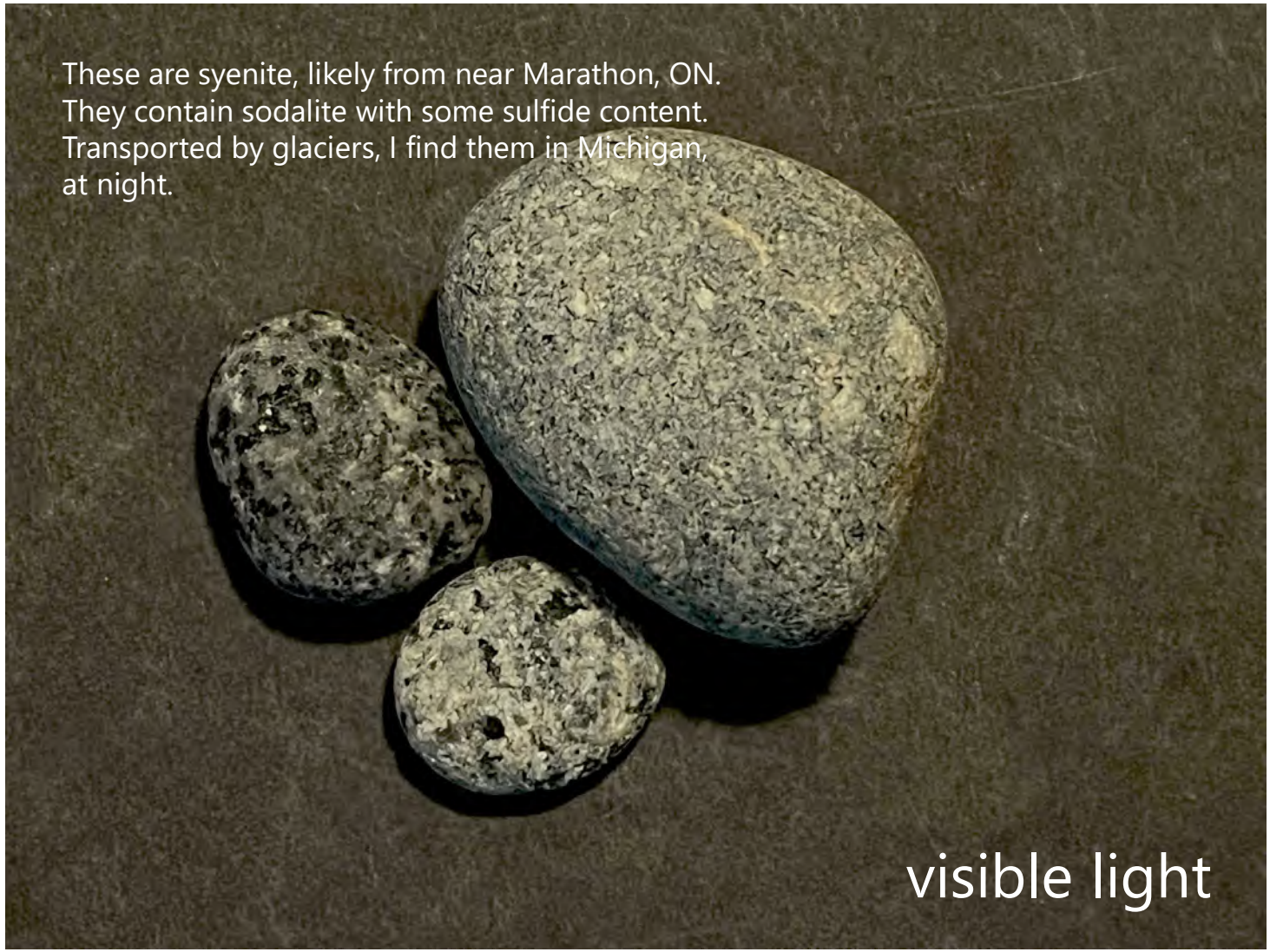
MJPHD

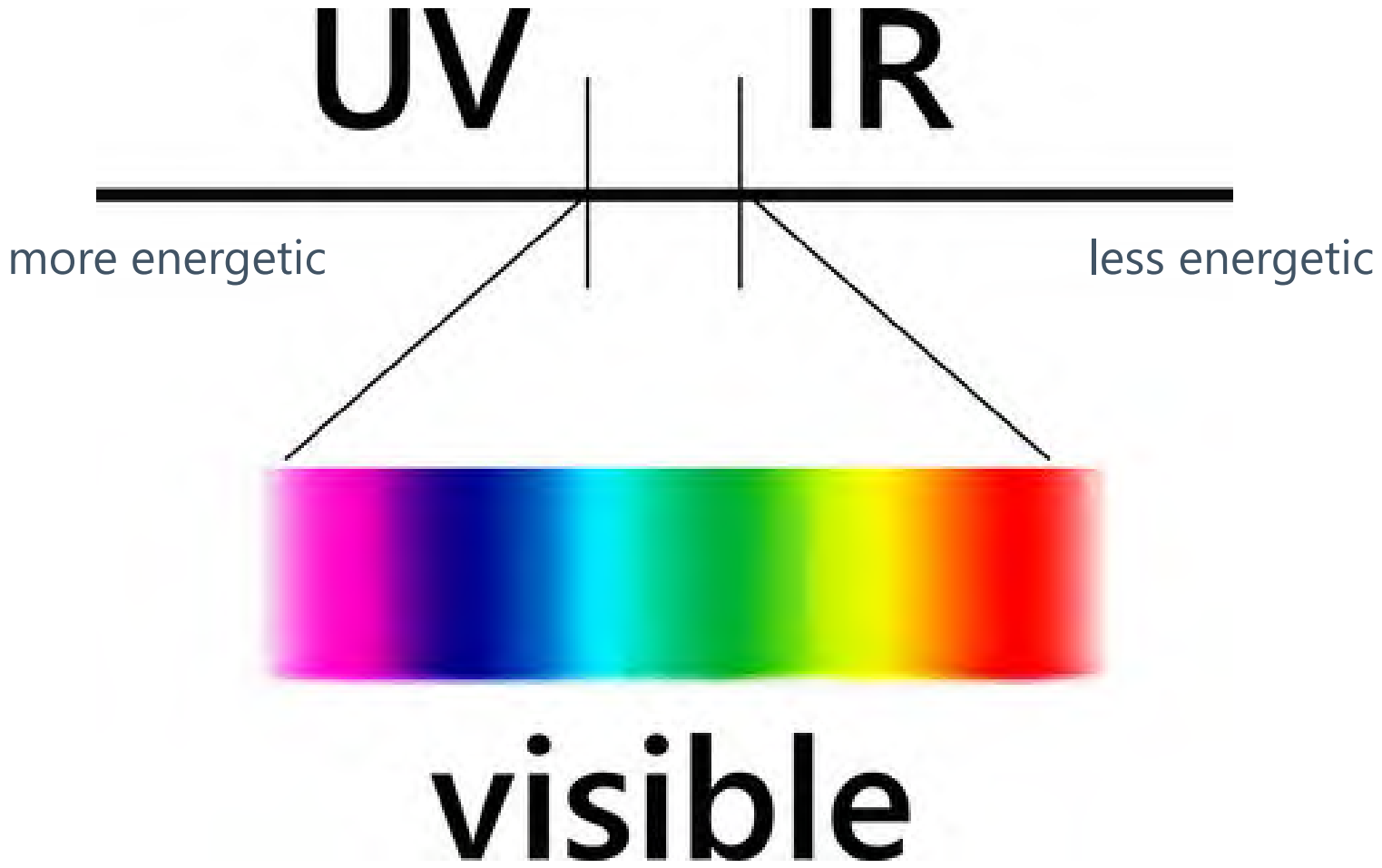
MICROPLASTICS:
WHAT ARE THEY AND WHERE ARE THEY

MARK JONES
CREATIVE DIRECTOR
MJPHD, LLC

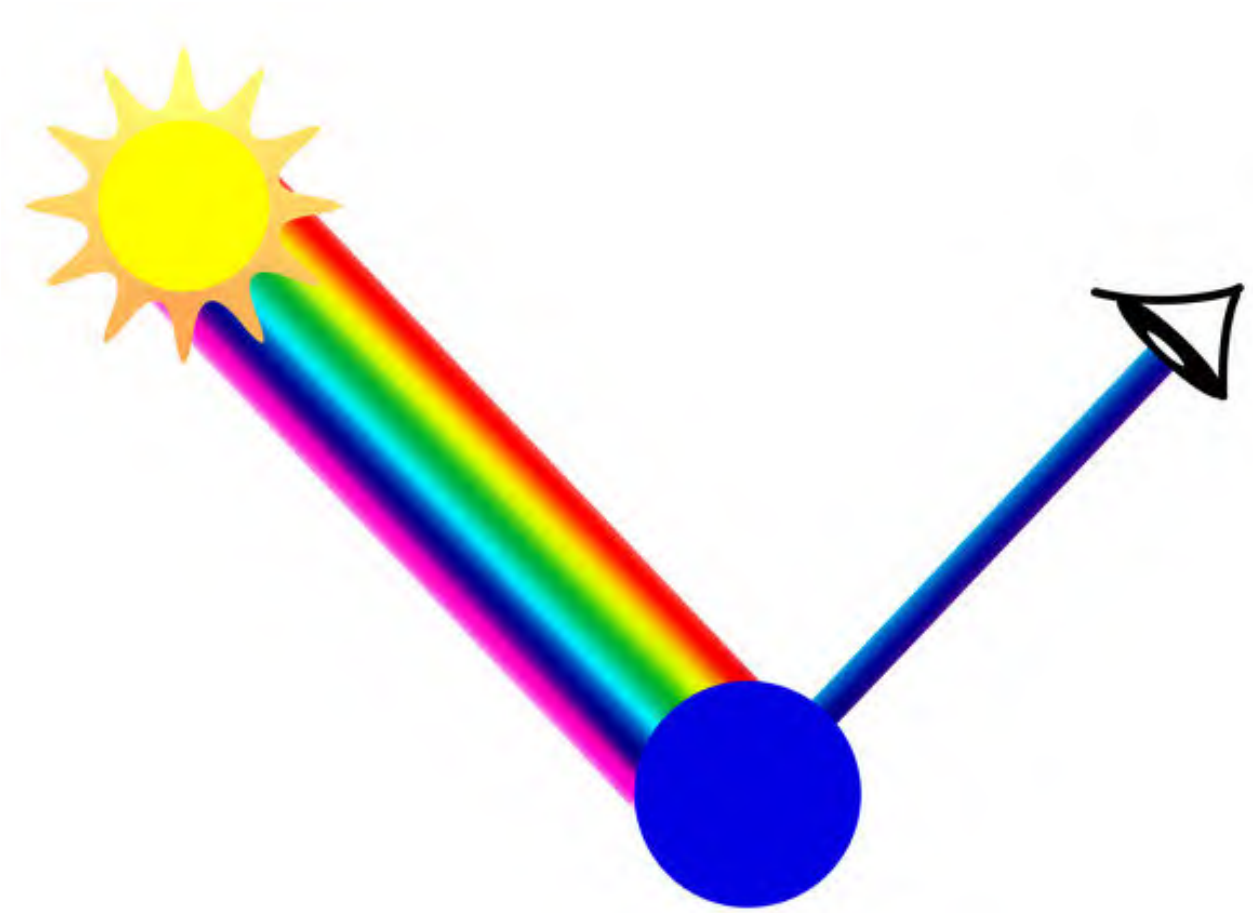
12 November 2025


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

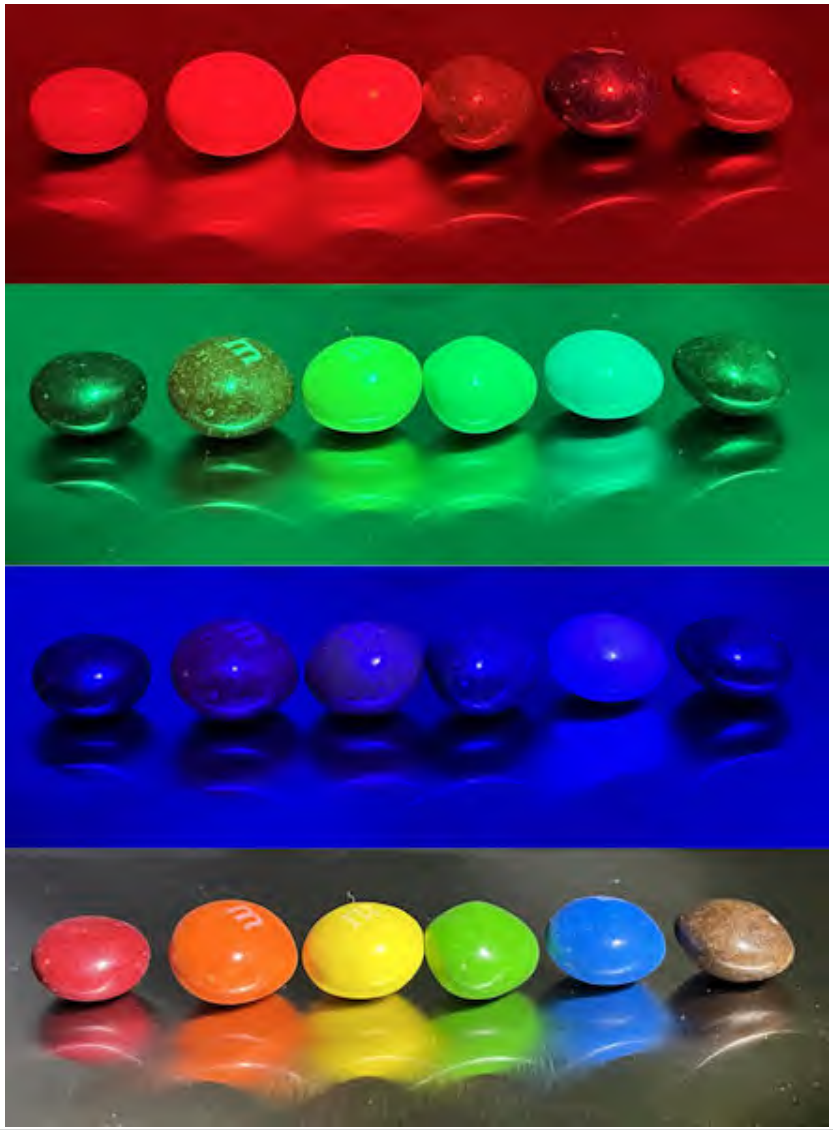


red light

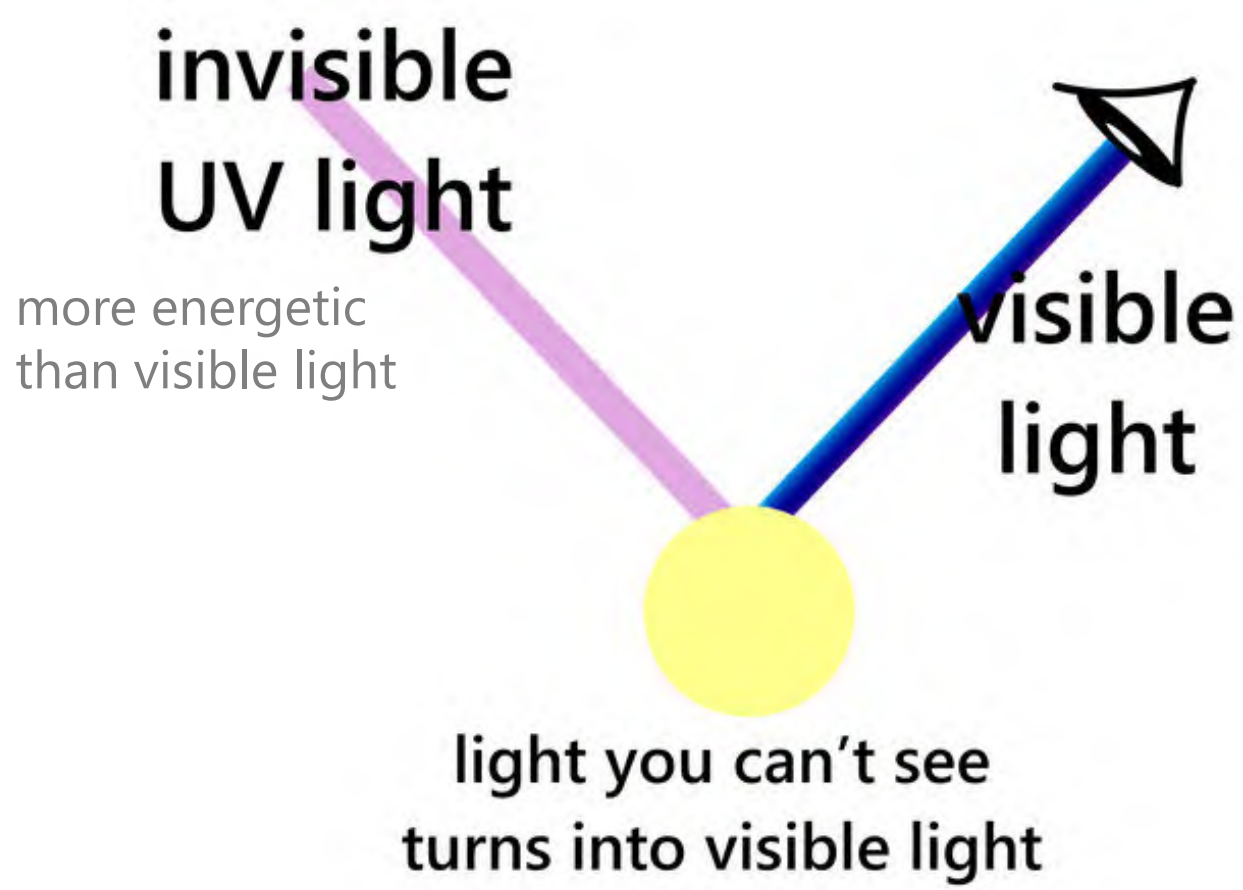
green light

blue light

white light



FLUORESCENCE



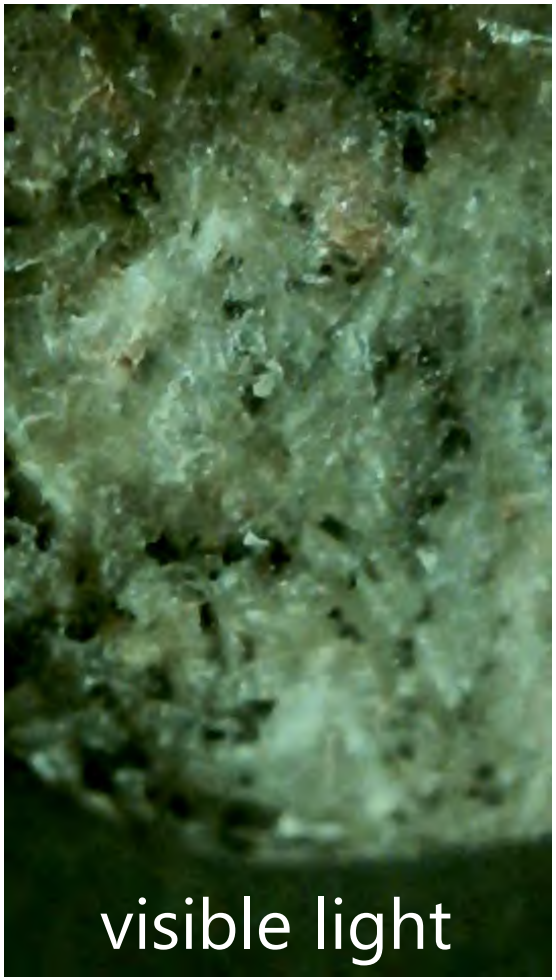
UV

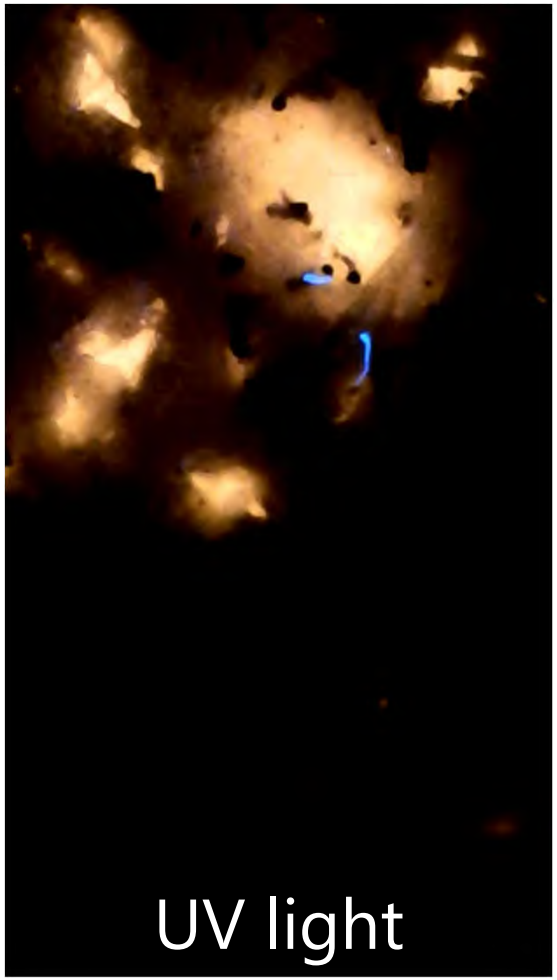
white light

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


visible light


manipulated image


visible light

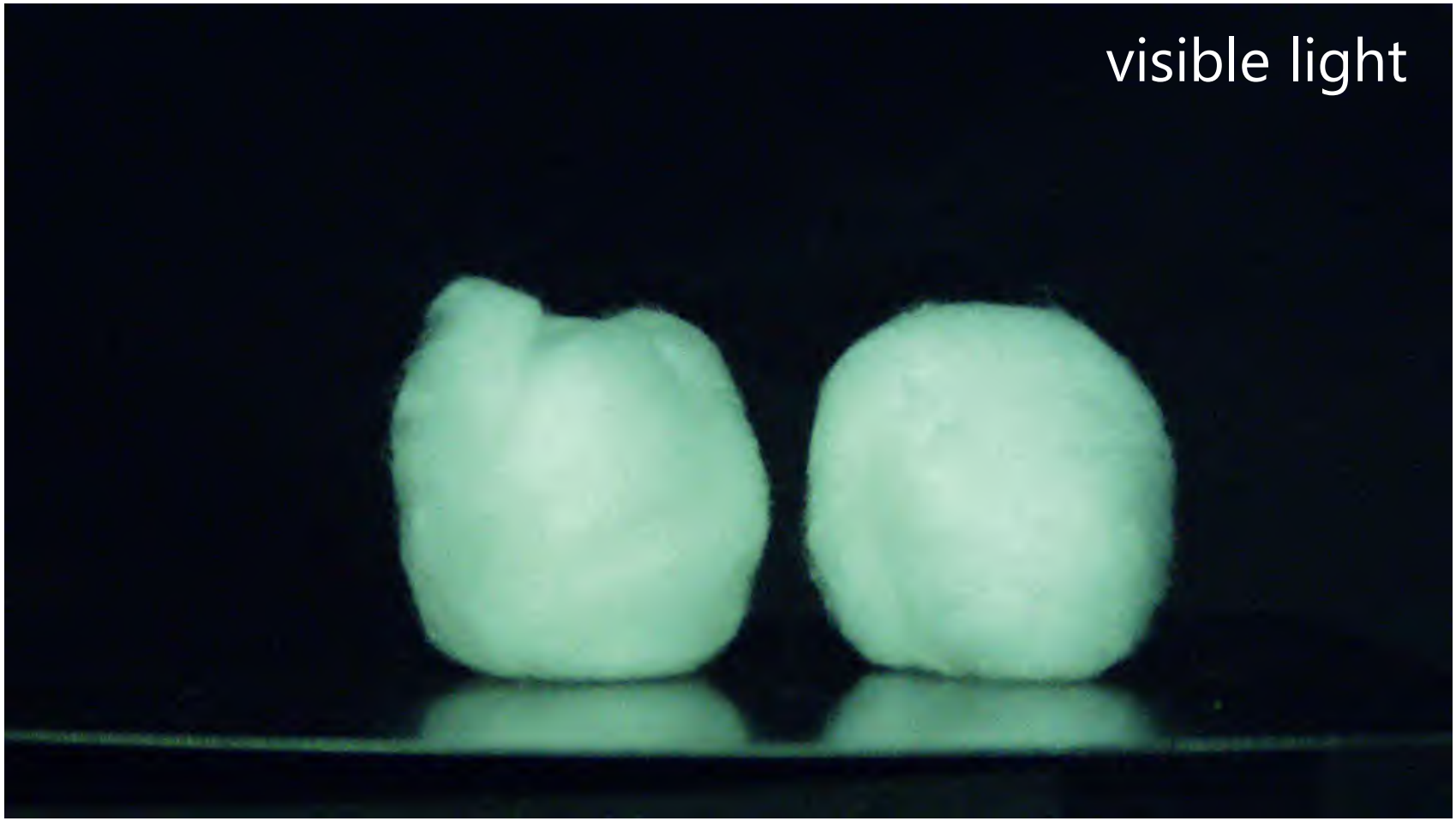

UV light

OBX Beach Sand

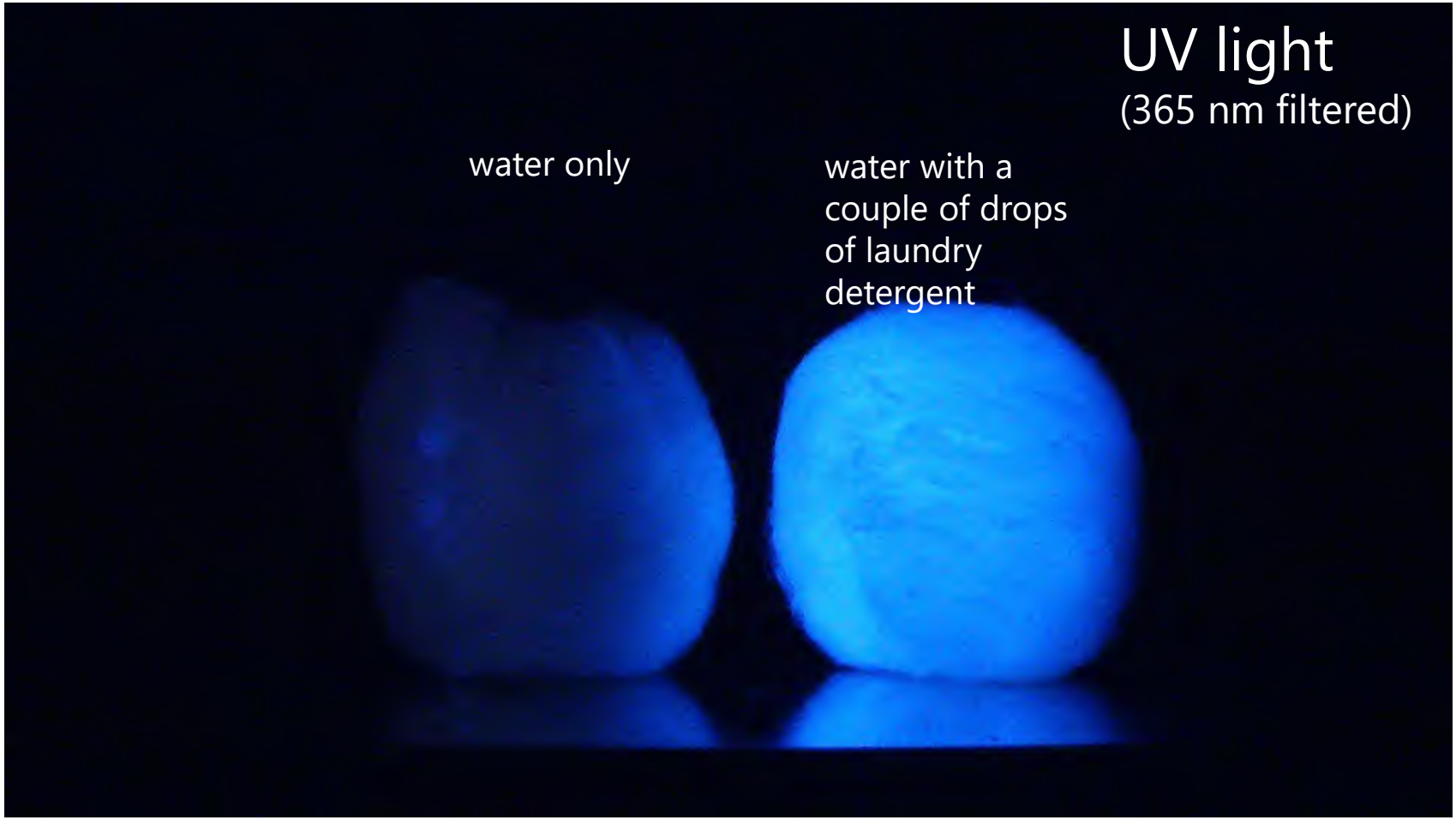
OBX Beach Sand

OBX Beach Sand

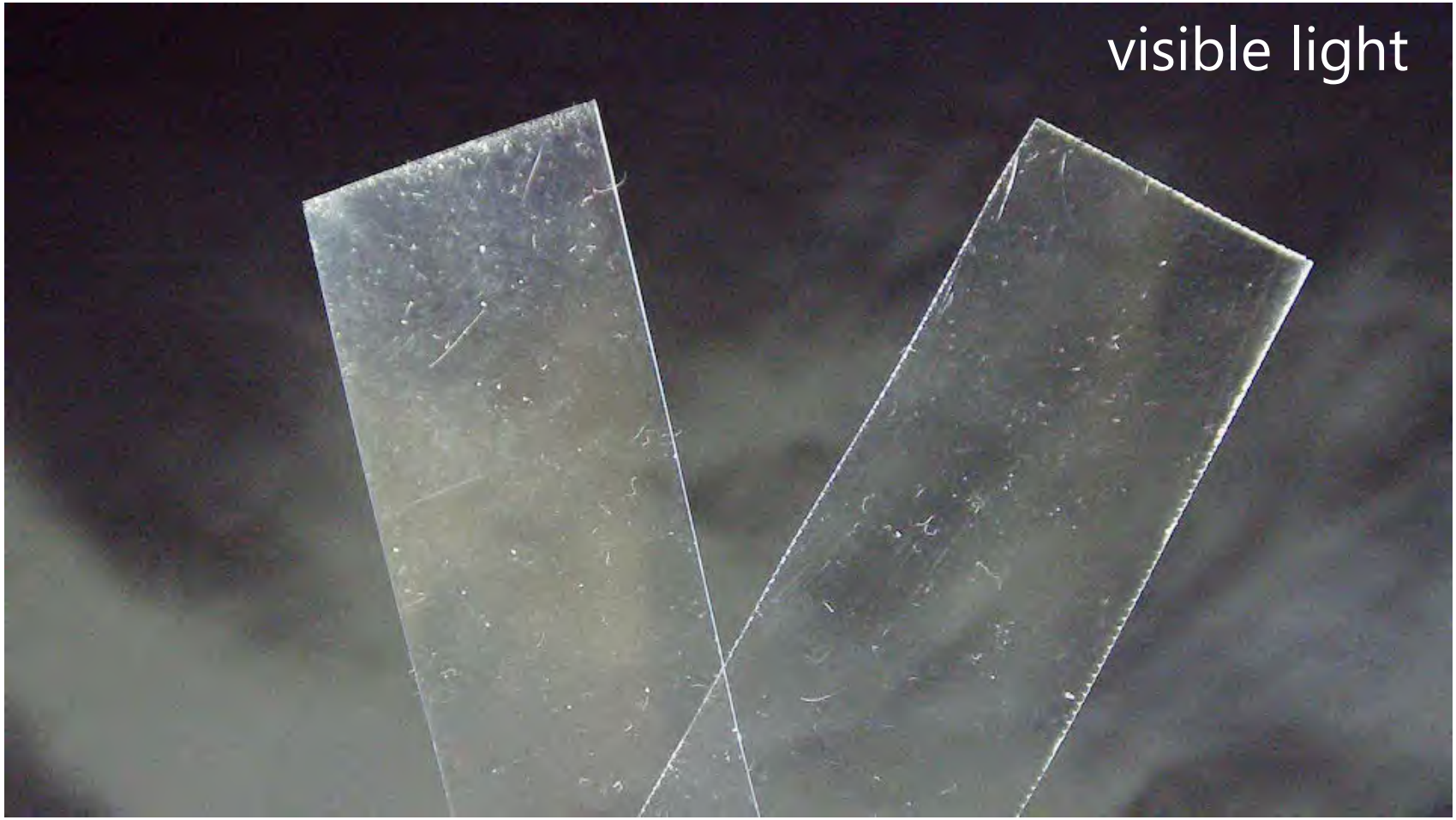
COTTON BALLS



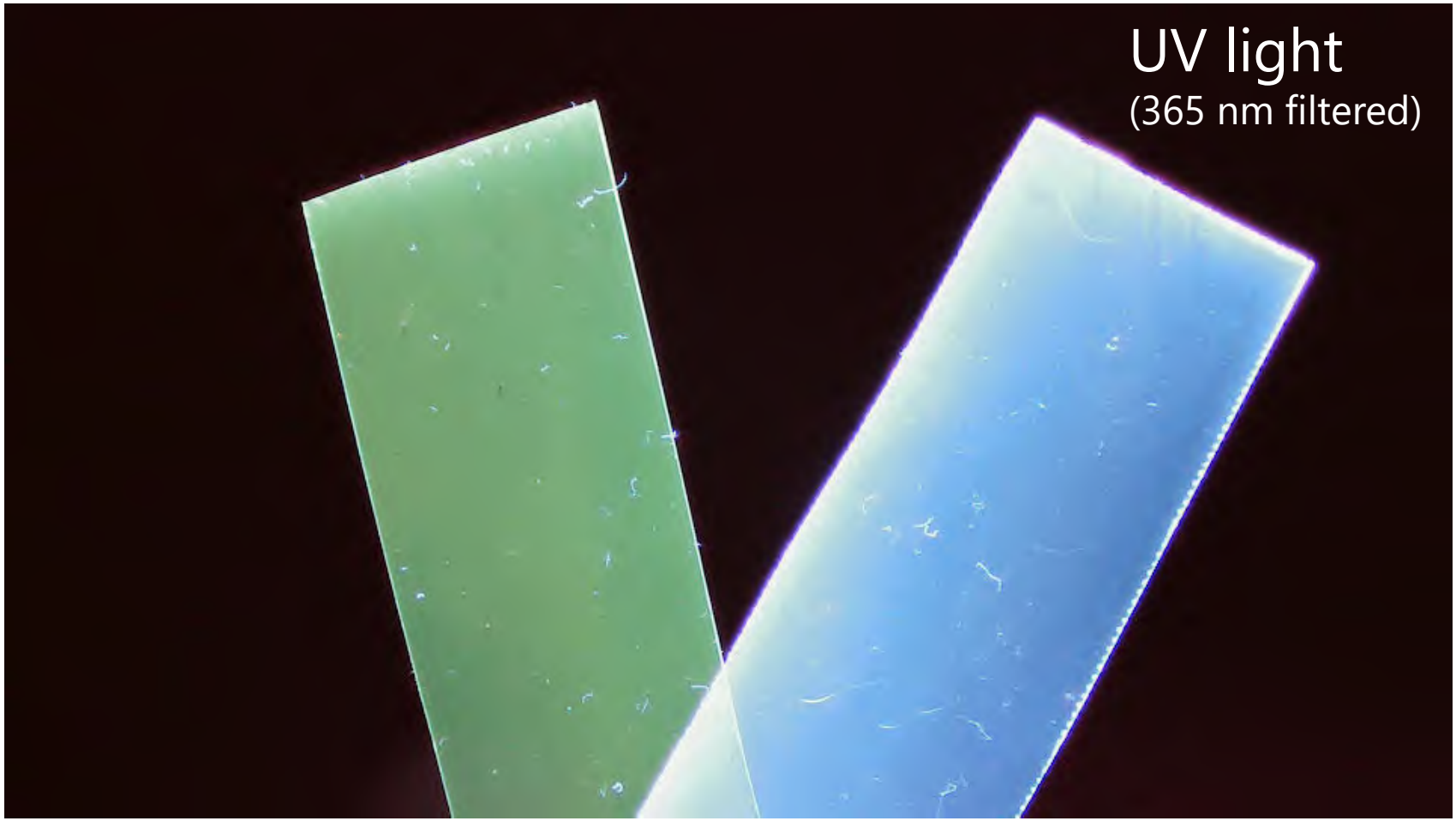
COTTON BALLS – OPTICAL BRIGHTENERS



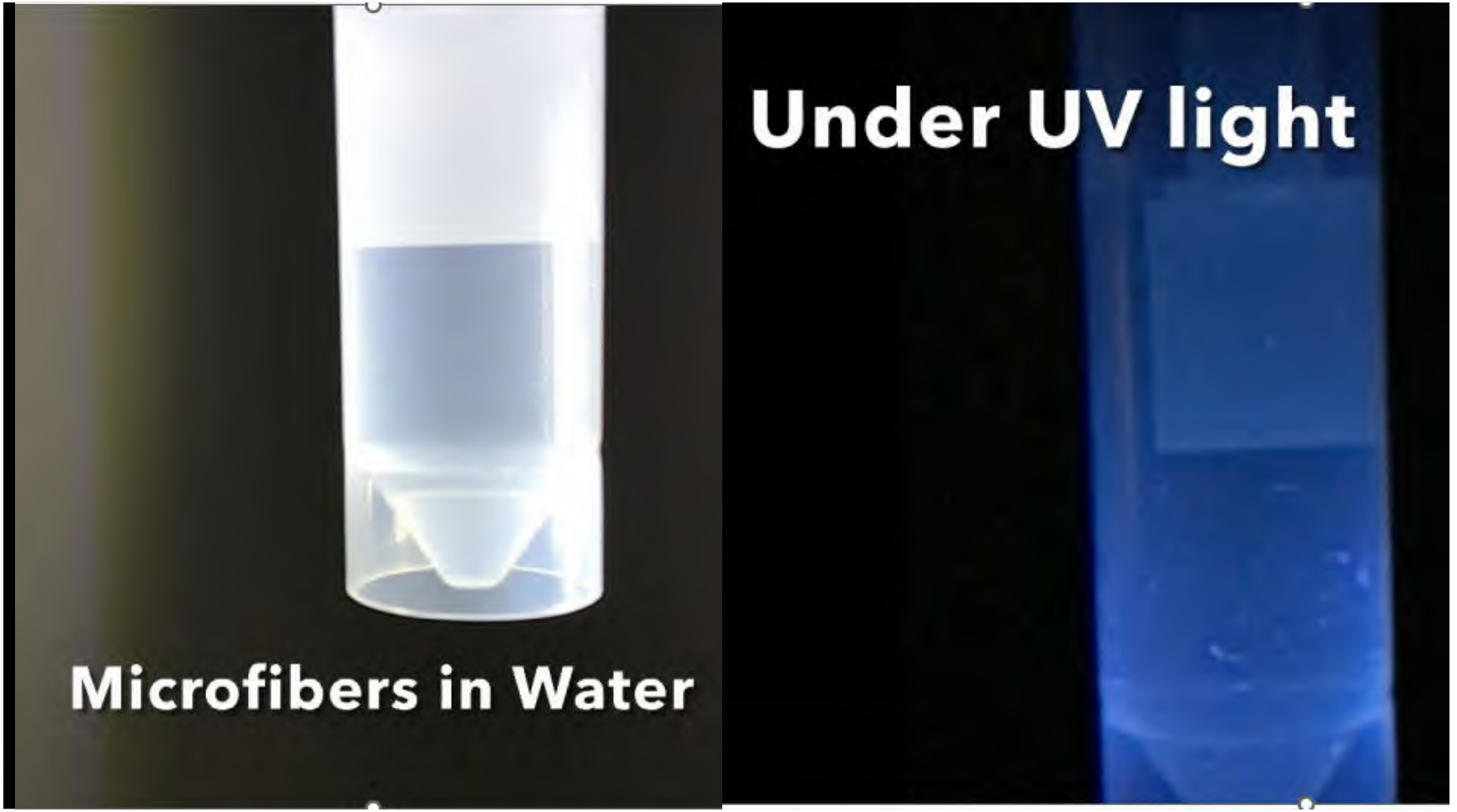
PET



PET – Optical Brighteners



MICROFIBERS




LED
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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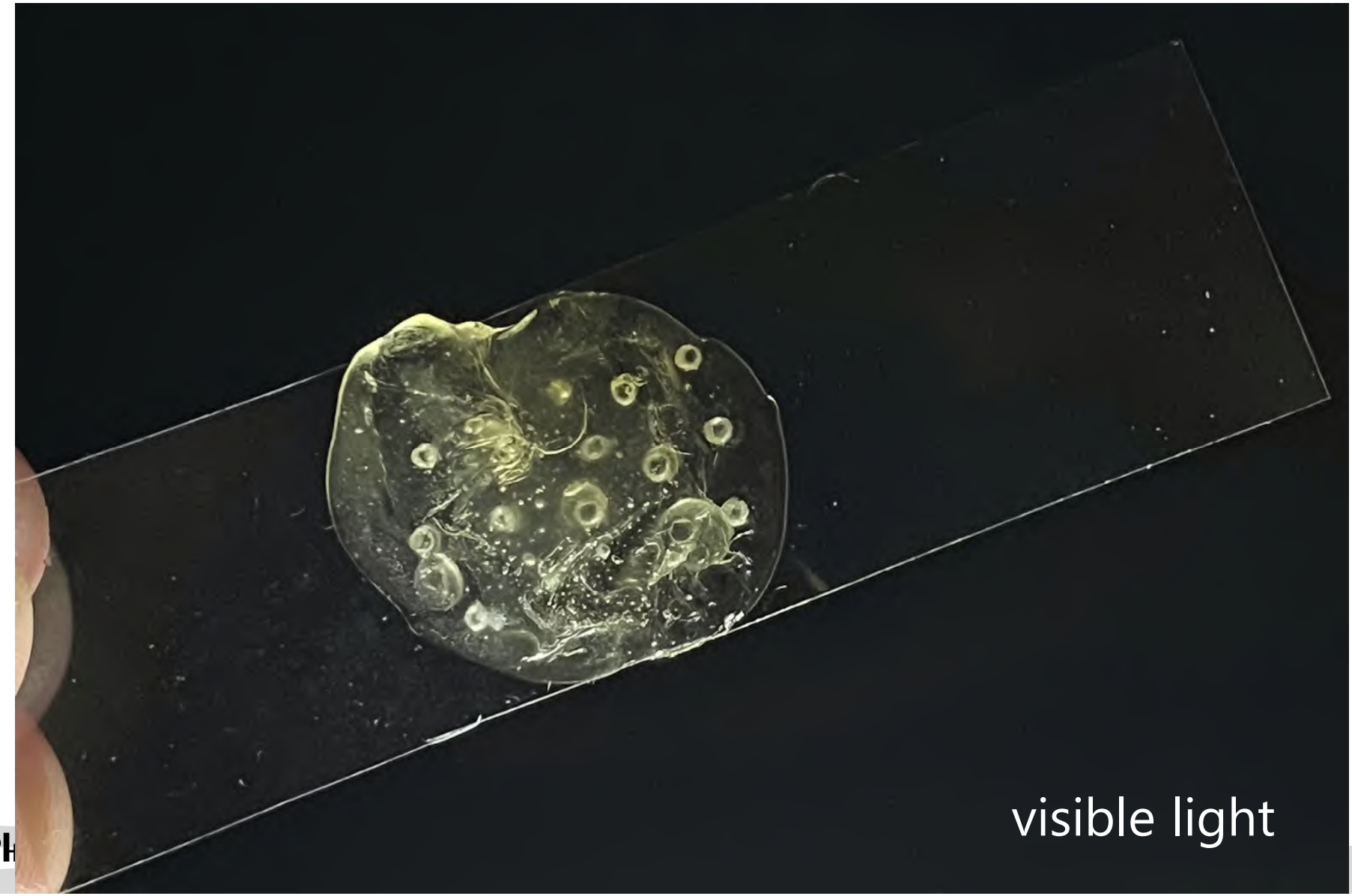

visible light

Get a sample of water.

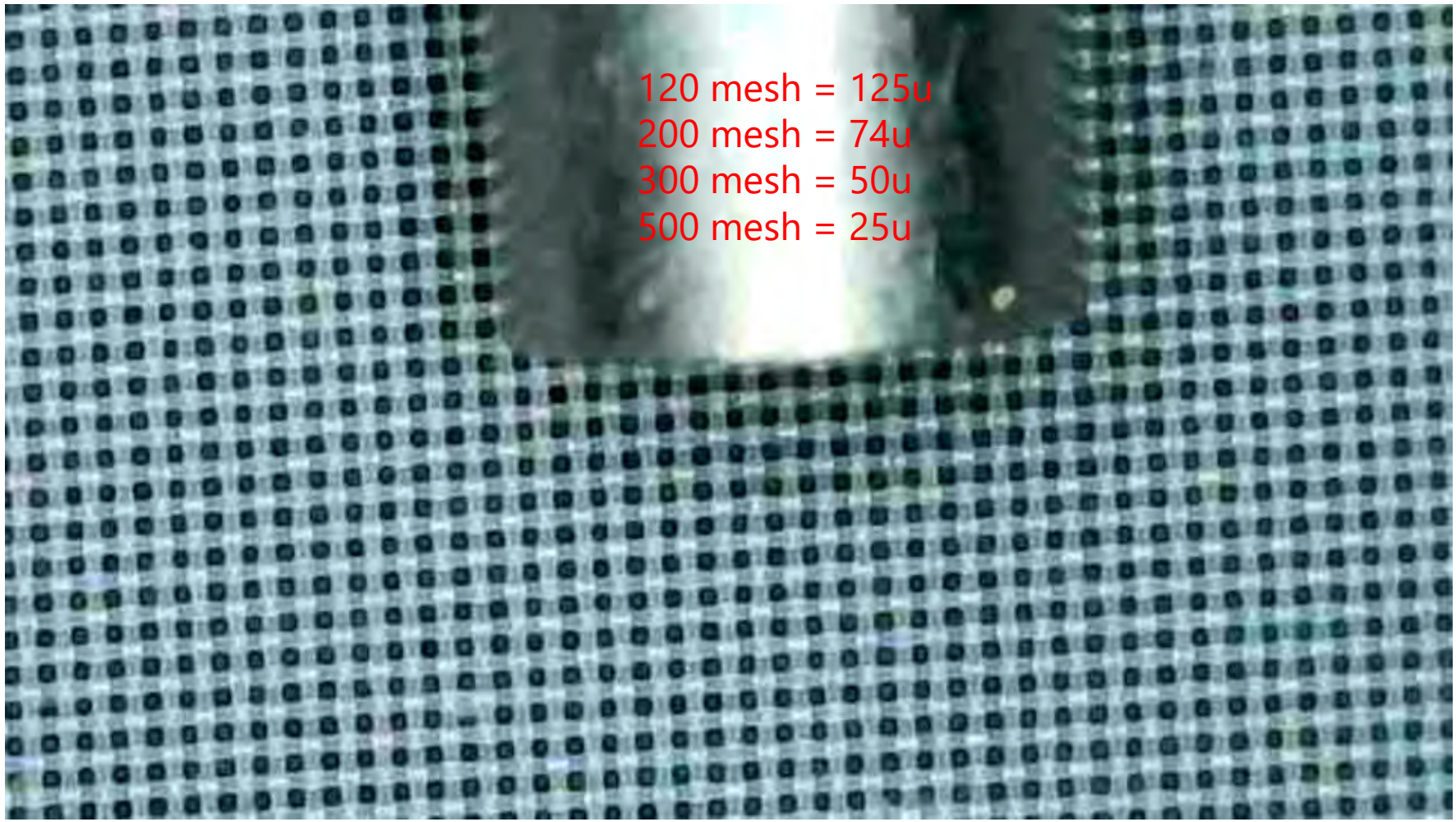
Filter out the small particles.

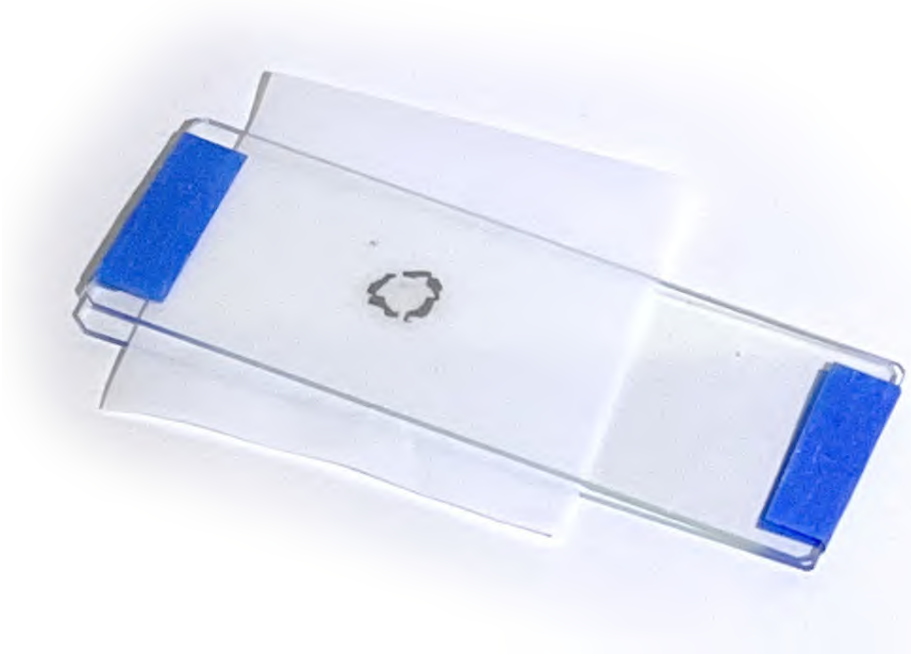
Count the particles.

current iteration designed to sample near but not at the surface

various options for filters explored

Silk Screen Fabric as Filters





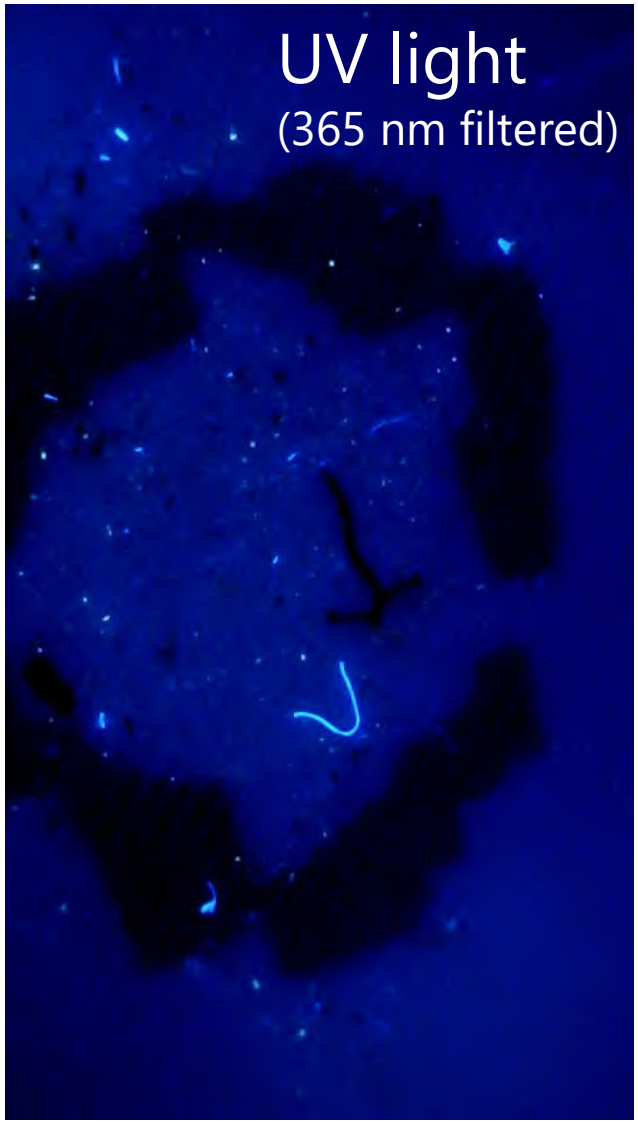
slide sandwich showing traced outline of funnel on filter media


LED
UV light
filter

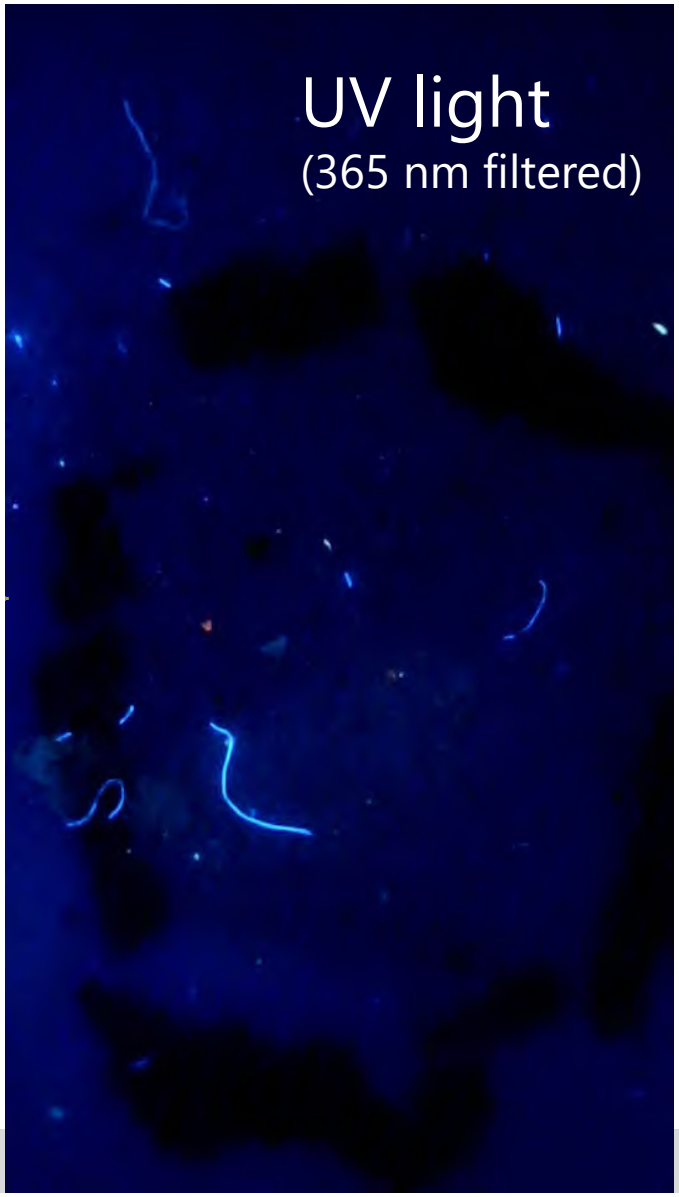
Sampling Steps

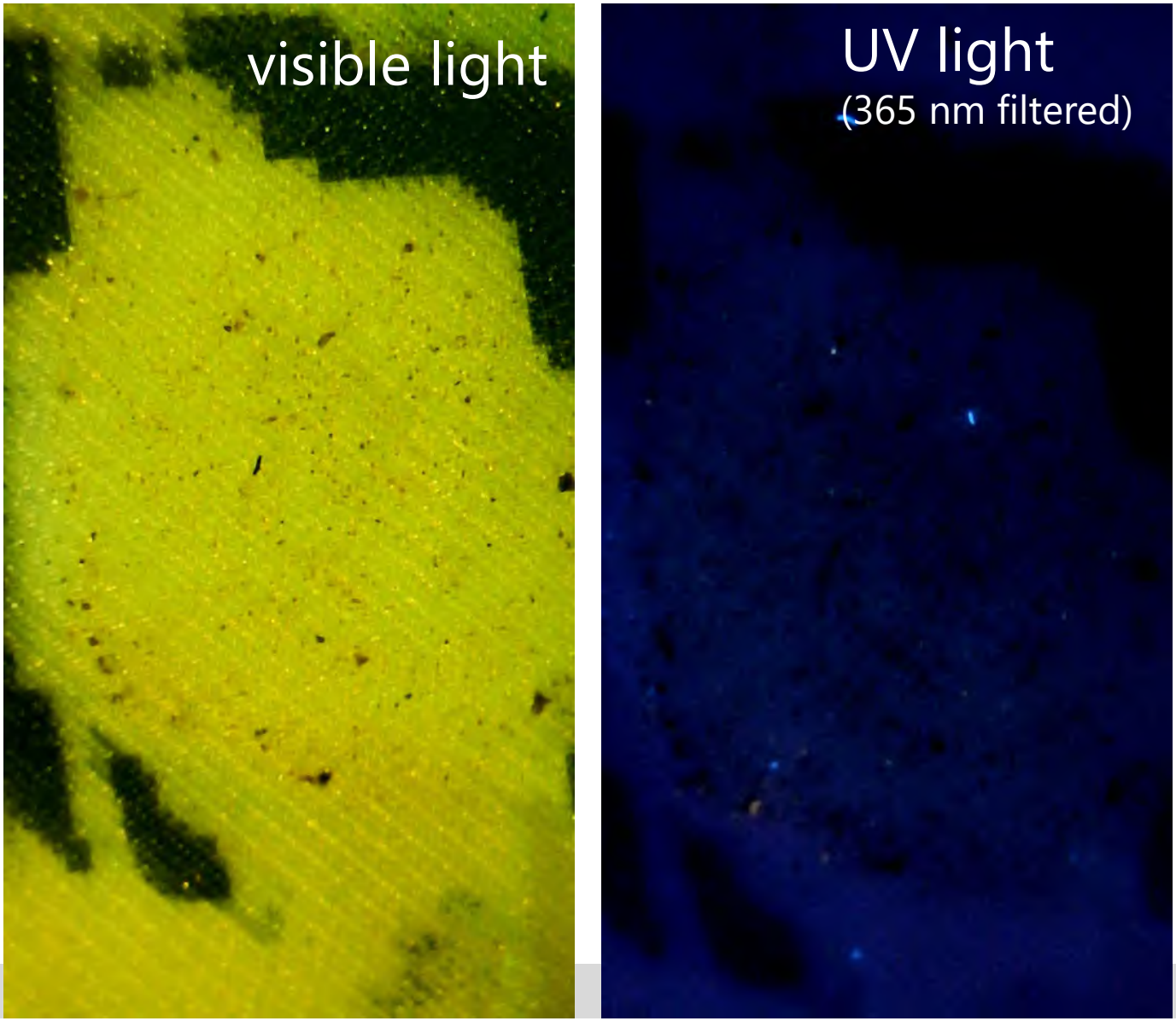
- Use masking tape to make microscope slide sandwich leaving one side open
- Open slide sandwich
- Rinse funnel with sample
- Dry tip
- Pull filter mesh around tip
- Push retainer over fabric snuggly
- Pass 500 mL of water through funnel
- If filtering slows or doesn't flow, use syringe to pressurize
- Carefully remove retainer
- Place on filter paper 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)

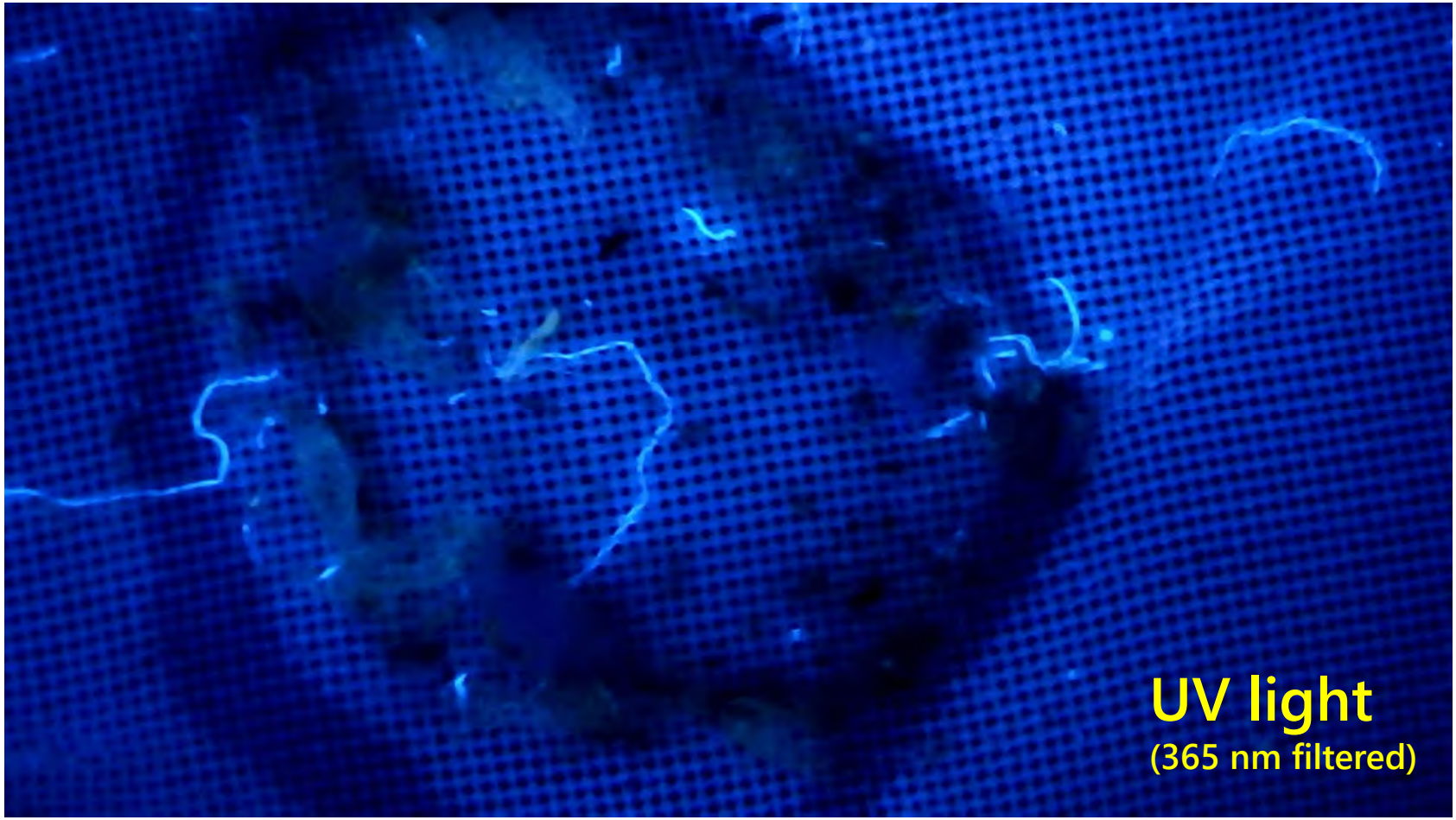

visible light


UV light
(365 nm filtered)


visible light
UV light
(365 nm filtered)

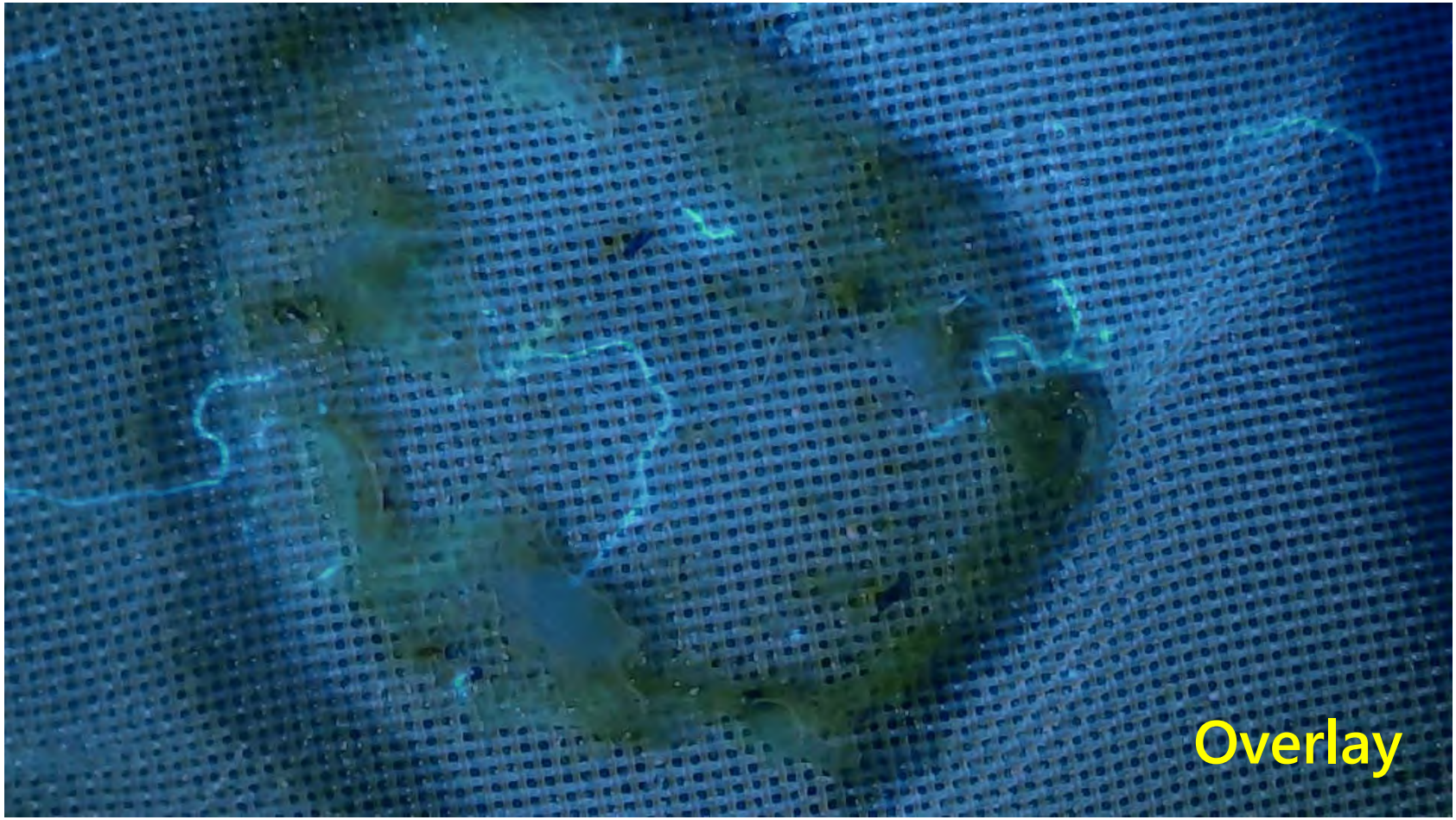
OBX Ocean Water

OBX Ocean Water



ible

OBX Ocean Water



ght
filtered)

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

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

[a] Aquatic Ecology and Water Quality Management Group, Wageningen University, the Netherlands
[b] KWR Watercycle Research Institute, the Netherlands
[c] World Health Organization (WHO), 20, Avenue Appia, 1211, Geneva, Switzerland

high quality data is difficult!

ARTICLE INFO

Article history:
Received 27 November 2018
Received in revised form
25 February 2019
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Available online 28 February 2019

Keywords:
Microplastics
Drinking water
Waste water
Surface water
Human health

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

"A new study by the University of Newcastle, Australia suggests that an average person could be ingesting approximately 5 grams of plastic every week. The equivalent of a credit card's worth of microplastics. This summary report highlights the key ways plastic gets into our body, and what we can do about it."

wwfint.awsassets.panda.org/downloads/plastic_ingestion_web_spreads.pdf

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

2.5 mg average particle to reach 5 grams.

Figure 2: Estimated microplastics ingested through consumption of common foods and beverages (particles (0-1mm) per week)

An average person potentially consumes as much as **1769** particles of plastic every week just from water

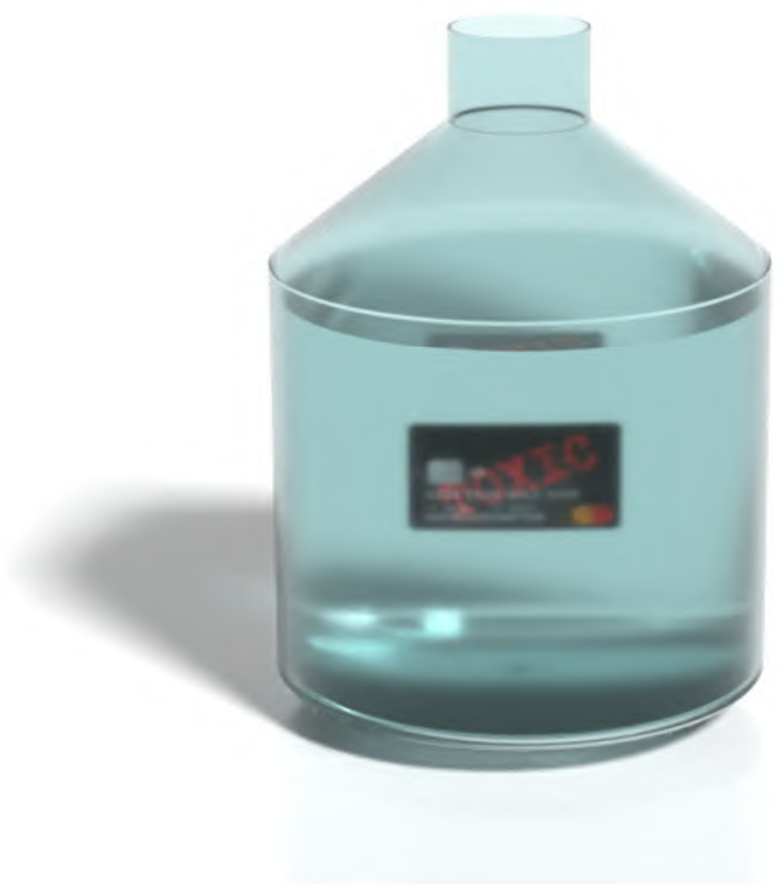
1769 Drinking water*

182 Shellfish

10 Beer

11 Salt

* *Drinking water includes both tap and bottled water*


TOXIC

Average 2.5 mg particles.

Plastic microparticles, 0.65 grams consisting of 523 particles, in a liter of water equaling the concentration in order to ingest 5 grams per week. Such a high concentration is easily seen both in water and upon drying. The particles are cut from 1.5 mm plastic monofilament.

Journal of Hazardous Materials 404 (2021) 124004

Contents lists available at ScienceDirect

Journal of Hazardous Materials

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

Research paper

Estimation of the mass of microplastics ingested – A pivotal first step towards human health risk assessment

Kala Senathirajah [a], Simon Attwood [b], Geetika Bhagwat [c], Maddison Carbery [c], Scott Wilson [d], Thava Palanisami [a,*]

[a] Global Innovative Centre for Advanced Nanomaterials(GICAN), Faculty of Engineering and Built Environment, The University of Newcastle, Callaghan, NSW 2308, Australia
[b] The World Wide Fund for Nature (WWF), 354 Tanglin Road, Singapore, Singapore
[c] School of Environmental and Life Sciences, The University of Newcastle, Callaghan, NSW 2308, Australia
[d] Department of Environmental Science, Macquarie University, Sydney, Australia

ARTICLE INFO

Keywords:
Exposure pathways
Human health
Ingestion
Microplastics
Plastic pollution
Risk

ABSTRACT

The ubiquitous presence of microplastics in the food web has been established. However, the mass of microplastics exposure to humans is not defined, impeding the human health risk assessment. Our objectives were to extract the data from the available evidence on the number and mass of microplastics from various sources, to determine the uncertainties in the existing data, to set future research directions, and derive a global average rate of microplastic ingestion to assist in the development of human health risk assessments and effective management and policy options. To enable the comparison of microplastics exposure across a range of sources, data extraction and standardization was coupled with the adoption of conservative assumptions. Following the analysis of data from fifty-nine publications, an average mass for individual microplastics in the 0–1 mm size range was calculated. Subsequently, we estimated that globally on average, humans may ingest 0.1–5 g of microplastics weekly through various exposure pathways. This was the first attempt to transform microplastic counts into a mass value relevant to human toxicology. The determination of an ingestion rate is fundamental to assess the human health risks of microplastic ingestion. These findings will contribute to future human health risk assessment frameworks.

> “humans may ingest 0.1-5 g of microplastics weekly through various exposure pathways”

https://doi.org/10.1016/j.jhazmat.2020.124004

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Environmental Science & Technology

pubs.acs.org/est

Article

Lifetime Accumulation of Microplastic in Children and Adults

Nur Hazimah Mohamed Nor,* Merel Kooi, Noël J. Diepens, and Albert A. Koelmans

Cite This: *Environ. Sci. Technol.* 2021, 55, 5084−5096

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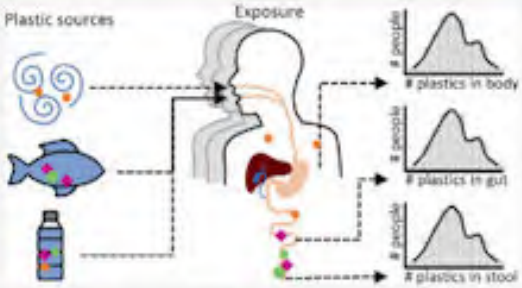
ABSTRACT: Human exposure to microplastic is recognized as a global problem, but the uncertainty, variability, and lifetime accumulation are unresolved. We provide a probabilistic lifetime exposure model for children and adults, which accounts for intake via eight food types and inhalation, intestinal absorption, biliary excretion, and plastic-associated chemical exposure via a physiologically based pharmacokinetic submodel. The model probabilistically simulates microplastic concentrations in the gut, body tissue, and stool, the latter allowing validation against empirical data. Rescaling methods were used to ensure comparability between microplastic abundance data. Microplastic (1−5000 μm) median intake rates are 553 particles/capita/day (184 ng/capita/day) and 883 particles/capita/day (583 ng/capita/day) for children and adults, respectively. This intake can irreversibly accumulate to 8.32×10^3 (90% CI, 7.08×10^2−1.91×10^6) particles/capita or 6.4 (90% CI, 0.1−2.31×10^3) ng/capita for children until age 18, and up to 5.01×10^4 (90% CI, 5.25×10^3−9.33×10^6) particles/capita or 40.7 (90% CI, 0.8−9.85×10^3) ng/capita for adults until age 70 in the body tissue for 1−10 μm particles. Simulated microplastic concentrations in stool agree with empirical data. Chemical absorption from food and ingested microplastic of the nine intake media based on biphasic, reversible, and size-specific sorption kinetics, reveals that the contribution of microplastics to total chemical intake is small. The as-yet-unknown contributions of other food types are discussed in light of future research needs.



883 particles per person per day

583 ng/person/day

4 µg per week

https://pubs.acs.org/doi/full/10.1021/acs.est.0c07384

Bert Koelmans makes point that a week's ingestion is like a grain of salt between chopsticks – mere micrograms.

Journal of Hazardous Materials Letters 3 (2022) 100071

Contents lists available at ScienceDirect

Journal of Hazardous Materials Letters

journal homepage: www.sciencedirect.com/journal/journal-of-hazardous-materials-letters

Ingested microplastics: Do humans eat one credit card per week?

Martin Pletz

Designing Plastics and Composite Materials, Department of Polymer Engineering and Science, Montanuniversitaet Leoben, Austria

ARTICLE INFO

Keywords:
Microplastics
Size distribution
Ingestion
Human health

ABSTRACT

Ingested Microplastic (MP) particles can harm the human body. Estimations of the total mass of ingested MP particles correspond to 50 plastic bags per year (Bai et al., 2022), one credit card per week (Gruber et al., 2022), or a median value of 4.1 μg/week for adults (Mohamed Nor et al., 2021). The first two estimations are based on an analysis (Senathirajah et al., 2021) that predicts a total ingested mass of MP particles $m_{i,MP}$ of 0.1–5 g/week. This work revisits and evaluates this calculation and compares its results and methods to Mohamed Nor et al. (2021). Senathirajah combines data of averaged MP particle masses $\bar{m}_{MP}$ from papers that reported MP particle sizes and MP particle counts n_{MP} in shellfish, salt, beer, and water based on other papers that detected MP particles. Combined with the estimated weekly consumption of those consumables, they compute $m_{i,MP}$. This work raises some serious issues of Senathirajah in the way they combine data and they obtained particle sizes. It concludes that Senathirajah overestimates $m_{i,MP}$ by several orders of magnitude and that $m_{i,MP}$ can be considered as a rather irrelevant factor for the toxic effects of MP particles on the human body.

a human eats a credit card worth of MPs not every week but every 23 thousand years.

https://www.sciencedirect.com/science/article/pii/S2666911022000247?via%3Dihub

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

PET Water Bottles

August 2025

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

SALTWATCH.ORG

MJPHD.net

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 Pritom Mondal, Megan Orr, Elvis Genbo Xu, and Syeed Md Iskander*

Cite This: *Environ. Sci. Technol.* 2023, 57, 8225−8235 Read Online

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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 styles 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*

DOI: 10.1021/acs.est.3c00924

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

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

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

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