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# Microfibers and Microplastics in Water:
## *How Searching for Yooper Lights Got Me Looking At Water in Different Ways*

Mark Jones
*Creative Director*
MJPhD, LLC

*10 May 2024*

SCIENCE RENDEZVOUS

**Microfibers and Microplastics in Water: How Searching for Yooper Lights Got Me Looking At Water in Different Ways**

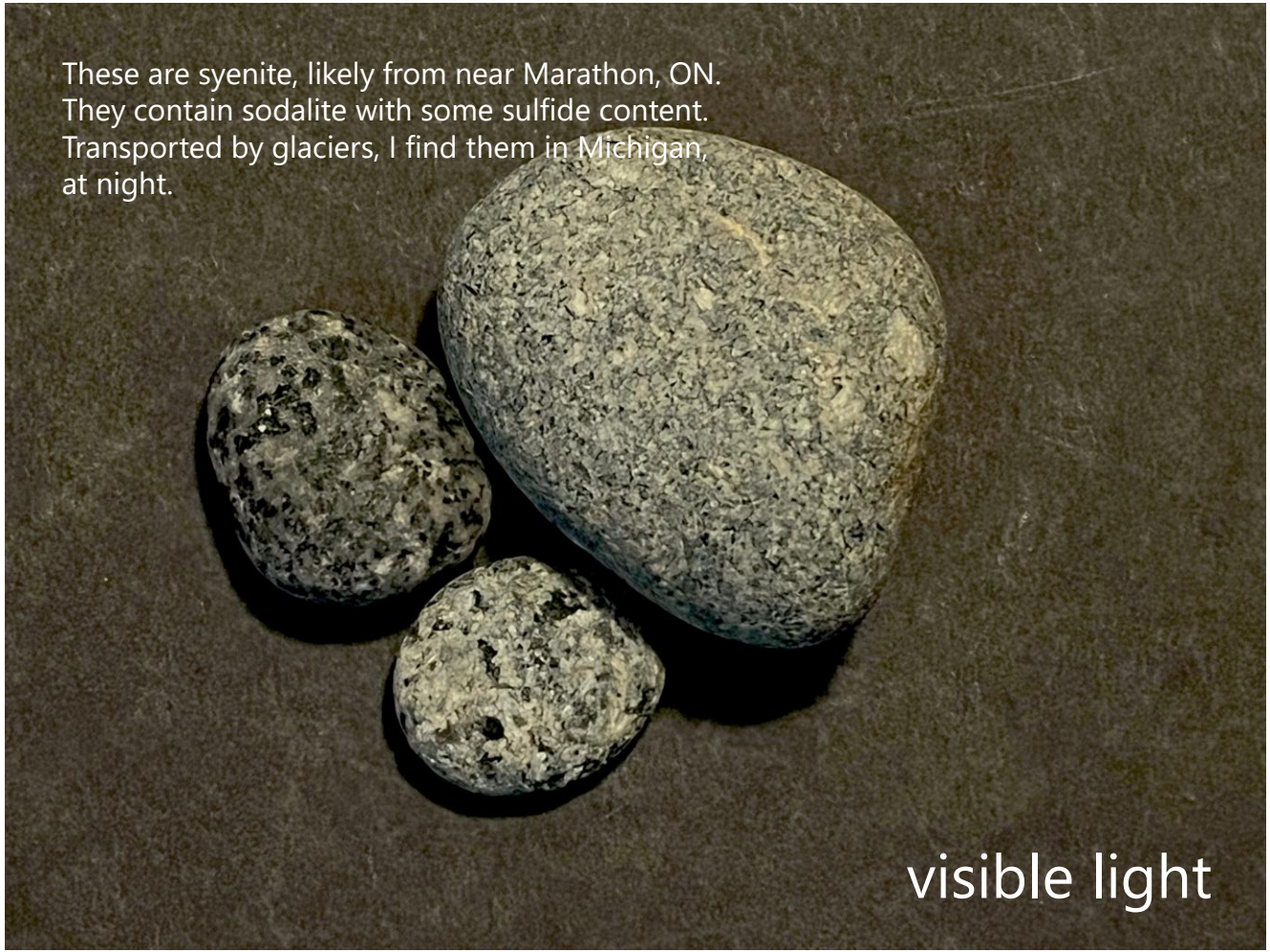
**Abstract:** A type of Canadian granite is especially flashy when illuminated with UV light. Commonly called Yooper lights, hunting them has become a sport on the shores of Lake Superior. The world looks very different under UV light. Things that escape notice during the day jump out at night under UV light. Yooper light hunting got me looking more closely at the water and the sand. Man-made microfibers and microplastics are revealed with a UV light and a microscope. Looking through different eyes allows seeing contamination that normally goes unnoticed.

Finding new ways to look at the world can yield interesting results.

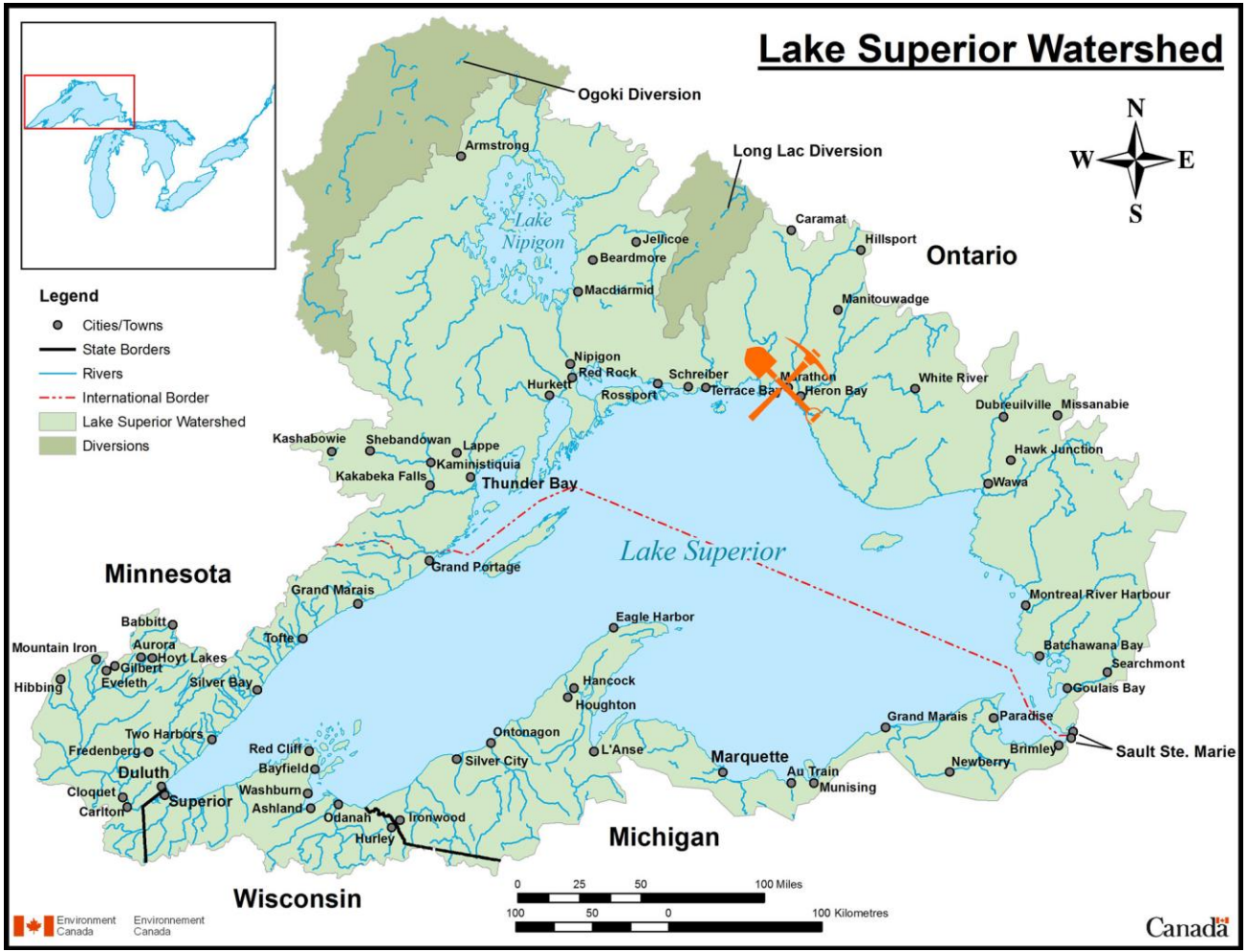
You never know what will prompt new discoveries.

Plastic particles are everywhere.

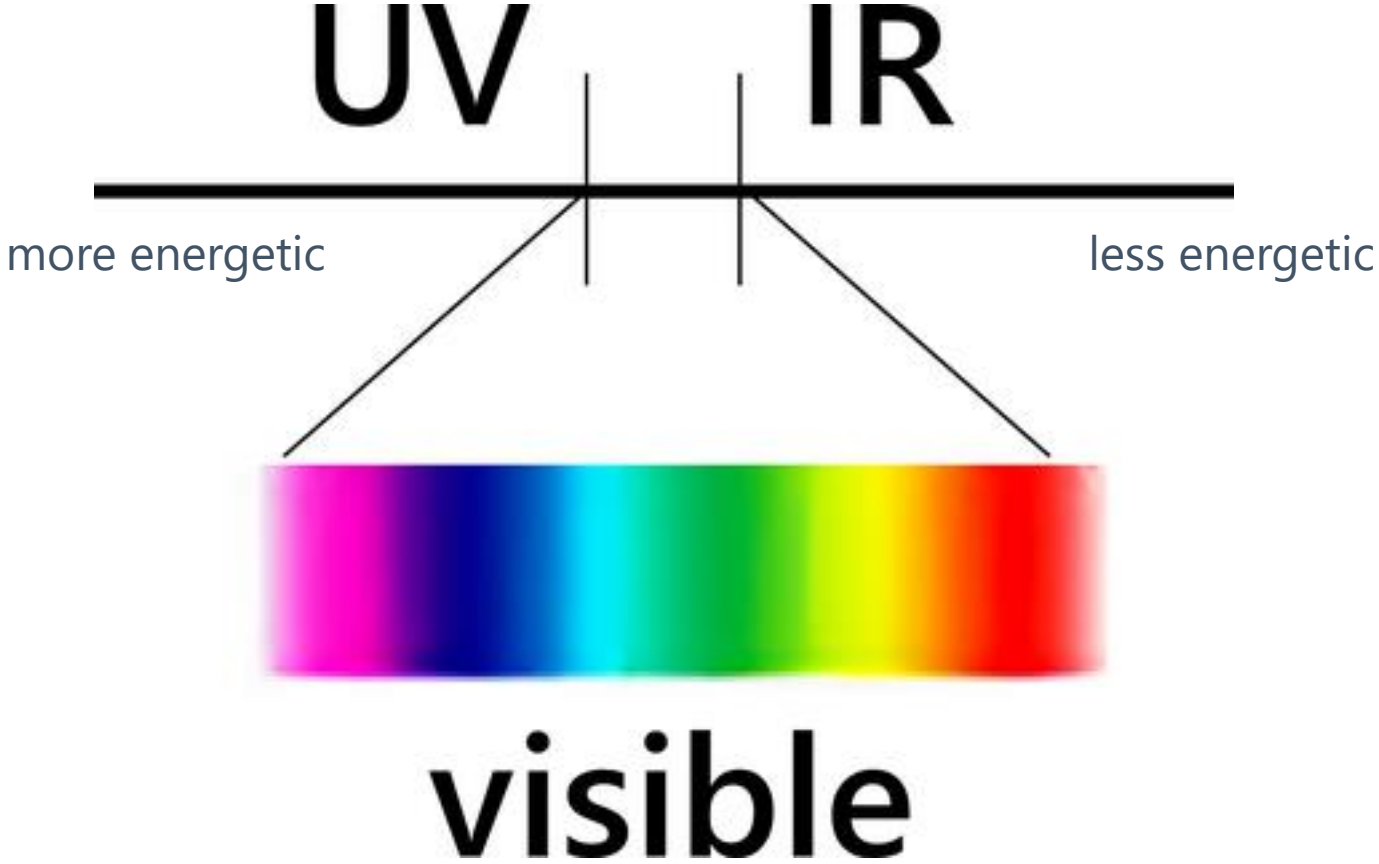
Dwayne told me to tell my story. It is a story with several twists and turns. It all began with something Canadian.


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

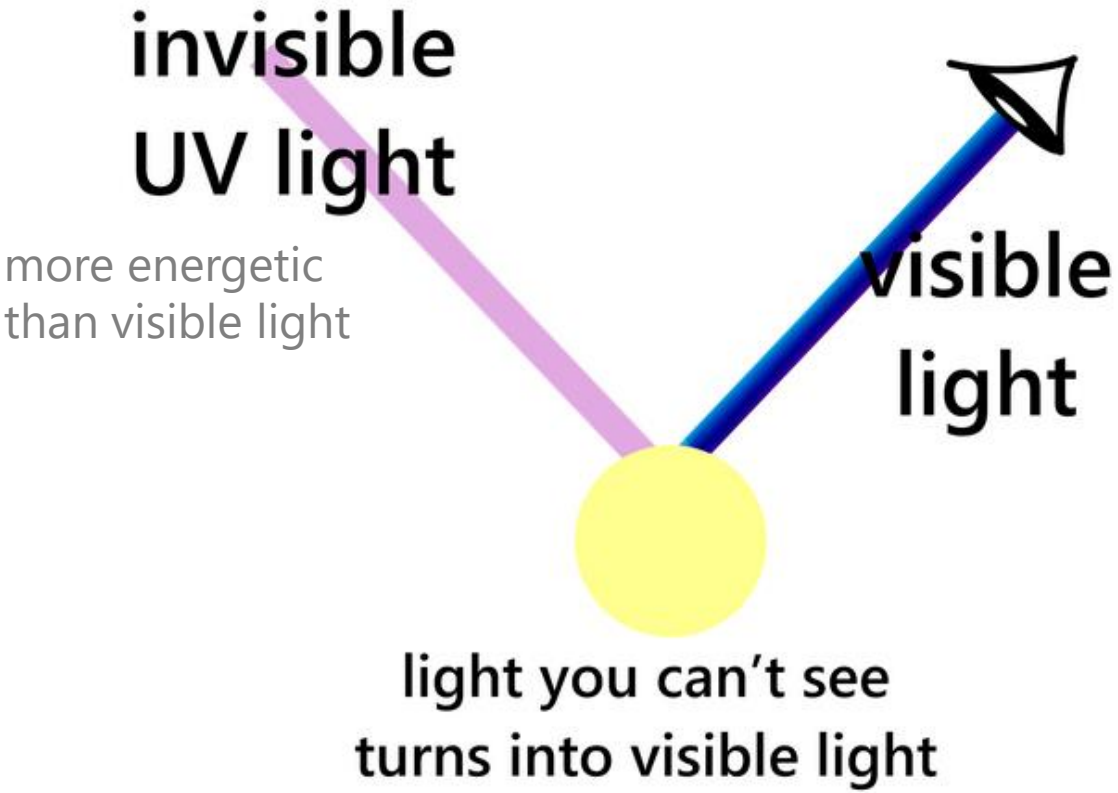

UV light
(365 nm filtered)


Lake Superior Watershed
Ogoki Diversion
Long Lac Diversion
N
W
E
S
Armstrong
Lake Nipigon
Jellicoe
Beardmore
Macdiarmid
Caramat
Hillsport
Ontario
Manitouwadge
Nipigon
Red Rock
Hurkett
Rossport
Schreiber
Terrace Bay
Marathon
Heron Bay
White River
Dubreuilville
Missanabie
Hawk Junction
Wawa
Kashabowie
Shebandowan
Lappe
Kaministiquia
Kakabeka Falls
Thunder Bay
Legend
Cities/Towns
State Borders
Rivers
International Border
Lake Superior Watershed
Diversions
Lake Superior
Minnesota
Grand Portage
Grand Marais
Babbitt
Aurora
Hoyt Lakes
Gilbert
Eveleth
Mountain Iron
Hibbing
Tofte
Silver Bay
Two Harbors
Fredenberg
Duluth
Cloquet
Carlton
Superior
Red Cliff
Bayfield
Washburn
Ashland
Odanah
Ironwood
Hurley
Wisconsin
Eagle Harbor
Hancock
Houghton
Ontonagon
Silver City
L'Anse
Marquette
Au Train
Munising
Michigan
Grand Marais
Paradise
Brimley
Newberry
Sault Ste. Marie
Montreal River Harbour
Batchawana Bay
Searchmont
Goulais Bay
0 25 50 100 Miles
100 50 0 100 Kilometres
Environment Canada
Environnement Canada
Canada

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


UV
IR
more energetic
less energetic
visible

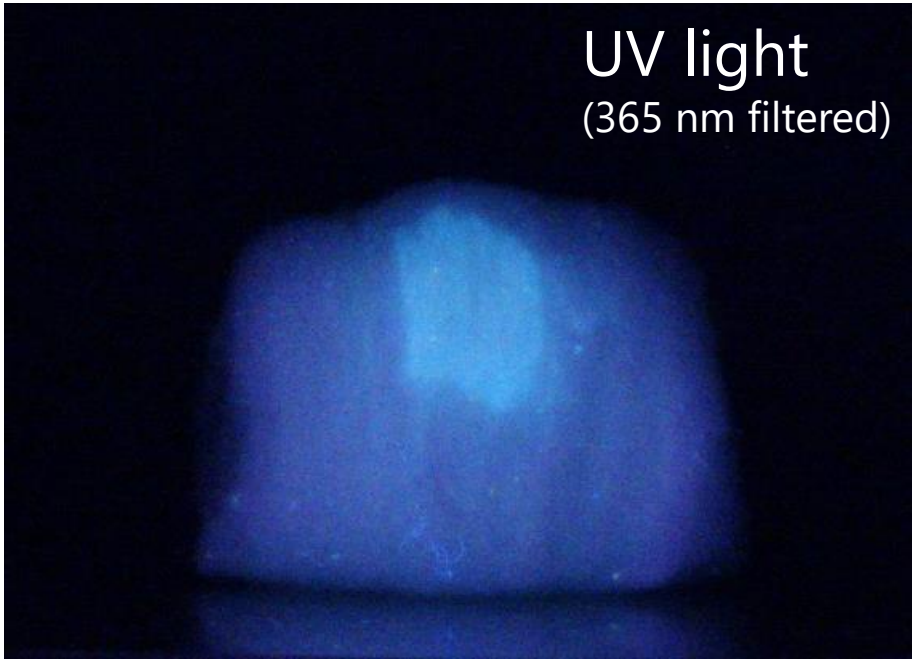
# FLUORESCENCE




UV light
(365 nm filtered)

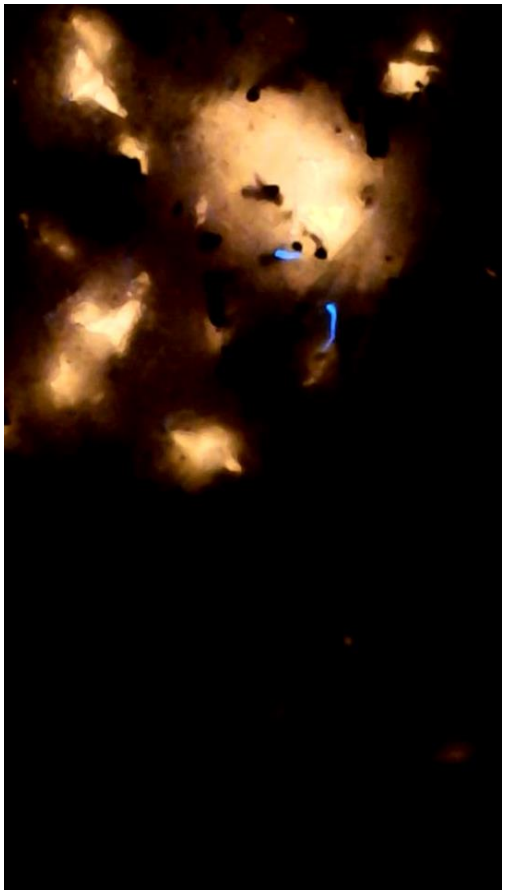

visible light

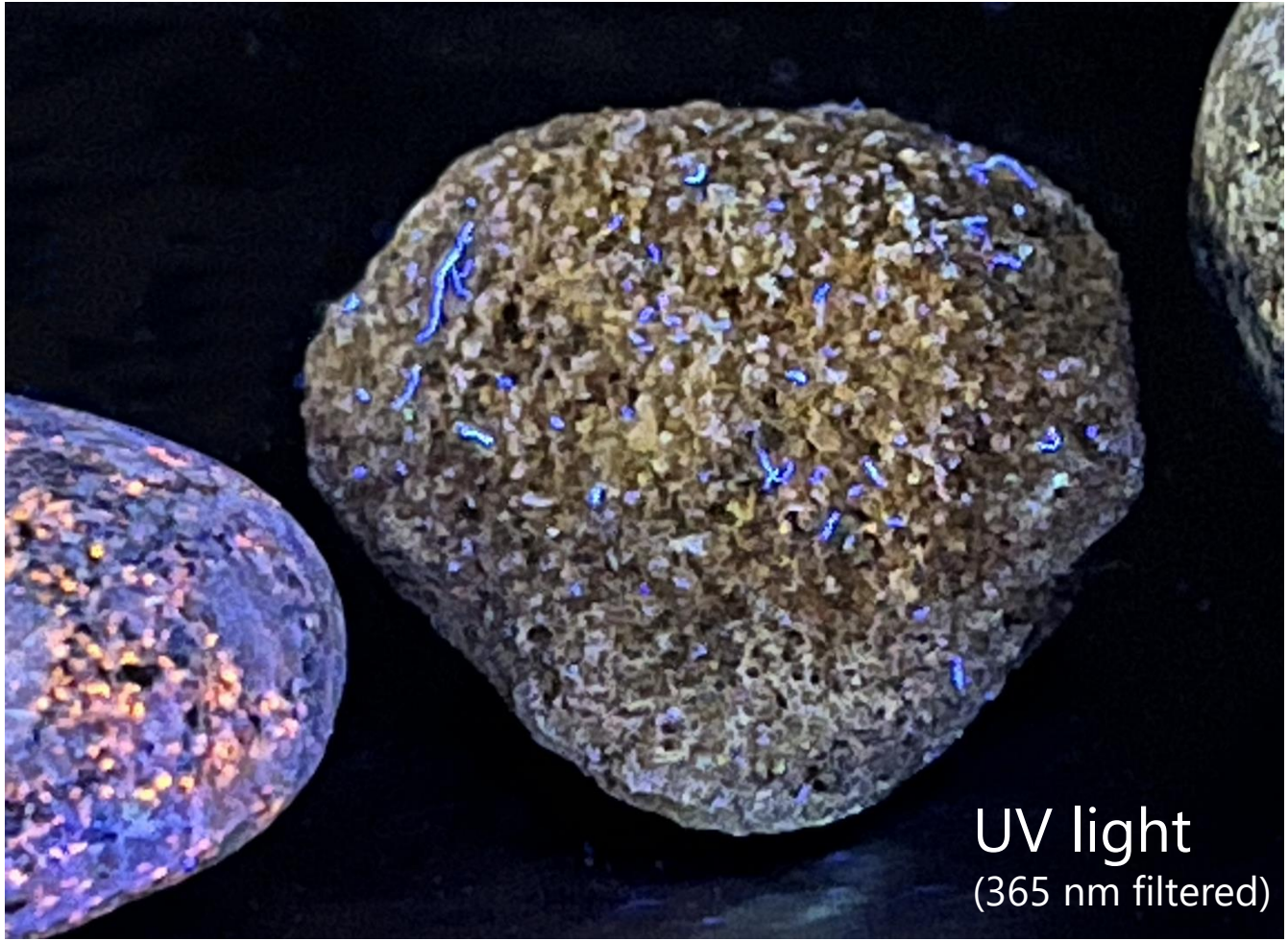

manipulated image


UV light
(365 nm filtered)

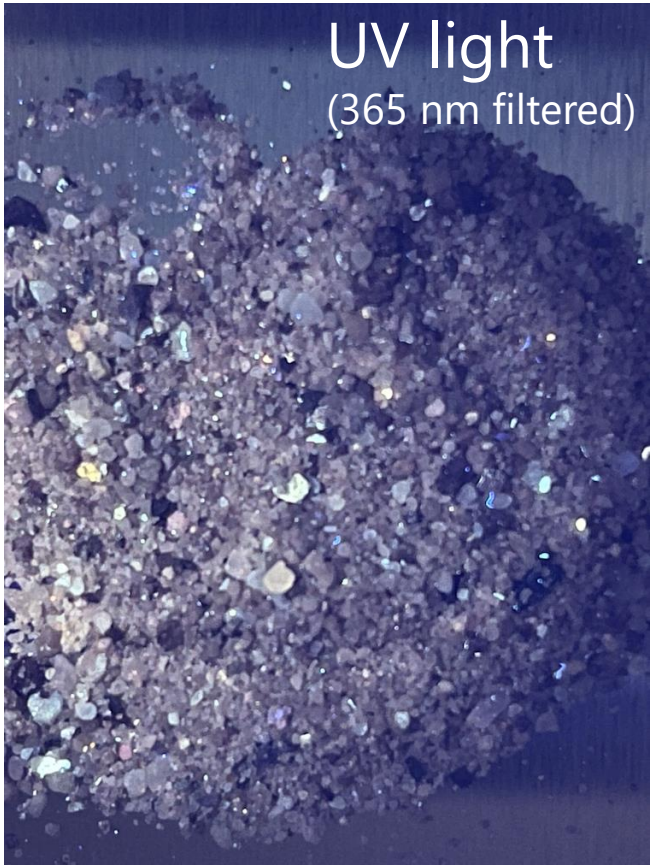
# 1ST CURVE IN THE ROAD: WHAT ARE THE BLUE FLECKS?


visible light

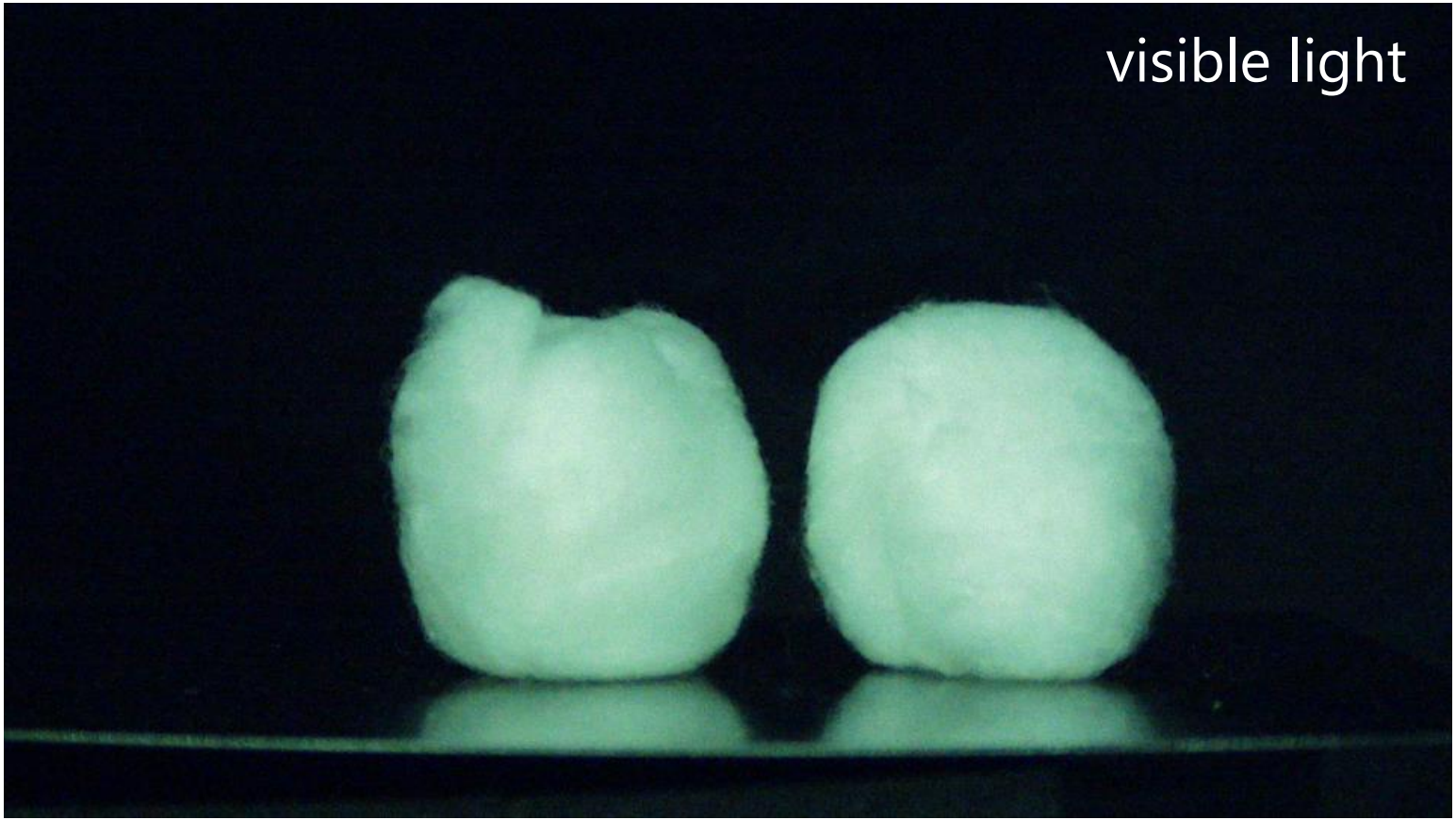



UV light
(365 nm filtered)

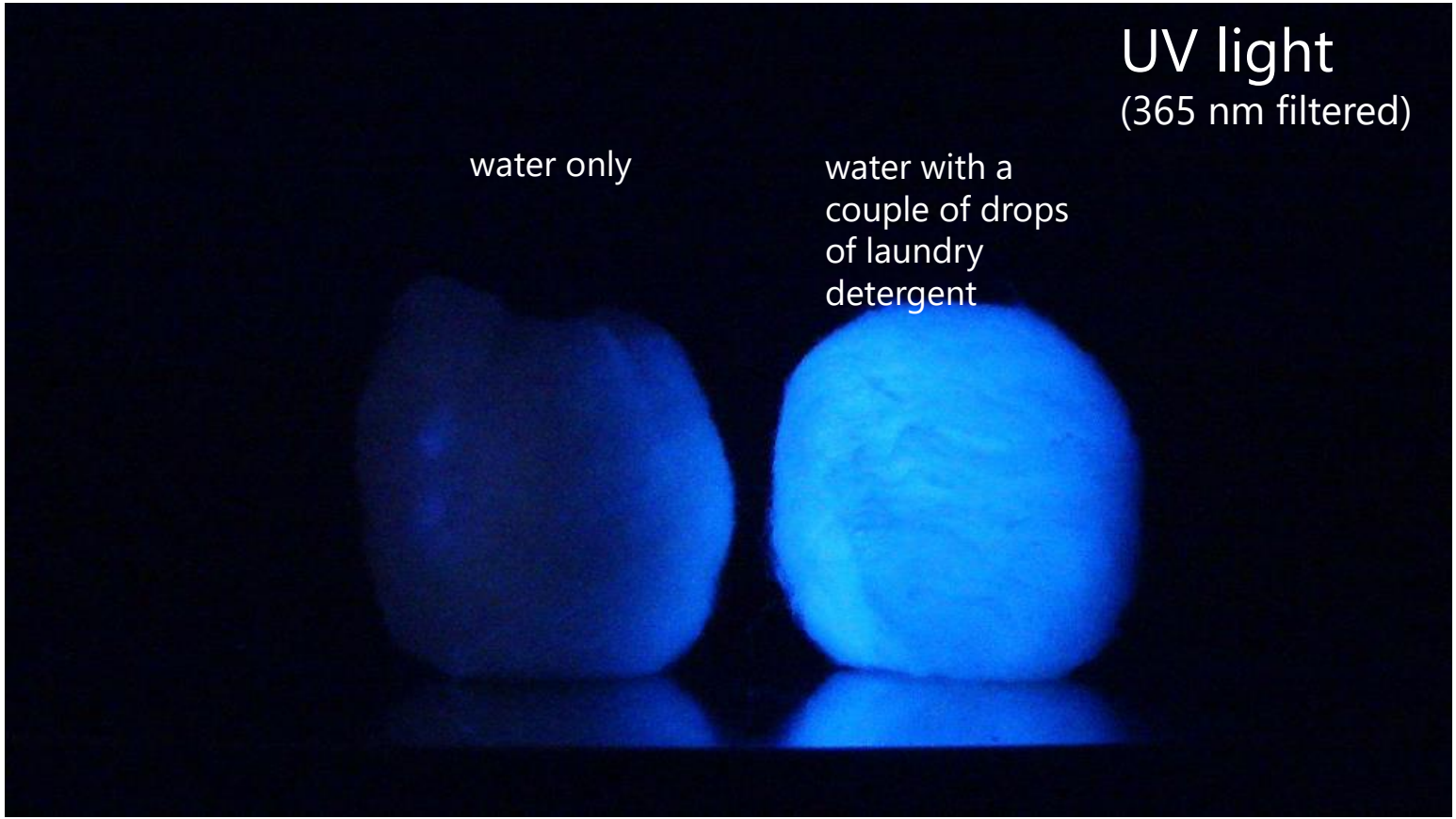

visible light


UV light
(365 nm filtered)

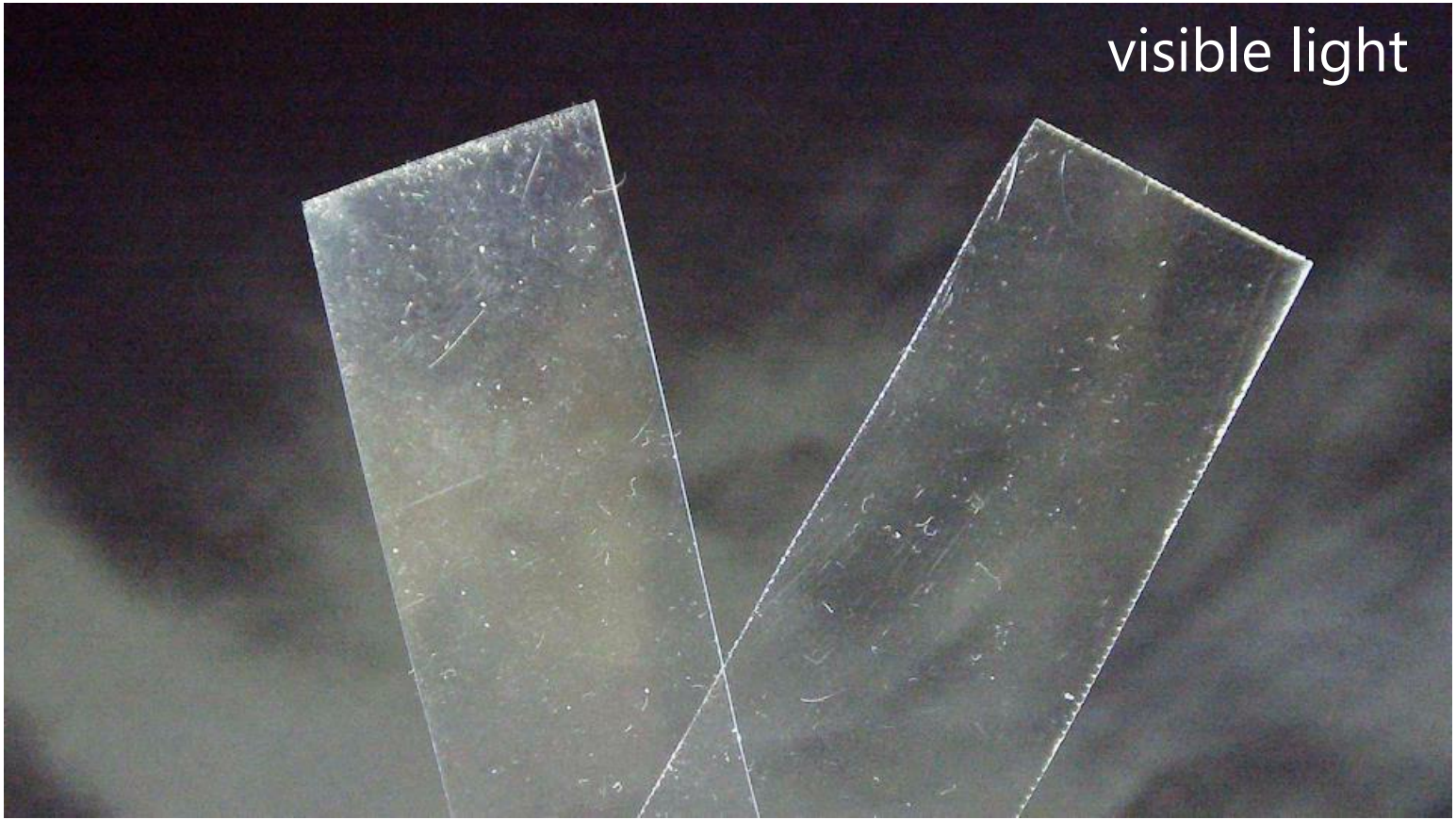
# Cotton Balls



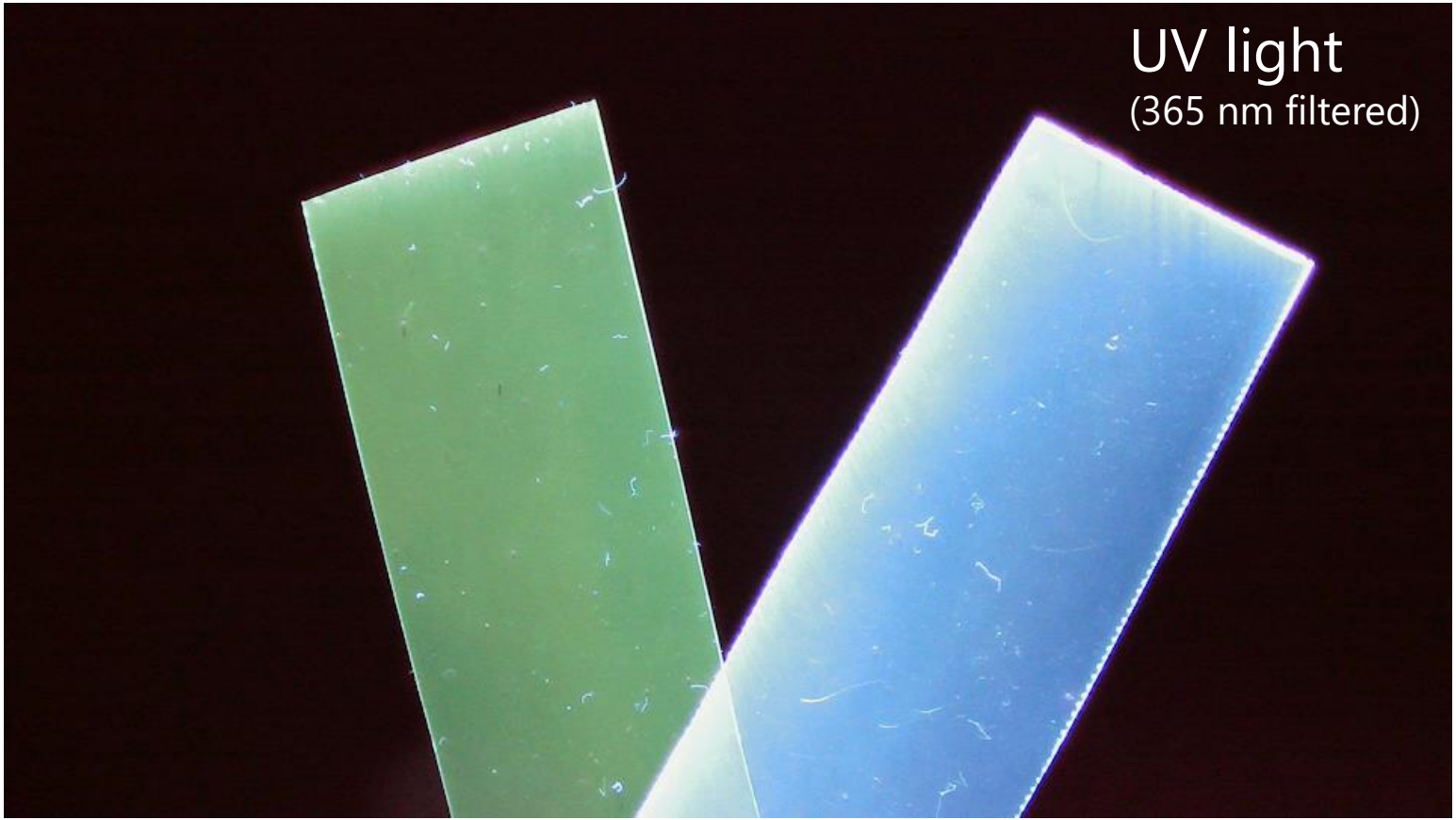
# Cotton Balls – Optical Brighteners



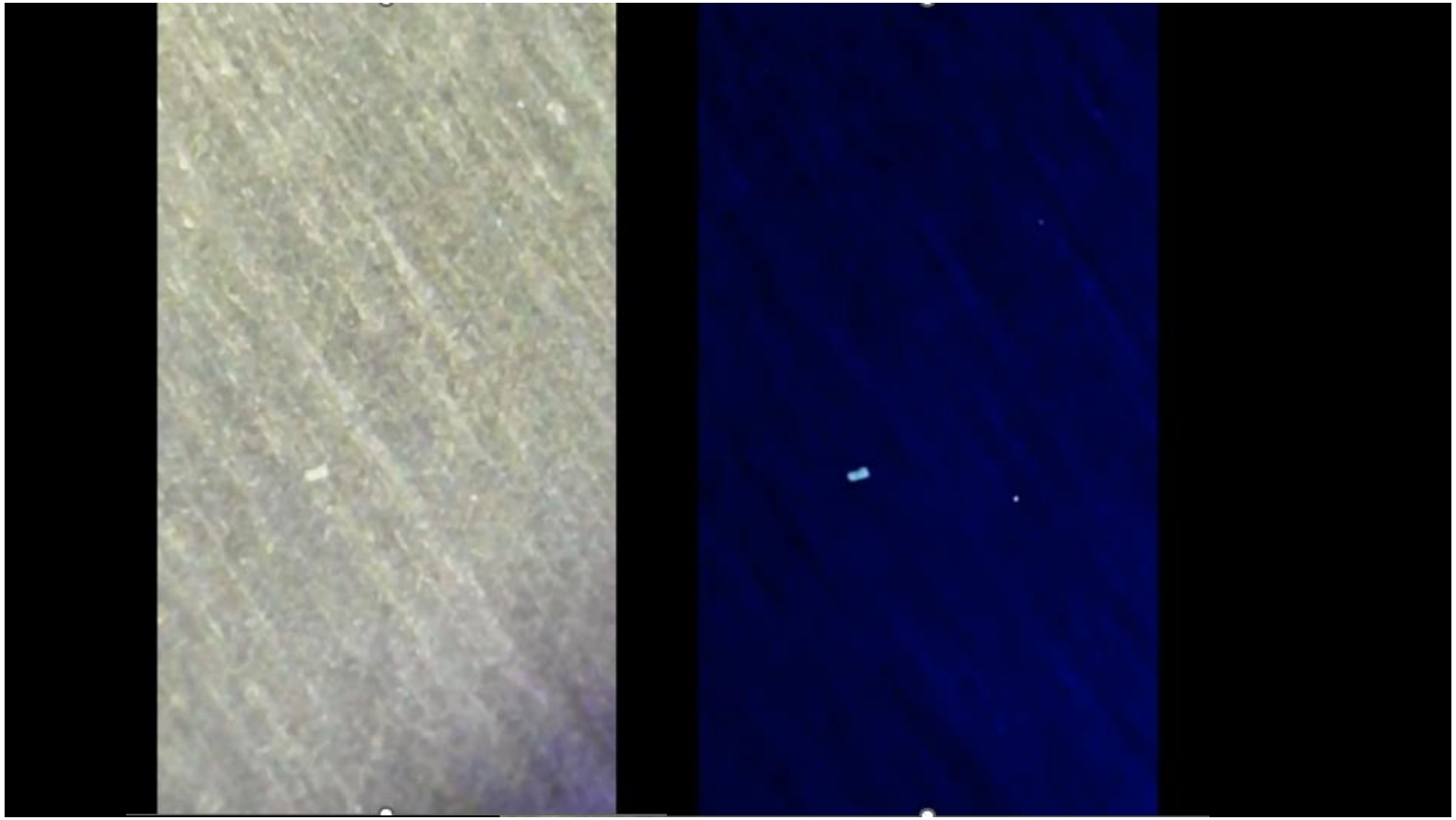
# PET



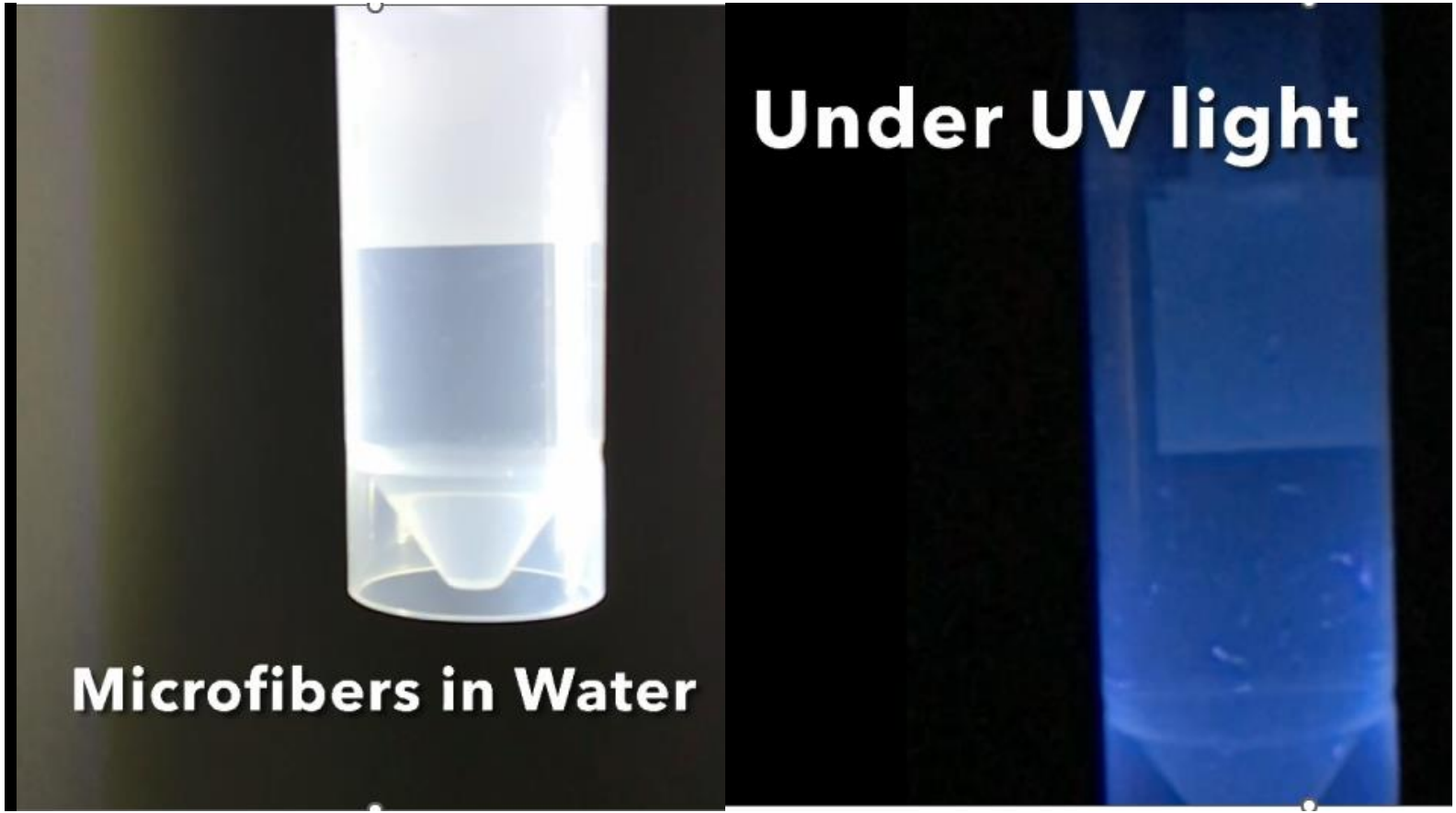
# PET – Optical Brighteners



# Isle Royale Water – Visible to UV



# MICROFIBERS




LED
UV light
filter

# 2ND CURVE IN THE ROAD: MICROPLASTICS LAB FOR STUDENTS?


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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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] Wetsus, European Centre of Excellence for Sustainable Water Technology, Leeuwarden, the Netherlands
[d] World Health Organization, 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
Accepted 26 February 2019
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 ($1 \times 10^{-2}$ to $10^{8}$ #/m$^3$) across individual samples and water types. However, only four out of 50 studies received

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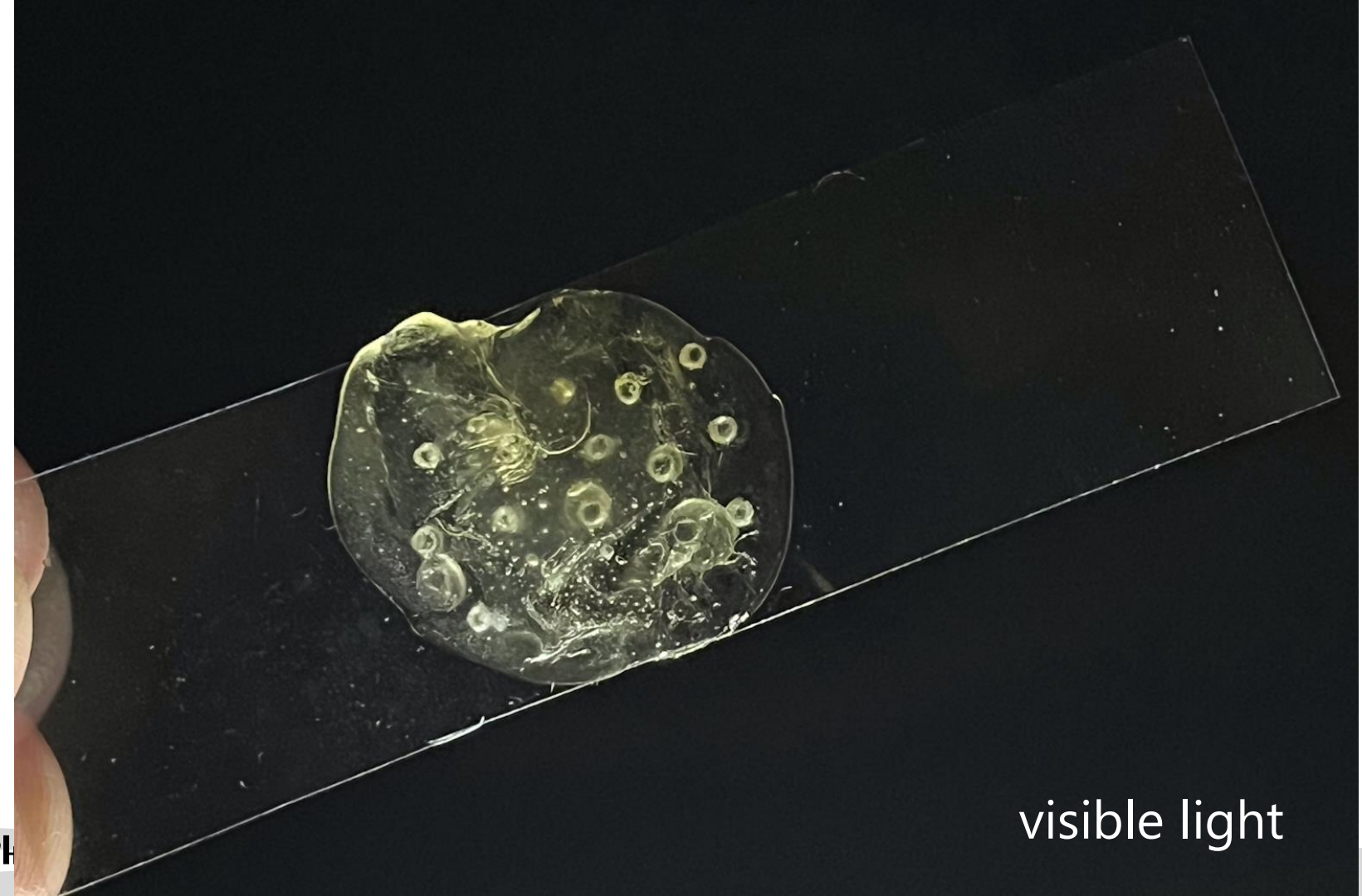
# 3RD CURVE IN THE ROAD: WHAT AM I SEEING?


visible light

# Particle Identification

## Cotton

### Longitudinal View

- Mature flat and ribbon-like with convolutions, thick wall and small lumen
- Immature very thin wall and a large lumen with few convolutions
- Dead very thin and almost transparent
- Mercerized smooth and cylindrical, fewer convolutions and lumen or sometimes may be absent

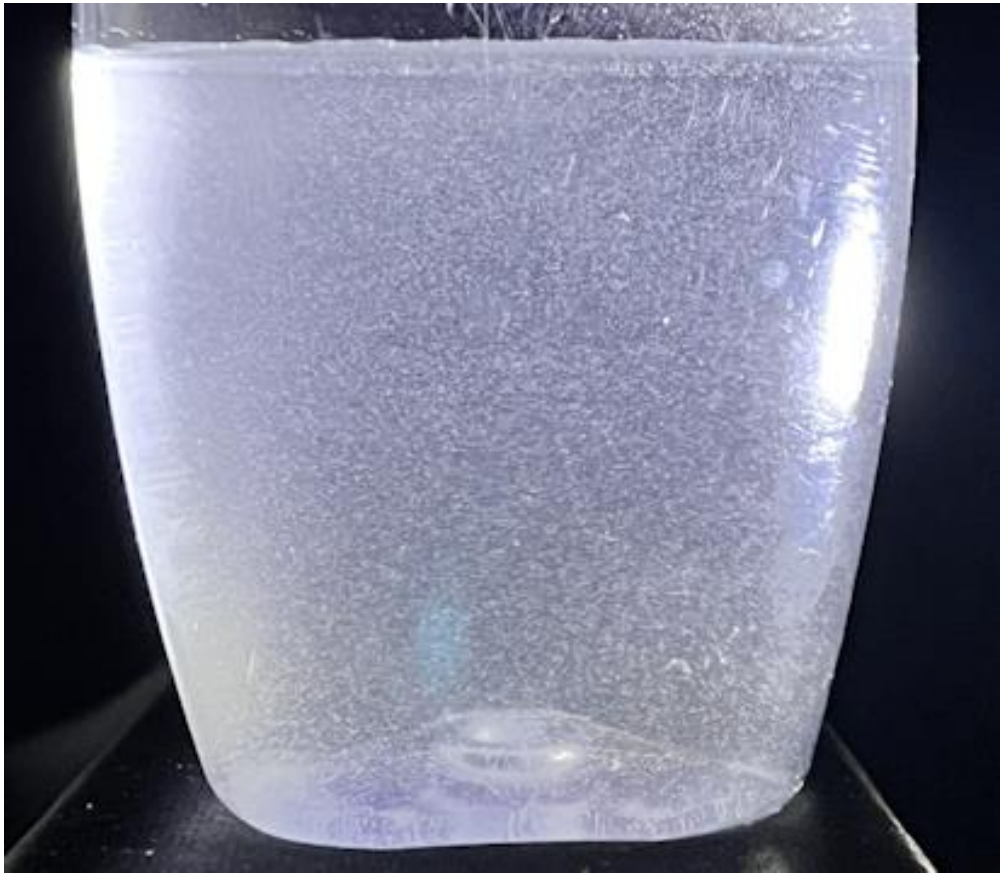
## Polyester

### Longitudinal View

Structureless, uniform diameter, rod-like appearance

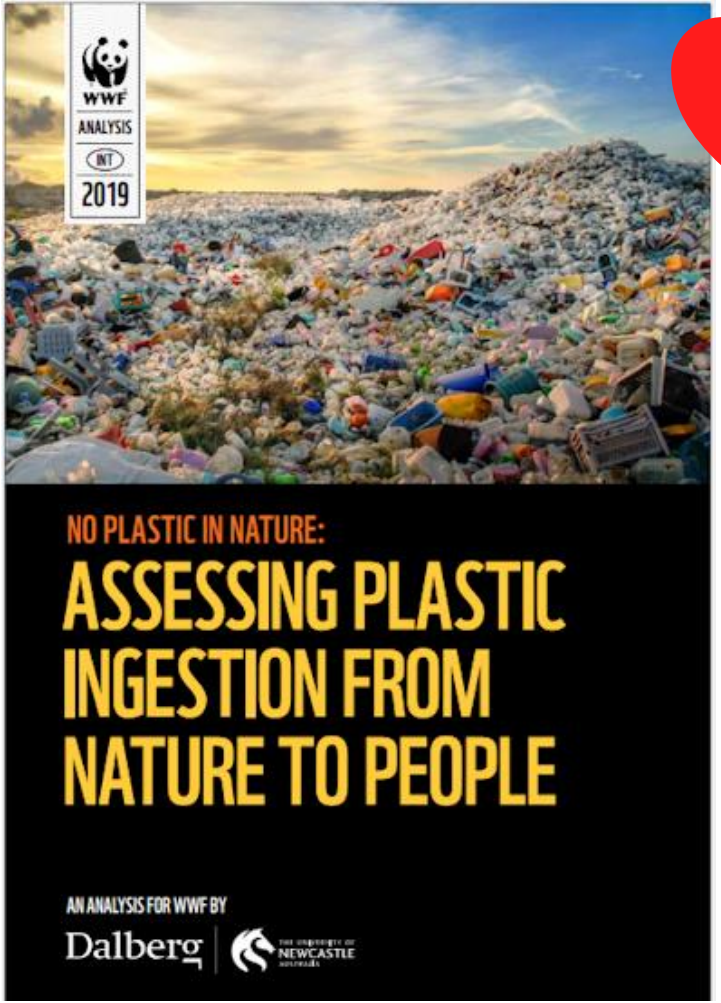
*https://www.textileschool.com/330/microscopic-appearance-of-fibres/*

# 4TH CURVE IN THE ROAD: LEARNING TO MAKE MICROPLASTICS



# 5TH CURVE IN THE ROAD: BOTTLED WATER (RIGHTING A WRONG)

Click to view video


"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


REUTERS

World Business Markets Sustainability More

World

# You may be eating a credit card's worth of plastic each week - study

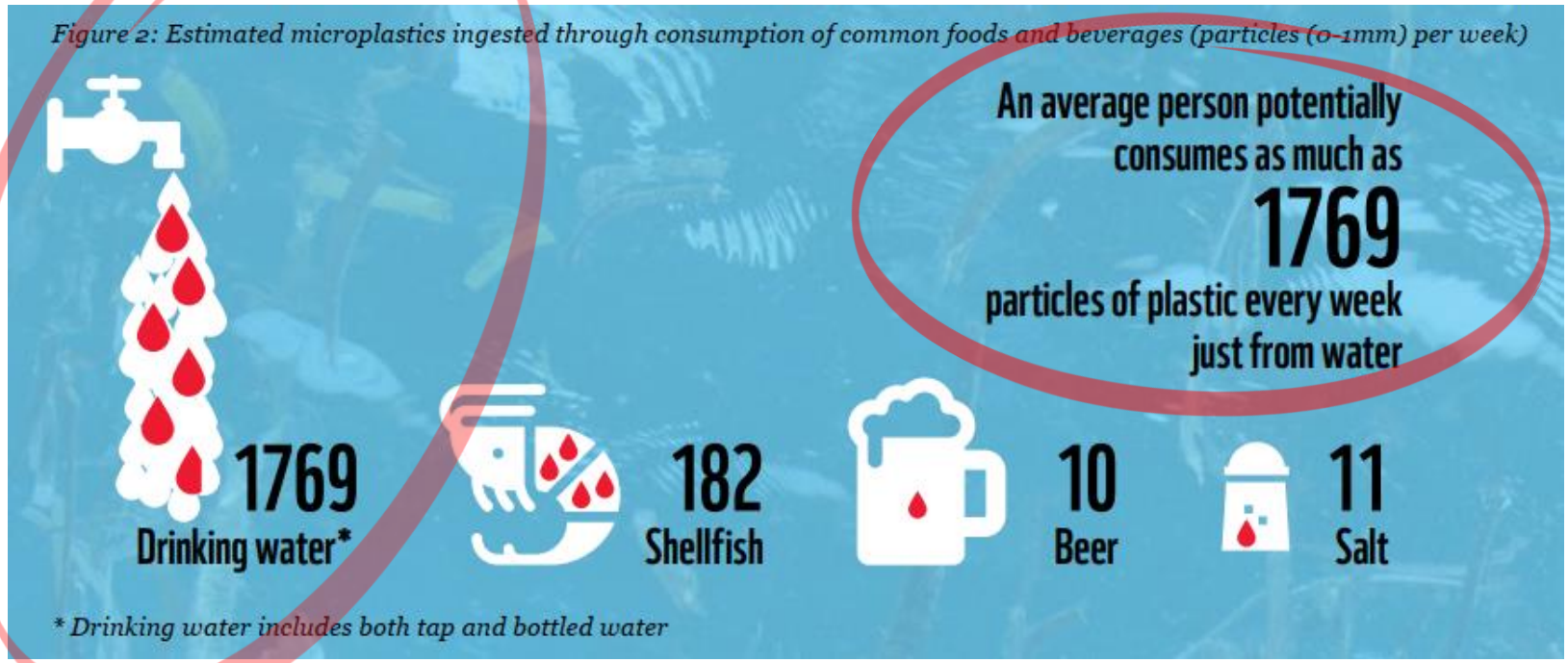
Reuters

June 11, 2019 9:29 PM EDT · Updated 5 years ago

Aa

www.reuters.com/article/us-environment-plastic/you-may-be-eating-a-credit-cards-worth-of-plastic-each-week-study-idUSKCN1TD009/


*2.5 mg average particle to reach 5 grams.*




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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5 g
0.1 g
PLASTIC PARTICLES
01/24
01/27
5678 9012 3456
0.02 credit cards worth
one model
another model


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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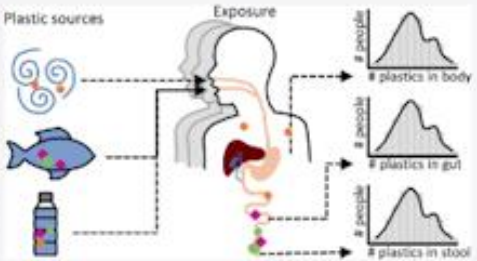
ABSTRACT: Human exposure to microplastic is recognized as a global problem, but the uncertainty, variability, and lifetime accumulation are unresolved. We provide a probabilistic lifetime exposure model for children and adults, which accounts for intake via eight food types and inhalation, intestinal 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 $\mu$m) 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 $8.32 \times 10^3$ (90% CI, $7.08 \times 10^2$−$1.91 \times 10^6$) particles/capita or 6.4 (90% CI, 0.1−$2.31 \times 10^3$) ng/capita for children until age 18, and up to $5.01 \times 10^4$ (90% CI, $5.25 \times 10^3$−$9.33 \times 10^6$) particles/capita or 40.7 (90% CI, 0.8−$9.85 \times 10^3$) ng/capita for adults until age 70 in the body tissue for 1−10 $\mu$m 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

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

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


Exposure and Health (2023) 15:33–51
https://doi.org/10.1007/s12403-022-00470-8

REVIEW PAPER

# To Waste or Not to Waste: Questioning Potential Health Risks of Micro- and Nanoplastics with a Focus on Their Ingestion and Potential Carcinogenicity

Elisabeth S. Gruber[1] · Vanessa Stadlbauer[2,3] · Verena Pichler[4] · Katharina Resch-Fauster[5] · Andrea Todorovic[5] · Thomas C. Meisel[6] · Sibylle Trawoeger[7] · Oldamur Hollóczki[8] · Suzanne D. Turner[9,10] · Wolfgang Wadsak[3,11] · A. Dick Vethaak[12,13] · Lukas Kenner[3,14,15,16]

Received: 8 October 2021 / Revised: 30 December 2021 / Accepted: 11 February 2022 / Published online: 22 March 2022


**Abstract**
Micro- and nanoplastics (MNPs) are recognized as emerging contaminants, especially in food, with unknown health significance. MNPs passing through the gastrointestinal tract have been brought in context with disruption of the gut microbiome. Several molecular mechanisms have been described to facilitate tissue uptake of MNPs, which then are involved in local inflammatory and immune responses. Furthermore, MNPs can act as potential transporters ("vectors") of contaminants and as chemosensitizers for toxic substances ("Trojan Horse effect"). In this review, we summarize current multidisciplinary knowledge of ingested MNPs and their potential adverse health effects. We discuss new insights into analytical and molecular modeling tools to help us better understand the local deposition and uptake of MNPs that might drive carcinogenic signaling. We present bioethical insights to basically re-consider the "culture of consumerism." Finally, we map out prominent research questions in accordance with the Sustainable Development Goals of the United Nations.

**Keywords** Microplastic · Nanoplastic · Carcinogenesis · Human health · Bioethics issue

"Translated into more imaginable numbers, on average we ingest five grams of MPs per week per person (roughly corresponding to the mass of a credit card)."

https://link.springer.com/article/10.1007/s12403-022-00470-8


MEDICAL UNIVERSITY OF VIENNA

DEUTSCH

Menu

# Health risk due to micro- and nanoplastics in food

Home › About us › News › 2022 › Health risk due to micro- and nanoplastics in food

All News

2022-03-24 – MEDICINE & SCIENCE

(Vienna, 24-03-2022) Five grams of plastic particles on average enter the human gastrointestinal tract per person

> Five grams of plastic particles on average enter the human gastrointestinal tract per person per week

www.meduniwien.ac.at/web/en/ueber-uns/news/default-0f889c8985-1/gesundheitsrisiko-durch-mikro-und-nanoplastik-in-lebensmitteln/


NEW YORK POST
READ THE LATEST ON Page Six

HEALTH

# You're eating a credit card's worth of plastic a week — and it's killing your gut

By Brooke Kato

Published March 30, 2022 | Updated March 30, 2022, 4:47 p.m. ET


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 $m_{LMP}$ 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 $m_{LMP}$. This work raises some serious issues of Senathirajah in the way they combine data and they obtained particle sizes. It concludes that Senathirajah overestimates $m_{LMP}$ by several orders of magnitude and that $m_{LMP}$ 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


Medical Xpress Topics Conditions

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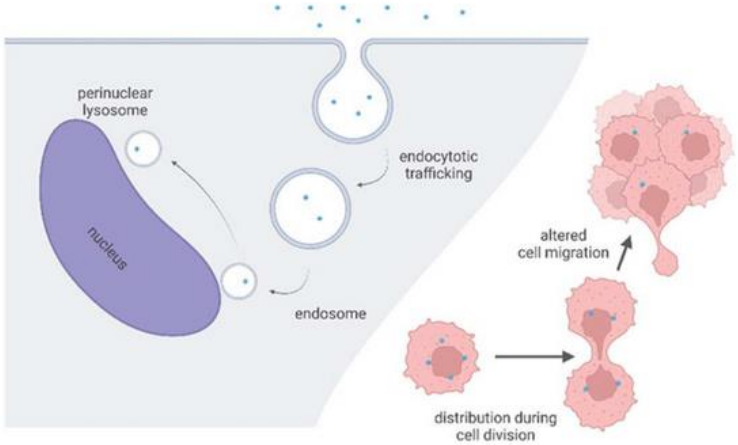
Home / Gastroenterology

MARCH 6, 2024 Editors' notes

# Micro- and nanoplastics in the body are passed on during cancer cell division, finds study

by Medical University of Vienna




Credit: *Chemosphere* (2024). DOI: 10.1016/j.chemosphere.2024.141463

> Plastic particles up to the weight of a credit card (approx. 5 grams) enter the gastrointestinal tract every week.

medicalxpress.com/news/2024-03-micro-nanoplastics-body-cancer-cell.html


ELSEVIER

Journal of Hazardous Materials

Volume 467, 5 April 2024, 133631

Research Paper

# Microplastics are detected in human gallstones and have the ability to form large cholesterol-microplastic heteroaggregates

Deyu Zhang [a 1], Chang Wu [a 1], Yue Liu [a 1], Wanshun Li [a 1], Shiyu Li [a], Lisi Peng [a], Le Kang [a], Saif Ullah [c], Zijun Gong [b], Zhaoshen Li [a], Dan Ding [d 2], Zhendong Jin [a 2], Haojie Huang [a 2]

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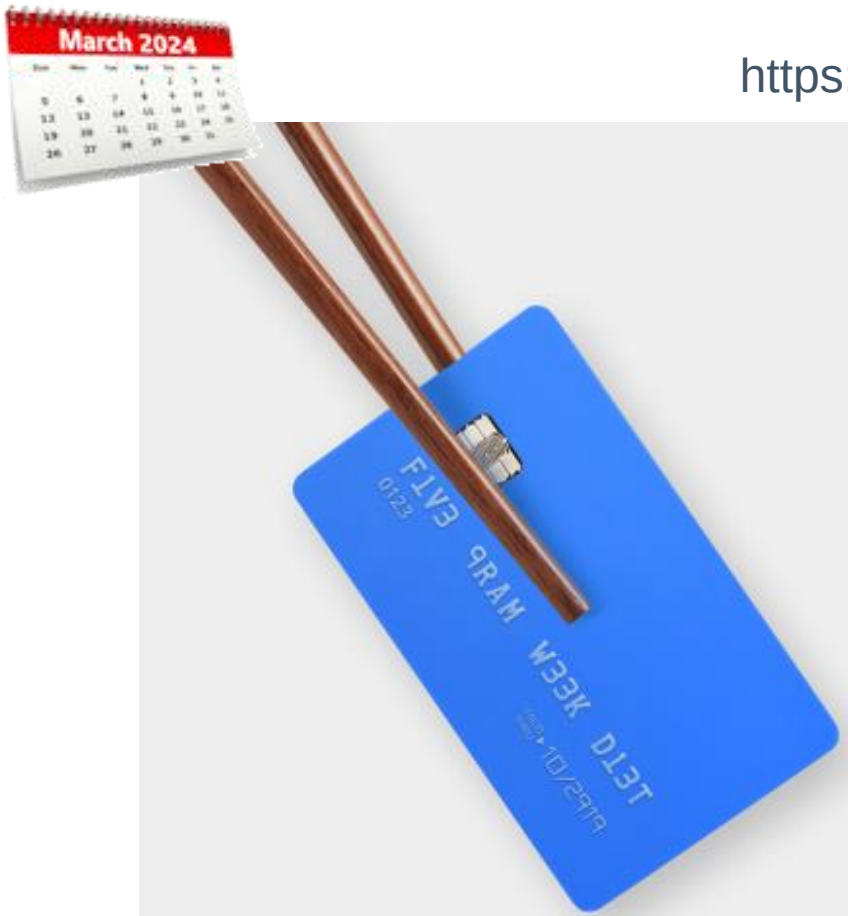
https://doi.org/10.1016/j.jhazmat.2024.133631  Get rights and content

The World Wildlife Fund reported that adults consume more than 5 g of plastic each week on average.

doi.org/10.1016/j.jhazmat.2024.133631

https://yourplasticdiet.org/




# A credit card a week?

On average people could be ingesting around 5 grams of plastic every week, which is the equivalent weight of a credit card. Our study suggests people could be consuming on average over 100,000 microplastics every year. That's approximately 21 grams a month, just over 250 grams a year.

**TAKE ACTION!**

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Does it matter that 5 grams per week is wrong?


Journal of Hazardous Materials 404 (2021) 124004

Contents lists available at ScienceDirect

Journal of Hazardous Materials

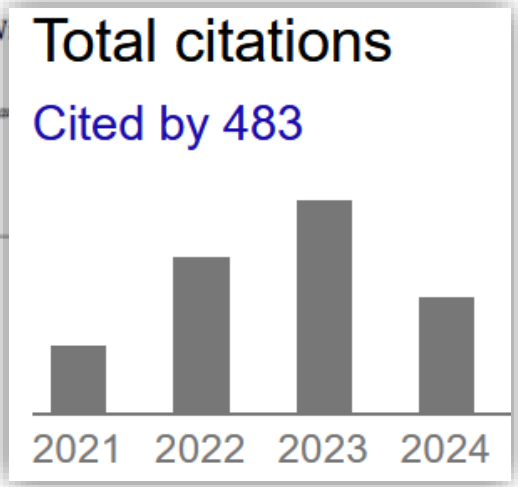
journal homepage: www.elsevier.com/locate/jhazmat

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 W
Thava Palanisami [a,*]

[a] Global Innovative Centre for Advanced Nanomaterials(GICAN), Faculty of Engineering and Built Environment, The University of Newcastle, Callagha
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




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

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# Microplastics are bad, but ignoring science is worse

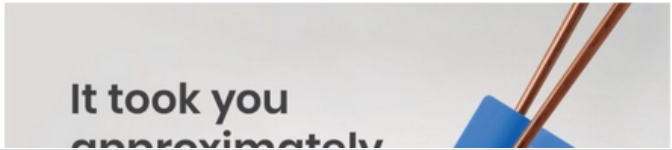
www.rdworldonline.com/microplastics-are-bad-but-ignoring-science-is-worse/

By Mark Jones | March 20, 2024

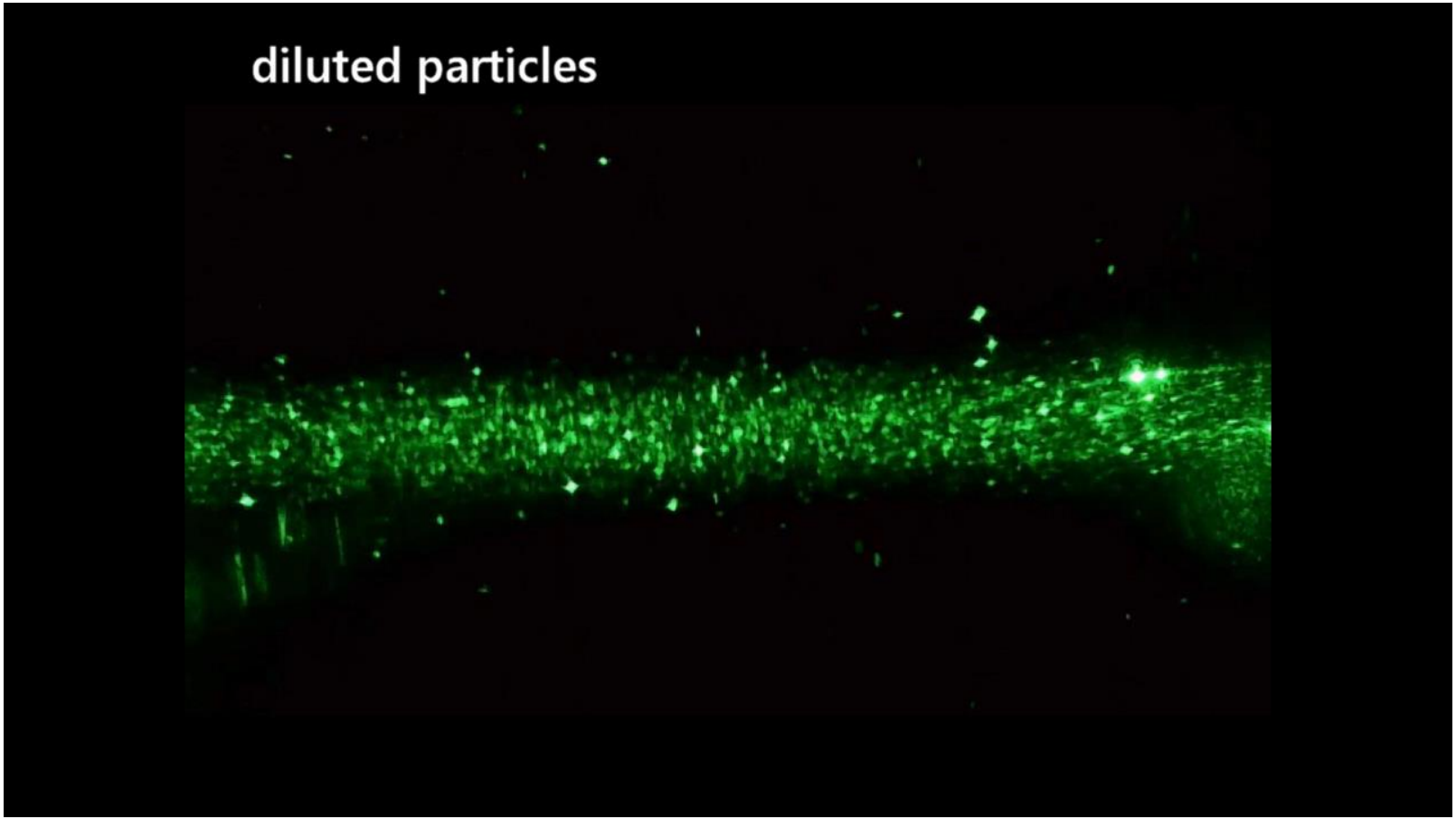
We all know that 98.6° F is human body temperature … only it isn't. A new **study** reconfirms something extensively covered during the COVID pandemic: Normal human body temperature falls between 97.3° and 98.2° F — with 97.9° F as today's average.

And 5 grams per week is the amount of plastic every person consumes … only it isn't. Like outdated body-temperature assertions, this 5-g value (widely reported in many science and news circles) is flawed. The difference is that data manipulation and memes didn't give us the 98.6° F value … but they did help propel the 5-g-of-plastic assertion. It has shaken my faith in the scientific community.

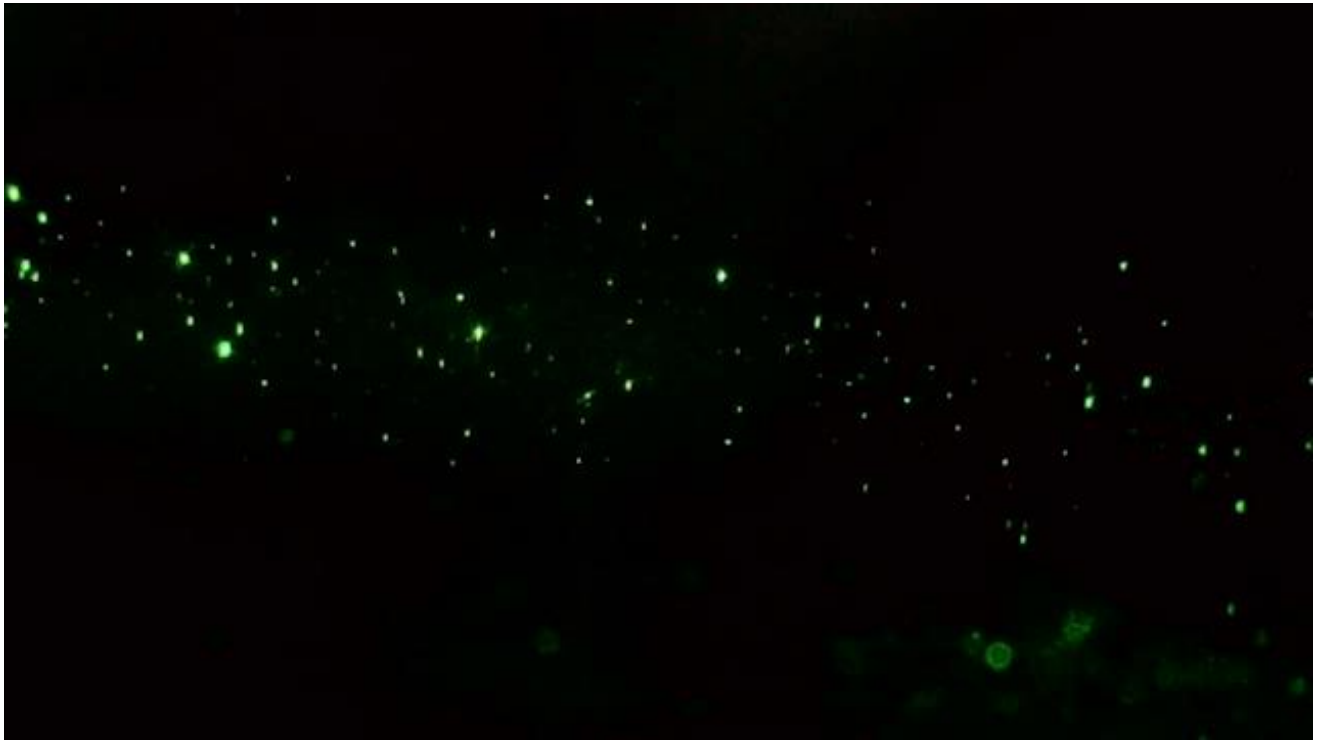
Now, the world widely accepts the average person consumes 5 g of plastic per week — the weight of a credit card. Thanks to one now-quite-famous picture of a credit card



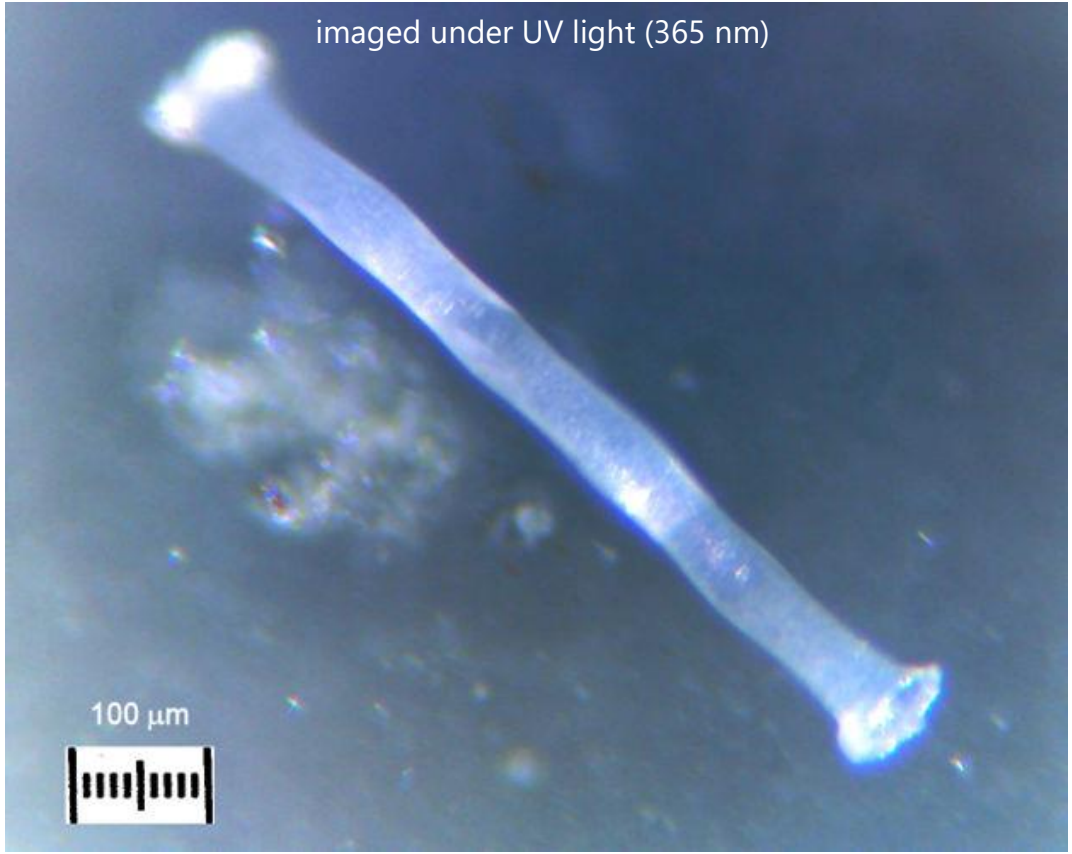
# 6TH CURVE IN THE ROAD: REMOVAL OF NANO AND MICROPLASTICS


diluted particles

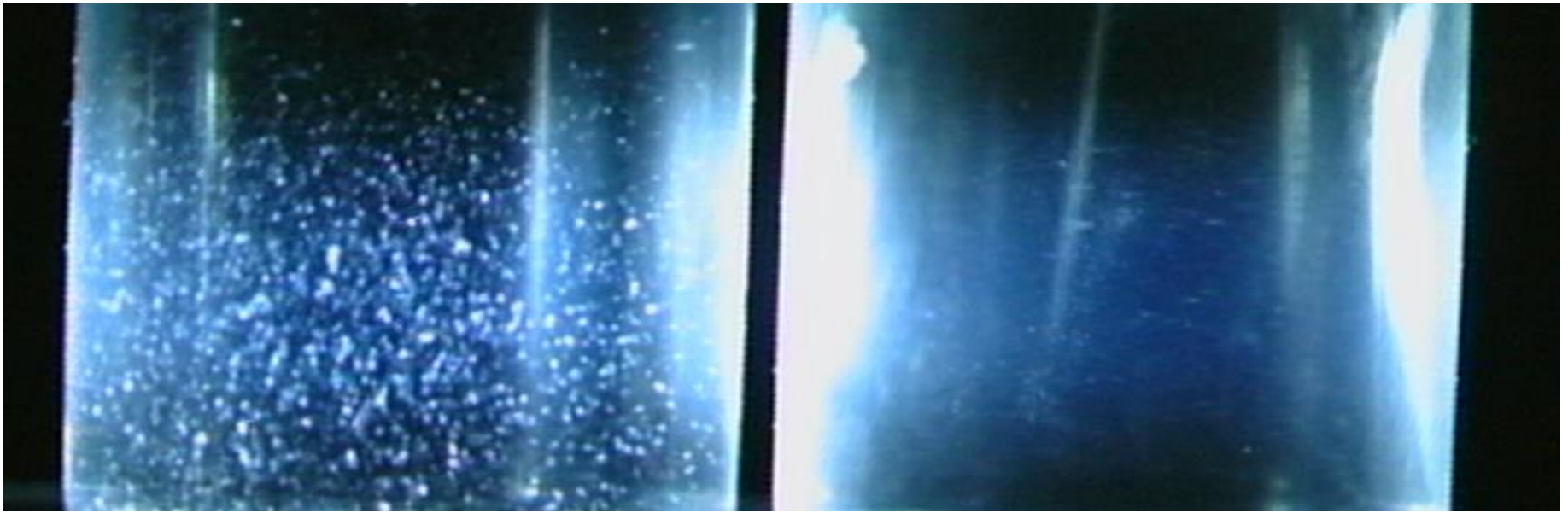
# Commercial Bottled Water



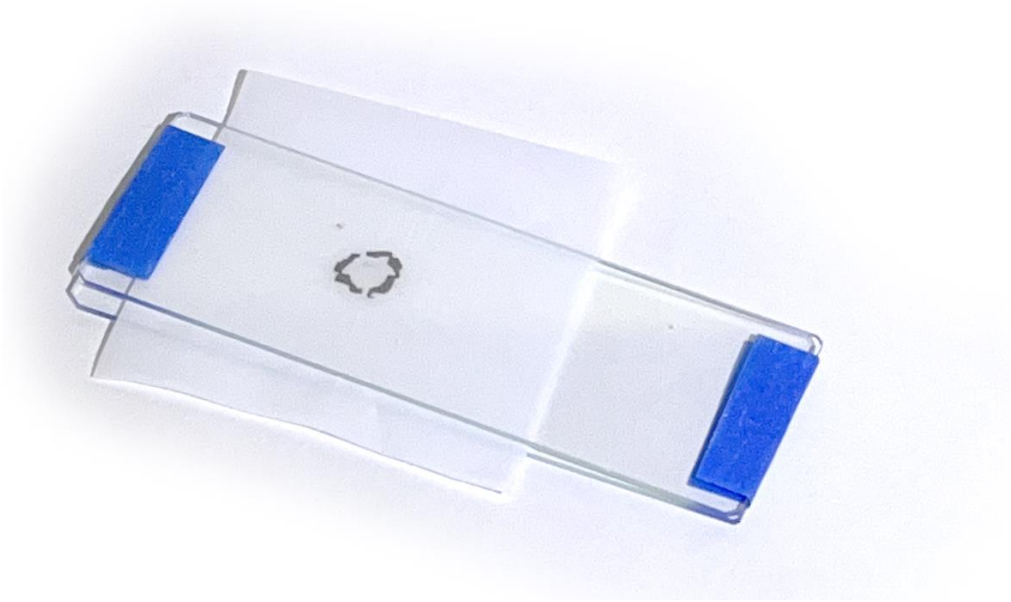
# From Commercial Bottled Water



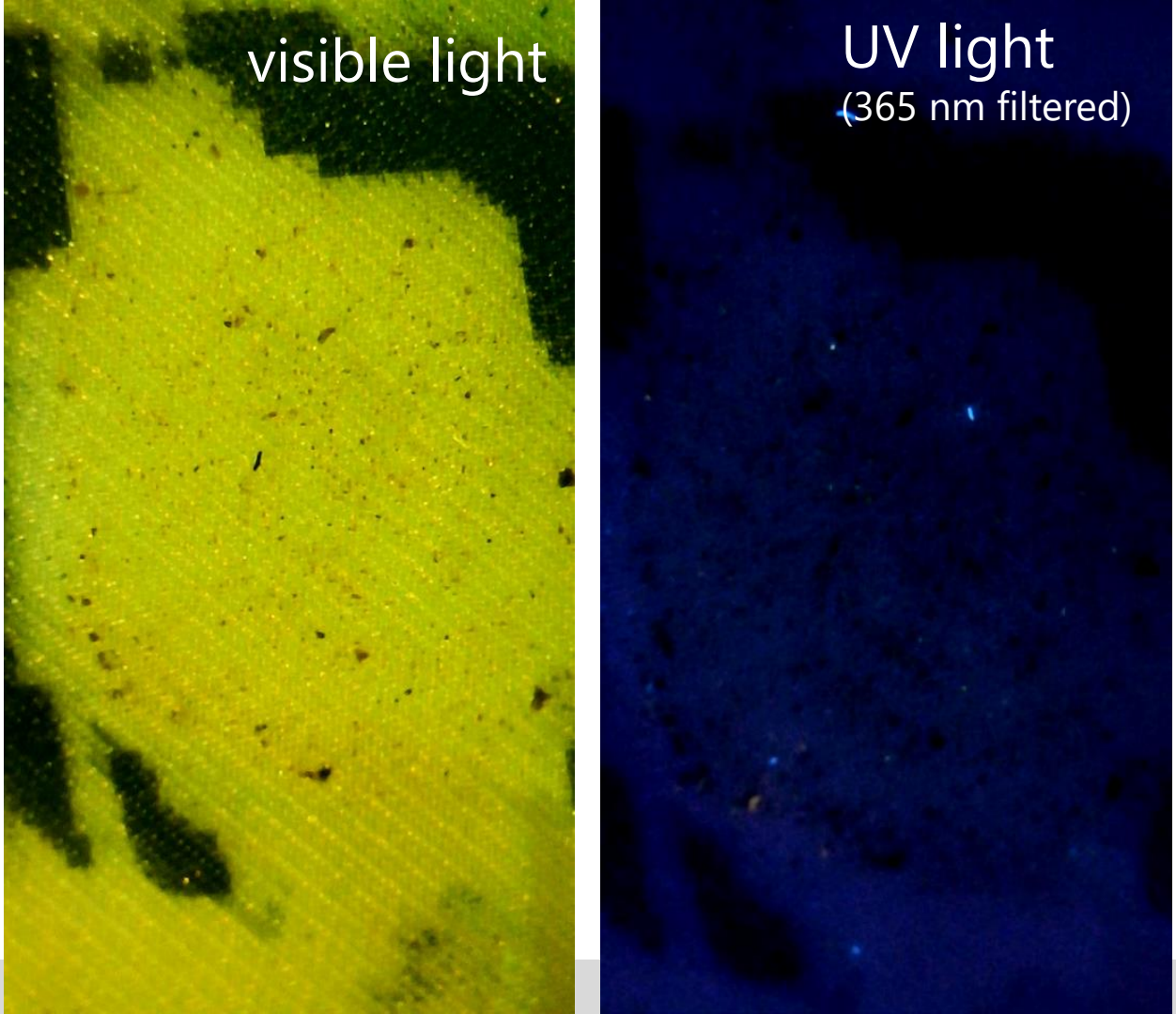
# Patent-Pending Method to Remove Micro and Nanoparticles



# 7TH CURVE IN THE ROAD: CLASSROOM MICROPLASTICS LAB




LED
UV light
filter

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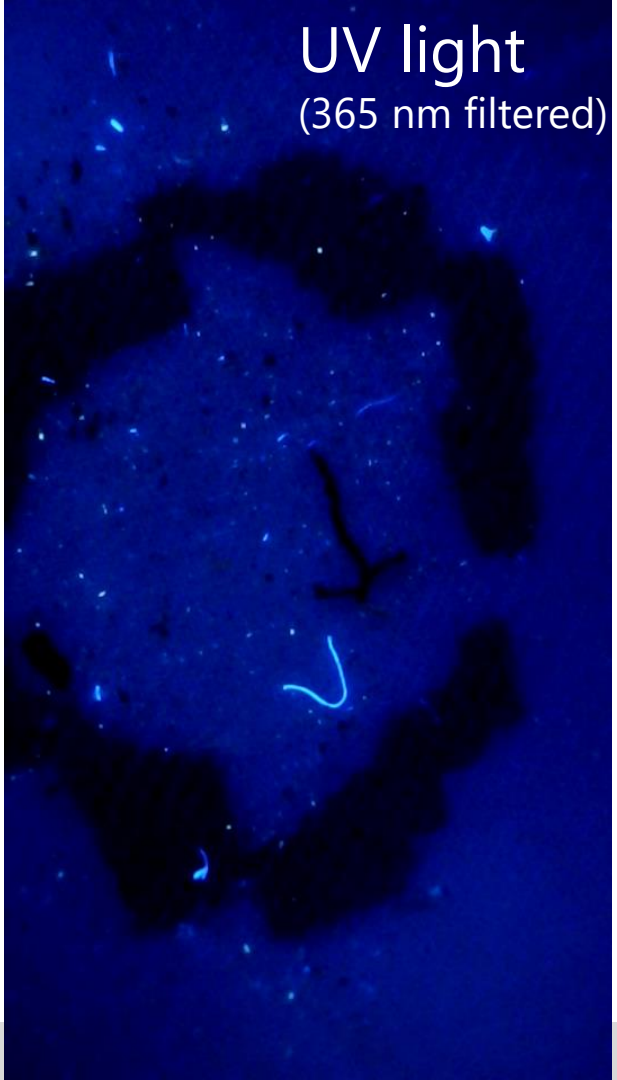
visible light


UV light
(365 nm filtered)

# 8TH CURVE IN THE ROAD: ?

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