MJPhD

Microplastics:
What are they and where are they

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MJPhD, LLC

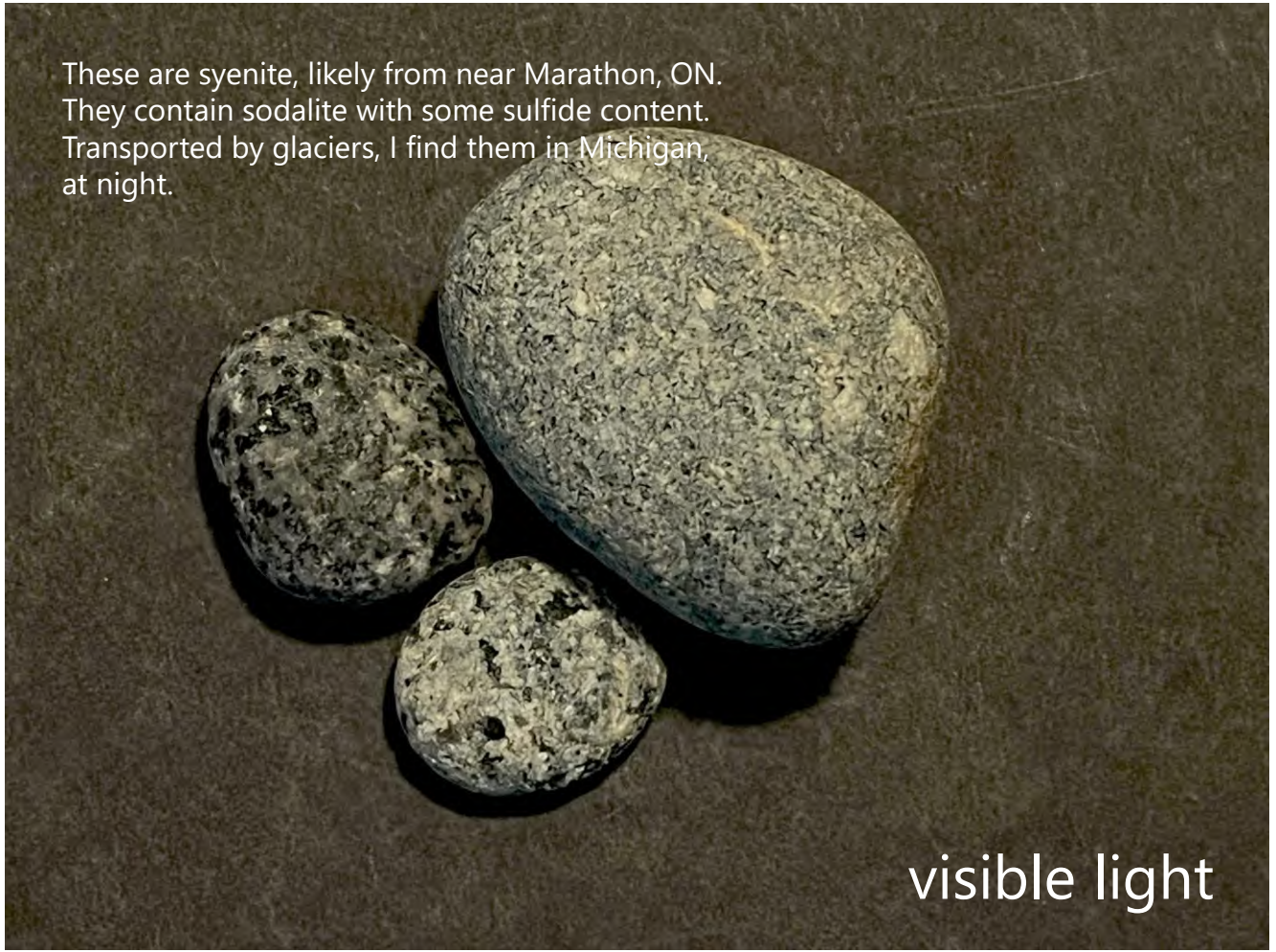
Dale LeCaptain
Professor
Dept. of Chemistry and Biochemistry
Central Michigan University

14 November 2026

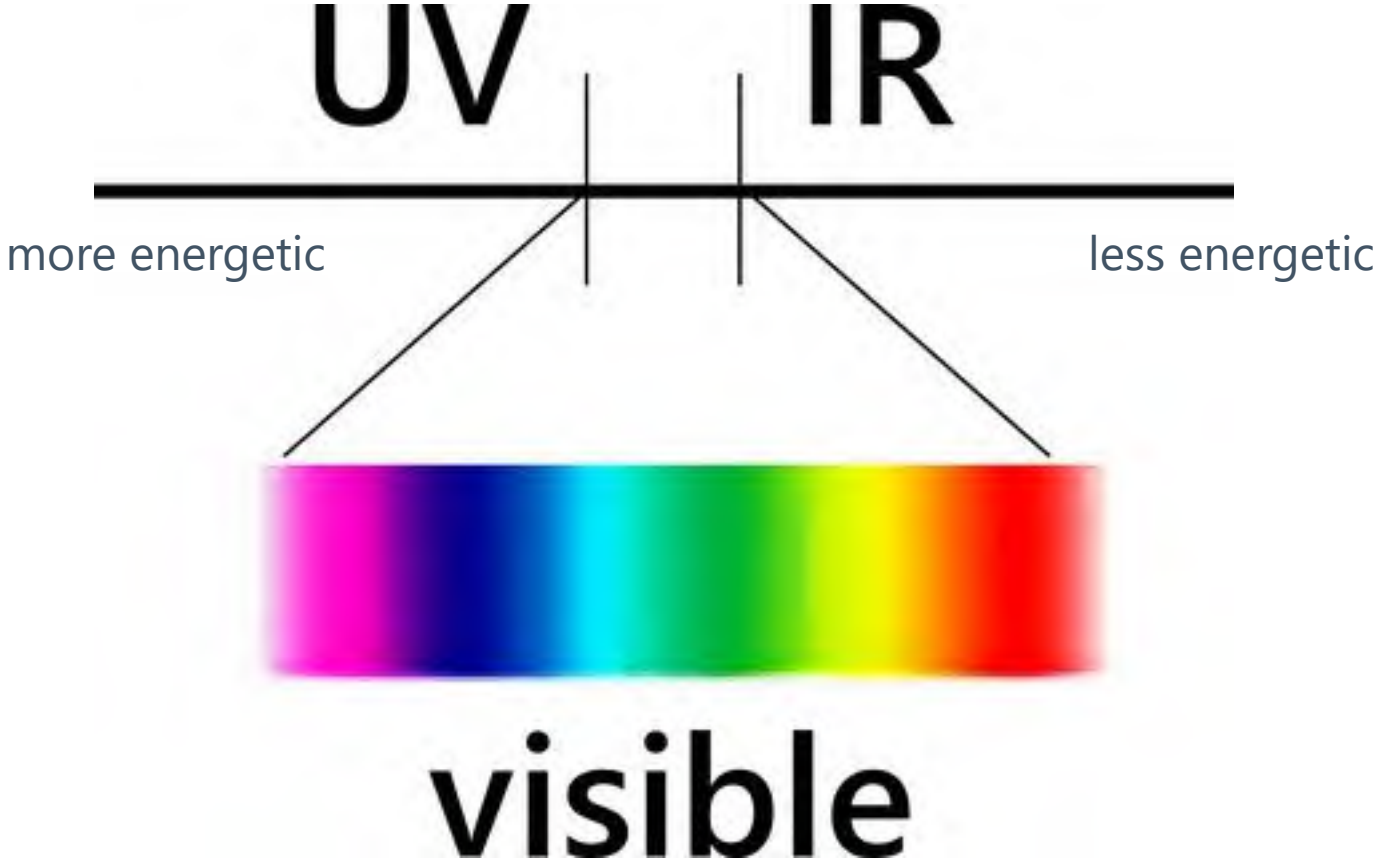



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GOOD & CHEAP WON'T BE FAST
FAST & GOOD WON'T BE CHEAP
CHEAP & FAST WON'T BE GOOD

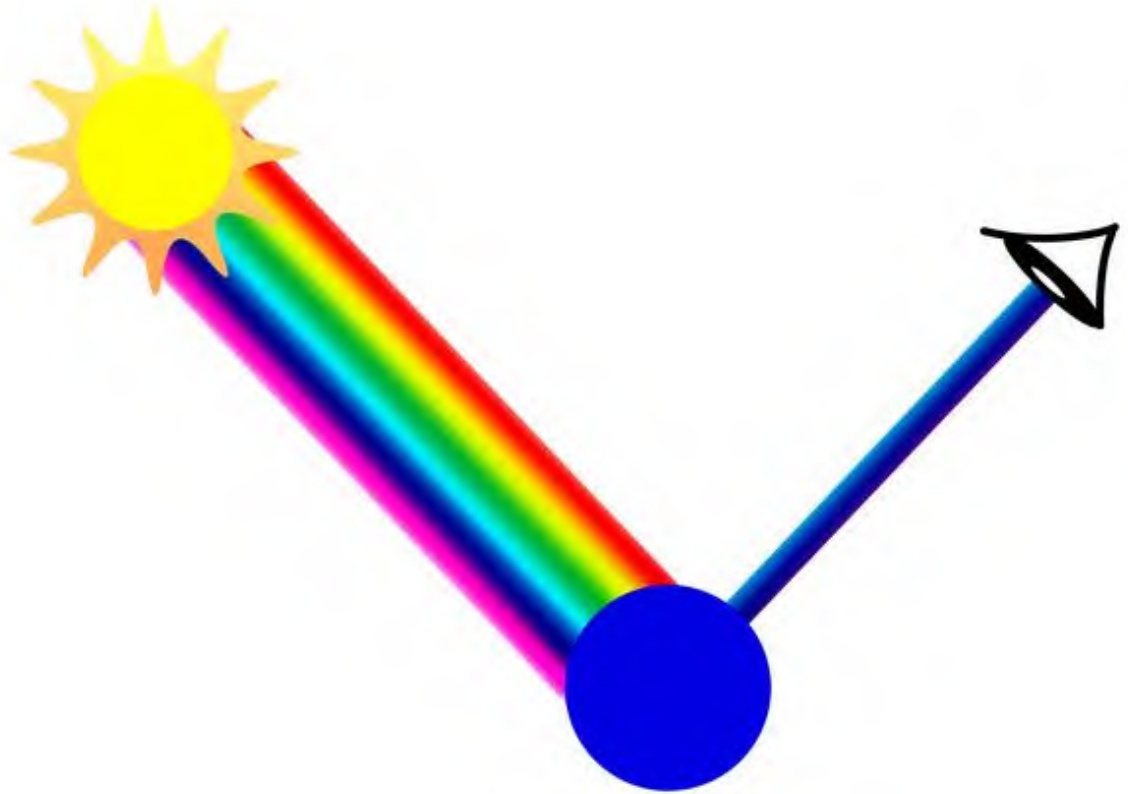



These are syenite, likely from near Marathon, ON.
They contain sodalite with some sulfide content.
Transported by glaciers, I find them in Michigan,
at night.
visible light


UV light
(365 nm filtered)


UV
IR
more energetic
less energetic
visible

Normal Vision and Colors



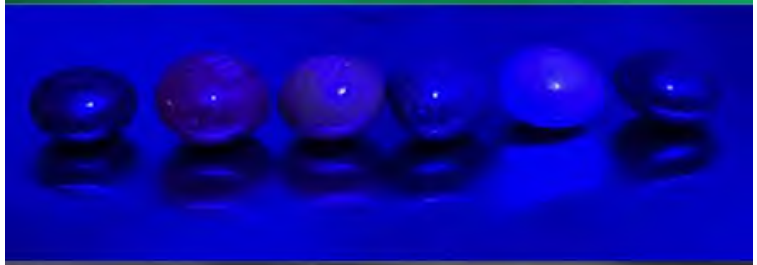
red light



green light



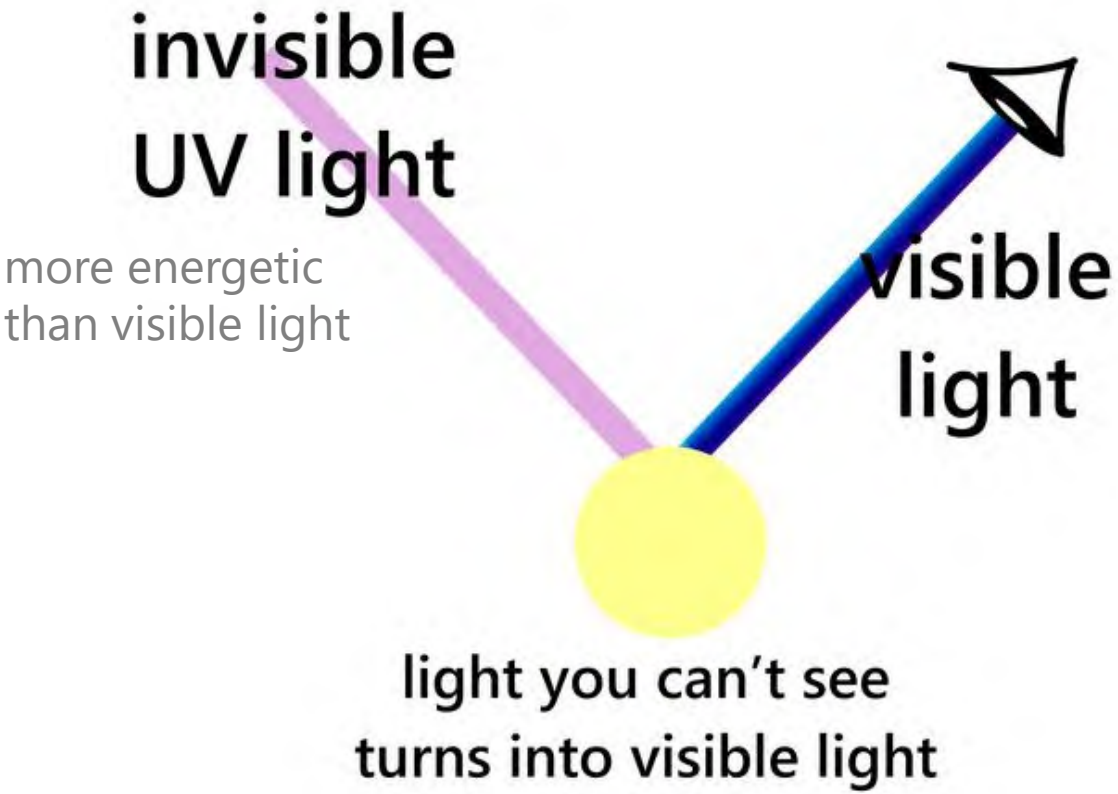
blue light



white light



FLUORESCENCE



UV

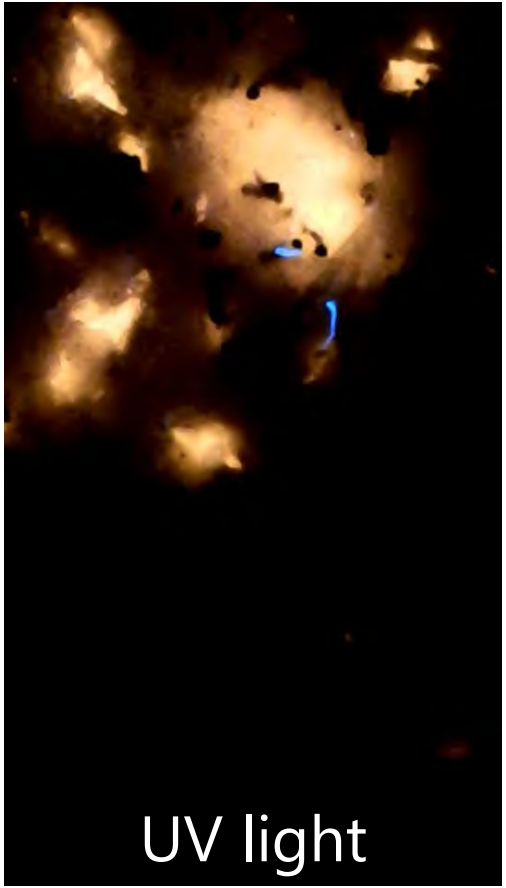
white light



The filter is important. It gets rid of stray visible light making fluorescence much easier to see.




visible light


UV light

OBX Beach Sand



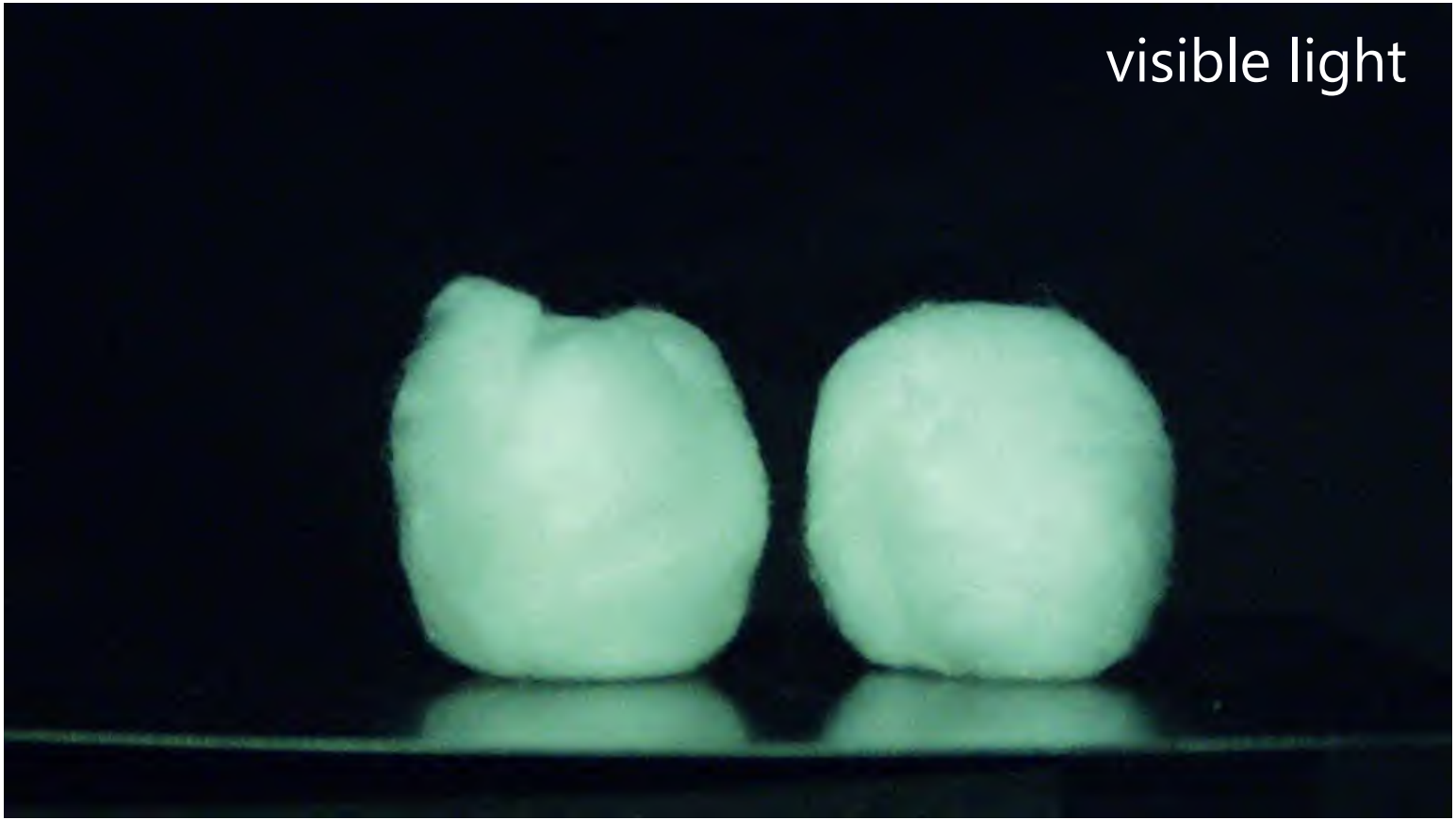
OBX Beach Sand



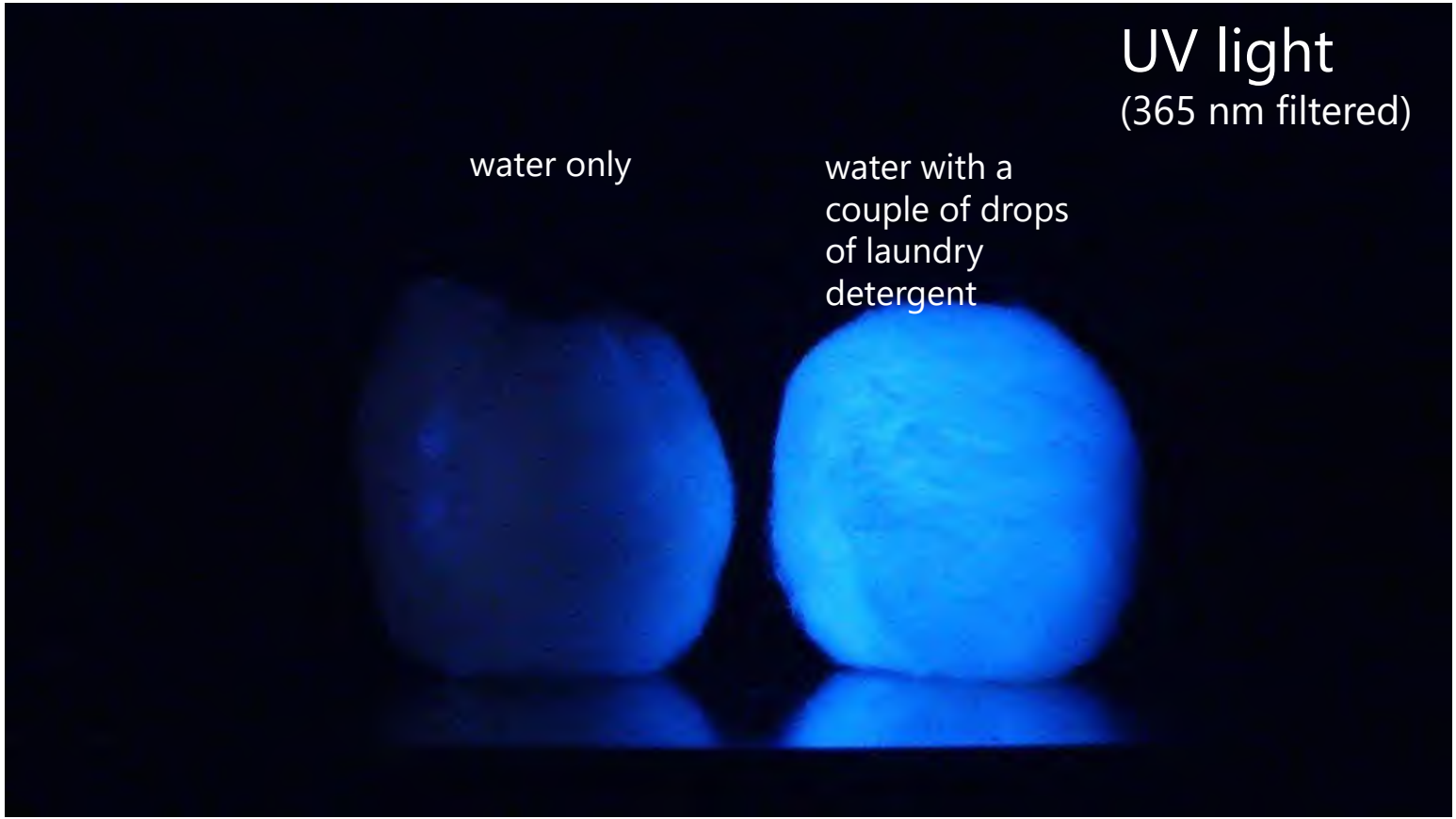
OBX Beach Sand



Cotton Balls



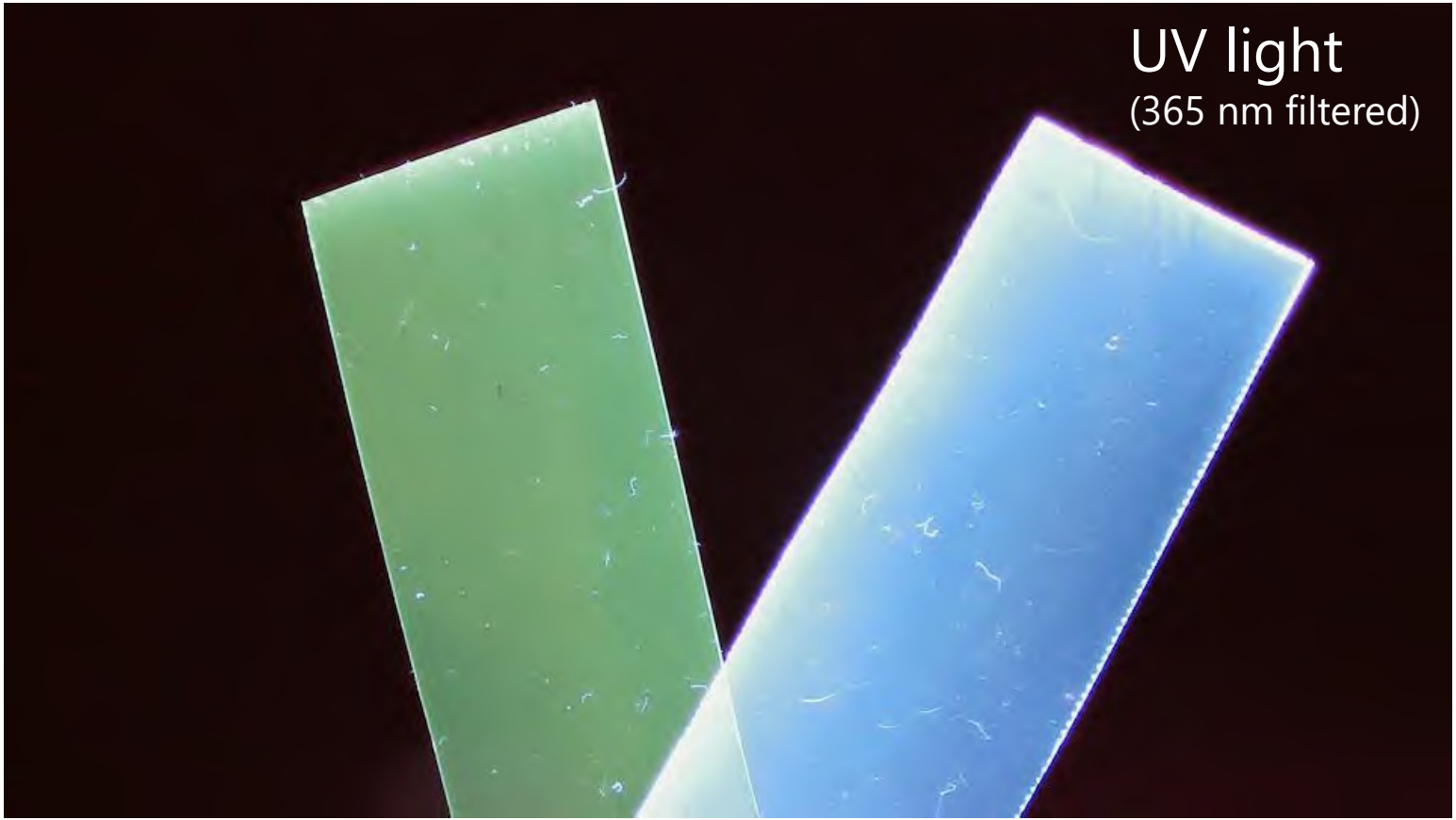
Cotton Balls – Optical Brighteners



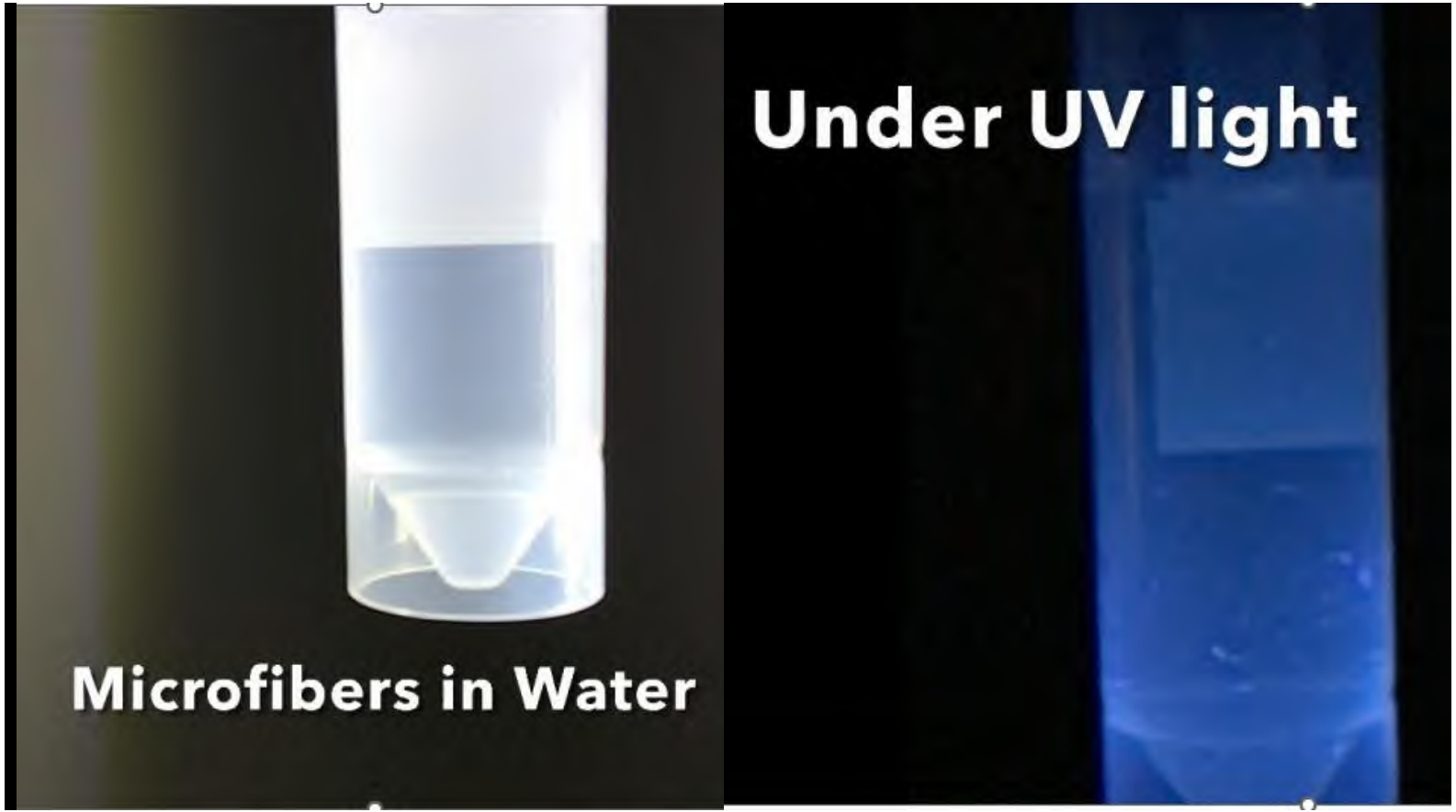
PET



PET – Optical Brighteners



MICROFIBERS




UV light
filter



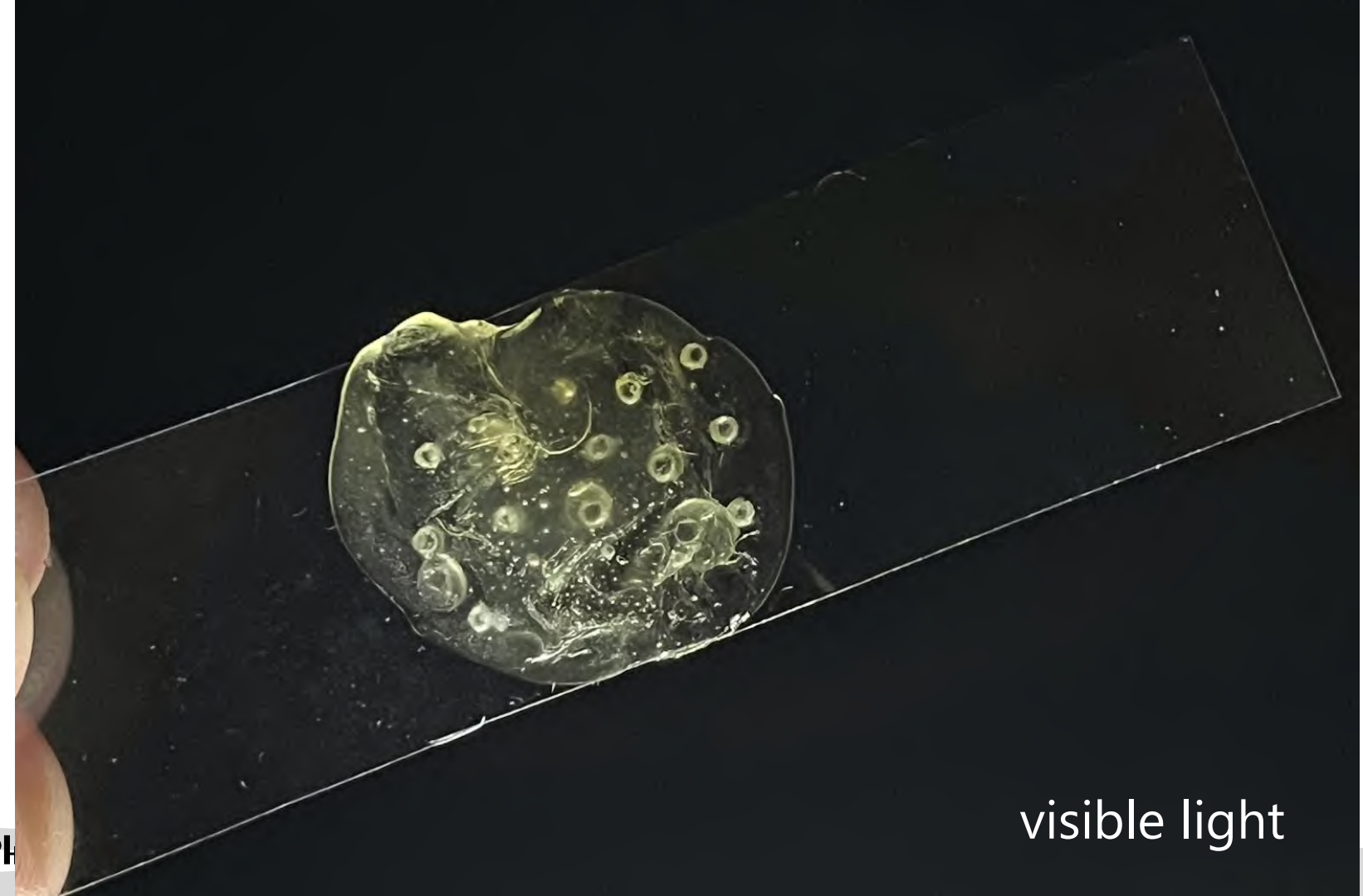
Midland Local Section

CENTRAL MICHIGAN UNIVERSITY

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

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visible light





Get a sample of water.

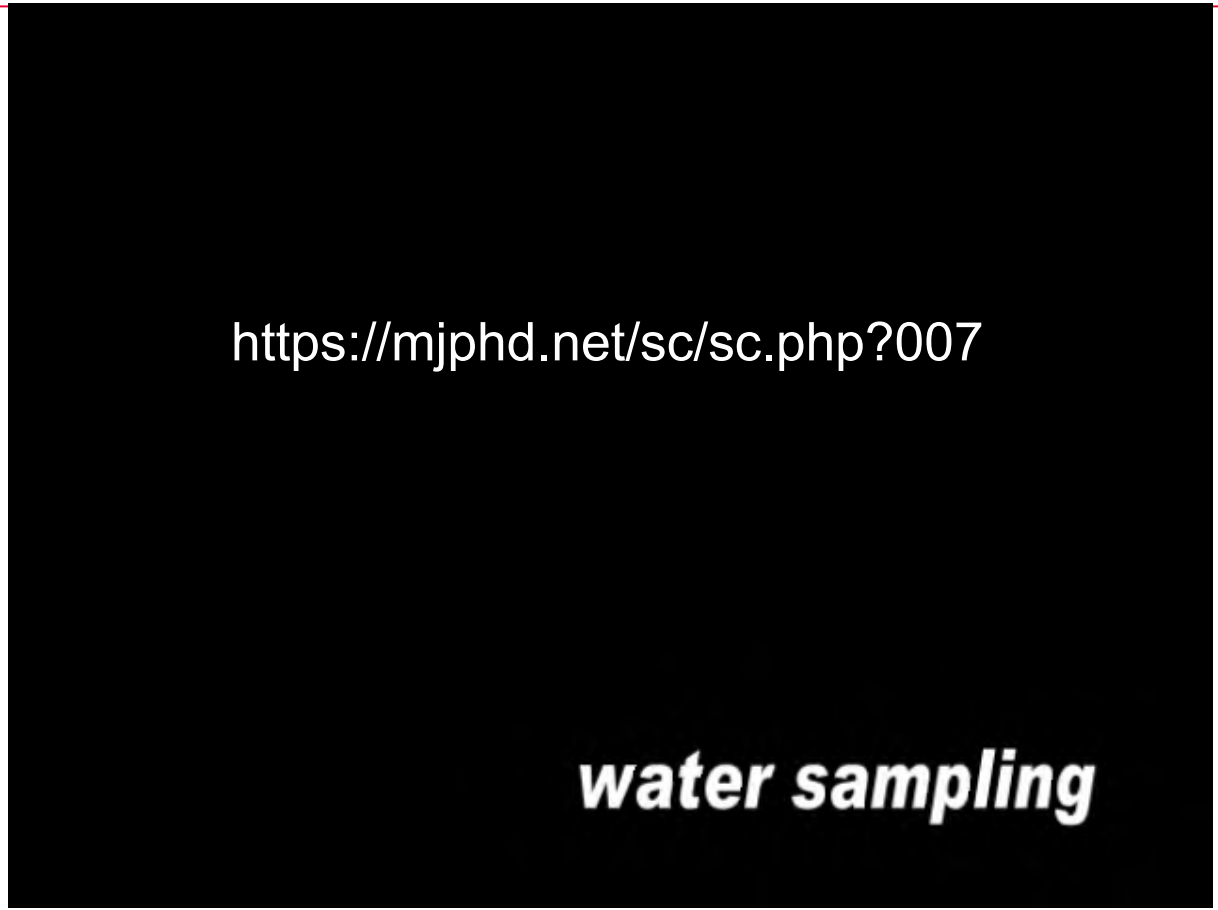
Filter out the small particles.

Observe the particles.



current iteration designed to sample near but not at the surface

SAMPLING



Sampling Ousel Falls, MT

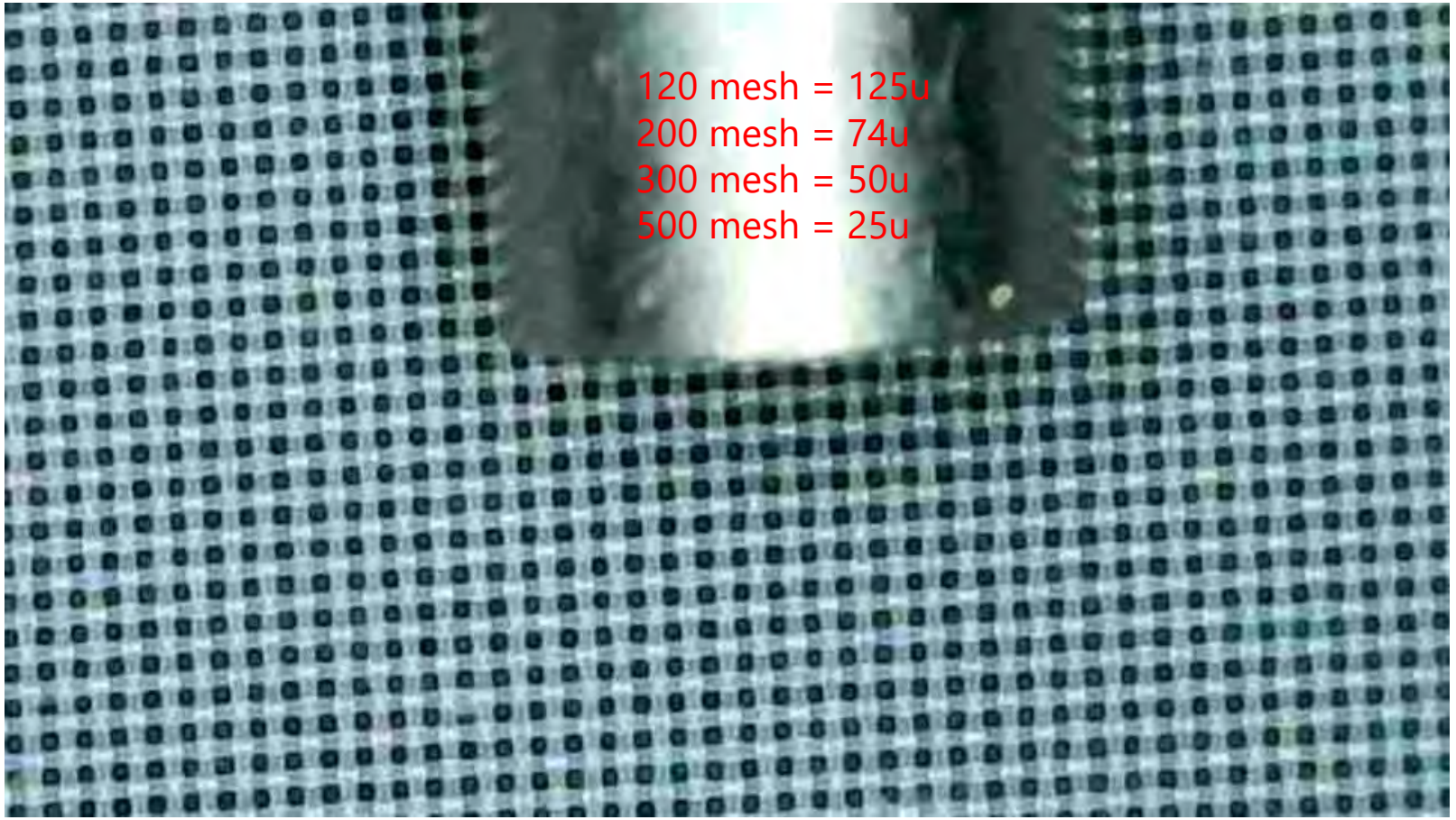


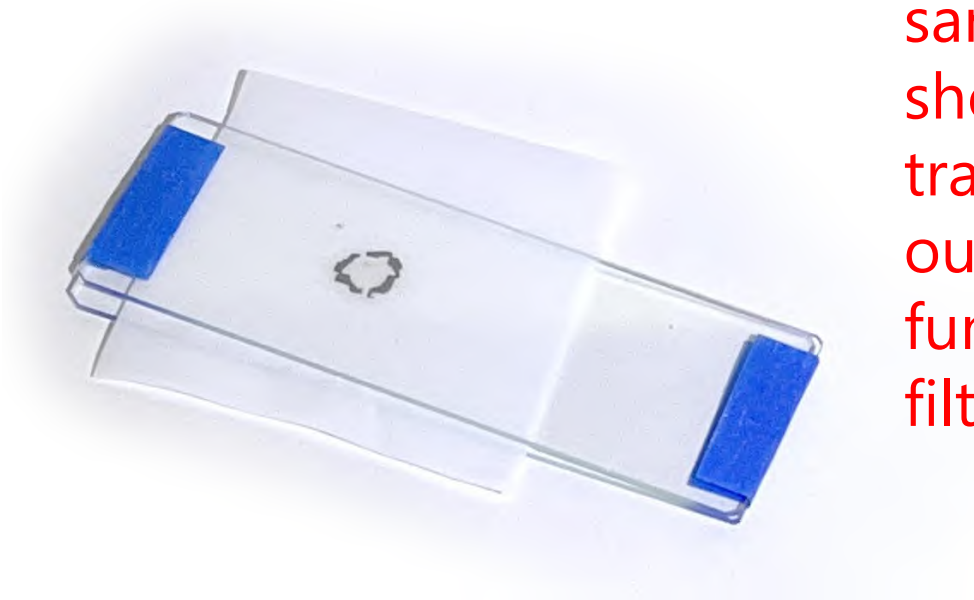




various options for filters explored

Silk Screen Fabric as Filters





slide sandwich showing traced outline of funnel on filter media

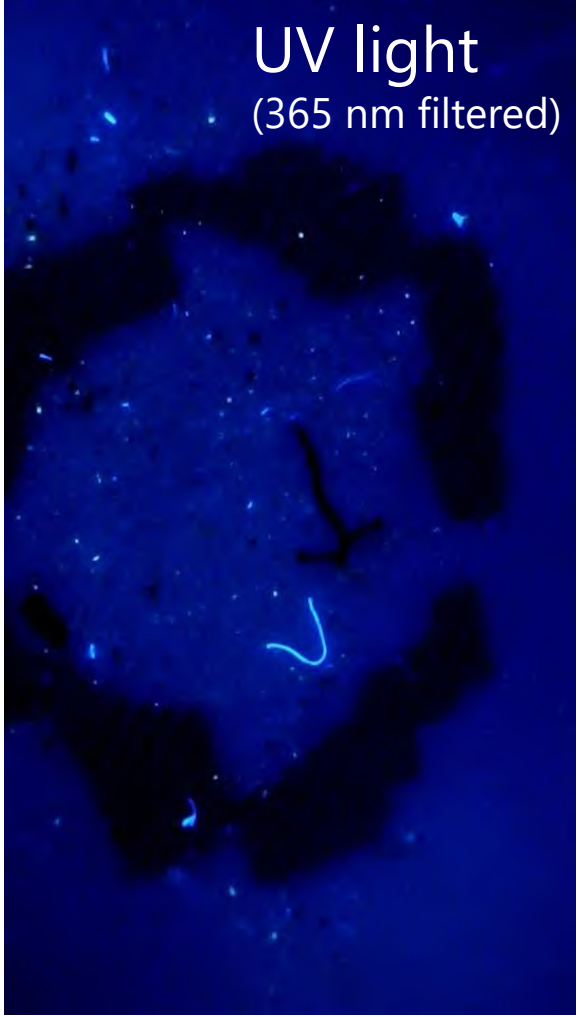
Portable/Rapid Setup



Sampling Steps

- Use masking tape to make microscope slide sandwich leaving one side open
- Open slide sandwich
- Rinse funnel with sample
- Dry tip
- Pull filter mesh around tip
- Push retainer over fabric snuggly
- Pass 500 mL of water through funnel
- If filtering slows or doesn’t flow, use syringe to pressurize
- Carefully remove retainer
- Touch to coffee filter to dry
- Put in on slide and close the sandwich
- Outline funnel tip on top slide with marker

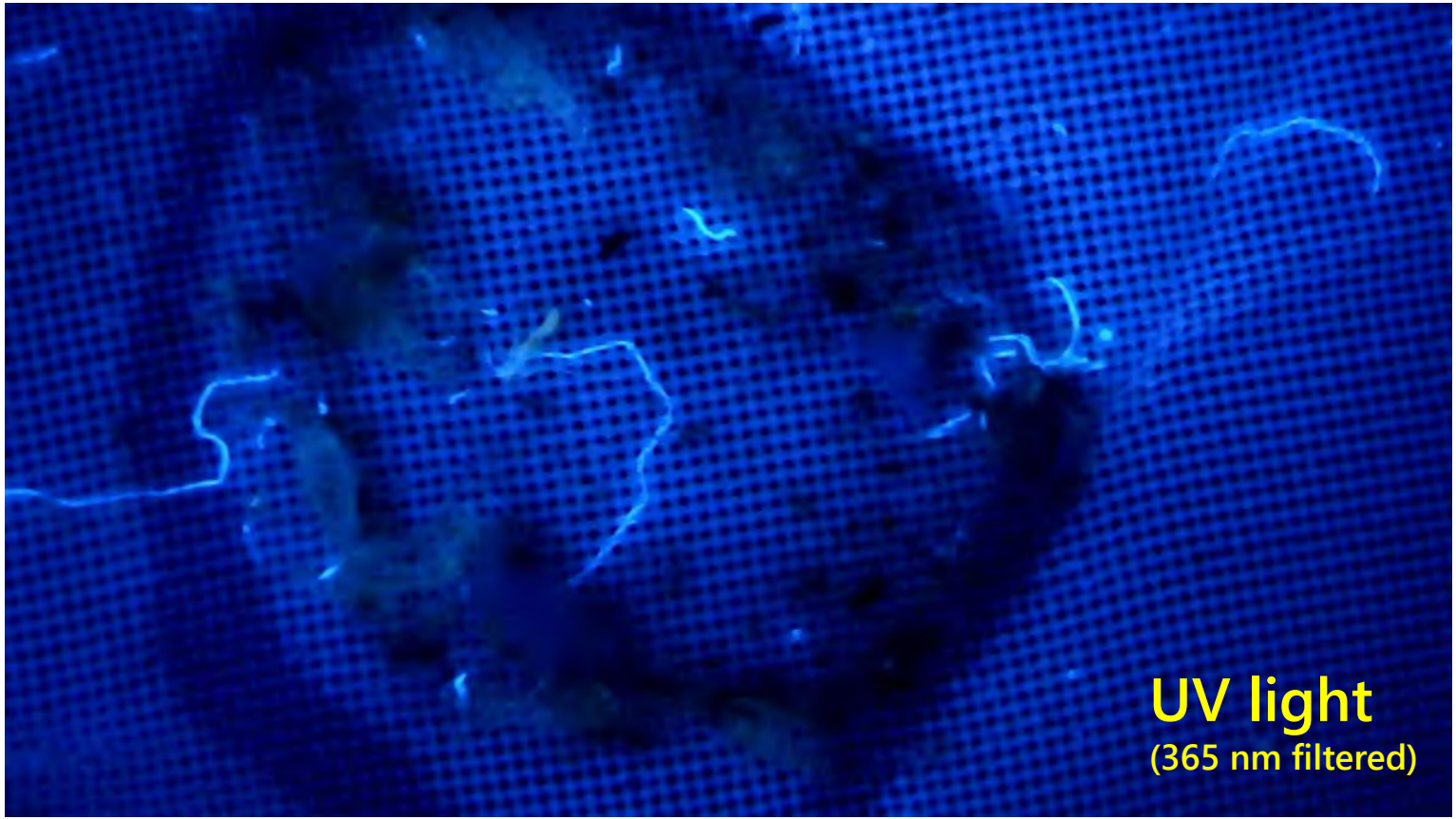

visible light


UV light
(365 nm filtered)

OBX Ocean Water



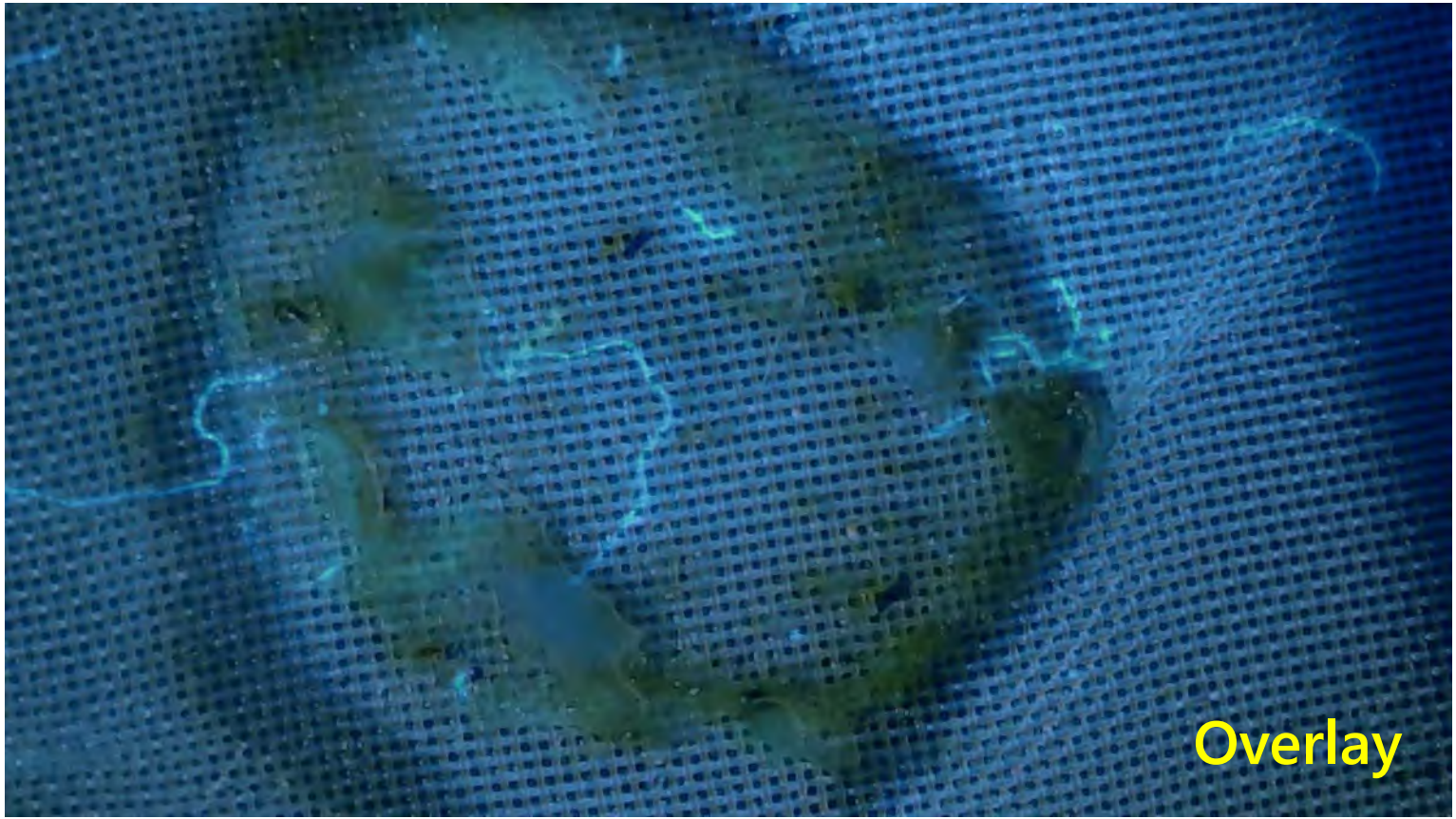
OBX Ocean Water



ible

OBX Ocean Water

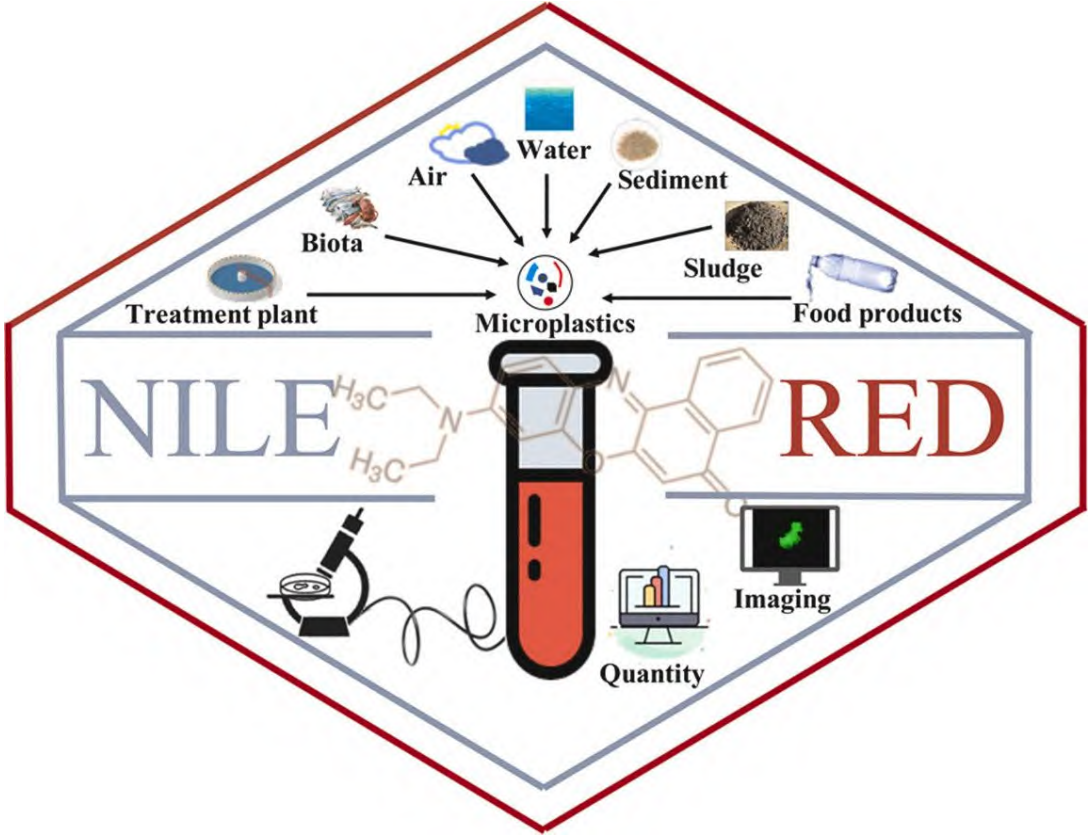
ght
filtered)



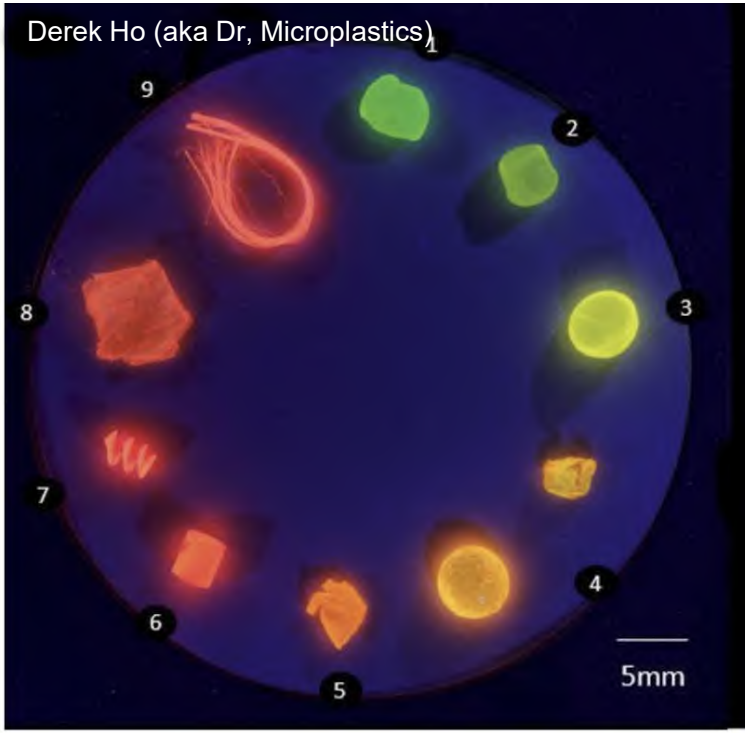


During presentation on 16 July, this was a live demo.

WHAT I AM NOT DOING



Shruti, V. C., et al. "Analyzing microplastics with Nile Red: Emerging trends, challenges, and prospects." *Journal of hazardous materials* 423 (2022): 127171.



Ho, Derek, and Julie Masura. "Dyeing to know: harmonizing nile red staining protocols for microplastic identification." *Colorants* 4.2 (2025): 20.

https://plasticfreepals.org/About/

Water Research 155 (2019) 410–422

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

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[b] KWR Watercycle Research Institute, the Netherlands
[c] Wetsus, European Centre of Excellence for Sustainable Water Technology, the Netherlands
[d] World Health Organization, 20, Avenue Appia, 1211, Geneva, Switzerland

high quality data is difficult!

ARTICLE INFO

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Keywords:
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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} #/m^3) across individual samples and water types. However, only four out of 50 studies received

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Observations and Hypothesis



- Observations:
  - it is impossible to find water free of particles
  - water with the same lot numbers and in the same cases/packages contain different amounts of plastic particles
  - bottles on the outside of cases/packages can, but don't always, contain more particles than those in the center of the case/package
  - there are particles produced from processing equipment present

- Hypothesis: impacts and flexing of polymer containers creates microplastic particles

Water Bottle Abuse



- half-filled commercial water bottle
- drop from approx. 2 feet 1500, 3000 or 4500 times
- use 66 cm diameter, cylindrical, baffled tumbler operating at 50 revolutions per minute
- half-filled to allow more distortion, to overcome centripetal force and to limit equipment damage

Water Bottle Abuse



- set on air dry (no heat)
- operate for 30 minutes for one or two cycles

Abuse Options







Abuse Options



- moved to 50 ml per container
- either never completely empty bottle or minimum triple rinse
- 50 mL filled and saved as blank

During presentation on 3 October, this was a live demo, not a video.

PET Water Bottles

August 2025

https://mjphd.net/sc/sc.php?010

Tested Lots of Containers



- washed ≥ 3 times with last wash retained for reference using the most particle free water on-hand
- abuse and record time
- take micrograph of visible particles
- look at before and after Rayleigh scattering to assess nanoparticles

Sampling Steps

- Triple rinse 2 vials with bottled water; one will be for the blank, one for sample
  - use piece of polyethylene between the bottle and cap
- Save a sample of “before”
- With between 50 and 100 mL in the bottle, seal it and begin beating it up for 10 to 15 minutes
  - never fully open the bottle but you can loosen and retighten the lid
- After the time is up, save a sample in one of the prewashed vials
- Observe particles over bright light

Labs

Environmental

- Use masking tape to make microscope slide sandwich leaving one side open
- Open slide sandwich
- Rinse funnel with sample
- Dry tip
- Pull filter mesh around tip
- Push retainer over fabric snuggly
- Pass 500 mL of water through funnel
- If filtering slows or doesn't flow, use syringe to pressurize
- Carefully remove retainer
- Place on filter paper to dry
- Put in on slide and close the sandwich
- Outline funnel tip on top slide with marker
- Observe under white and UV light

Bottled Water

- Triple rinse 2 vials with bottled water; one will be for the blank, one for sample
  - use piece of polyethylene between the bottle and cap
- Save a sample of "before"
- With between 50 and 100 mL in the bottle, seal it and begin beating it up for 10 to 15 minutes
  - never fully open the bottle but you can loosen and retighten the lid
- After the time is up, save a sample in one of the prewashed vials
- Observe particles over bright light



Yooperlites and that using different light to view the world can illuminate new things

Microplastics are everywhere and in the news every day, yet there is a lot of misinformation

How to construct equipment to look for microplastics

MIDLAND ACS LOCAL SECTION





Water Chemistry in the Great Lakes Region

SALTWATCH.ORG



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wwf.panda.org/wwf_news/?348337/Revealed-plastic-ingestion-by-people-could-be-equating-to-a-credit-card-a-week

Environmental Science & Technology

pubs.acs.org/est

Cutting Boards: An Overlooked Source of Microplastics in Human Food?

Himani Yadav, Md Rakib Hasan Khan, Mohiuddin Quadir, Kelly A. Rusch, Partho Protim Mondal, Megan Orr, Elvis Genbo Xu, and Syeed Md Iskander*

Cite This: *Environ. Sci. Technol.* 2023, 57, 8225–8235

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ABSTRACT: Plastic cutting boards are a potentially significant source of microplastics in human food. Thus, we investigated the impact of chopping styles and board materials on microplastics released during chopping. As chopping progressed, the effects of chopping style on microplastic release became evident. The mass and number of microplastics released from polypropylene chopping boards were greater than polyethylene by 5−60% and 14−71%, respectively. Chopping on polyethylene boards was associated with a greater release of microplastics with a vegetable (i.e., carrots) than chopping without carrots. Microplastics showed a broad, bottom-skewed normal distribution, dominated by <100 μm spherical-shaped microplastics. Based on our assumptions, we estimated a per-person annual exposure of 7.4−50.7 g of microplastics from a polyethylene chopping board and 49.5 g of microplastics from a polypropylene chopping board. We further estimated that a person could be exposed to 14.5 to 71.9 million polyethylene microplastics annually, compared to 79.4 million polypropylene microplastics from chopping boards. The preliminary toxicity study of the polyethylene microplastics did not show adverse effects on the viability of mouse fibroblast cells for 72 h. This study identifies plastic chopping boards as a substantial source of microplastics in human food, which requires careful attention.

KEYWORDS: *polyethylene, polypropylene, human exposure, FTIR, toxicity*

MISINFORMATION

> "cumulative annual release of 7.4–50.7 g of polyethylene. . . . from a polypropylene chopping board was 49.5 g"

DOI: 10.1021/acs.est.3c00924

assuming 1 use per day,
that's 0.14 g per use

ewg

Who We Are ⌄ Areas of Focus ⌄ Consumer Guides Research News & Insights ⌄

NEWS & INSIGHTS / NEWS / 2023 / 10

Making meals without microplastics: Tips for safer cutting boards



MISINFORMATION

"50 grams per year – roughly equivalent to the weight of ten plastic credit cards"

https://www.ewg.org/news-insights/news/2023/10/making-meals-without-microplastics-tips-safer-cutting-boards