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Science in the Meme Age: Flawed Studies, Zombie Facts and What Can Be Done

Mark Jones
Creative Director
MJPhD, LLC

15 October 2026

RMC

Title: Microplastic Misinformation in the Meme Age: Flawed Studies, Zombie Facts and What Can Be Done

Abstract: Most have heard we consume 5 grams of plastic per week. That is the reported weight of plastic hiding in our food as microplastics. Many may have seen the reporting showing a credit card, weighing about 5 grams, between two chopsticks. I saw that image and immediately had my doubts. Planting the picture that each bite contained a credit card's worth of plastic was intentionally misleading. A little digging showed how misleading it is. Actual consumption is about a million times lower. I'll examine where the error occurred, how it spread and how subsequent measurements in peer-reviewed papers failed to change the perception. Science is supposed to be self-correcting. It is a foundational assumption. Testing, replication, and new evidence are supposed to correct errors. Truth is supposed to vanquish erroneous conclusions. There is ample evidence the system is broken. The pace of publication is increasing while the pace of correction is slowing. Even when major errors are present and when multiple analyses confirm the error, the incorrect results continue to live on as zombie facts. Getting a paper corrected is a challenge. Getting public perception corrected is nearly impossible.

A widely reported fact about microplastic consumption is wrong.

Correction in the scientific literature is slow to correct public perception and the scientific literature.

Plastic particles are everywhere.

before I jump in, I'm going to tell you the story of how I got interested in microplastcis.

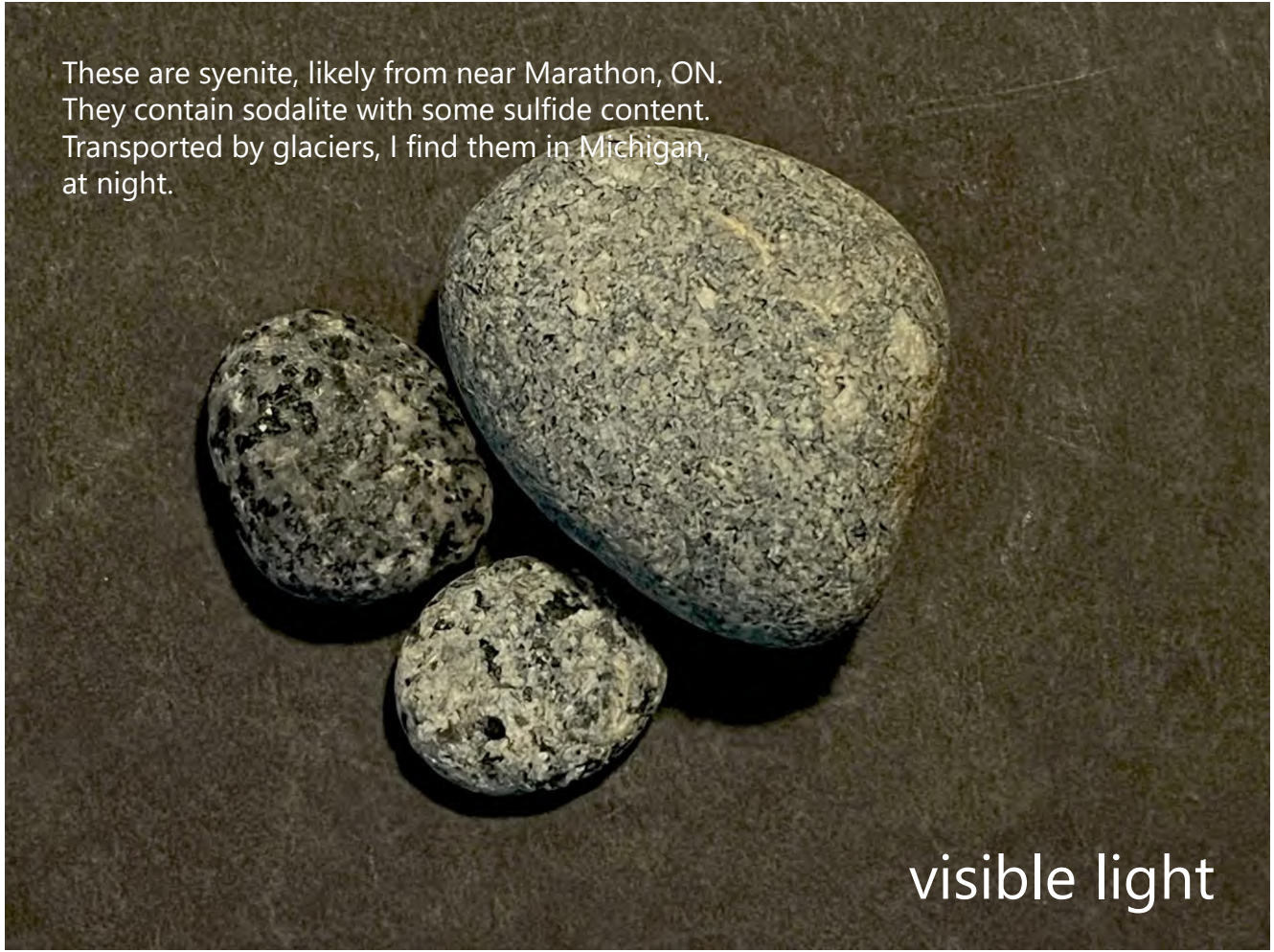
types of stories:
tragedies
comedies
fantasy
allegory – teach something
cautionary tale
epic
legend
monomyth – story of herosim

Dow

~31 years

Done.

~5 years


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

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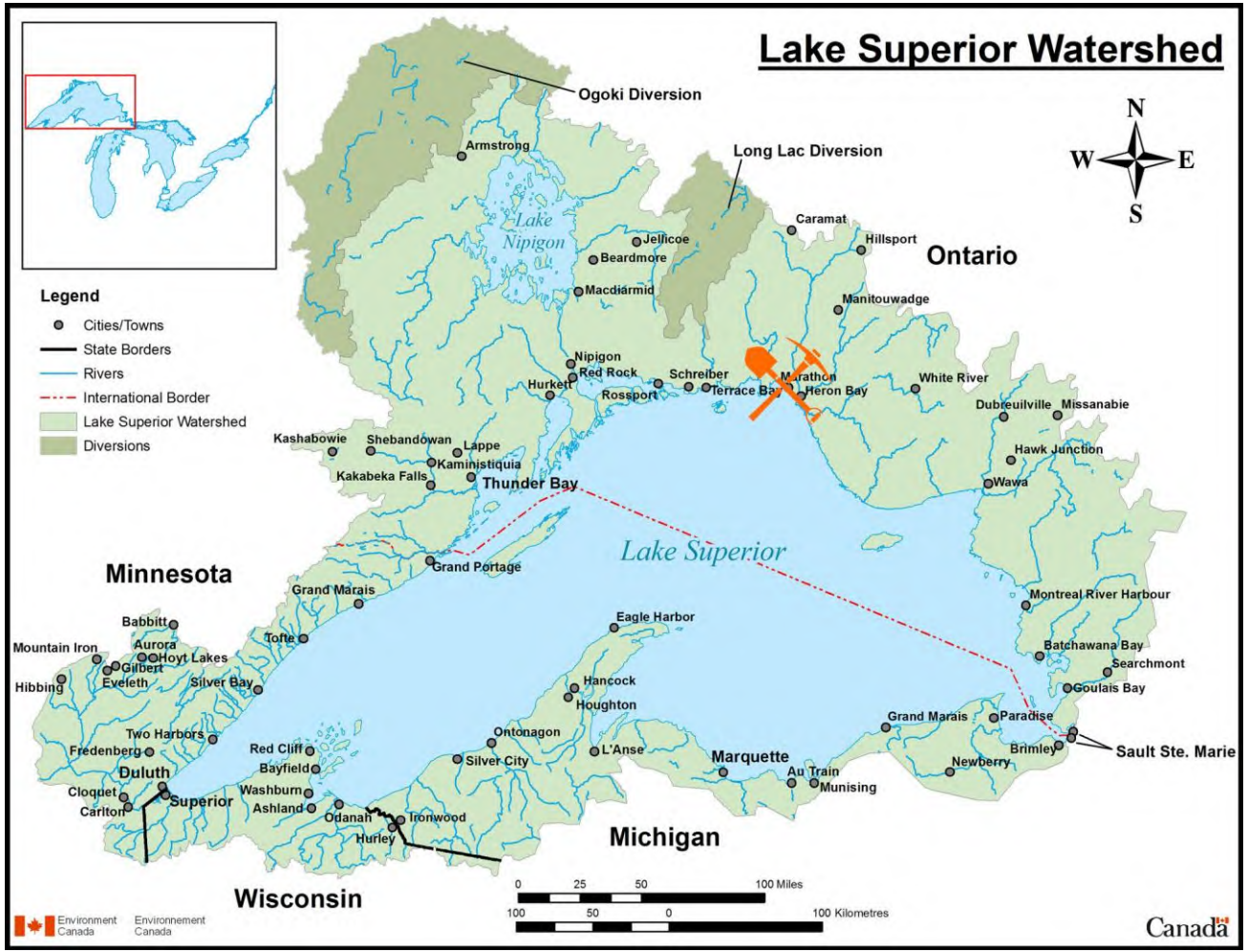
UV light
(365 nm filtered)


Lake Superior Watershed
Ogoki Diversion
Long Lac Diversion
N
W
E
S
Ontario
Minnesota
Wisconsin
Michigan
Lake Superior
Lake Nipigon
Legend
Cities/Towns
State Borders
Rivers
International Border
Lake Superior Watershed
Diversions
Armstrong
Caramat
Hillsport
Jellicoe
Beardmore
Macdiarmid
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
Grand Portage
Grand Marais
Babbitt
Mountain Iron
Aurora
Hoyt Lakes
Gilbert
Eveleth
Hibbing
Silver Bay
Tofte
Two Harbors
Fredenberg
Duluth
Superior
Cloquet
Carlton
Red Cliff
Bayfield
Washburn
Ashland
Odanah
Ironwood
Hurley
Ontonagon
Silver City
Eagle Harbor
Hancock
Houghton
L'Anse
Marquette
Au Train
Munising
Grand Marais
Paradise
Newberry
Brimley
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

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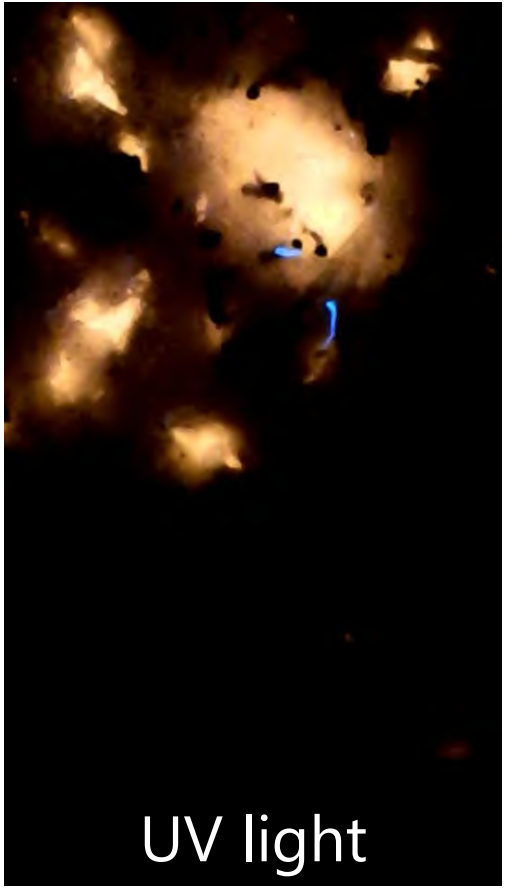
The filter is important. It gets rid of stray visible light making fluorescence much easier to see.

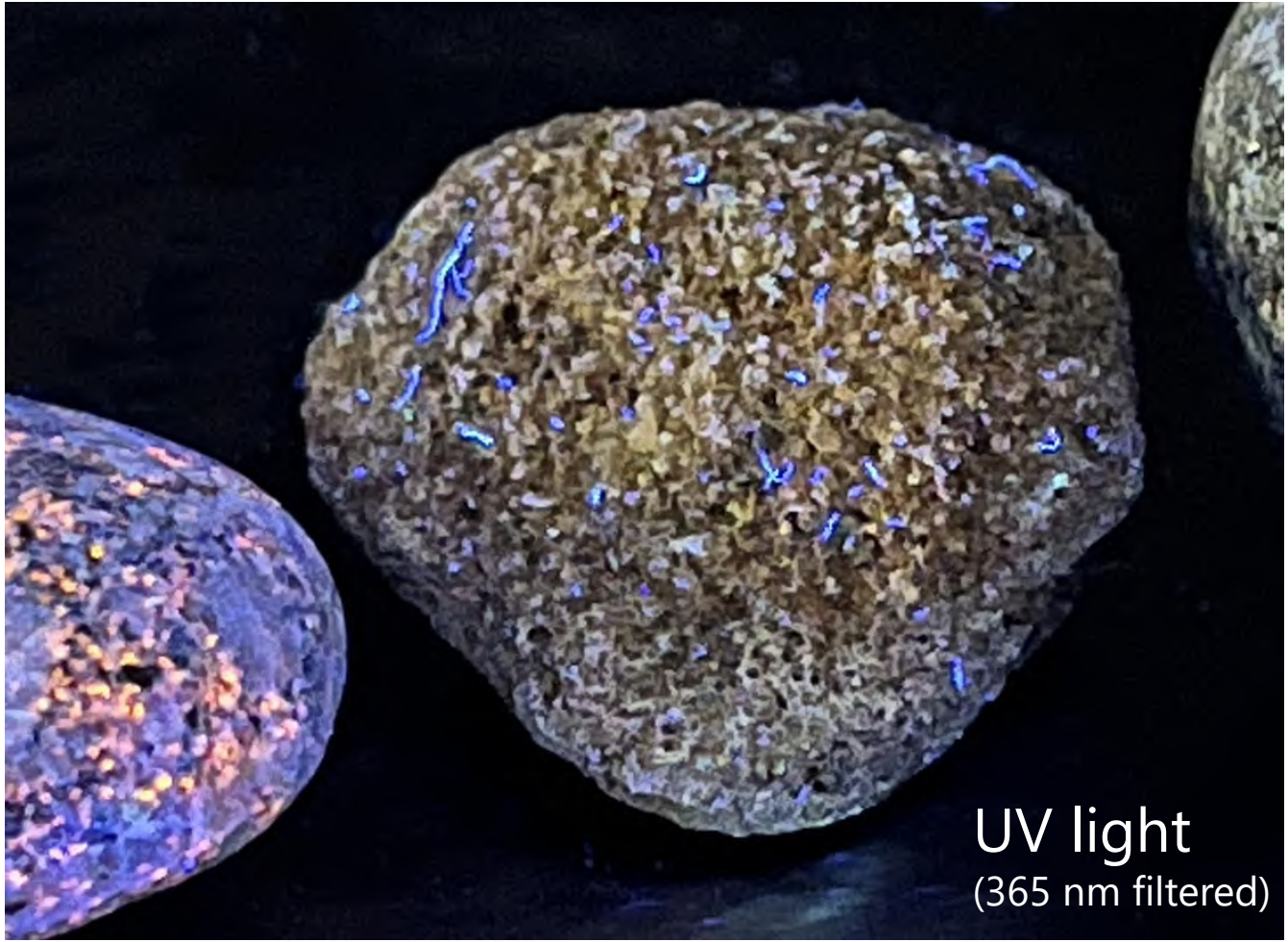
visible light

manipulated image

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

visible light


UV light



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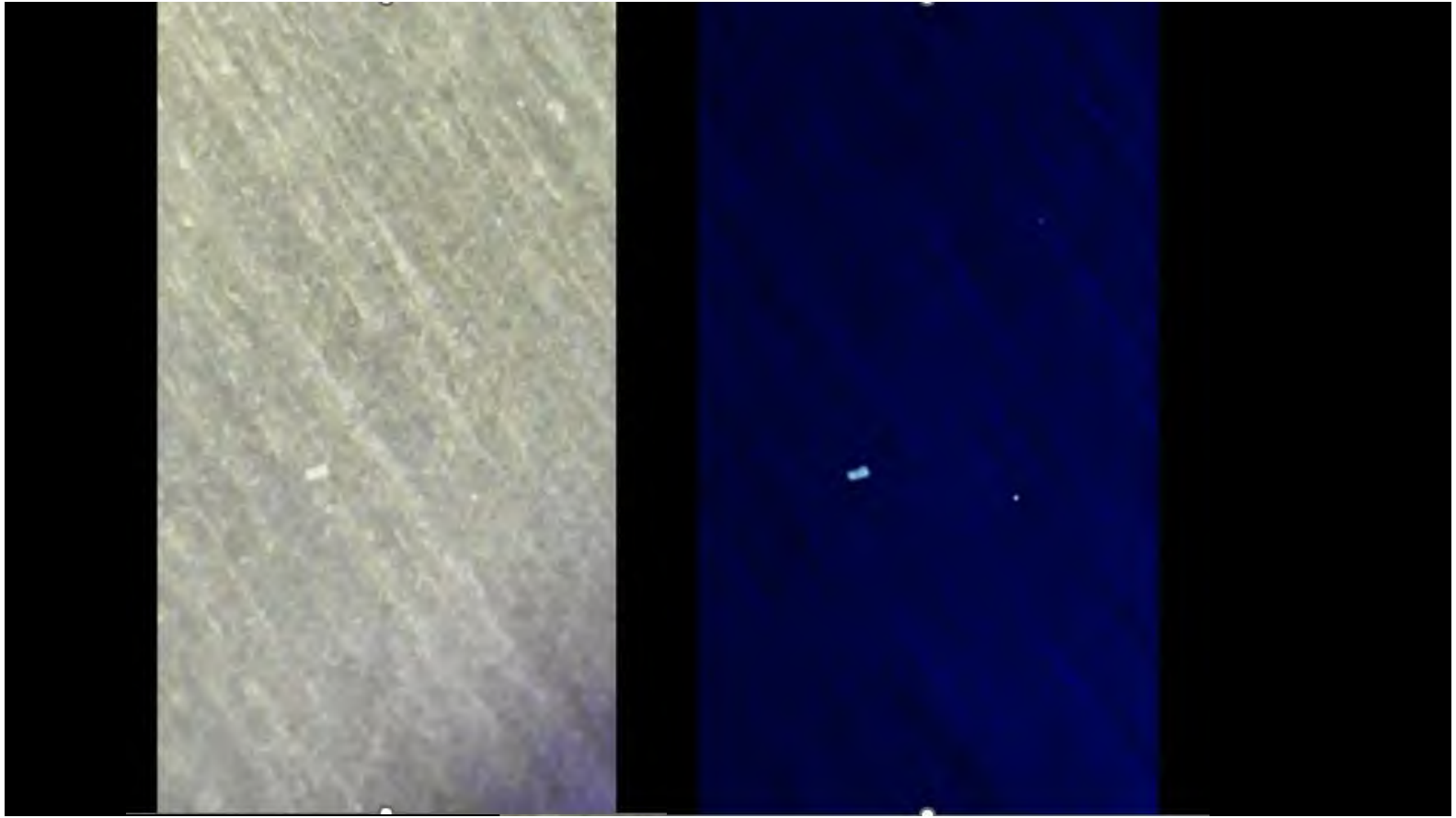
OBX Beach Sand

OBX Beach Sand

OBX Beach Sand

Isle Royale Water – Visible to UV



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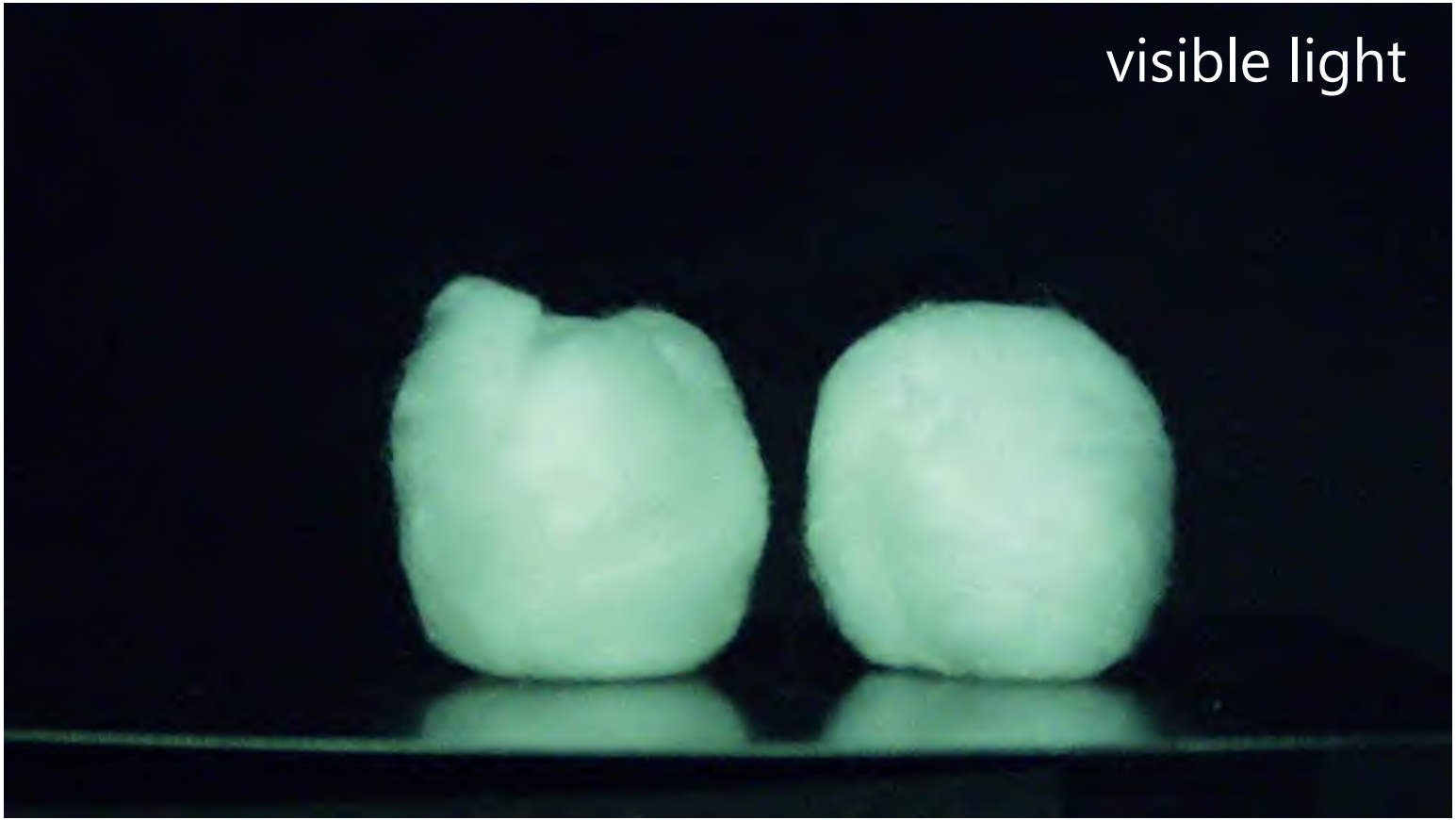
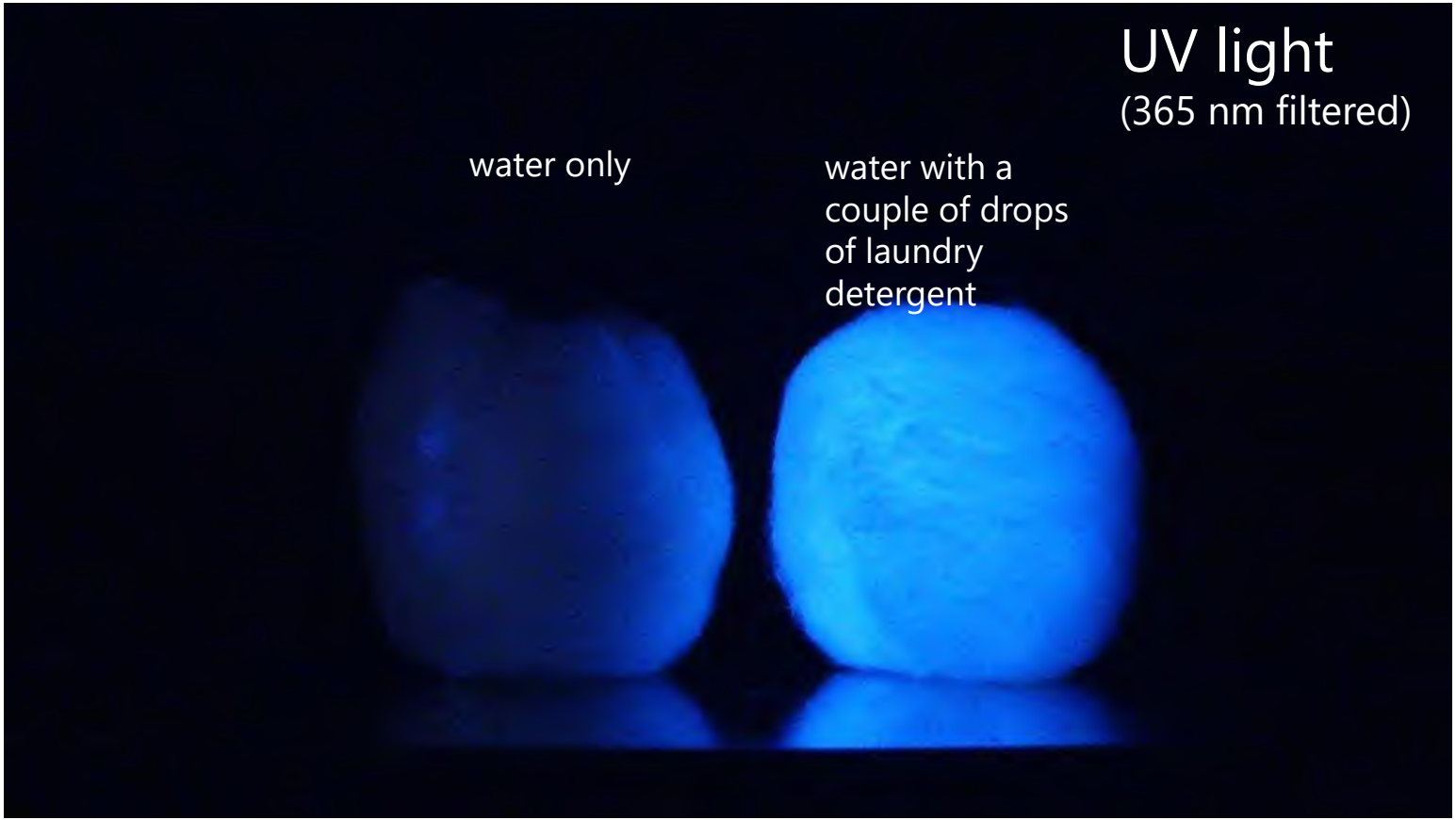
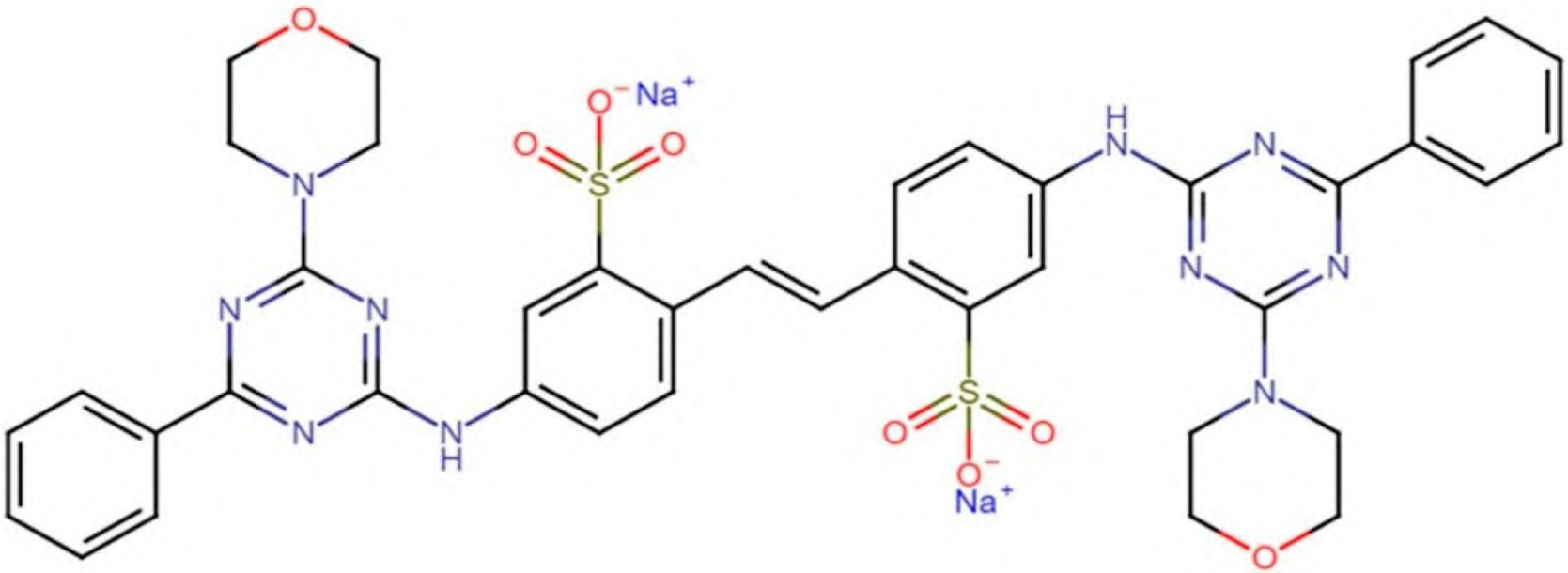
Cotton Balls



Cotton Balls – Optical Brighteners

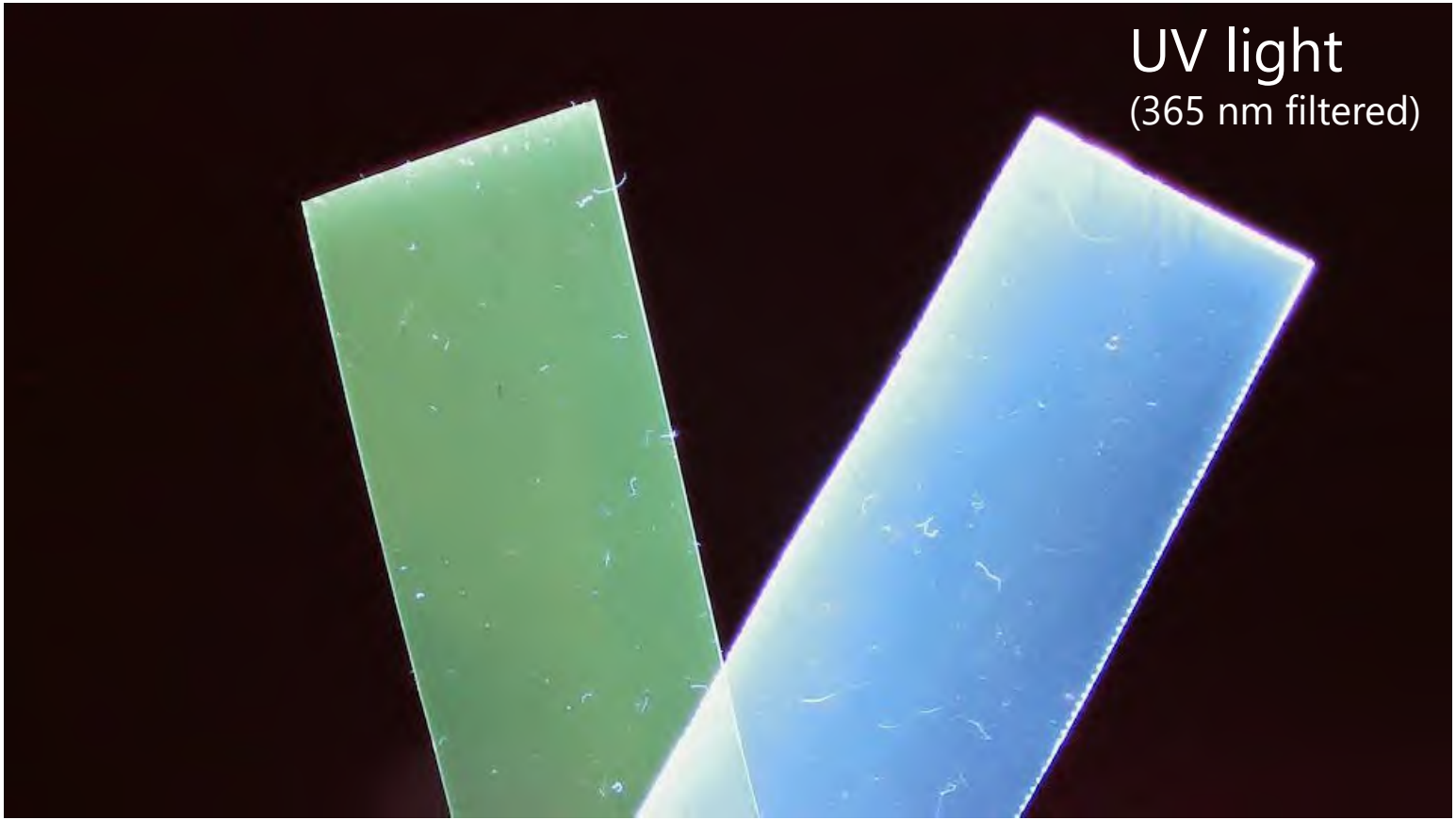


Optical Brighteners



PET

PET – Optical Brighteners



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] Aq[illegible]ic Ecology and Water Quality Manage[illegible] Wageningen Univers[illegible] the Netherlands
[illegible]

high quality data is difficult!

ARTICLE INFO

Article history:
Received 27 November 2018
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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

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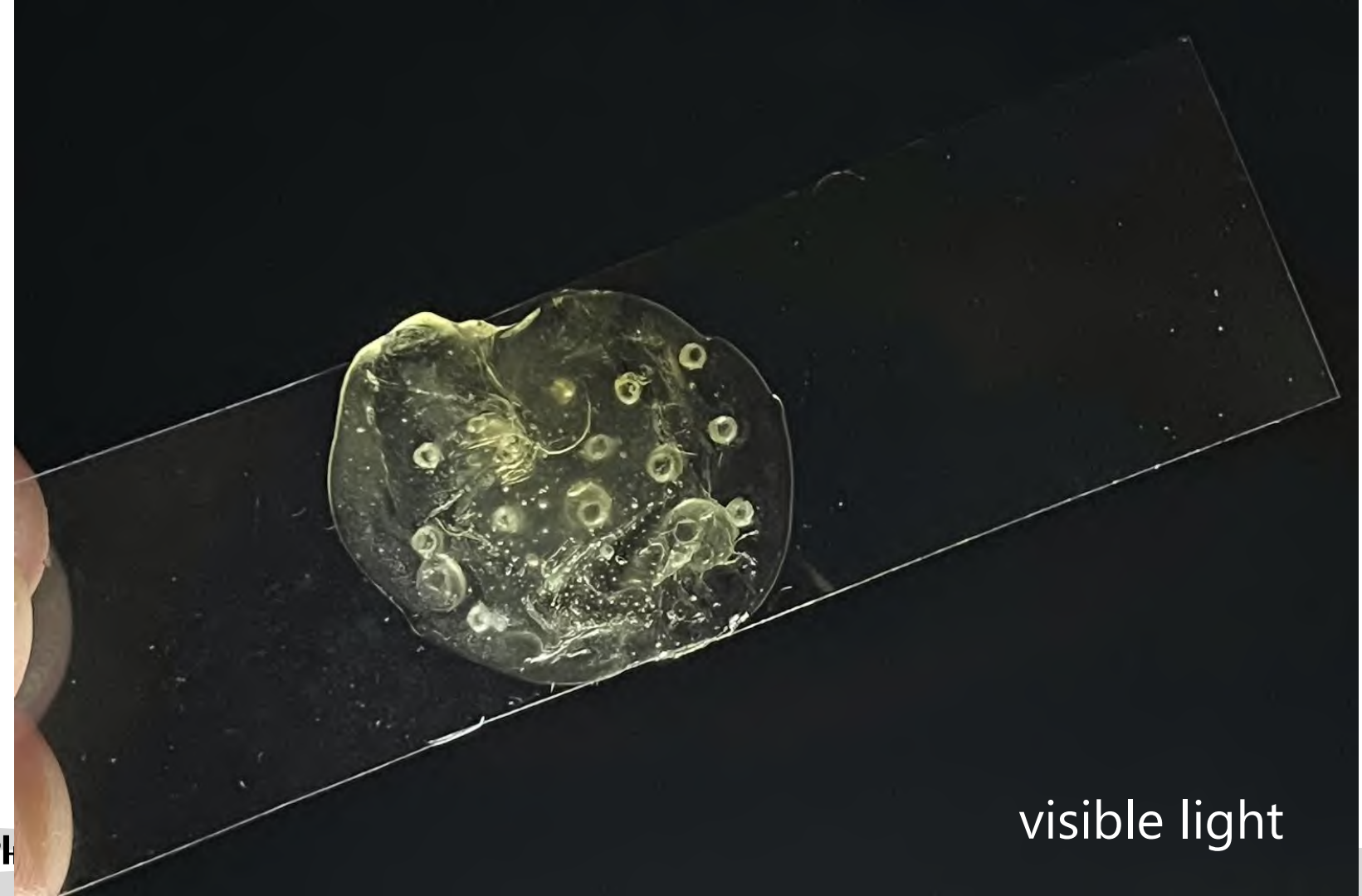
3RD CURVE IN THE ROAD: WHAT AM I SEEING?


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

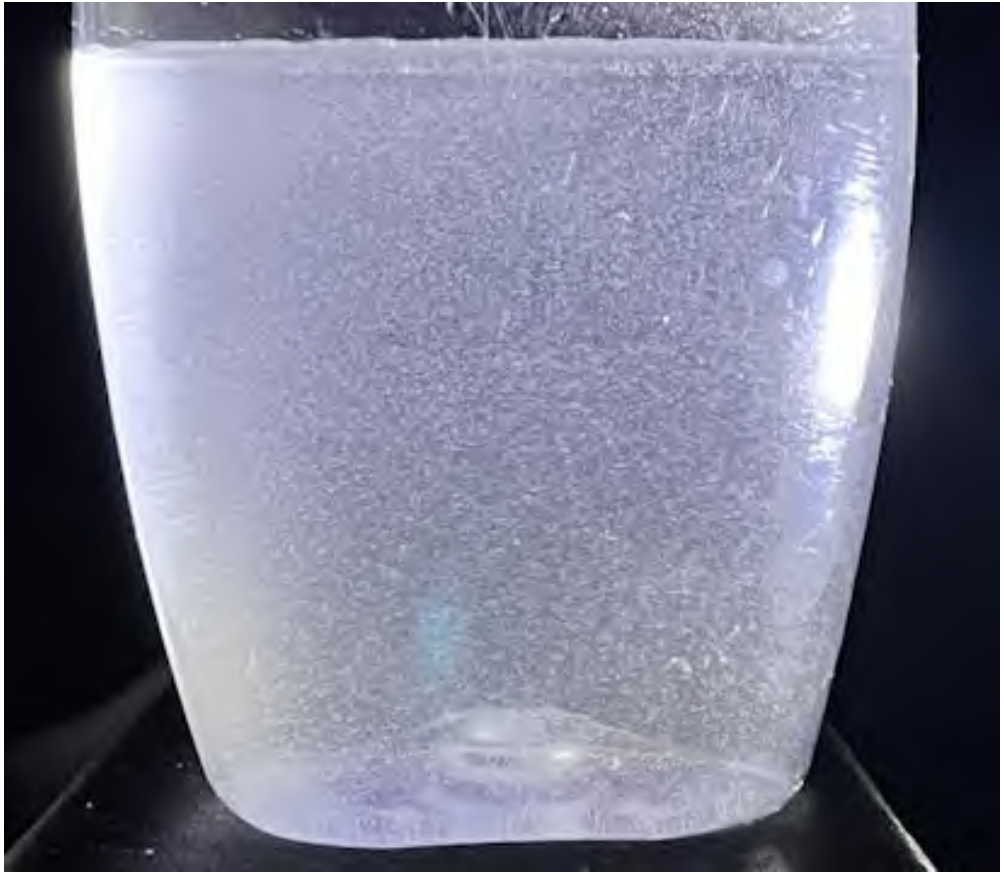
Polyester

Longitudinal View

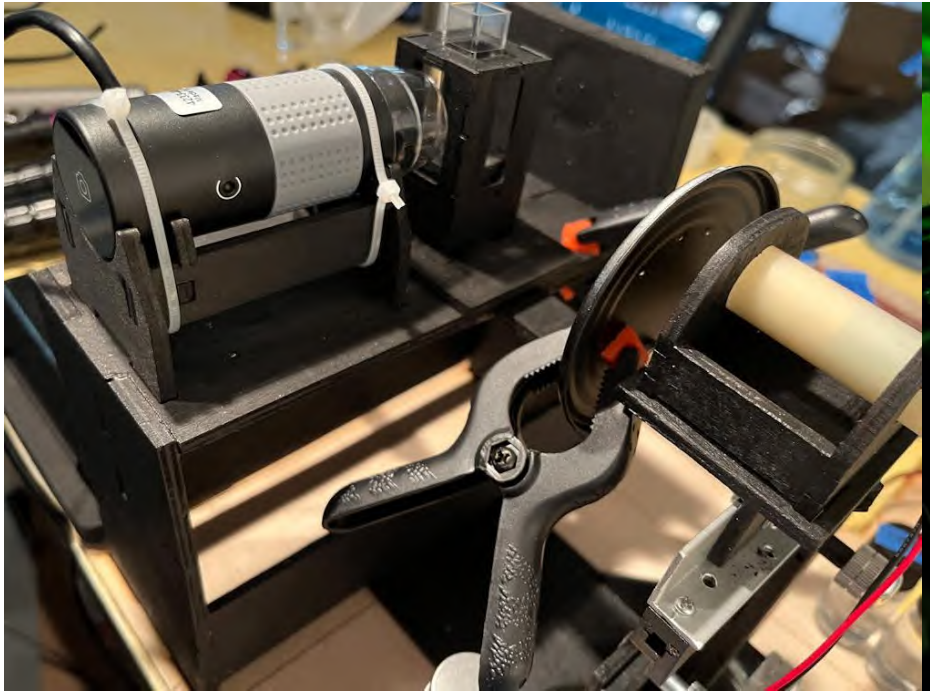
Structureless, uniform diameter, rod-like appearance

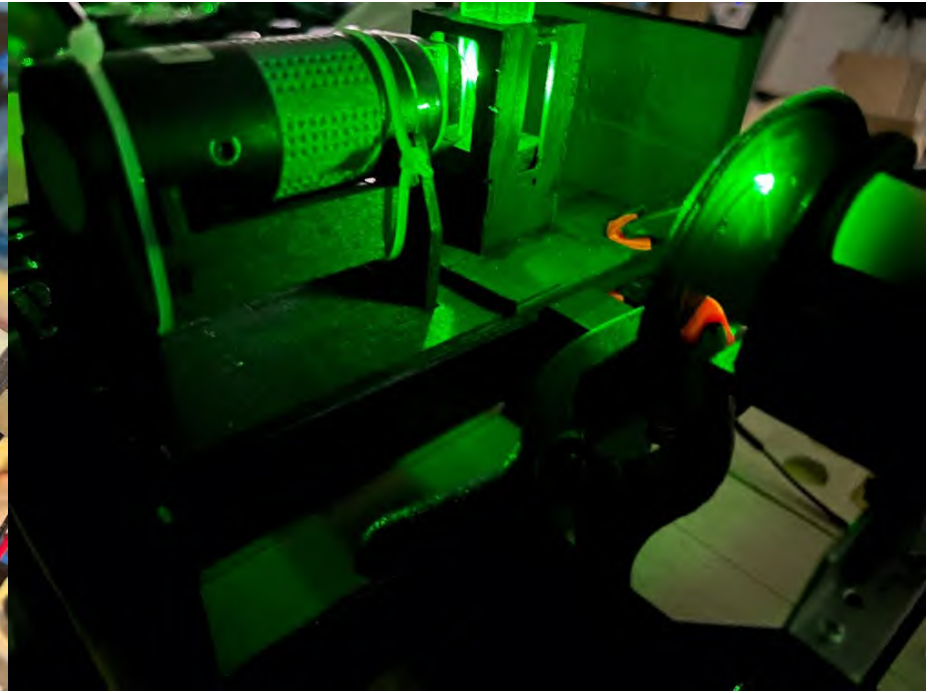
https://www.textileschool.com/330/microscopic-appearance-of-fibres/

4TH CURVE IN THE ROAD: LEARNING TO MAKE MICROPLASTICS



Rayleigh Scattering





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

"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

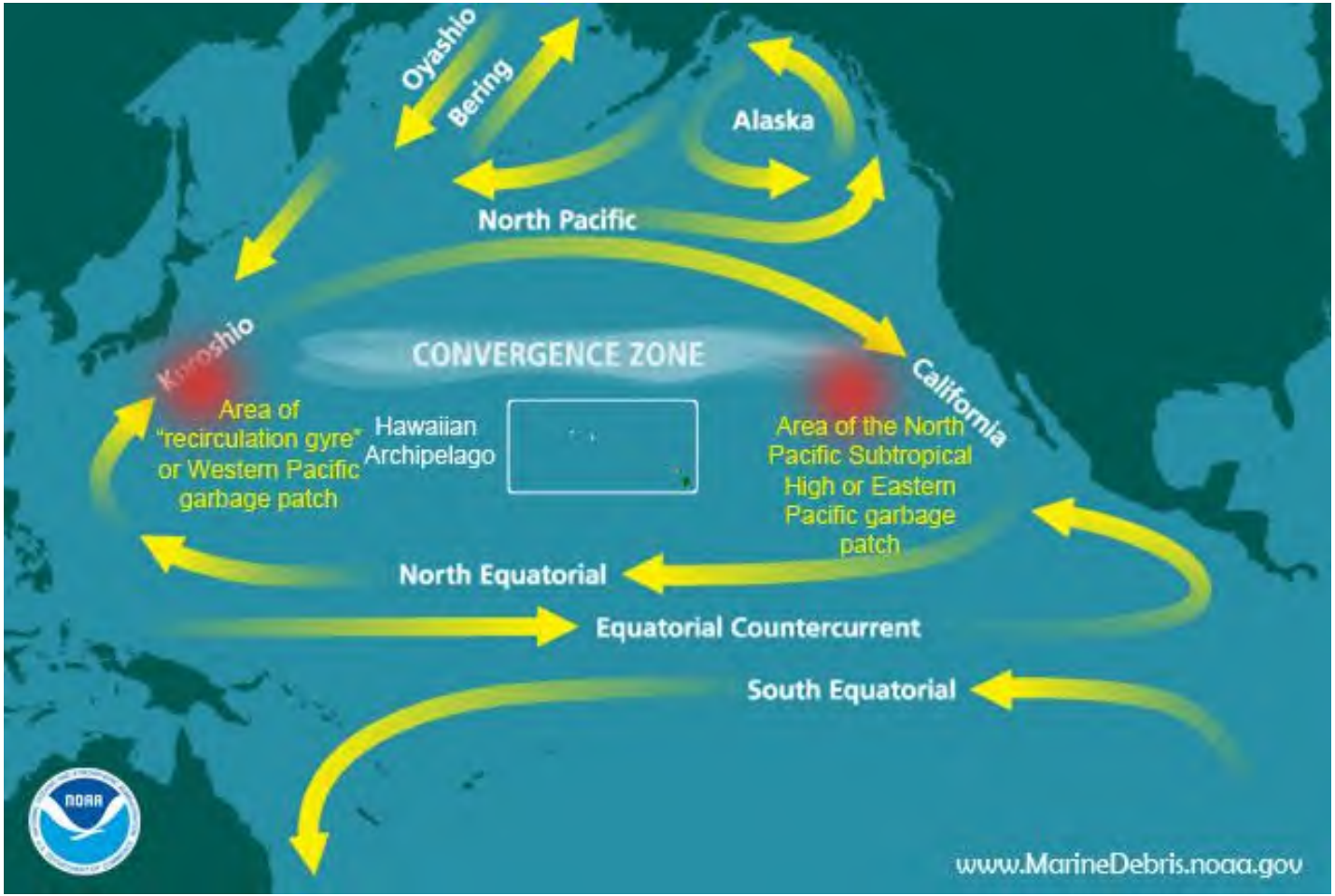
It took
you up to
1 WEEK
to eat this
credit card

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

The Great Pacific Garbage Patch

Caption:
A Part of the Great Pacific Garbage Patch

http://b.parsons.edu/~pany468/parsons/political_website/source2/index.html


Oyashio
Bering
Alaska
North Pacific
Kuroshio
CONVERGENCE ZONE
California
Area of "recirculation gyre" or Western Pacific garbage patch
Hawaiian Archipelago
Area of the North Pacific Subtropical High or Eastern Pacific garbage patch
North Equatorial
Equatorial Countercurrent
South Equatorial
NOAA
www.MarineDebris.noaa.gov

The Great Pacific Garbage Patch

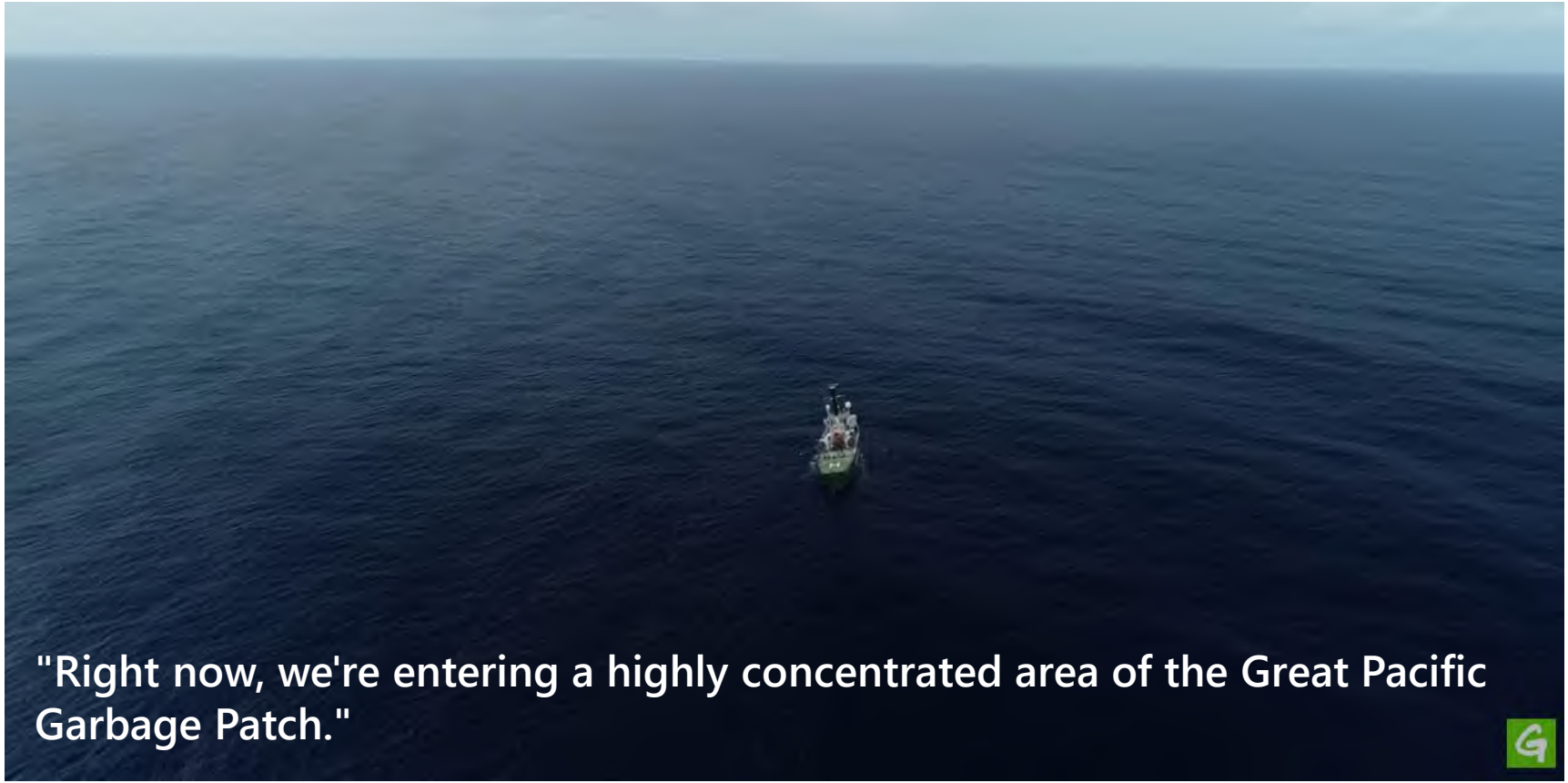
http://b.parsons.edu/~pany468/parsons/political_website/source2/index.html

Caption:
A Part of the Great Pacific Garbage Patch

Article text:
"these patches are almost entirely made up of tiny bits of plastic, called microplastics."

Hills in background:
Honduras

Greenpeace's Arctic Sunrise In The Great Pacific Garbage Patch



https://www.youtube.com/watch?v=DcpEcngTrOQ

Newsroom

Future Students
Research and Innovation
The Conversation
Industry
International
Community and Alumni
Library
Current Students
Current Staff
College of Engineering, Science and Environment
College of Health, Medicine and Wellbeing
College of Human and Social Futures
Pathways and Academic Learning Support Centre
Sustainable Development Goals

Plastic ingestion by people could be equating to a credit card a week

Wednesday, 12 June 2019

Tweet LinkedIn

A new study finds on average people could be ingesting approximately 5 grams of plastic every week, which is the equivalent weight of a credit card.

Dr Thava Palanisami

The analysis *No Plastic in Nature: Assessing Plastic Ingestion from Nature to People* prepared by Dalberg, based on a study commissioned by WWF and carried out by University of Newcastle, Australia, suggests people are consuming about 2000 tiny pieces of plastic every week. That's approximately 21 grams a month, just over 250 grams a year.

The University of Newcastle is the first to combine data from over 50 studies on the ingestion of microplastic by people. The findings are an important step towards understanding the impact of plastic pollution on humans. It also further confirms the urgent need

www.newcastle.edu.au/newsroom/featured/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/

www.cnn.com/2019/06/11/health/microplastics-ingestion-wwf-study-scn-intl/index.html

per week

whole card = 5 g

per day

1/7 card = 710 mg

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per meal

1/21 card = 240 mg

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*

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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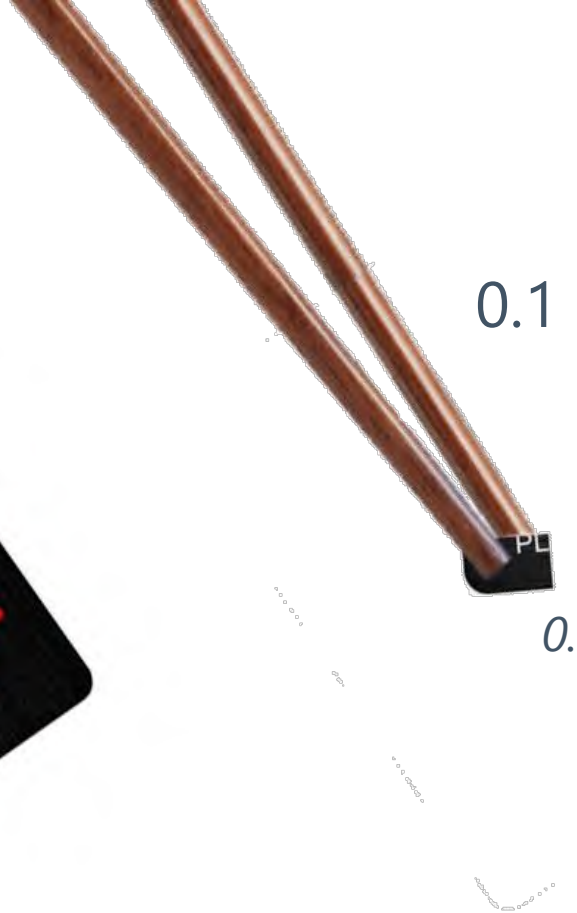
Table 6
Summary of the annual average number of microplastics (particles) ingested (particles), and global average rate of microplastics ingested (g) per person per year.

Source of particles	$ANMP_{ingested}$ (particles)	GARMI (0–1 mm) Scenario 1 (g)	GARMI (0–1 mm) Scenario 2 (g)	GARMI (0–1 mm) Scenario 3 (g)
Shellfish	9,445	26.4	0.0	0.0
Salt	565	1.6	7.4	14.2
Beer	523	1.46	0.3	0.5
Drinking water	91,994	257.5	0.0	0.0
Total (per year)	**102,527**	**287.0**	**7.7**	**14.7**
TOTAL (PER WEEK)	*1,972*	*5.5*	*0.1*	*0.3*

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



one model **another model**

Errors

"an average person could be ingesting approximately 5 grams of plastic every week."

- got diameter wrong
  - weight even more wrong
- reported as if statistical when actually different models

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

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3 mg/particle

For PET, 1.6 mm diameter particle

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

Observable

1769 particles/ 7L

253 particles/L

Calculated

~4.5 g/ 7L

~0.6 g/L

~1.5 mm diameter PET sphere

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.

Table 6
Summary of the annual average number of microplastics (particles) ingested (particles), and global average rate of microplastics ingested (g) per person per year.

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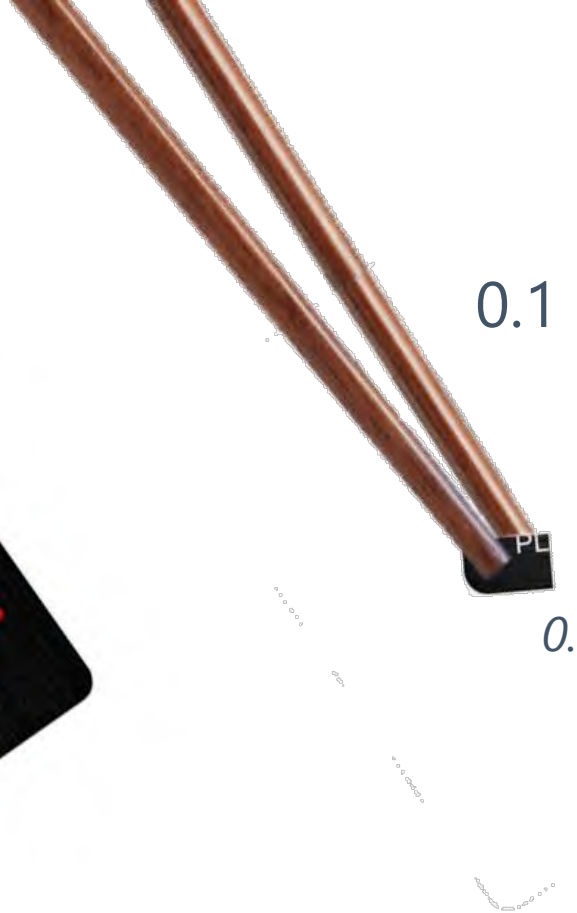
https://doi.org/10.1016/j.jhazmat.2020.124004



one model **another model**

"an average person could be ingesting approximately 5 grams of plastic every week."

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

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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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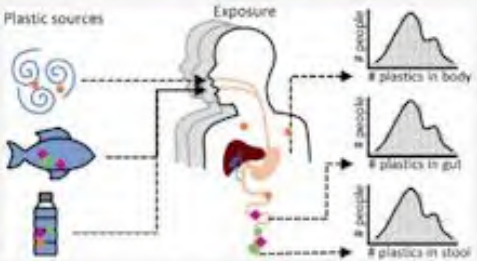
ACCESS | Metrics & More | Article Recommendations | Supporting Information

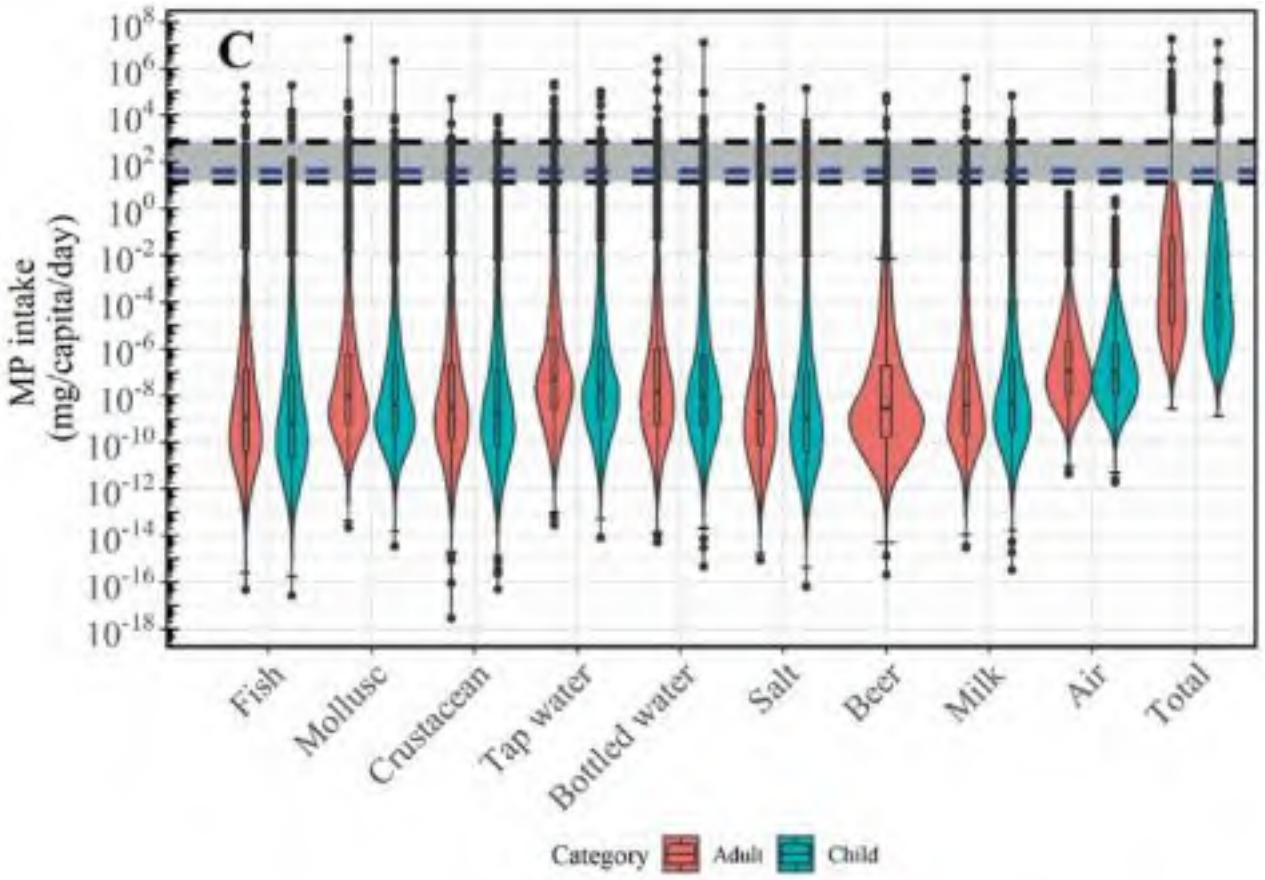
ABSTRACT: Human exposure to microplastic is recognized as a global problem, but the uncertainty, variability, and lifetime accumulation are unresolved. We provide a probabilistic lifetime exposure model for children and adults, which accounts for intake via eight food types and inhalation, intestinal 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

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



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.

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]

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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

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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/

ScienceDaily

Your source for the latest research news

SD Health Tech Enviro Society Quirky

Science News *from research organizations*

Health risk due to micro- and nanoplastics in food

Date: March 24, 2022

Source: Medical University of Vienna

Summary: Five grams of plastic particles on average enter the human gastrointestinal tract per person per week. This is roughly equivalent to the weight of a credit card. Whether ingested micro- and nanoplastics pose a health risk is being investigated in numerous studies but is largely unknown to date. A research team has now summarized the current state of scientific knowledge.

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

www.sciencedaily.com/releases/2022/03/220324130253.htm

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

nypost.com/2022/03/30/youre-eating-a-credit-cards-worth-of-plastic-a-week-and-its-killing-your-gut/

Junk Food and Tainted Water: People Ingest a Credit Card Worth of Nanoplastics Weekly, Study Says

Mar 31, 2022 at 5:09 PM EDT

Bottled water or tap?

How you answer that question could have some major implications for your long-term health, a new study into the health effects of ingested plastic particles shows.

That study also contained this startling fact: People are eating the equivalent of one plastic credit card every week in their diet. The plastic particles enter the human food chain through plastic waste contained in fish, sea salt and drinking water, the study shows.

Scientists say such nanoplastics disrupt the human gut bacteria and can lead to killer diseases like cancer and diabetes.

www.newsweek.com/junk-food-tainted-water-people-ingest-credit-card-worth-nanoplastics-weekly-study-says-1693970

TastingTable. RECIPES NEWS EXCLUSIVES RESTAURANTS COOK DRINK

COOK

You Probably Eat A Credit Card's Worth Of Plastic Every Week

BY GILLIE HOUSTON / UPDATED: OCT. 19, 2022 6:53 PM EST

www.tastingtable.com/1062298/you-probably-eat-a-credit-cards-worth-of-plastic-every-week/

Journal of Hazardous Materials Letters 3 (2022) 100071

Contents lists available at ScienceDirect

Journal of Hazardous Materials Letters

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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

Chapter 10

Emerging Aquatic Contaminants

One Health Framework for Risk Assessment and Remediation in the Post COVID-19 Anthropocene

ook • 2023

Sources, consequences, and control of nanoparticles and microplastics in the environment

A. Guhananthan [a], Aswin Kuttykattil [b], Thavamani Palanisami [b] and Selvakumar Rajendran [a,b]

[a] *Department of Nanobiotechnology, PSG Institute of Advanced Studies, Coimbatore, Tamil Nadu, India,* [b] *Environmental Plastic and Innovation Cluster (EPIC), Global Innovation Centre for Advanced Nanomaterials (GICAN), University of Newcastle, Callaghan, NSW, Australia*

10.1 Introduction

Nanoparticles (NP) and microplastics (MPs) are the most recent anthropogenic contaminants which pose threat to the environment and health. Both NPs and MPs from various sources interact with water, air, and soil in a complex way affecting aquatic and terrestrial ecosystems (Fred-Ahmadu et al., 2020). Their bioaccumulation leads to, cytotoxicity, genotoxicity, organ failure, and sometimes death in living organisms. Nanoparticles can be classified into different types based on their origin (natural nanoparticles (NNPs) and engineered nanoparticles (ENPs)), dimension, size, and chemical composition (Ealia and Saravanakumar, 2017). Fig. 10.1 illustrates various sources of nanoparticles.

"Senathirajah and Palanisami (2019) estimated that on average, humans may consume 5 g of MPs per week"

ACS ES&T Water

pubs.acs.org/estwater

Review

Strategies to Reduce Risk and Mitigate Impacts of Disaster: Increasing Water Quality Resilience from Microplastics in the Water Supply System

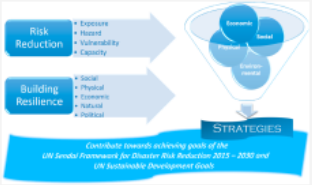
Kala Senathirajah* and Thava Palanisami

Cite This: *ACS EST Water* 2023, 3, 2816−2834

Read Online

ACCESS | Metrics & More | Article Recommendations

ABSTRACT: Microplastics contaminating the water supply system qualifies as a disaster. This has major far-reaching implications, posing significant threats to economic growth and human livelihoods, as well as environmental and human health and well-being. Thus, we need to reduce the risk and mitigate against the effects of microplastics to build resilience and ensure continuity and efficiency of water supply system functions. To date, microplastics in the water supply cycle have not been considered in the context of disaster management. Hence, we provide an understanding of the disaster risk that microplastics pose using a conceptual mathematical framework. Additionally, we enhance understanding of the resilience of the social and physical infrastructure by highlighting hazards that people and infrastructure in the community face. Insights of the social, economic, and other human factors that make them vulnerable highlights capacities required to reduce risk and mitigate impacts. By evaluating the social and physical infrastructure resilience to microplastics in the water supply system and recommending multidisciplinary strategies to build resilience over time, we aim to catalyze action to address the problem. This will also contribute toward achieving targets of the Sendai Framework for Disaster Risk Reduction 2015−2030 and UN Sustainable Development Goals.



1. INTRODUCTION

Plastics are versatile, synthetic, widely used, persistent materials found in all aspects of our lives, in all sectors, and as pollution all around the globe. The plastic pollution crisis meets all criteria to qualify as a slow-onset disaster.[1] Microplastics are ubiquitous plastic fragments, spheres, fibers, filaments, and films, viz., plastic particles greater than 100 nm and less than 5 mm in size. Nanoplastics are particles less than 100 nm.[2] Microplastics have been detected in the air, water, and terrestrial environments, found from Mount Everest to the Marianna trench.[3] Microplastics have been found in plants,[4] animals, and humans,[5] in human placenta,[6] lungs, blood, and even breastmilk.[7] A recent study estimated that we could be ingesting cumulatively 0.1 to 5 g of microplastics a week[8] from a combination of sources, including from drinking water which is a fundamental need for survival. Microplastics have been detected in water supply sources, tap water, and bottled water around the world.[8,9]

Microplastics contaminate the water supply system (WSS) due to numerous reasons, including the existing social systems' policies and consumptive behaviors, and limitations in treatment. The fate and transport of microplastics through the water supply cycle (WSC) are varied, and thus the timeframes and implications also range greatly depending on the entry and exit points. For example, microplastics exiting via ingestion by a human has different implications to microplastics exiting via biosolids application for agriculture, although notably both instances impinge on the health and well-being of humans[5] and ecosystems.[10] The transport and fate of microplastics are a function of numerous factors including polymer type, size, shape, specific surface area, density, crystallinity, molecular structure, formation of biofilm and additives, among others. These also influence the vulnerability of the WSS and its sensitivity to the microplastic contamination.

Access to safe drinking water and wastewater services (W&WWS) are a human right,[11,12] and are essential to ensure health and well-being, good hygiene practices, economic prosperity, and minimize the spread of water borne diseases.[13] There are many disruptive events that impact W&WWS. Key to the continuity of service is water quality (WQ). From a

Received: April 20, 2023
Revised: August 11, 2023
Accepted: August 14, 2023
Published: August 29, 2023

A recent study estimated that we could be ingesting cumulatively 0.1 to 5 g of microplastics a week

https://pubs.acs.org/doi/abs/10.1021/acsestwater.3c00206

MJPhD

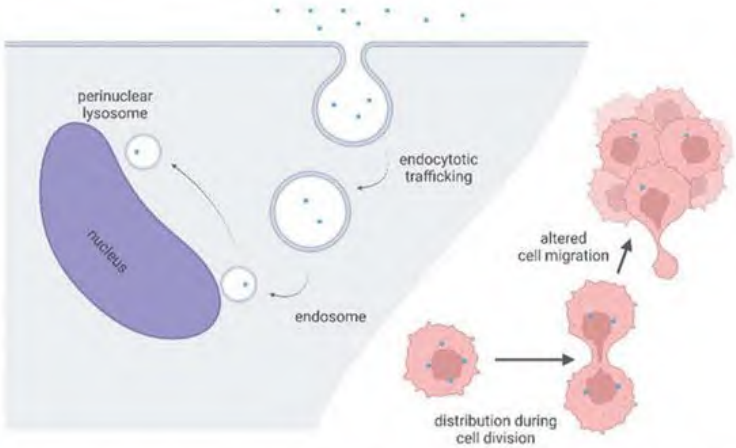
Medical Xpress Topics Conditions

Home / Oncology & Cancer
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

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

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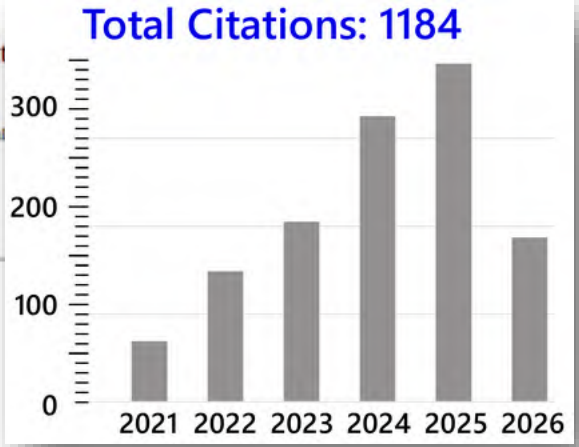
Research paper

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
Thava Palanisami [a,*]

[a] Global Innovative Centre for Advanced Nanomaterials(GICAN), Faculty of Engineering and Built Environment, The University of Newcastle, Cal
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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Streamed live on Apr 28, 2022

California Attorney General Rob Bonta makes a major announcement on the California Department of Justice's efforts to protect the environment from plastic pollution.

https://www.youtube.com/watch?v=fhaURS9U04s

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

WHO WE ARE WHAT WE DO UNDP OUR IMPACT GET INVOLVED

Why UNDP is tackling the developmental dimensions of plastic pollution

The burdens disproportionately affect the vulnerable

JUNE 20, 2024

"the average person could be ingesting a credit card worth of plastics, approximately five grams every week."

www.undp.org/blog/why-undp-tackling-developmental-dimensions-plastic-pollution

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!

R&D WORLD

Microplastics are bad, but ignoring science is worse

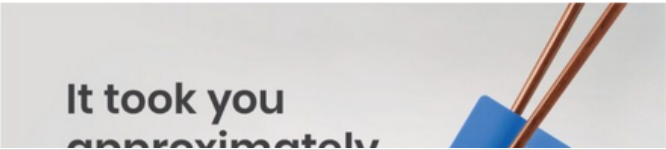
www.rdworldonline.com/microplastics-are-bad-but-ignoring-science-is-worse/

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



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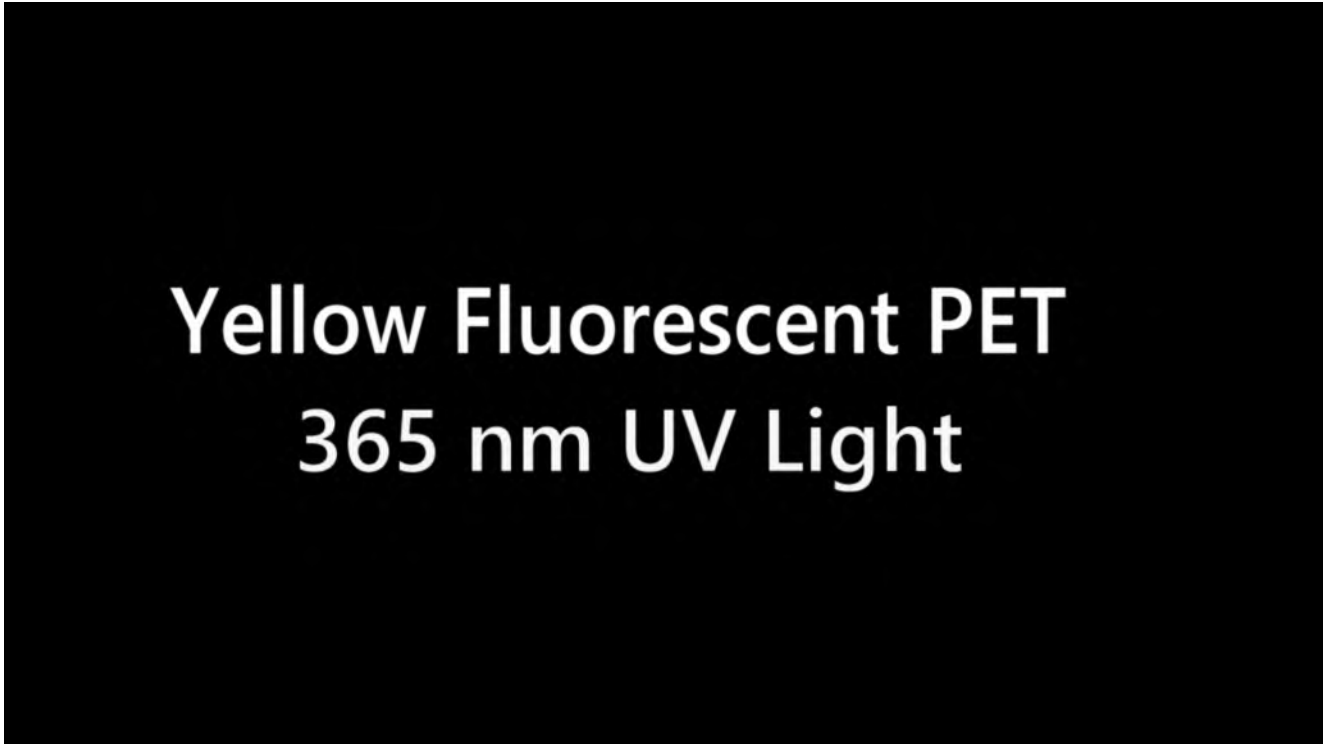
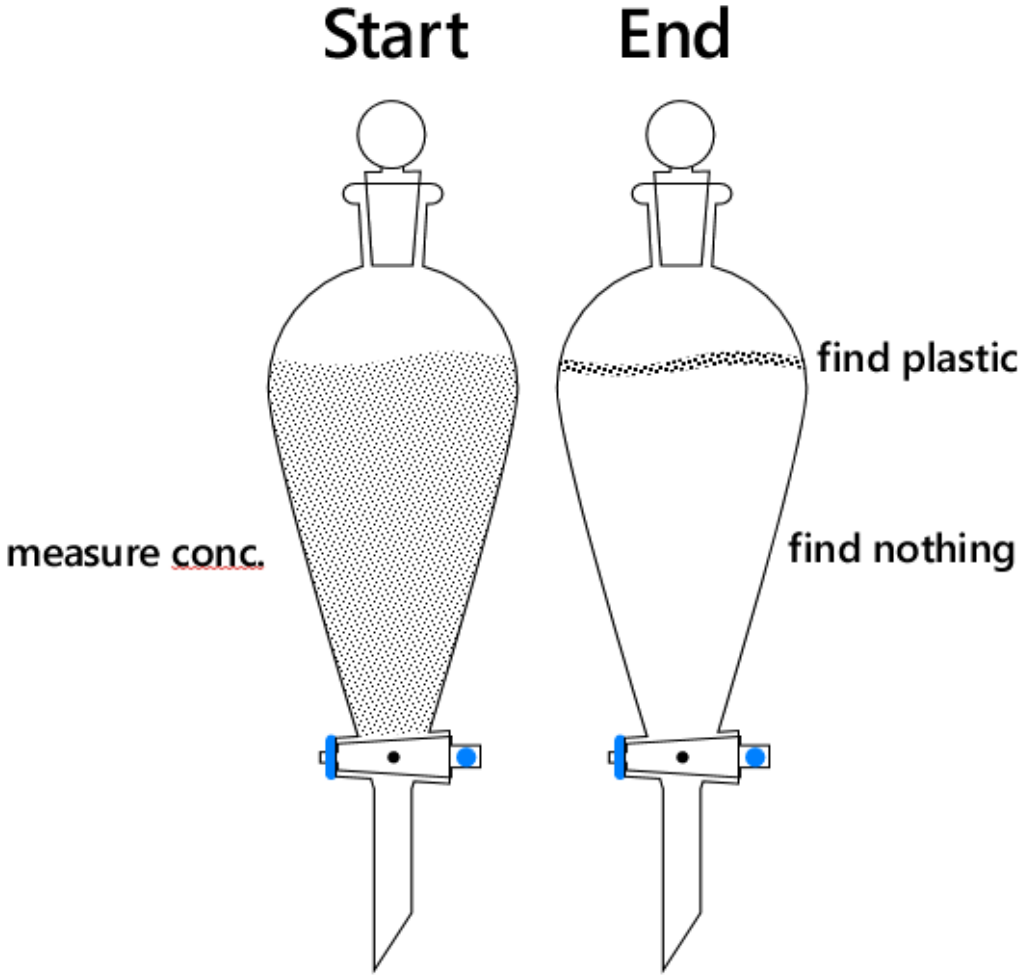
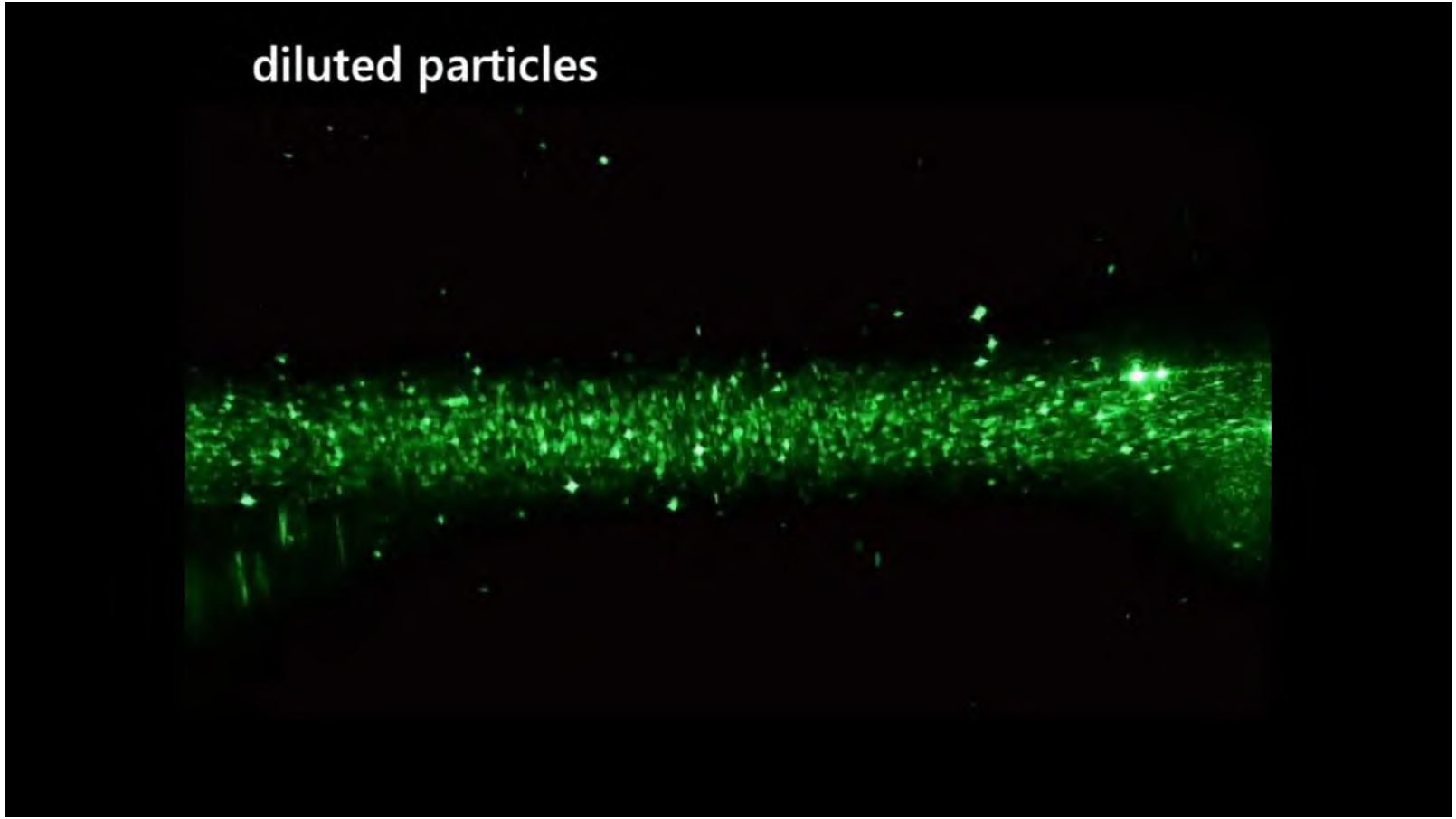
6TH CURVE IN THE ROAD: REMOVAL OF NANO AND MICROPLASTICS

LAB INVESTIGATIONS



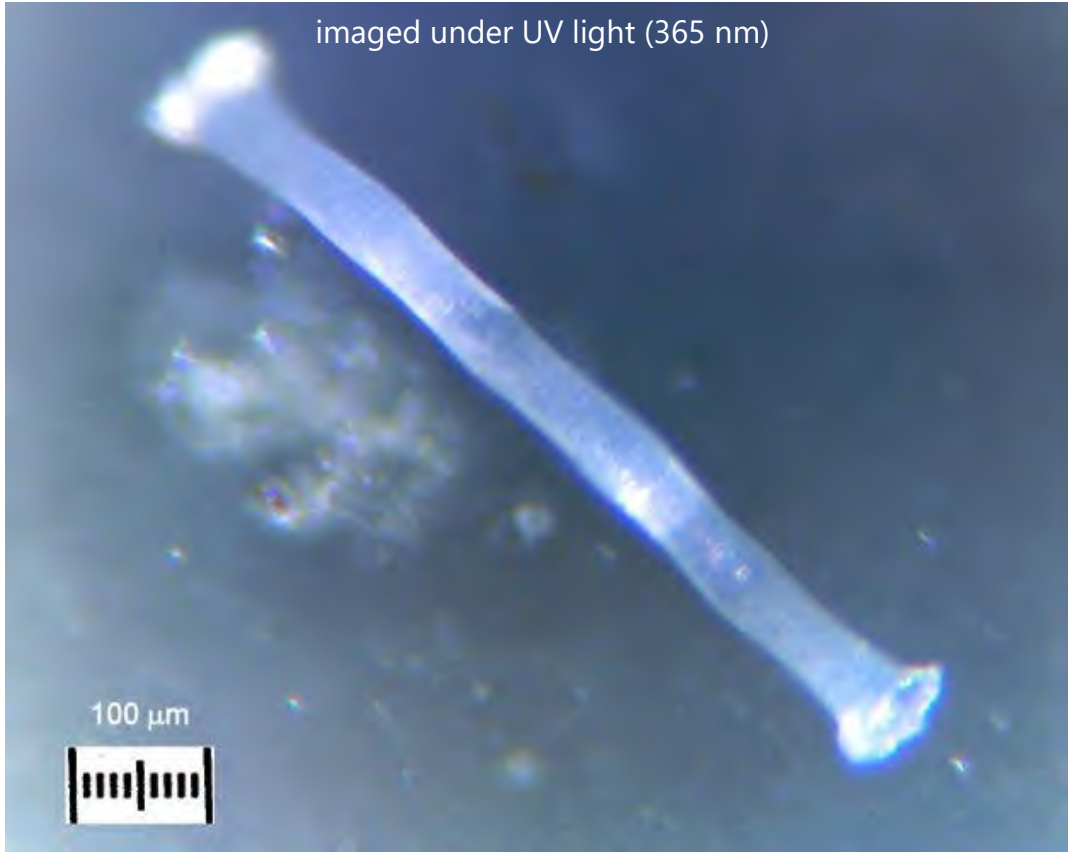
https://mjphd.net/sc/sc.php?003


Start
End
find plastic
measure conc.
find nothing


diluted particles

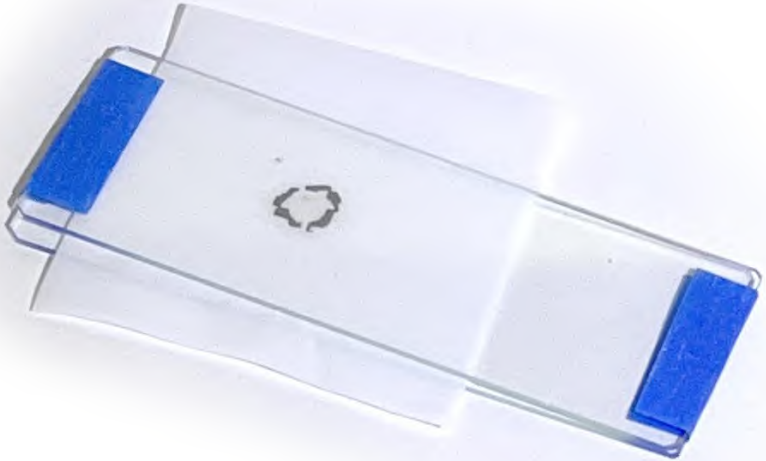
Commercial Bottled Water

From Commercial Bottled Water

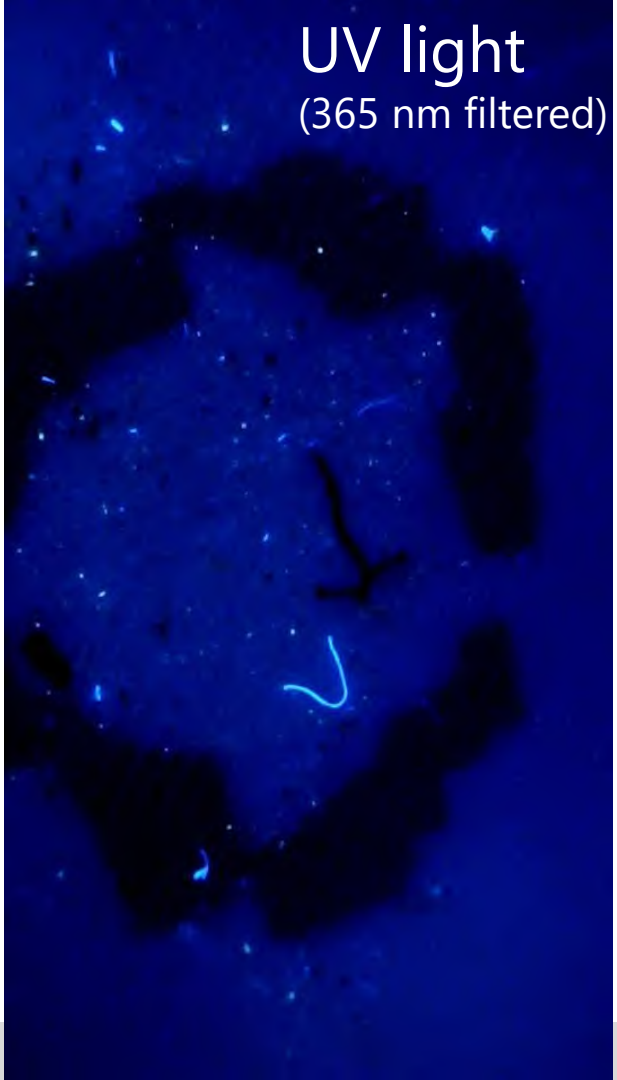


Patent-Pending Method to Remove Micro and Nanoparticles

7TH CURVE IN THE ROAD: CLASSROOM MICROPLASTICS LAB



LED
UV light
filter



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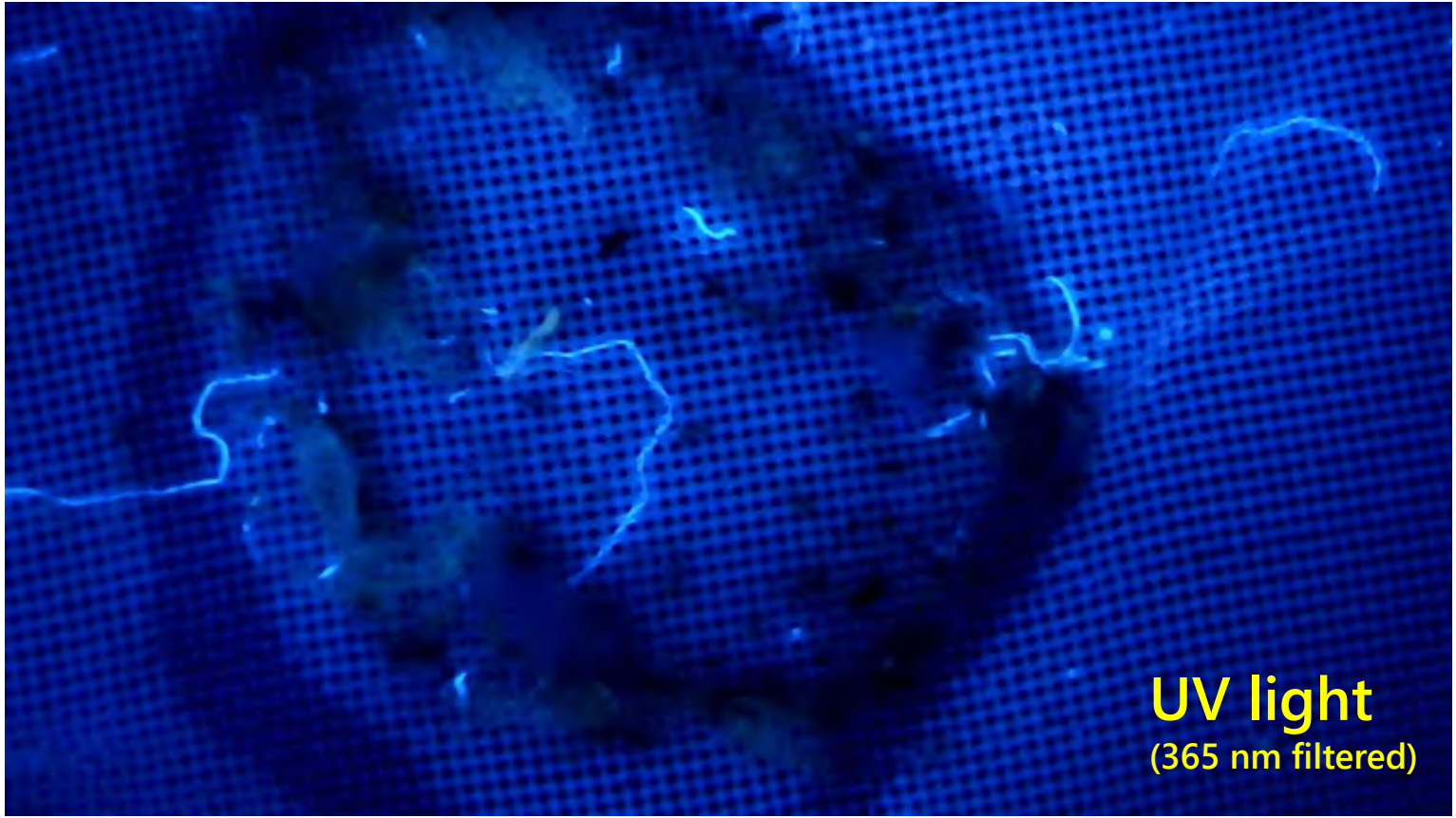
OBX Ocean Water

OBX Ocean Water

ible



OBX Ocean Water

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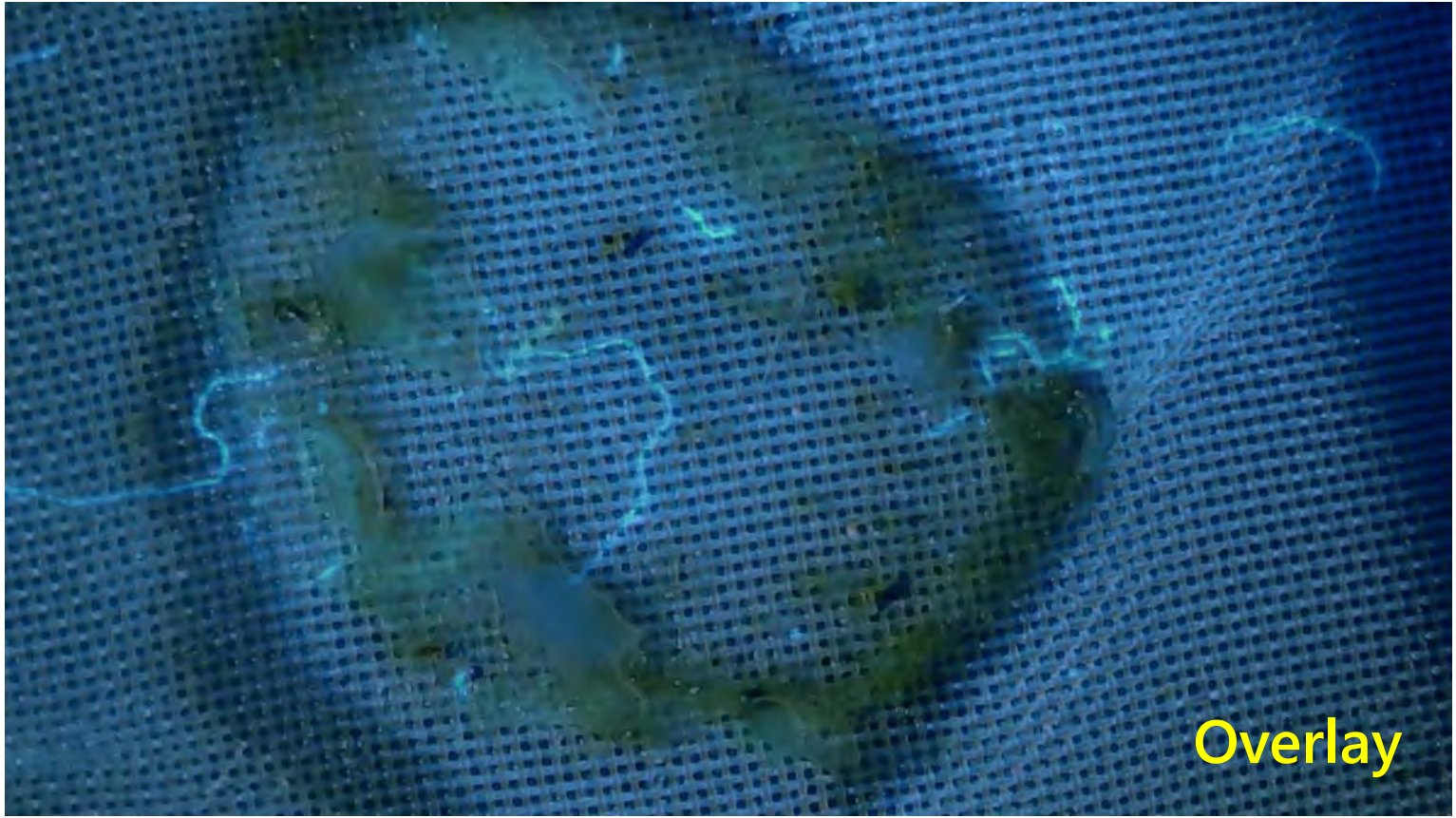
filtered)



8TH CURVE IN THE ROAD: PATENT APPLICATION

Captured
Particles
13 March 2025

US 20260242249A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2026/0242249 A1

(43) Pub. Date: Aug. 20, 2026

Jones

(54) **PLASTIC MICRO- AND NANOPARTICLE REMOVAL PROCESS AND DEVICES**

(71) Applicant: **Mark Edward Jones**, Midland, MI (US)

(72) Inventor: **Mark Edward Jones**, Midland, MI (US)

(21) Appl. No.: **19/056,017**

(22) Filed: **Feb. 18, 2025**

Publication Classification

(51) **Int. Cl.**

C02F 1/28	(2023.01)
A23L 2/70	(2006.01)
A23L 2/80	(2006.01)
A23L 5/20	(2016.01)
C02F 1/26	(2023.01)
C02F 101/30	(2006.01)

(52) **U.S. Cl.**

CPC ***C02F 1/285*** (2013.01); ***A23L 2/70*** (2013.01); ***A23L 2/80*** (2013.01); ***A23L 5/23*** (2016.08); ***A23L 5/273*** (2016.08); ***C02F 1/26*** (2013.01); *C02F 2101/30* (2013.01)

(57) **ABSTRACT**

The invention describes removal of microparticles and nanoparticles of plastic from water, beverages and other water-based liquids using particle capturing solids and devices based on particle capturing solids. Particle capturing solids described include resilient thermoplastic polymers and lipophilic water-insoluble oils that are solids at room temperature. Devices are described that use particle capturing solids, facilitating easy introduction and retrieval from water, beverages and other water-based liquids.

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9TH CURVE IN THE ROAD: MORE QUIXOTIC QUESTS

Picasso, 1955

Toxic-Free FUTURE

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Our Work | Research | Get The Facts | Take Action | Donate

PRESS ROOM

First-ever study finds cancer-causing chemicals in black plastic food-contact items sold in the U.S.

October 1, 2024

Highest levels of toxic flame retardants found in a spatula, sushi tray, and beaded necklace—likely the result of dirty plastic recycling

Toxic-Free Future urges the U.S. and states to ban poison plastics and harmful chemical additives through the Global Plastics Treaty and state policy

SEATTLE, WA — A new peer-reviewed study in *Chemosphere* finds, for the first-time, certain toxic chemicals in black plastic food-contact items sold in the United States. Led by scientists from Toxic-Free Future and Vrije Universiteit Amsterdam, the testing uncovered high levels of cancer-causing, hormone-disrupting flame retardant chemicals in a variety of household products made with black plastics including food serviceware, kitchen utensils, and toys.

Press Contact

Stephanie Stohler,
sstohler@toxicfreefuture.org

To receive timely press releases and statements to your inbox, members of the media can request to be added to our press list.

"testing uncovered high levels of cancer-causing, hormone-disrupting flame retardants chemicals in a variety of household products made with black plastics..... Toxic flame retardant chemicals were found in 85% of analyzed products"

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FR in Durable Goods

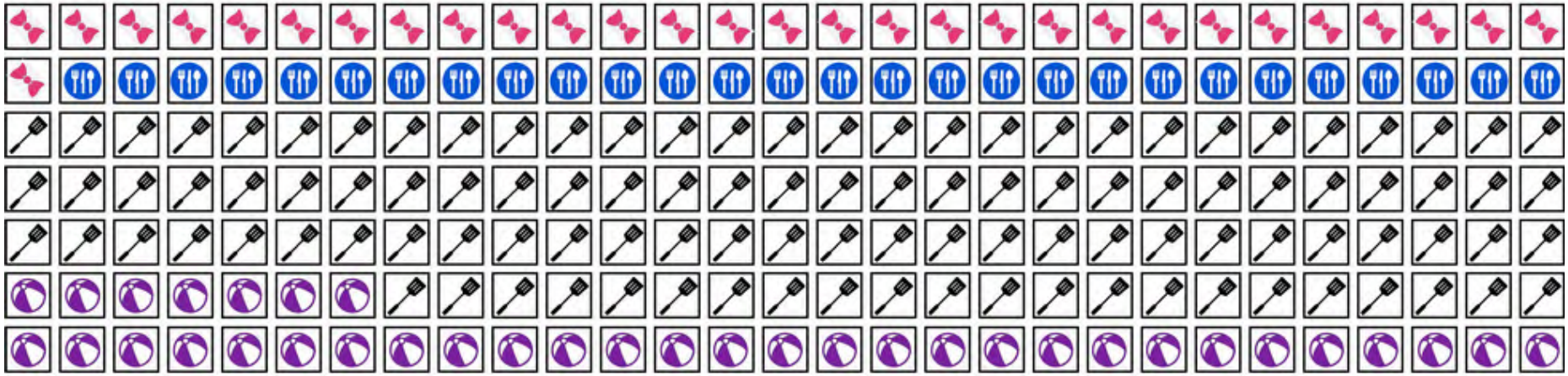
source: midjourney.com

- flame retardants are used in engineering plastics for safety
- they will enter the recycle stream
- in human-touch applications, these materials are viewed as safe

Risk of Exposure to Brominated Flame Retardants

Toxic-Free FUTURE

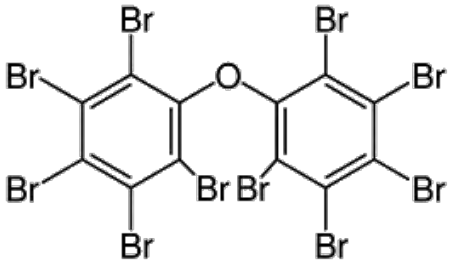
- measure concentration present in objects
- use correlation to estimate exposures
- compare exposure to some “safe” level, such as EPA reference dose



203 total items: 30 hair accessories, 28 food service, 36 toys, 109 kitchen items

Risk of Exposure to Brominated Flame Retardants

- BDE-209, one of the earliest banned flame retardants, became a focus

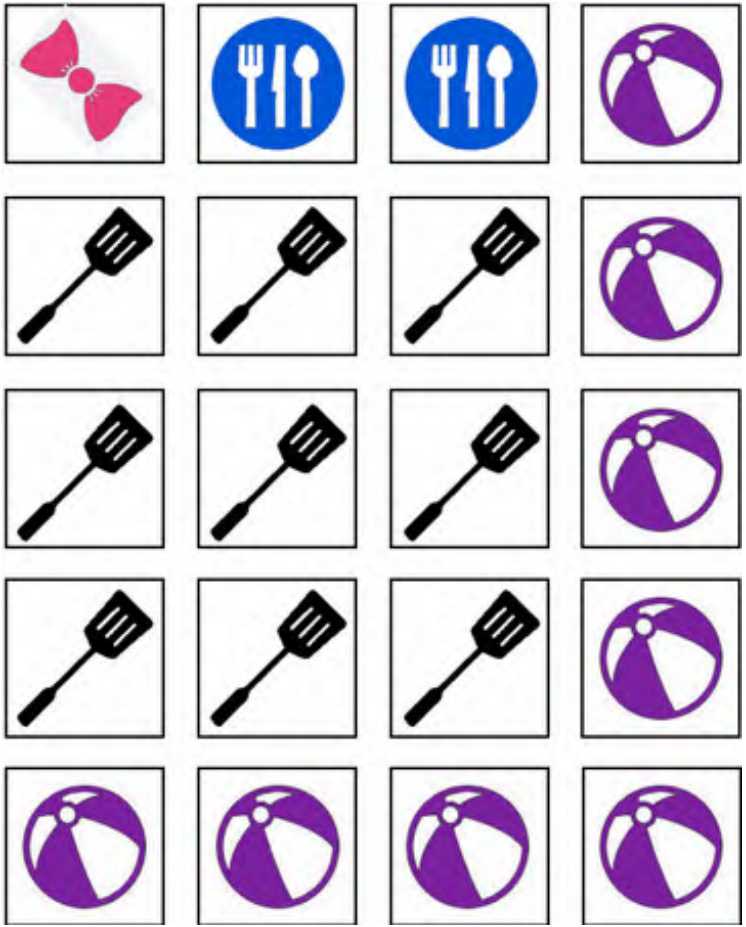


BDE-209

BDE-209 – decabromoether - commercialised in the 1970s. Now recognised as a hazardous and persistent pollutant under 2017 Stockholm Convention on Persistent Organic Pollutants meaning that treaty members must eliminate its production and use.

XRF analysis

retain only top 20 highest Br levels



Compound-sensitive LC-MS method used to analyze compositions and concentrations present in 20 of the 203 items in the collected cohort, only those with highest Br levels measured by XRF.

Harmful flame retardants (FRs) used in electronics were found in **black plastic household products**—including toys and kitchen utensils—likely due to recycled content.

Presumed FR Source

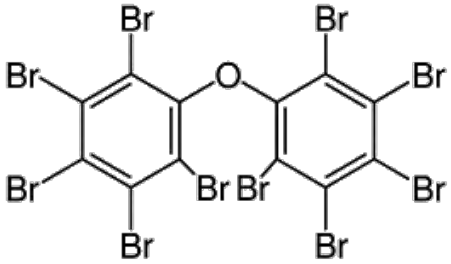
TBBPA, BDE-209, 2,4,6-TBP, DBDPE, TTBP-TAZ, BDP, RDP, & TPHP are or have been intentionally used in electronics.

FRs Detected

This study found ΣFR concentrations up to 22,790 mg/kg in food serviceware, hair accessories, kitchen utensils, and toys.

- 17 out of 20 products analyzed contained brominated and/or organophosphate FRs. 85%
- Most frequently detected compounds included TBBPA, BDE-209, 2,4,6-TBP, RDP, BDP, and DBDPE.
- Items containing polymers used in electronics had significantly higher FR levels.

Toxic-Free FUTURE VU VRIJE UNIVERSITEIT AMSTERDAM A.I.LFE



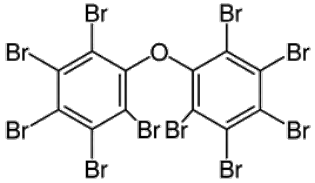
BDE-209

reported median value of 34.7μg/day for kitchen items

concluded too close to ~~42μg/day~~ EPA reference dose

correction 1 : 420 mg/day

showing BDE-209 in ug/day



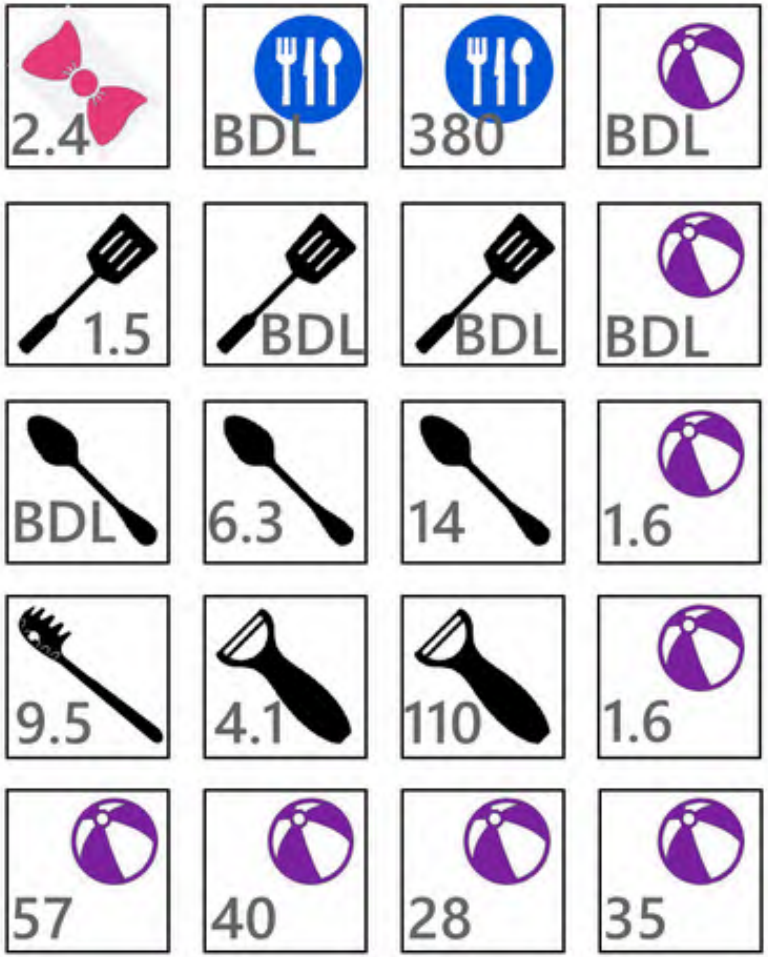
BDE-209

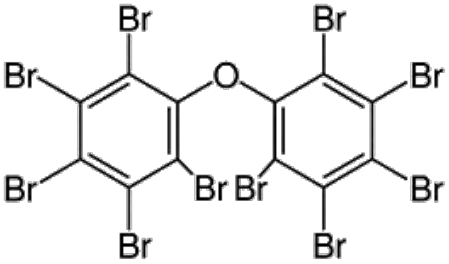
reported median value of 34.7μg/day

actual median 4.1 μg/day

average is 16 μg/day (24 ignoring BDL)

reference dose is 420 μg/day





BDE-209

34.7μg/day is actually the average of all 20 measured samples with BDLs entered as zero

showing BDE-209 in ug/day

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It Gets Worse

CORRIGENDUM 2

concentration → correlation → exposure

correlation from Kuang et al.

$$f(C) = E$$

$$E \propto C$$

for immersion in hot oil for 15 minutes

conclude simple touching creates no exposure

Kuang J, Abdallah MA, Harrad S. Brominated flame retardants in black plastic kitchen utensils: Concentrations and human exposure implications. Science of The Total Environment. 2018 Jan 1;610:1138-46. doi.org/10.1016/j.scitotenv.2017.08.173.

In Corrigendum 2, state they only sampled handles.

The KitchenAid spatula shown in the paper has a nylon blade and ABS handle.

average exposure ~0

Elsevier Guidelines for Retraction

- They have clear evidence that the findings are unreliable, either as a result of major error (e.g., miscalculation or experimental error), or as a result of fabrication (e.g., of data) or falsification (e.g., image manipulation).
- It constitutes plagiarism.
- The findings have previously been published elsewhere and the authors have failed to provide proper attribution to previous sources or disclosure to the editor, permission to republish, or justification (i.e. redundant publication).
- It contains material or data that the authors were not authorised to publish.
- Copyright has been infringed or there is some other serious legal issue (e.g., libel, breach of privacy).
- It reports unethical research and/or breaches Elsevier's publishing ethics policies regarding the conduct of research involving human participants and/or animals.
- There is evidence of compromised peer-review or systematic manipulation of the editorial process.
- There is evidence or material concerns of authorship being sold.
- There is evidence of citation manipulation.
- The author(s) failed to disclose a major competing interest (a conflict of interest) that, in the view of the editor, would have materially affected interpretations of the work or recommendations by editors and/or peer reviewers.
- There is evidence of any other breach of the journal's publishing policies and the editor has therefore lost confidence in the validity or integrity of the article.

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From e-waste to living space: Flame retardants contaminating household items add to concern about plastic recycling

Chemosphere (2024) - 4 Comments
doi: 10.1016/j.chemosphere.2024.143319 issn: 0045-6535 pubmed: 39271080 issn: 1879-1298

Megan Liu, Sicco H. Brandsma, Erika Schreder

#1 *Actinopolyspora biskrensis* comment accepted December 2024

Some concerns: https://nationalpost.com/news/canada/black-plastic

Correction apparently pending, although I'm not sure I agree with the author's statement:

"However, it is important to note that this does not impact our results," Liu told National Post. "The levels of flame retardants that we found in black plastic household items are still of high concern, and our recommendations remain the same."

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R&D WORLD

Pull those black plastic spatulas out of the trash

https://www.rdworldonline.com/pull-those-plastic-spatulas-out-of-the-trash/

By Mark Jones, Ph.D. | January 23, 2025

2024 was the year of spatulageddon. Plastic spatulas were trashed due to reports of dangers lurking within. The journal article that raised concern contained an error, **an obvious error**. A **correction was made** but there is more to the story.

[Adobe Stock]

How a recycling study spawned spatula hysteria

The study causing spatulageddon is "**From e-waste to living space:**

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ELSEVIER

Chemosphere

Volume 365, October 2024, 143319

From e-waste to living space: Flame retardants contaminating household items add to concern about plastic recycling

Megan Liu [a], Sicco H. Brandsma [b], Erika Schreder [a]

https://doi.org/10.1016/j.chemosphere.2024.143319

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Refers to

Response to the letter to the editor
Chemosphere, Volume 385, September 2025, Pages 144547
Megan Liu, Sicco H. Brandsma, Erika Schreder

paywalled

Letter to the editor
Chemosphere, Volume 385, September 2025, Pages 144542
Mark E. Jones

paywalled

Referred to by

Corrigendum to 'From e-waste to living space: Flame retardants contaminating household items add to concern about plastic recycling'...
Chemosphere, Available online 3 July 2025, Pages 144552
Megan Liu, Sicco H. Brandsma, Erika Schreder

Corrigendum to 'From e-waste to living space: Flame retardants contaminating household items add to concern about plastic recycling'...
Chemosphere, Volume 370, February 2025, Pages 143903
Megan Liu, Sicco H. Brandsma, Erika Schreder

Retraction Watch

Viral paper on black plastic kitchen utensils earns second correction

The authors of a paper that went viral with attention-grabbing headlines urging people to throw out their black plastic kitchen tools have corrected the work for a second time.

But a letter accompanying the correction suggests the latest update still fails "to completely correct the math and methodological errors present in the study," according to Mark Jones, an industrial chemist and consultant who has been following the case. "The errors are sufficient to warrant a restating of the abstract, sections of the paper and conclusions, if not a retraction."

10TH CURVE IN THE ROAD: ?

A widely reported fact about microplastic consumption is wrong.

Correction in the scientific literature is slow to correct public perception and the scientific literature.

Plastic particles are everywhere.

MJPHD.net

The New York Times

Researchers don’t have strong evidence yet for how these particles affect our health.

https://www.nytimes.com/2024/01/11/well/live/bottled-water-nanoplastics.html

The Washington Post

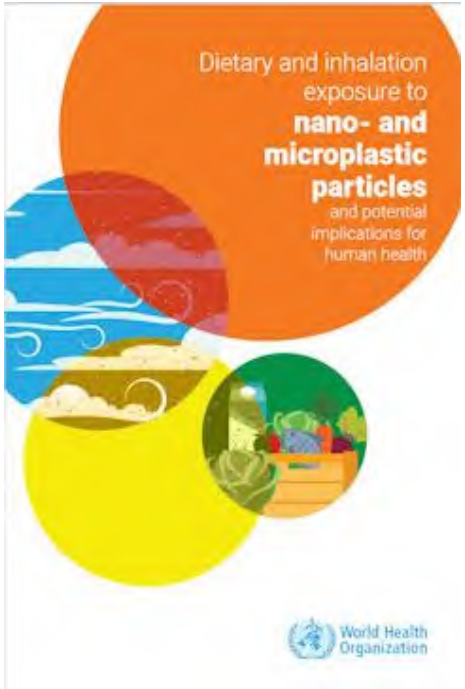
Researchers don’t yet know how dangerous tiny plastics are for human health.

https://www.washingtonpost.com/climate-environment/2024/01/08/microplastics-nanoplastics-bottled-water-study/

IBWA

There currently is both a lack of standardized methods and no scientific consensus on the potential health impacts of nano- and microplastic particles. Therefore, media reports about these particles in drinking water do nothing more than unnecessarily scare consumers.

https://bottledwater.org/nr/ibwa-responds-to-new-nanoparticle-imaging-study/



The weight of the scientific evidence provided by current data on adverse effects of NMP on human health is low,

https://iris.who.int/bitstream/handle/10665/362049/9789240054608-eng.pdf

Bloomberg US Edition

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Bottled Water Contains More Plastic Particles Than Previously Thought

Researchers found hundreds of thousands of plastic particles in one-liter bottles of water sold in the US, 90% of them small enough to enter the human bloodstream.

https://www.bloomberg.com/news/articles/2024-01-08/bottled-water-contains-previously-undetected-nanoplastics

U.S. ›

Bottled water contains up to 100 times more plastic than previously estimated, new study says

By Aliza Chasan
Updated on: January 9, 2024 / 7:52 PM EST / CBS News

PNAS RESEARCH ARTICLE | CHEMISTRY ENVIRONMENTAL SCIENCES OPEN ACCESS

Rapid single-particle chemical imaging of nanoplastics by SRS microscopy

Naixin Qian[a], Xin Gao[a], Xiaoqi Lang[a], Huiping Deng[b], Teodora Maria Bratu[b], Qixuan Chen[c], Phoebe Stapleton[d], Beizhan Yan[b,1], and Wei Min[a,e,1]

Edited by Eric O. Potma, University of California, Irvine, CA; received January 11, 2023; accepted October 24, 2023 by Editorial Board Member Shaul Mukamel

Plastics are now omnipresent in our daily lives. The existence of microplastics (1 μm to 5 mm in length) and possibly even nanoplastics (<1 μm) has recently raised health concerns. In particular, nanoplastics are believed to be more toxic since their smaller size renders them much more amenable, compared to microplastics, to enter the human body. However, detecting nanoplastics imposes tremendous analytical challenges on both the nano-level sensitivity and the plastic-identifying specificity, leading to a knowledge gap in this mysterious nanoworld surrounding us. To address these challenges, we developed a hyperspectral stimulated Raman scattering (SRS) imaging platform with an automated plastic identification algorithm that allows micro-nano plastic analysis at the single-particle level with high chemical specificity and throughput. We first validated the sensitivity enhancement of the narrow band of SRS to enable high-speed single nanoplastic detection below 100 nm. We then devised a data-driven spectral matching algorithm to address spectral identification challenges imposed by sensitive narrow-band hyperspectral imaging and achieve robust determination of common plastic polymers. With the established technique, we studied the micro-nano plastics from bottled water as a model system. We successfully detected and identified nanoplastics from major plastic types. Micro-nano plastics concentrations were estimated to be about $2.4 \pm 1.3 \times 10^5$ particles per liter of bottled water, about 90% of which are nanoplastics. This is orders of magnitude more than the microplastic abundance reported previously in bottled water. High-throughput single-particle counting revealed extraordinary particle heterogeneity and nonorthogonality between plastic composition and morphologies; the resulting multidimensional profiling sheds light on the science of nanoplastics.

optical microscopy | nanoplastics | Raman imaging | single particle analysis | Stimulated Raman Scattering

Plastic pollution has been a rising global concern, with increasing plastic consumption

Significance

Micro-nano plastics originating from the prevalent usage of plastics have raised increasingly alarming concerns worldwide. However, there remains a fundamental knowledge gap in nanoplastics because of the lack of effective analytical techniques. This study developed a powerful optical imaging technique for rapid analysis of nanoplastics with unprecedented sensitivity and specificity. As a demonstration, micro-nano plastics in bottled water are analyzed with multidimensional profiling of individual plastic particles. Quantification suggests more than 10^5 particles in each liter of bottled water, the majority of which are nanoplastics. This study holds

https://www.pnas.org/doi/10.1073/pnas.2300582121

Science of the Total Environment 759 (2021) 143470

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Science of the Total Environment

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

Review

Nanomaterials in the environment, human exposure pathway, and health effects: A review

Arindam Malakar [a], Sushil R. Kanel [a,b,*], Chittaranjan Ray [a], Daniel D. Snow [c], Mallikarjuna N. Nadagouda [d]

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[b] Department of Chemistry, Wright State University, Dayton, OH 45435, USA
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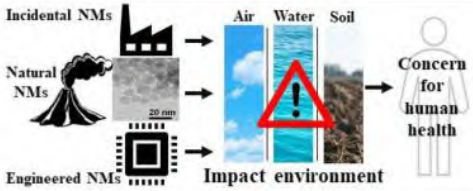
[d] Department of Mechanical and Materials Engineering, Wright State University, 3640 Colonel Glenn Hwy., Dayton, OH 45435, USA

HIGHLIGHTS

- The ubiquitous presence of natural and synthetic nanomaterials in the environment
- Nanomaterials influence on the natural ecosystem.
- Exposure pathways and life cycle of nanomaterials in the human body
- Nanotoxicity of nanomaterials on human health

GRAPHICAL ABSTRACT



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ABSTRACT

Nanomaterials (NMs), both natural and synthetic, are produced, transformed, and exported into our environment daily. Natural NMs annual flux to the environment is around 97% of the total and is significantly higher than synthetic NMs. However, synthetic NMs are considered to have a detrimental effect on the environment. The extensive usage of synthetic NMs in different fields, including chemical, engineering, electronics, and medicine, makes them susceptible to be discharged into the atmosphere, various water sources, soil, and landfill waste. As ever-larger quantities of NMs end up in our environment and start interacting with the biota, it is crucial to understand their behavior under various environmental conditions, their exposure pathway, and their health effects on human beings. This review paper comprises a large portion of the latest research on NMs and the environment. The article describes the natural and synthetic NMs, covering both incidental and engineered NMs and their behavior in the natural environment. The review includes a brief discussion on sampling strategies and various analytical tools to study NMs in complex environmental matrices. The interaction of NMs in natural environments and their pathway to human exposure has been summarized. The potential of NMs to impact human health has been elaborated. The nanotoxicological effect of NMs based on their inherent properties concerning to human health is also reviewed. The knowledge gaps and future research needs on NMs are reported. The findings in this paper will be a resource for researchers working on NMs all over the world to understand better the challenges associated with NMs in the natural environment and their human health effects.
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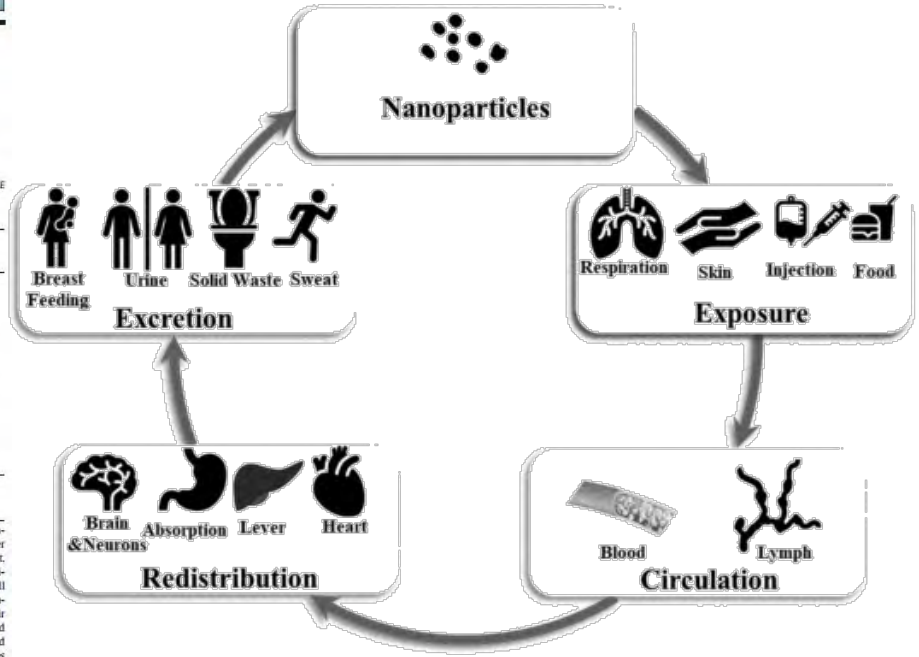

Fig. 7. Exposure pathway, circulation, redistribution, and final excretion of nanomaterials inside the human body.

https://doi.org/10.1016/j.scitotenv.2020.143470

frontiers in Chemistry

ORIGINAL RESEARCH
published: 11 September 2018
doi: 10.3389/fchem.2018.00407

Synthetic Polymer Contamination in Bottled Water

Sherri A. Mason, Victoria G. Welch and Joseph Neratko*

Department of Chemistry, State University of New York at Fredonia, Fredonia, NY, United States

Eleven globally sourced brands of bottled water, purchased in 19 locations in nine different countries, were tested for microplastic contamination using Nile Red tagging. Of the 259 total bottles processed, 93% showed some sign of microplastic contamination. After accounting for possible background (lab) contamination, an average of 10.4 microplastic particles >100 um in size per liter of bottled water processed were found. Fragments were the most common morphology (66%) followed by fibers. Half of these particles were confirmed to be polymeric in nature using FTIR spectroscopy with polypropylene being the most common polymer type (54%), which matches a common plastic used for the manufacture of bottle caps. A small fraction of particles (4%) showed the presence of industrial lubricants. While spectroscopic analysis of particles smaller than 100 um was not possible, the adsorption of the Nile Red dye indicates that these particles are most probably plastic. Including these smaller particles (6.5–100 um), an average of 325 microplastic particles per liter of bottled water was found. Microplastic contamination range of 0 to over 10,000 microplastic particles per liter with 95% of particles being between 6.5 and 100 um in size. Data suggests the contamination is at least partially coming from the packaging and/or the bottling process itself. Given the prevalence of the consumption of bottled water across the globe, the results of this study support the need for further studies on the impacts of micro- and nano- plastics on human health.

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Reviewed by:
Gerrit Popper

MJPhD

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Detection of nanoparticles suspended in a light scattering medium

Yan Ye[1,2✉] & David Y. H. Pui[2]

Intentionally intensifying the light scattering of medium molecules can allow the detection of suspended nanoparticles under conditions not suitable for conventional optical microscopies or laser particle counters. Here, we demonstrate how the collective light scattering of medium molecules and nanoparticles is imaged in response to the power, frequency, and oscillating direction of the incident light wave electric field, and how this response can be used to distinguish between nanoparticles and microparticles, such as viruses or bacteria. Under conditions that the medium light scattering is intensified, suspended nanoparticles appear as magnified shiny moving dots superimposed on the quasi-steady background of medium light scattering. Utilizing the visual enlargement resulted from the enhanced light scattering and possible light interference, we can detect directly suspended nanoparticles that are much smaller than visible light wavelengths even in unopened water bottles or other large containers. This suggests new approaches for detecting nanoparticles with many potential applications.

https://www.nature.com/articles/s41598-021-99768-x

iPhone Video
of
Unopened Water Bottles