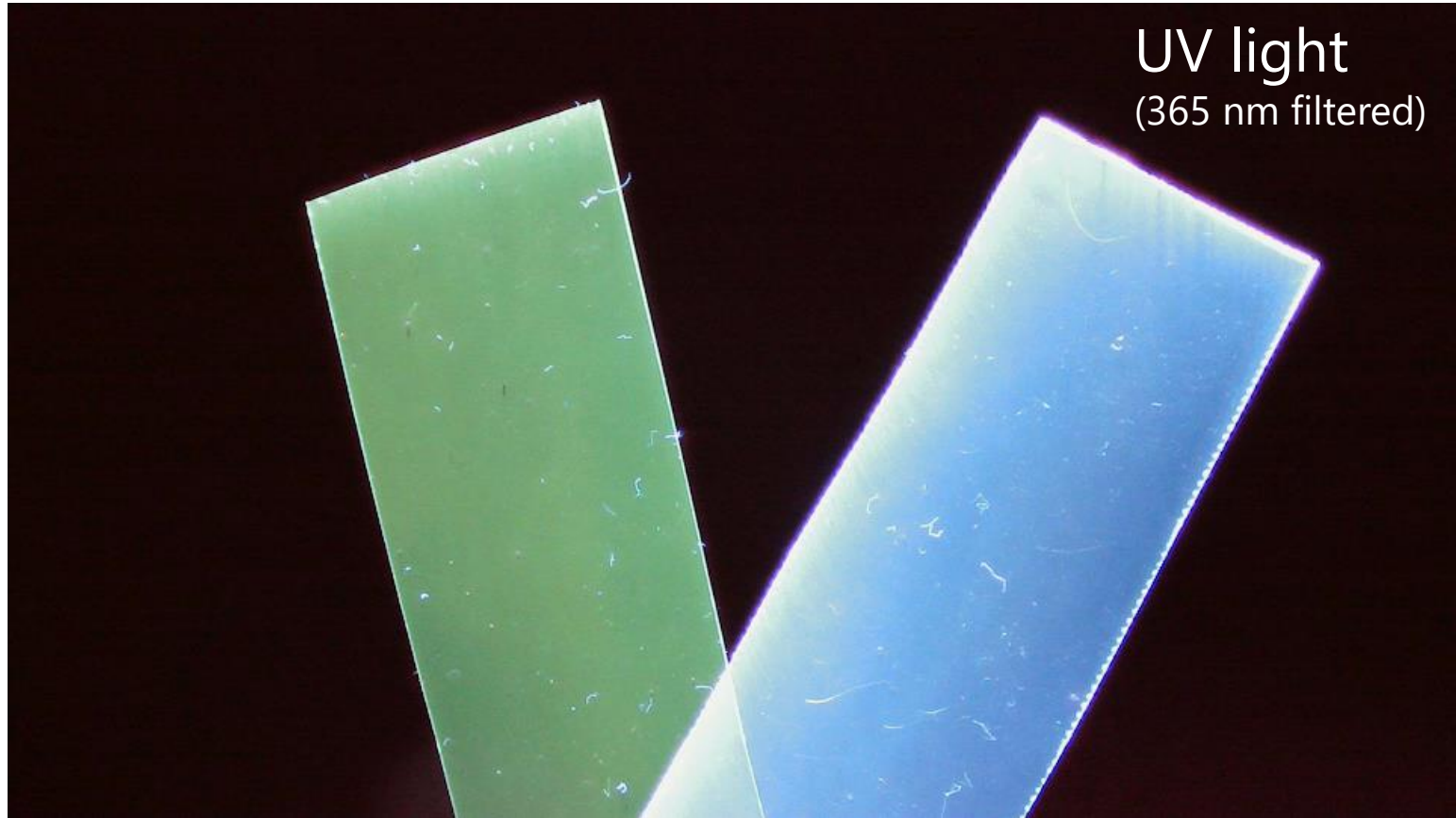
OBX BEACH SAND

UV light
(365 nm filtered)

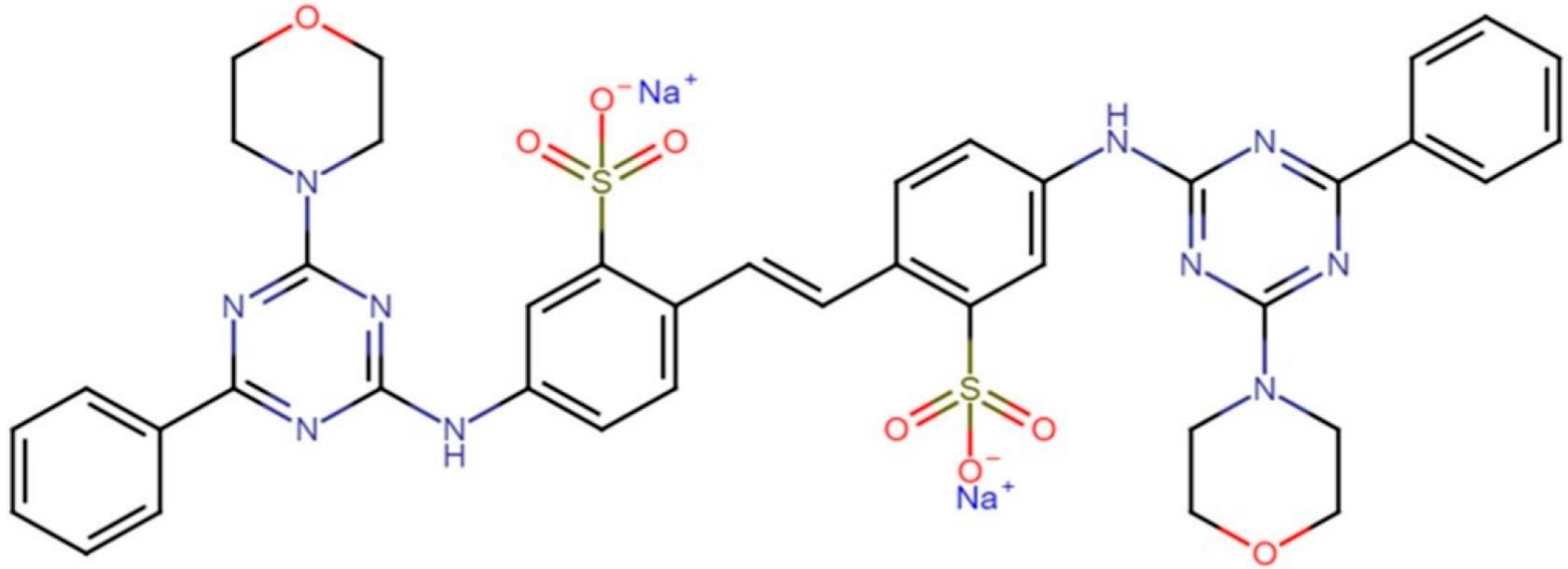




PET – OPTICAL BRIGHTENERS



OPTICAL BRIGHTENERS





Midland Local Section



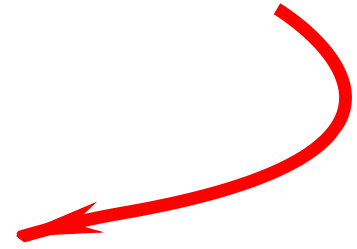
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Water Chemistry in the Great Lakes Region

<https://www.cmich.edu/academics/colleges/college-science-engineering/centers/cmu-biological-station/h2o-q-in-the-classroom>



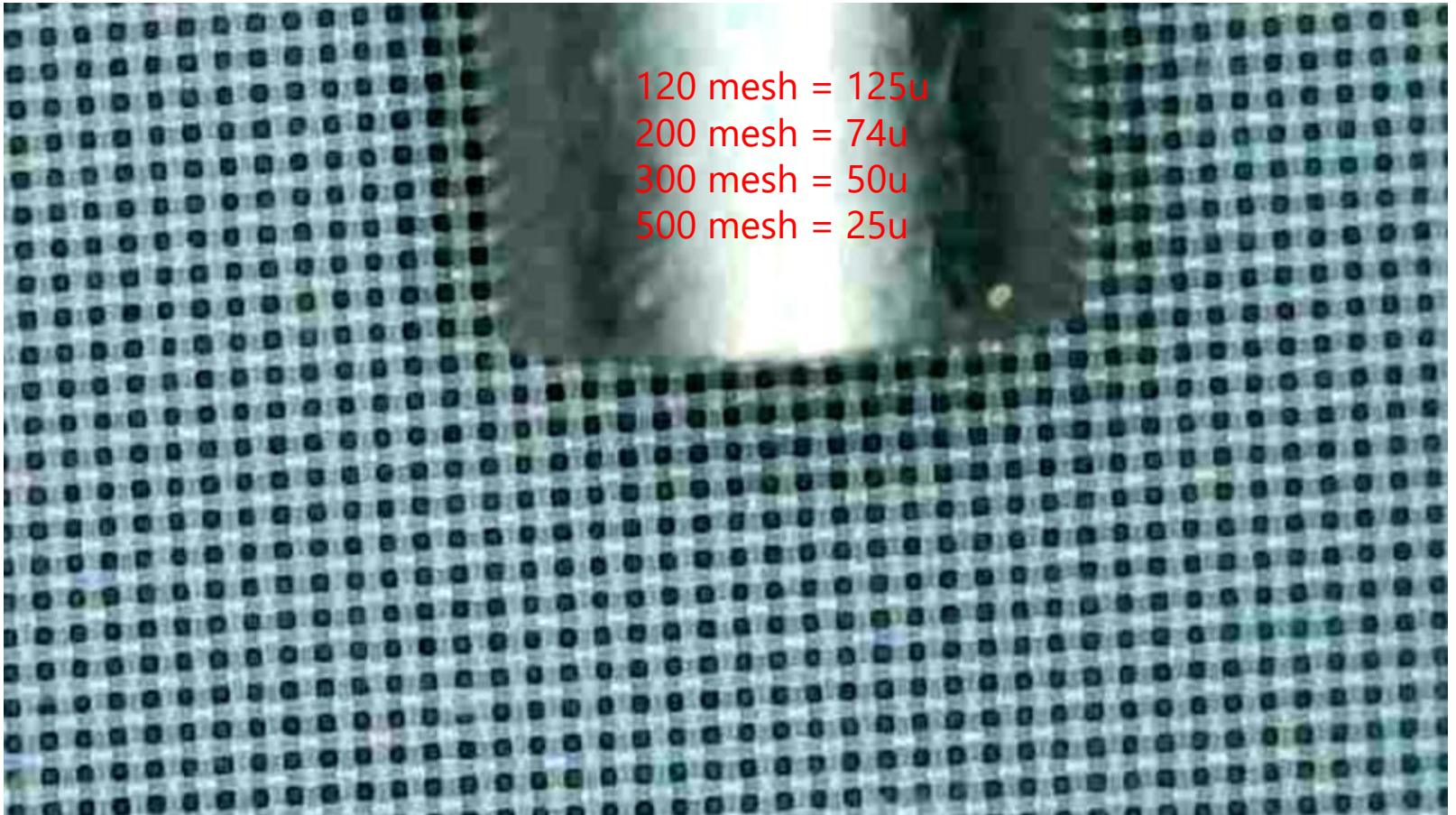
UV light
filter

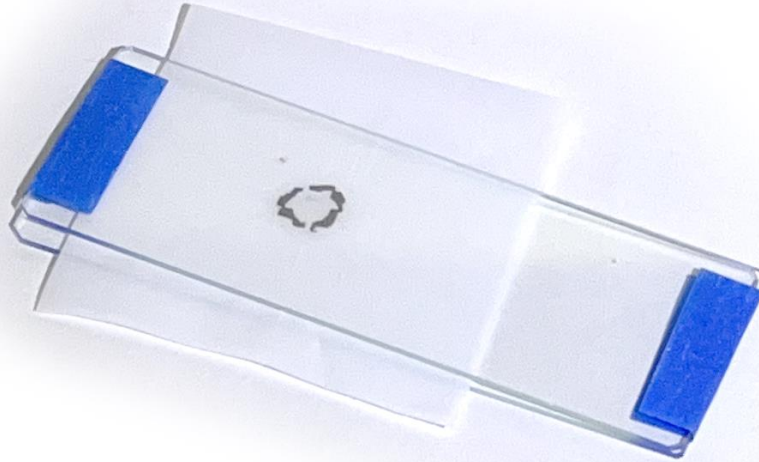




current iteration designed
to filter at microscope
resolution

SILK SCREEN FABRIC AS FILTERS

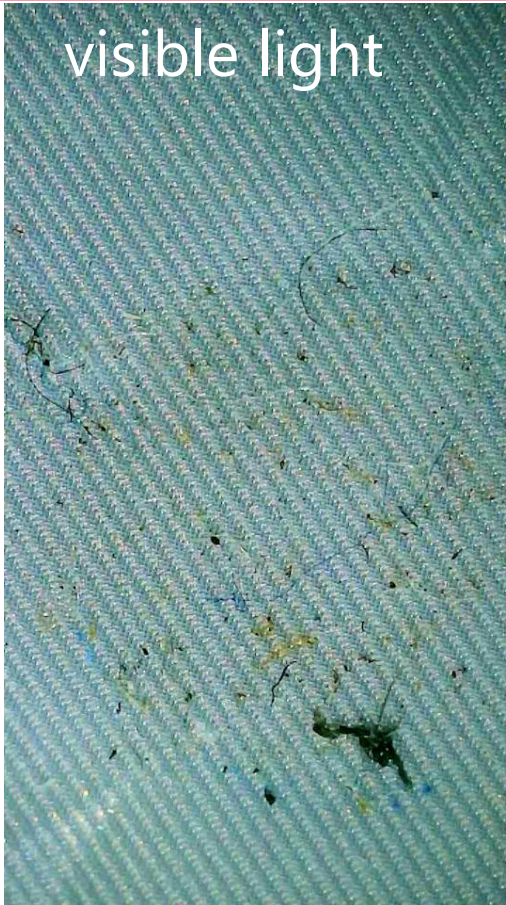




slide
sandwich
showing
traced
outline of
funnel on
filter media

FRESHLY FALLEN SNOW – 18 FEBRUARY

visible light



UV light
(365 nm filtered)



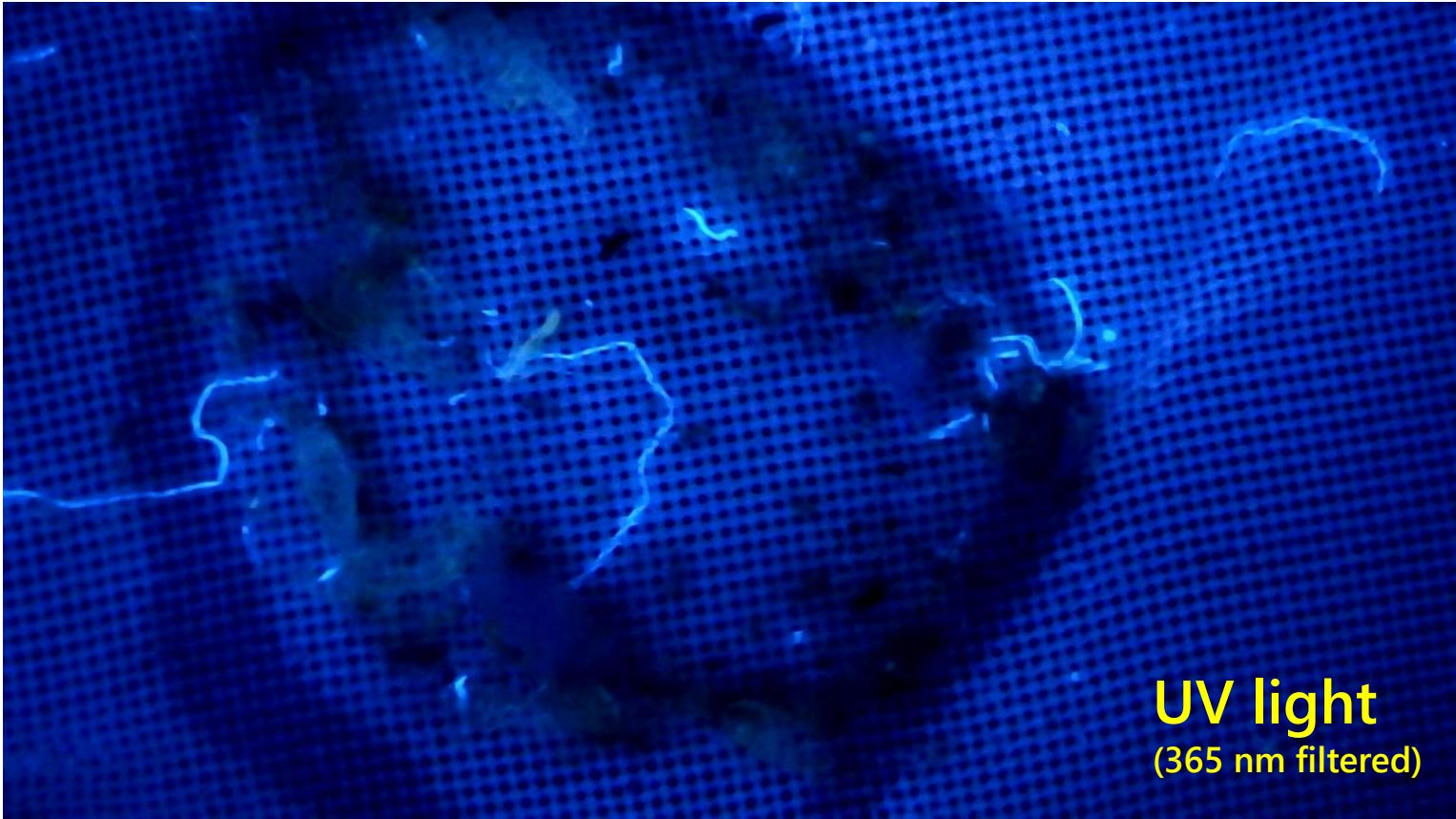
both



OBX OCEAN WATER



Visible



ble

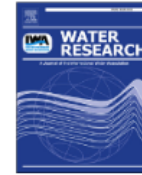
UV light
(365 nm filtered)



Contents lists available at ScienceDirect

Water Research

journal homepage: www.elsevier.com/locate/watres



Review

Microplastics in freshwaters and drinking water: Critical review and assessment of data quality



Albert A. Koelmans^{a,*}, Nur Hazimah Mohamed Nor^a, Enya Hermsen^a, Merel Kooi^a,
Svenja M. Mintenig^{b,c}, Jennifer De France^{d,**}

high quality data is difficult!

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ABSTRACT

Microplastics have recently been detected in drinking water as well as in drinking water sources. This presence has triggered discussions on possible implications for human health. However, there have been questions regarding the quality of these occurrence studies since there are no standard sampling, extraction and identification methods for microplastics. Accordingly, we assessed the quality of fifty studies researching microplastics in drinking water and in its major freshwater sources. This includes an assessment of microplastic occurrence data from river and lake water, groundwater, tap water and bottled drinking water. Studies of occurrence in wastewater were also reviewed. We review and propose best practices to sample, extract and detect microplastics and provide a quantitative quality assessment of studies reporting microplastic concentrations. Further, we summarize the findings related to microplastic concentrations, polymer types and particle shapes. Microplastics are frequently present in freshwaters and drinking water, and number concentrations spanned ten orders of magnitude (1×10^{-2} to $10^8 \text{ \#}/\text{m}^3$) across individual samples and water types. However, only four out of 50 studies received positive scores for all assessed quality criteria, implying there is a significant need to improve quality





Tire Particles

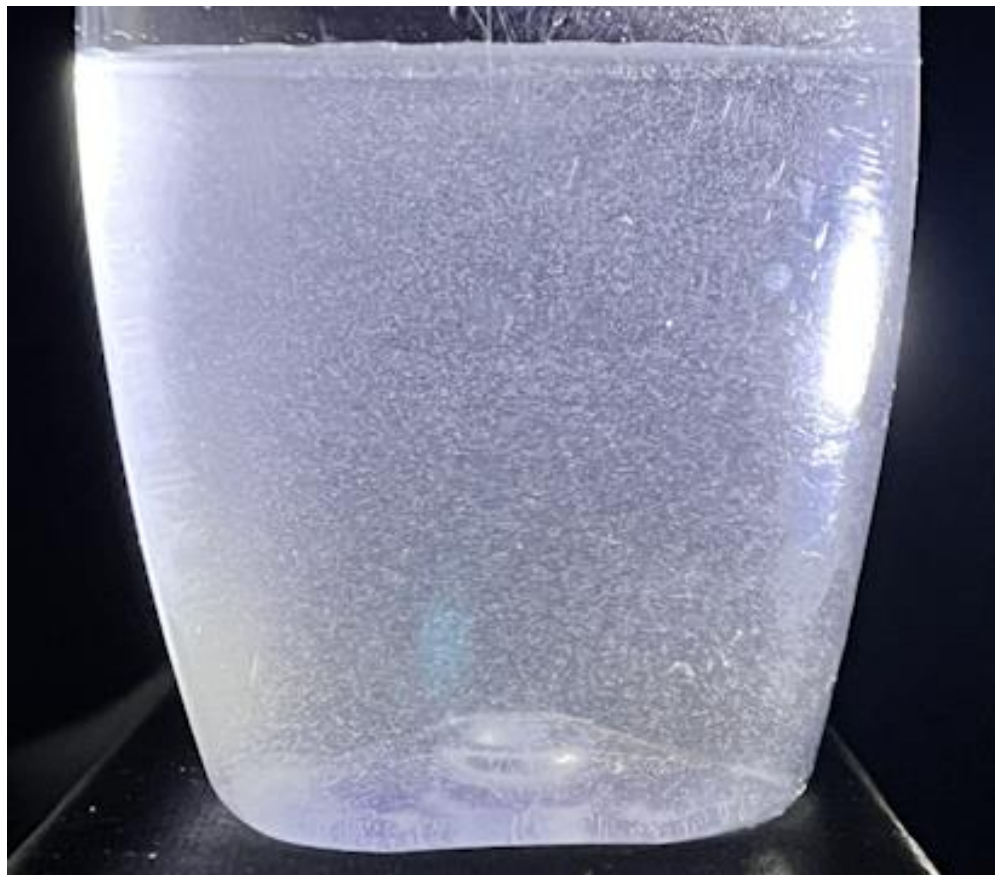
13 March 2025

TIRE PARTICLES WITH SOLVENT



A glass jar containing a liquid suspension with a pink cylindrical object inside, used for making microplastic suspension.

***Making Microplastic
Suspension
small batch***



Yellow Fluorescent PET

365 nm UV Light



HDPE

25 February 2025

Microplastics in the Environment –

Development of a Sample Preparation Method with Further

Application and Evaluation in Fluvial and Marine Compartments

Von der Fakultät für Georessourcen und Materialtechnik der
Rheinisch-Westfälischen Technischen Hochschule Aachen

zur Erlangung des akademischen Grades einer
Doktorin der Naturwissenschaften
genehmigte Dissertation

vorgelegt von
M. Sc. Simone Elisabeth Lechthaler
aus Düsseldorf

Berichter: PD Dr. rer. nat. Georg Stauch
Univ.-Prof. Dr.-Ing. Holger Schüttrumpf

Tag der mündlichen Prüfung: 10.05.2021

Diese Dissertation ist auf den Internetseiten der Universitätsbibliothek online verfügbar.

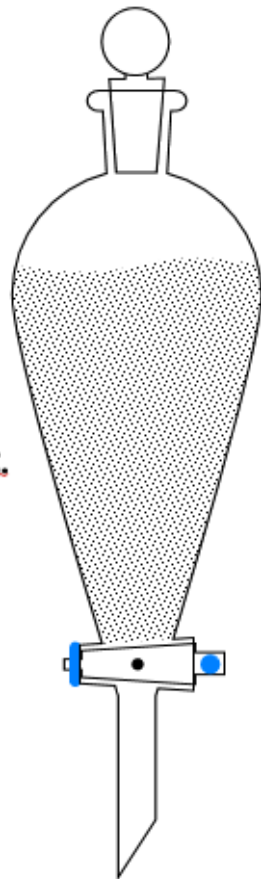
“extraction” into oil as a way
of concentrating
microplastic particles was
described in 2021 by
Simone Elisabeth
Lechthaler

what about nano?

Start

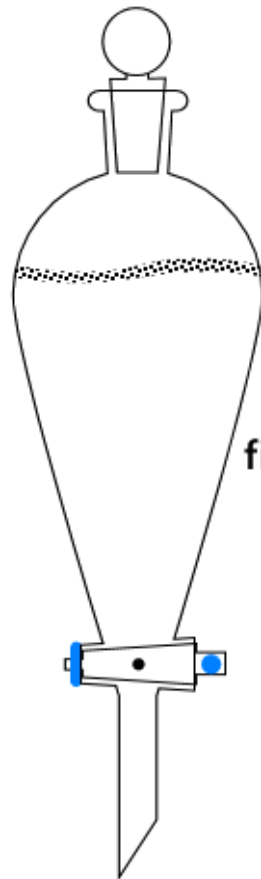
End

measure conc.



find plastic

find nothing



Yellow Fluorescent PET

Sep Funnel Extraction

19 February 2025

365 nm light

all water
layer



oil layer

$\frac{1}{4}$ starting

Snow

17 March 2025

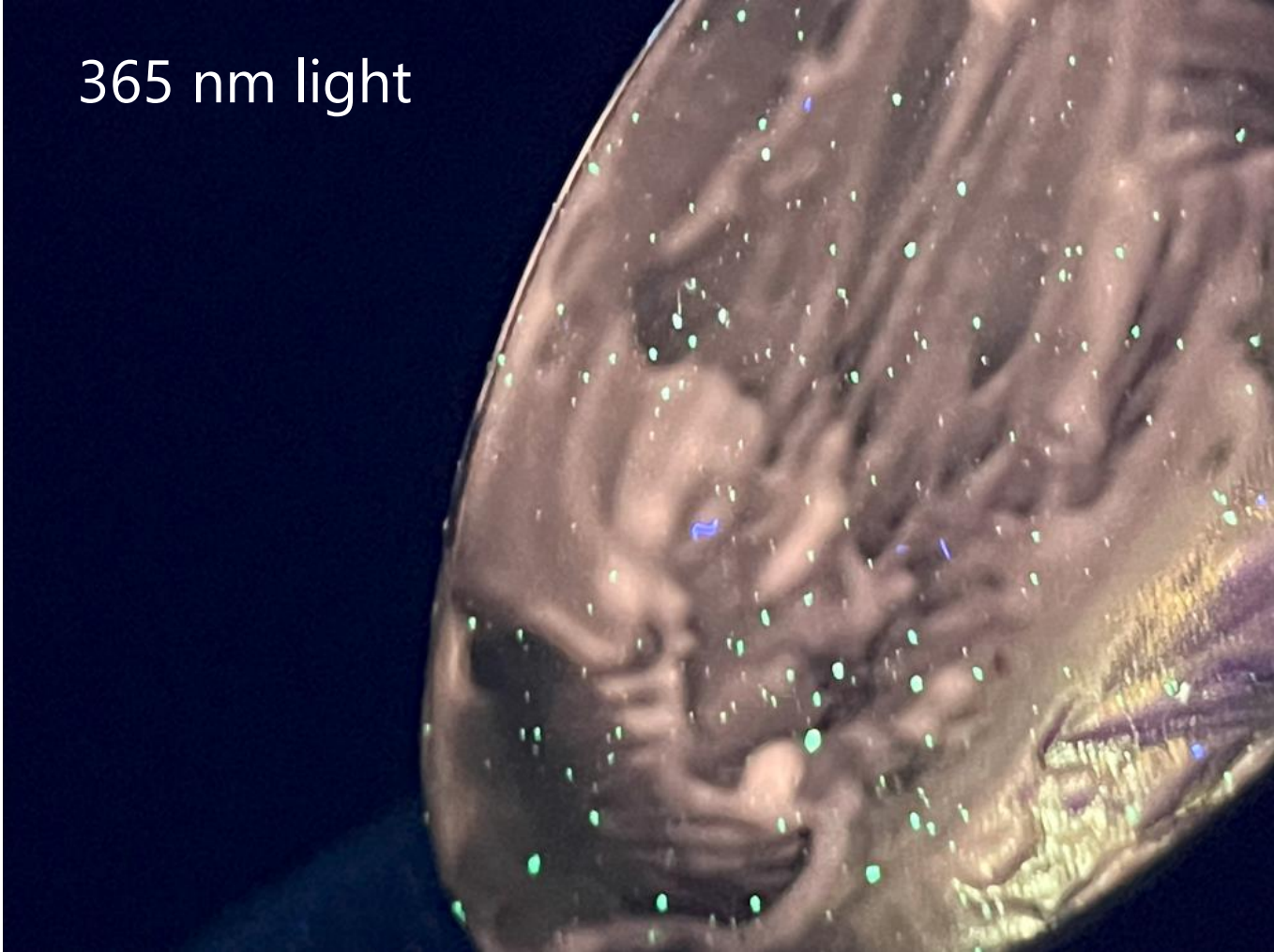
SUMMARY

- again showed the lipophilic nature of micro- and nanoplastic particles can be used to concentrate them
- what worked for manufactured samples also works for environmental samples
- did not show, but also works for potable water samples

Collecting Particles

13 March 2025

365 nm light

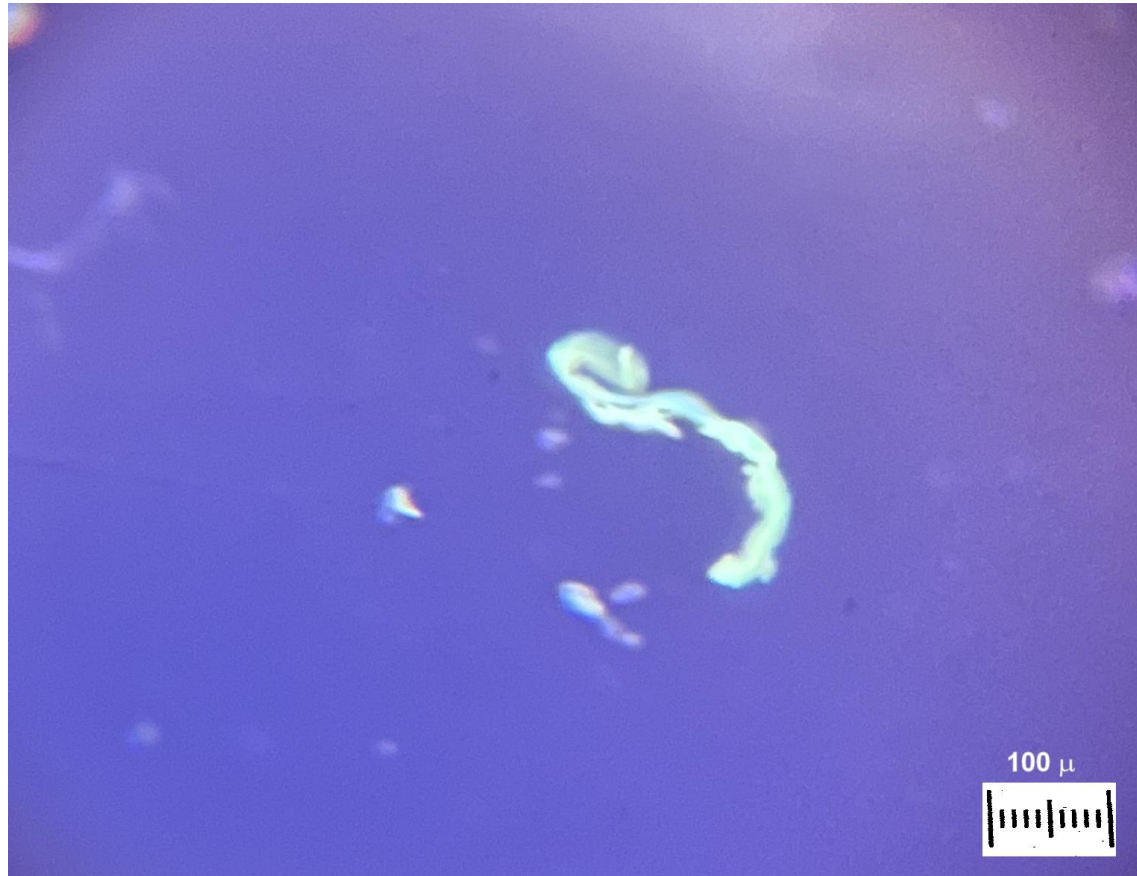


A close-up photograph of a hand holding a silver spoon. The spoon's bowl is covered with dark, irregular particles, likely dust or debris. The background is a blurred grey surface. The text 'Captured Particles' is overlaid on the left side of the image.

Captured Particles

13 March 2025

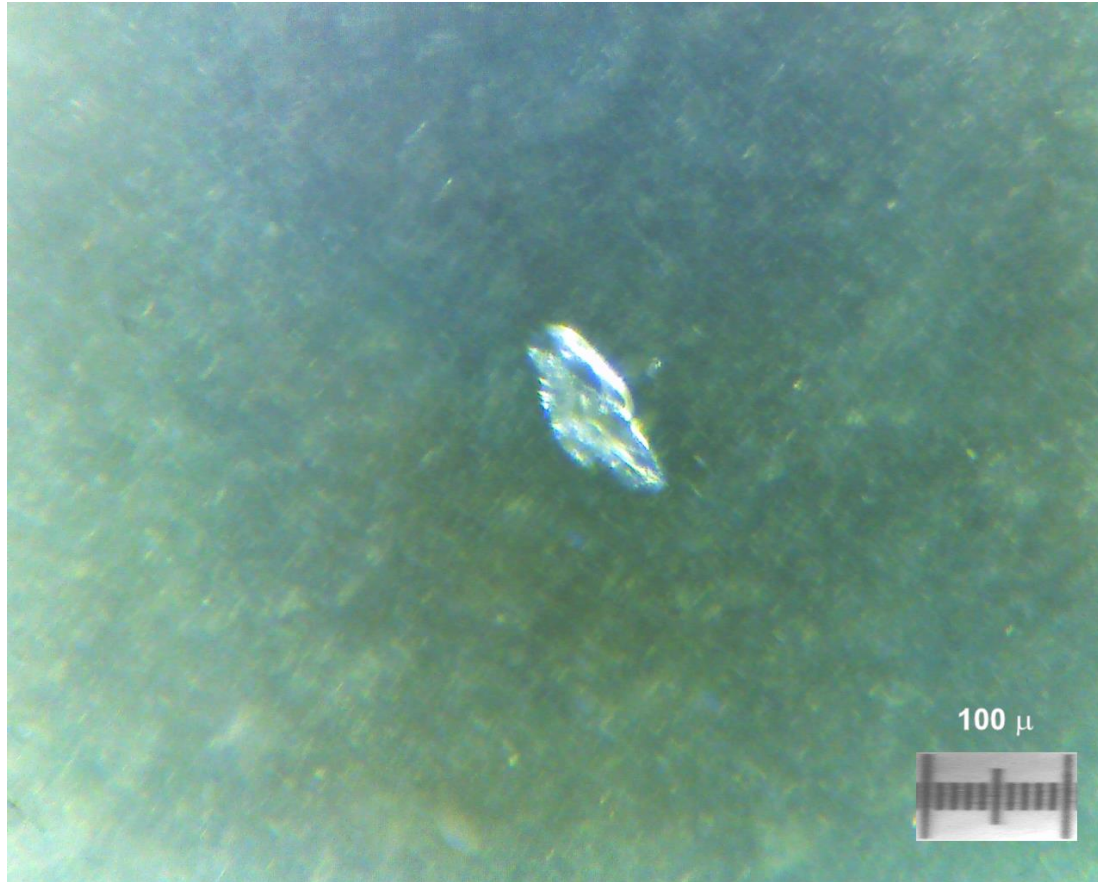
PET SUSPENSION



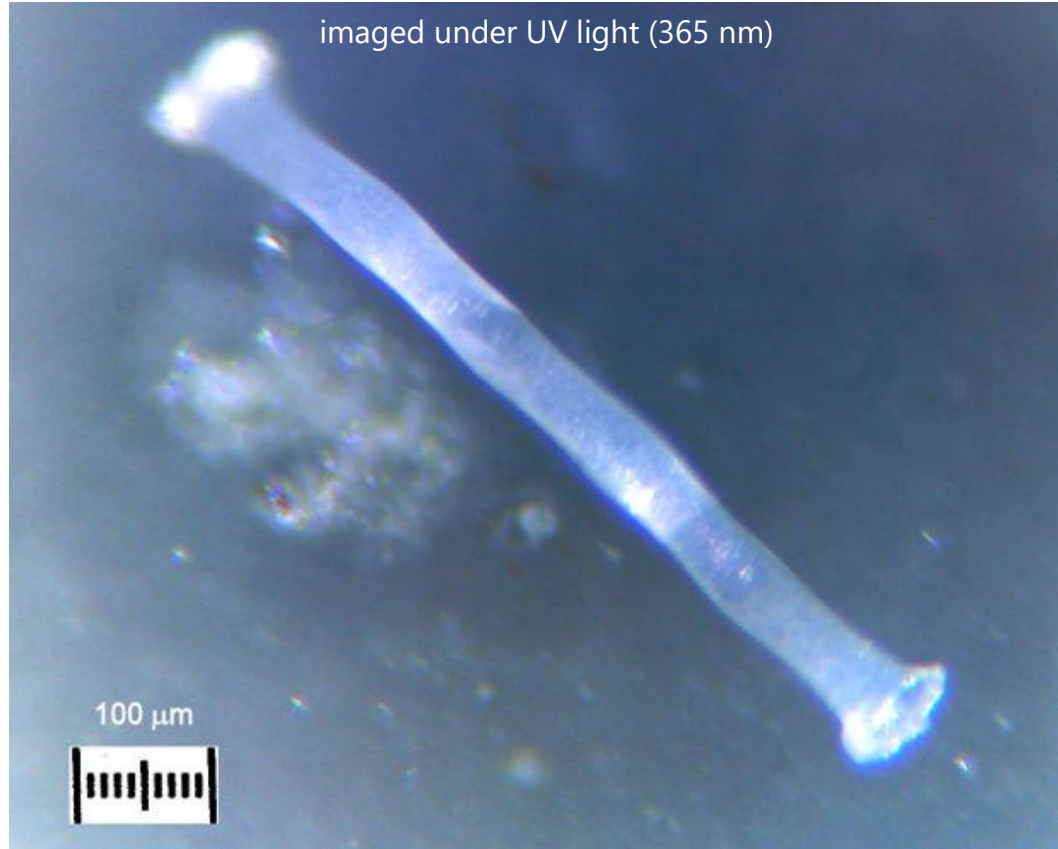
Commercial Bottled Water

19 March 2025

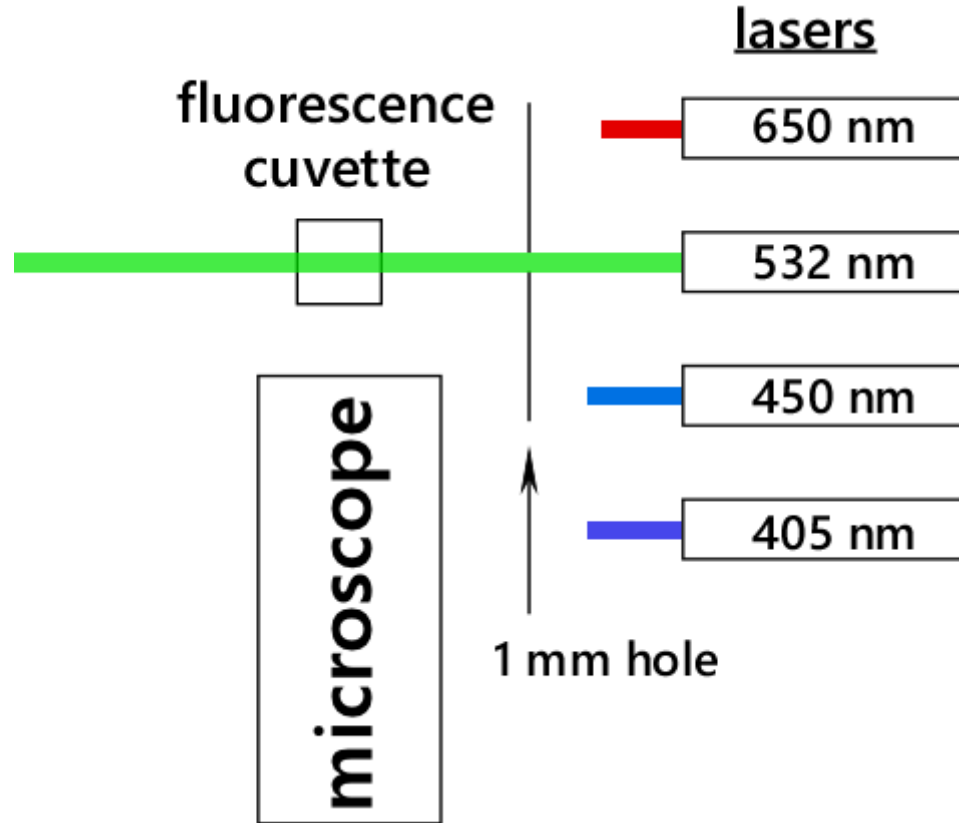
FROM COMMERCIAL BOTTLED WATER



FROM COMMERCIAL BOTTLED WATER



RAYLEIGH SCATTERING

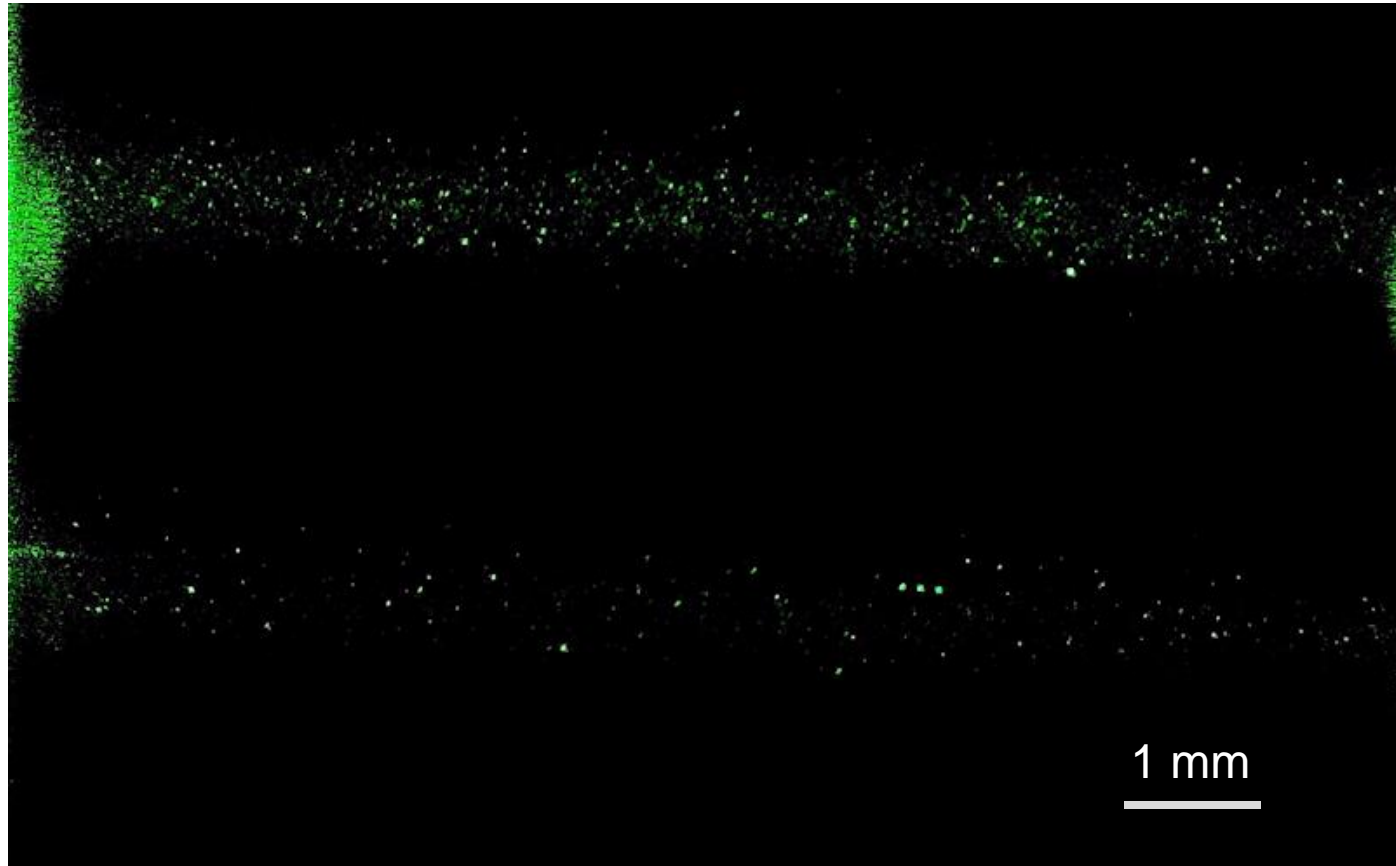


Ye, Yan, and David YH Pui. "Detection of nanoparticles suspended in a light scattering medium." Scientific reports 11, no. 1 (2021): 20268.

RAYLEIGH SCATTERING

water bottle-
fresh

fugitive
adhesive



SUMMARY

- lipophilic solids capture plastic particles
- allow easy imaging of particles sampled
- hard if not impossible to get to zero but substantial reductions are possible

ATTEMPTS TO AGGLOMERATE

before heating

imaged under UV light (365 nm)



100 μ



after heating ~200 C for 15 min



100 μ





Development of options to include microplastics in testing of water quality with students.

Microplastics are lipophilic, a property that can be used in their collection and concentration.

Lipophilic solids work to remove micro- and nanoplastic particles from water.



Central Michigan University students:

- Lilah Brand
 - Nora Jannenga
 - Elizabeth Buttle
 - Carter Lynch
 - Jacob Leff
-

3D Printing Wizard

- Henry LeCaptain



MJPHD.net