The Rapids

US EPA's Trash Free Waters Monthly Update

August 2023

epa.gov/trash-free-waters

Introduction

Hello everyone,

Last month, the National Academies came out with a report entitled ***Recycled Plastics in Infrastructure: Practices, Understanding, and Opportunities***. The report discusses how the use of recycled plastics in infrastructure applications has the potential to help expand the market and demand for plastics recycling.

The Office of Science and Technology Policy and the Council on Environmental Quality, on behalf of the interagency Ocean Policy Committee, are requesting input through August 28, 2023, to inform the development of a National Strategy for a Sustainable Ocean Economy. The National Strategy will describe the vision, goals, and high-level actions for a robust, equitable, secure, sustainable ocean economy enabled by healthy, resilient ocean ecosystems. You can find the Federal Register notice **here**.

Open Oceans Global is working on a pilot program with a satellite imagery firm and a machine learning consultant to identify beaches fouled by plastic from space. They need 50 ground truth images of densely packed plastic on a shoreline at least 5 meters square. **If you can help, click here for the details.**

Thanks,
Romell Nandi
US EPA Trash Free Waters National Program Lead

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EPA Announcements

EPA Deadline Closes for Comments on the *Draft National Strategy to Prevent Plastic Pollution*
EPA, after extending the original deadline for commenting on the ***Draft National Strategy to Prevent Plastic Pollution*** from June 16, officially closed the comment period on July 31. The Agency received almost 92,000 comments from interested parties. The Agency will now go through the process of categorizing and reviewing comments and modifying the draft strategy as needed.

People, Prosperity, and the Planet (P3) Program
EPA announced $523,796 in funding to 21 student teams for their research and innovative solutions to address environmental and public health challenges as part of the Agency's People, Prosperity, and the Planet (P3) Program. The 21 Phase I recipients announced on August 1 will receive grants of up to $25,000 each to help them develop their proof of concept and will be eligible to compete for a Phase II grant of up to $100,000 to further implement their designs. Two of the awardees got funding for microplastics-related proposals: The University of Tennessee-Chattanooga got an award to study **Microplastics Sampling for Stormwater Management** and Southern Illinois University got an award to research **Physicochemical degradation of microplastics.**

EPA Completes Pickup of Hazardous Waste and E-Waste from All Guam Public Schools
Following Typhoon Mawar, EPA and their contractors committed to visit every Guam public school, in addition to other education-related facilities, to help assess the amounts and different types of typhoon-impacted hazardous waste and electronic waste (e-waste) needing proper disposal. All 41 public schools on Guam have now been assessed for hazardous waste and e-waste, and all of that material has now been picked up and removed from the schools.

Underground Infrastructure: EPA invests $278 million to improve water infrastructure for Tribes, Alaska Native Villages
The Biden-Harris administration announced over $278 million in funding to improve access to safe and reliable drinking water and wastewater services for American Indian Tribes and Alaska Native Villages.

Funding Opportunities

Marine Debris Foundation Marine Debris Grants
This grant funds research with the goal of eliminating marine debris and plastic pollution. Any proposed projects should focus on reduction, prevention, removal, or assessments of marine debris and plastic pollution. Grants will be given for up to $30,000. **Applications are accepted until August 31st.**

Environmental Justice Thriving Communities Technical Assistance Center
EPA's Region 1 is offering this funding opportunity of up to $10 million to help communities and other environmental justice stakeholders in the New England states access federal assistance and resources to address environmental and energy justice concerns. EPA Region 1 includes the states of Maine, Vermont, New Hampshire, Massachusetts, Rhode Island and Connecticut and 10 Tribal Nations. **Applications are accepted until September 29th.**

NSF Critical Aspects of Sustainability (CAS): Micro- and Nanoplastics (MNP)
This grant funds research that helps improve the understanding of micro- and nanoplastics with regard to characterization, behavior, reactivity with the environment, removal from land and water systems, and impacts on human and animal health. **Applications are accepted year-round.**

USDA Individual Water and Wastewater Grants
The USDA Rural Development branch provides grants to households in an area that was recognized as a Colonia before October 1, 1989. This money can be used to install plumbing, kitchen sinks, showers, water heaters, etc. Funds could be used to install equipment in these households that would limit pollution from water runoff. The money can also be used to close abandoned septic tanks, preventing potential contaminants from entering the waterway. The amount awarded is dependent on the type of work proposed with a maximum of $5,000. **Applications are accepted year-round.**

USDA Water and Waste Disposal Loan and Grant Program
This opportunity provides funding for clean and reliable drinking water systems, as well as stormwater management. Most state and local governments, private nonprofits, and federally recognized tribes are eligible applicants. The loans available are long term and low interest. Additionally, a grant and a loan can be provided in tandem if funding allows. **Applications are accepted year-round.**

Upcoming Events

International Conference on Wastewater
August 10, New York, US
This conference, hosted by World Academy of Science, Engineering and Technology, will discuss proper treatment of polluted wastewater. The conference will also include discussion on potential solutions on removal of pollutants to maximize water reuse.

Plastic Free Back to School
August 17, 5 pm EST, Virtual
This webinar, lead by the plastic pollution coalition, will provide the community with information on how to minimize plastic use in back to school purchases. Many clothing items contain microfibers, lunch containers are often made of plastic, and school supplies can contain plastics. This webinar will provide information on avoiding these products as well as the implications plastics have on children's health.

International Conference on Water Pollution, Measurement, Modeling and Assessment
August 16-17, Istanbul, Turkey
This conference, hosted by World Academy of Science, Engineering and Technology, will discuss various topics regarding water pollution including point source pollution, nonpoint source pollution, and groundwater pollution. The conference will emphasize the environmental impacts of said pollution as well as potential solutions to prevent water pollution and urban runoff. Since the conference is international, and given the global nature of water pollution, another focus will be water pollution by country.

International Research Conference's Conference on Microplastic and Plastic Pollution Studies
August 19-20, London, UK
On August 19 and 20, experts on microplastic pollution from around the world will gather to discuss various research on the issues related to microplastic pollution as well as potential solutions. Many presenters will give informational presentations and discuss their published research.

12th SETAC Young Environmental Scientists Meeting
August 28-September 1, Landau, Germany
This meeting provides young environmental scientists with the opportunity to practice presenting their research. Training courses and workshops are included. Career Talks will be held by established environmental scientists to provide the young audience with career development advice.

Save the dates for future months...

2023 U.S. Product Stewardship Forum - Product Stewardship Institute
September 11-14, Oregon
From September 11 to 14, the Product Stewardship Forum conference will focus on Extended Producer Responsibility (EPR). Stakeholders from around the globe will gather to discuss product stewardship. There will also be discussions on previously enacted and anticipated packaging EPR laws.

National Zero Waste Conference
October 25-26, virtual
Zero Waste USA will be hosting this conference. Zero waste businesses and institutions will be attending to share information about their materials. There will be discussions regarding zero waste lifestyles and ocean plastics. There will also be information on recycling correctly and World Cleanup Day.

3rd Global Symposium on Waste Plastic
November 2-4, virtual
In this symposium, experts from a variety of engineering disciplines will share their knowledge in areas that can contribute to the accelerated development of alternative plastics and mitigate the effects of traditional plastics in our environments.

Interstate Technology and Regulatory Council Microplastic Webinar
November 7, 1:00-3:15 EST, Virtual
This webinar will discuss the role that microplastics play in modern life as well as the dangerous pollution that microplastics cause. Discussions will include aspects regarding the environmental distribution, human and environmental health impacts, and regulations of microplastics.

Microplastics Workshop for Early Career Researchers
November 12-17, Ascona, Switzerland
This six day workshop will allow researchers to present their microplastic research, discuss career paths for microplastic researchers, and network with global experts. Attendees are required to be present for all six days of the workshop.

In case you missed it...

Circular Economy in the Textile Sector
July 6, virtual
This webinar provided insight into the challenges and opportunities for achieving a circular economy for the textile industry.

International Conference on Environmental Pollution and Public Health (ICEPPH)
July 6-7, New York
This conference, held by the World Academy of Science, Engineering, and Technology, addressed various types of environmental pollution (including water quality and water pollution). The speakers discussed the various links between water quality and public health.

International Conference on Environmental Sustainability and Pollution Sources (ICESPS)
July 12-13, New York
This conference, held by the World Academy of Science, Engineering, and Technology, addressed various types of environmental pollution, the sources of pollution, and the impacts of pollution. Presentations focused- among other types of solutions- on successful ways of implementing recycling and waste management programs.

Plastic Waste and Microplastic Research Conference Co-ordinated by Various Organizations
July 12-14, England
This research conference addressed the link between plastic use and microplastic pollution and accumulation. The speakers also focused on the plastics that have infiltrated the food chain, specifically spotlighting microplastics presence in almost all human organs.

International Conference on Biodegradable and Recyclable Plastics by World Academy of Science
July 19-20, Denmark
From July 19 to 20, the International Conference on Biodegradable and Recyclable Plastics held a conference on the development of biodegradable plastics; and a large scale shift to biodegradables is likely to impact the environment. The energy expenditure needed to produce biodegradable plastics, the mechanisms behind landfill degradation of bioplastics and potential government regulation on biodegradable plastics was addressed as well.

ICEWE 2023: 17. International Conference on Energy, Water and Environment
July 24-25, Istanbul
This international conference covered a wide range of environmental topics from global warming to solar energy to water quality and pollution prevention. Water reuse, water policy, and wastewater management were all addressed.

The Microplastics Breakdown

EXPOSURE OF HUMANS TO MICROPLASTICS

Evidence of Microplastics in Groundwater: A Growing Risk for Human Health
Sarawut Sangkham, Md. Aminul Islam, Sangeet Adhikari, Rakesh Kumar, Prabhakar Sharma, Pornpun Sakunkoo, Prosun Bhattacharya, Ananda Tiwari
According to this literature review, when microplastics (MPs) are present in the subsurface, they can undergo chemical reactions or biodegradation and may release chemicals into groundwater. The researchers found that groundwater contamination by MPs is not frequently mentioned in the scientific literature. Their review focused on 13 studies published before November 2022 that evaluated MPs in groundwater. The authors observed that studies on MPs in groundwater have mainly been conducted in coastal areas in Europe and North America and there is still a need for more research in other geographical regions (such as Asia, Africa, and South America) and to examine a broader range of groundwater aquifer systems. According to the authors, the most frequent polymer types occurring in groundwater found in these studies were polyethylene terephthalate (PET), polyethylene (PE), polyvinyl chloride (PVC), polyamide (PA), and polystyrene (PS). Relying on a ranking in the literature based on the hazards associated with each of these polymers, they observed that the most hazardous polymer in groundwater is PVC, followed by PA, PS, PET, and PP. Their review of the literature indicated that MPs prevalence is not uniform in all groundwaters and can be affected by the soil type and anthropogenic activities on the top-ground layer. Furthermore, MPs transport in aquifers is unpredictable and MPs can travel long distances or get trapped in water-bearing porous rocks. Thus, the researchers concluded that it is difficult to predict the presence of MPs in groundwater, as their prevalence does not affect the chemical and physical properties of water, and the main public health consequences are chronic, so it may take a long period to detect them based on adverse health impacts. Additionally, they observed that there are challenges associated with attempting to compare existing research findings because of the differences in sample collection and processing protocols. The article concluded with a discussion of the potential health risks to humans due to MP contamination in groundwater; the recommendation that further information on all dimensions for risk assessment be developed and recommendations for future research, e.g., monitoring MPs at different levels in groundwater; research focused on MP fate and transit in groundwater aquifers. **Read the full abstract here**: **https://www.sciencedirect.com/science/article/pii/S2352801X23000814#sec5**

FATE AND TRANSPORT OF MICROPLASTICS

Interactions between Microplastics and Contaminants: A review Focusing on the Effect of Aging Process

Hongwei Luo, Chaolin Tu, Dongqin He, Anping Zhang, Jianqiang Sun, Jun Li, Juan Xu, Xiangliang Pan

The goal of this literature review was to summarize research centered on the aging process of microplastics (MPs), specifically, the factors that impact aging, and the effects of aging on the interaction of MPs with contaminants. As described in the article, the aging of MPs is influenced by several processes including photodegradation, thermal degradation, biodegradation and mechanical fragmentation. Photoaging (i.e., aging occurring in the presence of light), was identified as the most common abiotic degradation pathway. Three stages of photoaging were described: (1) initiation, characterized by UV-induced polymer chain breakage and free radical formation; (2) propagation, involving autoxidation; (3) termination, marked by the formation of inert products. Photoaging in aquatic environments was found to significantly affect MPs' interactions with other pollutants such as antibiotics. As described by the researchers in this study, thermal degradation is similar to photodegradation in that both processes are forms of oxidative degradation. However, they noted that a significant distinction between photo- and thermal degradation lies in the accumulation of oxidation products, such as ketones. Physical degradation (also referred to as mechanical crushing), as described, is induced by environmental elements like waves, tides, sand and rocks. This process results in an increase in the quantity of MPs, a reduction in MP size – resulting in the generation of nanoplastics. A study was described in which three types of polymers (polypropylene (PP), polyethylene (PE) and expanded polystyrene (EPS)) were exposed to UV light, which was followed by mechanical abrasion with treated sand. According to this review, the results showed that EPS was more susceptible to sand abrasion, while PE and PP were less likely to crumble due to mechanical abrasion in the absence of UV light, which suggested that UV irradiation promotes the rate of mechanical disintegration. Biodegradation was defined in the review as the decomposition of MPs facilitated by the ingestion and digestion by certain organisms (such as bacteria, fungi and algae) present in the environment. The discussion provided an overview of several studies with results demonstrating the effects of biodegradation on MPs, which included impacts on the structure of the particles. This review article also discussed some of the MP characteristics which affects the aging process, e.g., size, the relative proportion of the crystalline portion of MPs as compared to the entirety of the material. Some of the environmental factors were addressed as well, including how they interact with/affect photodegradation and thermal degradation. Other findings and topics that were covered in this article included: aging effects on the adsorption of heavy metals by MPs, the adsorption of organic pollutants, and the adsorption of microorganisms. The authors recommended that there are future in-depth studies be conducted that are focused on the potential hazards of aged MPs in different environments e.g., soil, sediment, aquatic environment, and effects of their interaction with environmental pollutants on human health and ecology. **Read the full abstract here: https://www.sciencedirect.com/science/article/pii/S0048969723042389**

Occurrence and Dynamics of Microplastics and Emerging Concern Microparticles in Coastal Sediments: Impact of Stormwater Upgrade and Port-Associated Facilities

M. Díaz-Jaramillo, M. Gonzalez, J.P. Tomba, L.I. Silva, M.S. Islas

This article began with the observations that urban runoff is a significant source of microplastic pollution in aquatic environments, especially in coastal areas; but there are no published studies about the impact of stormwater upgrades on microparticle transport. As described, the authors evaluated the characteristics, abundance, and distribution of microplastics in subtidal sediments from the southwestern Atlantic region of Argentina, described as being influenced by a recently upgraded stormwater outfall and port facilities. Specifically, the study area was located at a stormwater outfall from Del Barco Creek, which discharged to Mar del Plata city's fishing port, a site that included shipyards, marinas, and seafood industries. The researchers analyzed temporal differences, seasonal dynamics and their relationship with the pre- and post-upgrade of the stormwater outfall. Sediment samples were collected during each of the four seasons from May 2019 to March 2020; microparticles were extracted using the Sediment Microplastic Isolation method, and then analyzed using methods including FT-IR and Raman spectroscopy. The researchers found microplastics (MPs) of a range of shapes (fragments and fibers being the most frequently observed), different colors, and from different sources, e.g., paints, and tire wear particles. Significantly, they also identified a difference in the

spatial and temporal abundance of the types of microparticles and an association with the distance to the stormwater outfall and seasons. Overall, and consistent with other findings they reviewed, higher abundances of plastic microparticles were found in wet seasons or during rain events preceded by dry periods in surface waters. Upgrades to the stormwater system were observed to intensify the transport and increase the presence of specific anthropogenic microparticles in subtidal sediments. This relationship was found to have been particularly significant for tire wear particles (TWPs). Further, the authors concluded that their results indicated that the occurrence of TWPs was a reliable urban runoff indicator to differentiate ex and in-situ sources in multi-polluted coastal environments. **Read the full abstract here**:
https://www.sciencedirect.com/science/article/pii/S0048969723043474?via%3Dihub

MICROPLASTICS AND ENVIRONMENTAL IMPACTS

Impacts and Mechanism of Biodegradable Microplastics on Lake Sediment Properties, Bacterial Dynamics, and Greenhouse Gasses Emissions

Zequn Fan, Cuiling Jiang, Tahir Muhammad, Imran Ali, Yakun Feng, Lei Sun, Hui Geng

According to this prepublication version of this article, the accumulation of microplastics (MPs) in freshwater ecosystems plays a critical role in greenhouse gases (GHGs) emissions from lake sediment by altering sediment properties and microbial communities. The study conducted by these researchers explored the potential effects of two different types (conventional and biodegradable) of MPs: polyethylene (PE) and biodegradable Poly (butylene-adipate-co-terephtalate) (PBAT) on carbon dioxide (CO2) and methane (CH4) emissions from lake sediments and associated microbial community. Sediment samples were collected from Xuanwu Lake, described as an urban lake in Nanjing, China. The MPs used were purchased and the concentrations used in the experimental conditions were selected based on the actual concentration that would be found in urban lake sediments. The researchers reported that CO2 emissions increased over the four-week study period under the experimental conditions. Cumulative CO2 and CH4 emissions were found to have significantly increased with the increasing concentrations of biodegradable MPs. Notably, CH4 emissions were found to have increased more than four times following the addition of biodegradable MPs as compared to conventional MPs, which the authors ascribed to the fact that there more dissolved organic carbon (DOC) was provided by biodegradable MPs for microbial respiration. Biodegradable MPs were found to have significantly increased the abundance of microbes. The authors observed that the accumulation of MPs could weaken microbial stress associated with the requirements of energy and substrate, and increase the microbial biomass carbon (MBC) value, thus eventually improving the respiratory capacity of microbes. The main conclusion of the study based on its results was that the abundant DOC provided by biodegradable MPs could promote the growth of microbes in lake sediment, which could change the structure and diversity of the microbial community, eventually enhancing the anaerobic respiration of microbes and promoting the emission of greenhouse gases like CO2 and CH4. **Read the full abstract here:**
https://www.sciencedirect.com/science/article/pii/S0048969723043504

MICROPLASTICS AND IMPACTS ON ORGANISMS

Can Microplastics Threaten Plant Productivity and Fruit Quality? Insights from Micro-Tom and Micro-PET/PVC

Marco Dainelli, Sara Pignattelli, Nadia Bazihizina, Sara Falsini, Alessio Papini, Ivan Baccelli, Stefano Mancuso, Andrea Coppi, Maria Beatrice Castellani, Ilaria Colzi, Cristina Gonnelli

This study focused on the impacts of microplastics in soils on the growth, productivity, and fruit quality of tomatoes (solanum lycopersicum L.). Plants were grown under different conditions; under experimental conditions some plants were grown in pots with what the researchers determined to be an environmentally realistic concentration of microplastics (polyethylene terephthalate (PET) and polyvinyl chloride (PVC)) and monitored during the entire crop life cycle. Two weeks after germination, the presence of microplastics in the root-zone was found to have induced a 17 % decrease in the leaf area of PET-treated tomato plants as compared to the control plants. The researchers found that exposure to each of the types of microplastic only had negligible effects on shoot traits but both resulted in a decrease in the number of fruits and, in the case of PVC, also their fresh weights. A decline in the nutritionally valuable lycopene, total soluble solids, and total

phenols was observed in the exposed plants. Exposure to PVC was associated with a decline in tissue water content in the plants. Microplastic exposure was also associated with lower chlorophyll content, fewer flowers and fruit, as well as declines in the fruits' mineral elemental composition. The overall results, the researchers asserted, demonstrated that microplastics not only can limit crop productivity but also can negatively impact fruit quality, which raises concerns about their potential health risks for humans. According to the researchers, their results highlighted for the first time that microplastics may be a threat for agroecosystems, not only for yield reduction and economical losses, but also for food safety. They recommended further investigation by broadening the range of treatments, the type, and size of plastic particles and scaling up from small pilot studies to large, field-based studies. **Read the full abstract here:** **https://www.sciencedirect.com/science/article/pii/S0048969723037427#s0045**

Small Particles, Big Problem: Measuring Microplastics' Impact on Fish
Meredith Evans Seeley
This blog post outlined a study conducted by the author's team at NIST on the potential effects of microplastics in fish habitats on the ability of the fish to ward off viral diseases, which she described as a major cause of fish death, particularly for fish in crowded settings. As described, rainbow trout were exposed to varying conditions- e.g., exposure to a deadly fish virus only, exposure to a combination of the virus and microplastics (such as polystyrene microplastics and nylon microfibers) ,or to the virus and natural microparticles made of sea grass. The fish exposed to the microplastics were found to die of a deadly fish virus more often than the ones that were exposed to the virus alone. This result was particularly evident for the nylon microfibers. The team did not find a significant difference in death when fish were exposed to the natural microparticles and the virus as compared to the virus alone. By measuring the immune system and gill tissues, the team noticed that the nylon microfibers led to a mild inflammatory response in the fish and highlighted that this result needed to be studied further. The team hypothesized that the fibers may have damaged and stressed the fish's gills and digestive tracts, which is where viruses enter the fish, thus allowing the virus to infect its host more easily.
Read the full blog post here: https://www.nist.gov/comment/116151

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