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## Micro pollutant on the environment: Causes, impacts, and solutions

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#### Abstract

Micro pollutants are substances that are found in low concentrations in water bodies, soil, and air, but which can have adverse effects on human health and the environment. The increasing use of synthetic chemicals in various industries has led to a rise in the number of micro pollutants present in the environment. This article discusses the causes, impacts, and solutions to micro pollutants on the environment. The sources of micro pollutants are identified, including pharmaceuticals, personal care products, pesticides and herbicides, flame retardants, microplastics, perfluorinated compounds, endocrine disruptors, heavy metals, and industrial chemicals. The impacts of micro pollutants on human health and the environment are described, such as water pollution, soil degradation, air pollution, and their effects on aquatic and terrestrial organisms. Finally, solutions to mitigate the effects of micro pollutants are discussed, including improving waste management systems, implementing better regulations, developing sustainable alternatives, and raising awareness about the issue.

**Keywords:** Micro pollutants, environment, causes, impacts, solutions

#### Introduction

Micropollutants are small-sized chemical substances present in the environment and pose a significant threat to human health and the ecosystem. They are often referred to as emerging pollutants because their impact has only recently been understood. Micropollutants are typically present in low concentrations but can have serious long-term effects on living organisms (Prabakaran, 2023) <sup>[1]</sup>.

Micropollutants, also known as emerging contaminants, are substances that are found in low concentrations in water bodies, soil, and air, but which can have adverse effects on human health and the environment. Some examples of micropollutants include:

**1. Pharmaceuticals:** Drugs such as birth control pills, painkillers, and antibiotics, which can enter water systems through urine and wastewater (Rogowska *et al.*, 2020) <sup>[3]</sup>

- Pharmaceuticals, also known as drugs, are an important part of modern medicine. They are used to treat a wide range of diseases and conditions, from headaches and colds to chronic illnesses like diabetes and cancer. While they have undoubtedly improved human health, pharmaceuticals also have a downside. They are one of the most common types of micropollutants, and their presence in water bodies has raised concerns about their potential impact on the environment and human health (Prabakaran 2022) <sup>[2]</sup>
- Pharmaceuticals enter water systems through a variety of pathways. One of the most common is human excretion (Issac and Kandasubramanian, 2021) <sup>[4]</sup>. When we take drugs, our bodies metabolize and eliminate them through urine and feces. Wastewater treatment plants are designed to remove many pollutants, but they are not always effective at removing pharmaceuticals. As a result, trace amounts of these drugs can end up in rivers, lakes, and other water bodies.
- Another pathway for pharmaceuticals to enter the environment is through improper disposal. When we throw unused or expired drugs in the trash or flush them down the toilet, they can also end up in water systems. In addition, drugs that are given to animals can also enter water systems through their manure.
- The presence of pharmaceuticals in water systems is a cause for concern. While the concentrations of these drugs are generally very low, some studies have suggested that they can have an impact on aquatic organisms, including fish, amphibians, and invertebrates. In addition, there is some evidence that exposure to pharmaceuticals may have an impact on human health, particularly in populations that are exposed to high levels of these drugs, such as wastewater treatment workers.

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- To address the issue of pharmaceuticals in water systems, there are several strategies that can be employed. One is to improve wastewater treatment processes to better remove these drugs. Another is to encourage the proper disposal of unused or expired drugs, either through drug take-back programs or through guidelines for safe disposal. Finally, reducing the amount of drugs that are prescribed and used in the first place can help to limit the amount of pharmaceuticals that enter water systems.
- In conclusion, while pharmaceuticals are an important part of modern medicine, their presence in water systems is a cause for concern. It is important to take steps to minimize their impact on the environment and human health, through improved treatment processes, proper disposal, and reducing their use where possible. By taking these steps, we can help to ensure that the benefits of pharmaceuticals are not outweighed by their potential negative impact on the environment and public health.

**2. Personal care products:** Cosmetics, lotions, and perfumes, which can enter water systems through showering, washing, and other personal care activities.

Personal care products such as cosmetics, lotions, and perfumes are a common part of our daily routine. However, many of these products contain chemicals that can have harmful effects on the environment and human health. When these products are washed off and disposed of, they can enter the water system and become micro pollutants.

Micro pollutants are substances that are found in low concentrations in water bodies, soil, and air, but which can have adverse effects on human health and the environment. Personal care products contain a variety of chemicals such as phthalates, parabens, and triclosan, which can cause hormonal disruption, reproductive problems, and other health issues.

When we use personal care products, the chemicals can be absorbed by our bodies and then excreted in urine or feces. These chemicals then enter the sewage system and can end up in our waterways and oceans. Once in the water, these chemicals can persist for a long time, causing harm to aquatic life and even making their way into our food chain.

Studies have shown that personal care products are a major source of micro pollutants in our waterways. In fact, a study conducted by the US Geological Survey found that at least one of these chemicals was detected in more than half of the water samples collected from streams across the United States.

To address the issue of personal care products as micro pollutants, there are steps that individuals and companies can take. Firstly, individuals can reduce their use of personal care products, choose products that are labeled as environmentally friendly and dispose of products properly.

On the other hand, companies can reformulate their products to eliminate the use of harmful chemicals and implement better labeling practices to inform consumers of the potential environmental impact of the products they purchase.

In conclusion, personal care products play a significant role in the presence of micro pollutants in our waterways. By taking simple steps such as reducing usage and disposing of products properly, individuals can help reduce the impact of these products on the environment. Companies also have a responsibility to reformulate their products and implement better labeling practices to ensure that consumers are aware of the potential environmental impact of the products they purchase.

**3. Pesticides and herbicides:** Chemicals used in agriculture and gardening to control pests and weeds, which can enter water systems through runoff (Lata *et al.*, 2021) [6].

Pesticides and herbicides are chemicals that are used extensively in agriculture and gardening to protect crops and plants from pests, insects, and weeds. However, they are also considered to be micro pollutants, as they can have adverse effects on the environment and human health.

Pesticides and herbicides are designed to be toxic to the organisms they are intended to kill or control. However, these chemicals can also harm non-target organisms, including beneficial insects, birds, and mammals, as well as humans who are exposed to them.

One of the main ways that pesticides and herbicides enter the environment is through runoff from agricultural and gardening areas. When it rains, these chemicals can be washed off the fields and gardens and enter nearby streams, rivers, and lakes. This runoff can also contaminate groundwater, which can then affect drinking water supplies.

Once in the environment, pesticides and herbicides can persist for long periods of time and can accumulate in the food chain. This means that even small amounts of these chemicals can have harmful effects on organisms, including humans, that consume them.

**Some of the adverse effects of pesticides and herbicides include**

- Damage to non-target organisms such as bees, butterflies, and birds, which can affect the ecosystem as a whole.
- Health problems for humans, including respiratory problems, skin irritation, and cancer.
- Contamination of soil and water, which can have long-term effects on the environment.

To reduce the negative effects of pesticides and herbicides, it is important to use them judiciously and to explore alternative methods of pest and weed control. These methods include crop rotation, integrated pest management, and the use of natural predators.

In conclusion, pesticides and herbicides are important tools for agriculture and gardening, but they can also have harmful effects on the environment and human health. It is important to use these chemicals responsibly and to explore alternative methods of pest and weed control to reduce their impact on the environment.

**4. Flame retardants:** Chemicals added to furniture and electronics to prevent fires, which can enter the environment through dust and air (Jamie *et al.*, 2023) [5].

Flame retardants are chemicals that are commonly added to furniture, electronics, and other products to make them more resistant to fire. While flame retardants may seem like a beneficial addition to these products, they can have harmful effects on the environment and human health. In fact, flame retardants are considered to be a type of micro pollutant, which are substances that can have adverse effects even at very low concentrations.

One way that flame retardants enter the environment is through dust. When products containing flame retardants are used and handled, the chemicals can be released into the air and settle as dust in homes and other indoor spaces. This dust can then be ingested or inhaled by humans and animals, leading to potential health problems.

In addition, flame retardants can enter the environment through the disposal of products containing these chemicals. When flame retardant-containing products are thrown away or recycled, the chemicals can leach into soil and water systems, leading to contamination of the environment.

One of the main concerns with flame retardants as micro pollutants is their potential impact on human health. Studies have linked exposure to flame retardants with a range of health problems, including developmental delays in children, thyroid problems, and cancer. These health effects are believed to be a result of the ability of flame retardants to disrupt hormone systems and interfere with normal bodily processes.

Furthermore, flame retardants can have negative effects on wildlife and ecosystems. Studies have shown that flame retardants can accumulate in the tissues of animals, leading to potential health problems such as reproductive issues and behavioral changes. In addition, flame retardants can persist in the environment for long periods of time, making them difficult to remove once they have been released.

As the potential risks associated with flame retardants as micro pollutants become more apparent, efforts are being made to reduce their use in products and find safer alternatives. Some companies are opting to use materials that are naturally flame-resistant, while others are developing new technologies that do not require the use of flame retardants. In addition, regulations are being put in place to limit the use of certain types of flame retardants and encourage the use of safer alternatives.

In conclusion, flame retardants are a type of micro pollutant that can have harmful effects on human health and the environment. As awareness of the risks associated with these chemicals grows, it is important to take steps to reduce their use and find safer alternatives. By doing so, we can help protect ourselves and the environment from the negative impacts of flame retardants as micro pollutants.

**5. Microplastics:** Tiny plastic particles that are a result of the breakdown of larger plastic items and can be found in water, soil, and air.

Microplastics are a type of micro pollutant that has gained significant attention in recent years due to their widespread presence in the environment and potential harmful effects on both human health and the environment. Microplastics are defined as small plastic particles, typically measuring less than 5 mm in size, that are generated by the degradation of larger plastic items such as packaging, bottles, and synthetic textiles.

The increasing production and consumption of plastic products have led to a significant increase in the amount of plastic waste generated worldwide. This plastic waste can enter the environment through various pathways, including littering, landfill leakage, and ocean dumping. Once in the environment, plastics can break down into smaller and smaller particles over time due to the effects of weathering, sunlight, and biological processes.

Microplastics can be found in a variety of environmental matrices, including water, soil, and air. Studies have shown that microplastics can be ingested by a wide range of organisms, including fish, birds, and other marine animals, which can lead to physical harm, as well as affecting their behavior and reproductive success. Additionally, microplastics have been found in drinking water and food products, raising concerns about potential health effects on

humans.

The impact of microplastics on human health is still not fully understood, but studies have shown that microplastics can carry and release toxic chemicals, including endocrine disruptors and carcinogens, which may have negative effects on human health. In addition, the presence of microplastics in the environment can also have economic implications, as microplastics can cause damage to marine ecosystems, tourism, and fishing industries.

Efforts are being made to reduce the amount of plastic waste generated and to prevent the release of microplastics into the environment. This includes measures such as the reduction of single-use plastics, improved waste management practices, and the development of new technologies for recycling and waste-to-energy conversion.

In conclusion, microplastics are a growing concern as a micro pollutant due to their widespread presence in the environment and potential negative effects on both human health and the environment. While efforts are being made to address the issue, further research and action are needed to better understand the impact of microplastics and to develop effective solutions for reducing their presence in the environment.

**6. Perfluorinated compounds:** Chemicals used in the production of non-stick coatings, water-repellent fabrics, and firefighting foams, which can enter water systems through manufacturing and use (Sudarshan *et al.*, 2022) <sup>[7]</sup>.

Perfluorinated compounds (PFCs) are a class of synthetic chemicals that have become widely used in a variety of industrial and consumer products. They are persistent in the environment, meaning they do not break down easily, and have been identified as a significant micro pollutant in water systems worldwide. In this article, we will explore the nature of PFCs, their sources and the potential impact they have on the environment and human health.

PFCs are a group of chemicals that are used in the production of non-stick coatings, water-repellent fabrics, and firefighting foams. They are also used in a range of other industrial applications, including electronics manufacturing, and as surfactants in household cleaning products. PFCs are highly stable and do not degrade naturally in the environment, which means they can persist for decades, and even centuries, in soil, water, and air.

The primary source of PFCs in the environment is through manufacturing and use, with most releases occurring during the production of consumer goods such as Teflon pans and waterproof clothing. PFCs can also enter the environment through the use of firefighting foams, which are widely used to extinguish fires, especially in airports and other industrial sites.

Once released into the environment, PFCs can contaminate water systems, including groundwater and surface water, which can then enter the food chain. Studies have shown that PFCs can accumulate in the tissues of animals and humans, including fish, birds, and mammals. This means that the higher an organism is in the food chain, the greater the concentration of PFCs they are likely to have in their tissues.

PFCs have been linked to a range of negative health effects in humans, including liver damage, immune system suppression, and developmental problems in infants and children. Studies have also shown that exposure to PFCs can lead to an increased risk of certain cancers, such as kidney and testicular cancer. The precise mechanisms through which PFCs cause



harm to human health are not yet fully understood, but it is thought that their persistent nature, combined with their ability to accumulate in human tissues, is a major contributing factor.

In conclusion, perfluorinated compounds are a significant micro pollutant that can have harmful effects on the environment and human health. Their widespread use in a variety of industrial and consumer products, combined with their persistence in the environment, means that they will continue to be a challenge for environmental regulators and public health officials. Efforts are underway to reduce the use of PFCs and to develop more sustainable alternatives, but it will take time to fully address this issue. In the meantime, it is important to be aware of the potential risks associated with PFC exposure and to take steps to minimize our exposure to these chemicals whenever possible.

These are just a few examples of micro pollutants, there are many others such as endocrine disruptors, heavy metals, and industrial chemicals that can have harmful effects on the environment and human health.

### Sources of Micro Pollutants

Micro pollutants can come from a variety of sources, including industrial processes, agricultural activities, and household products. They can also come from pharmaceuticals, personal care products, and other chemicals that are used on a daily basis. These substances can enter the environment through various pathways, including wastewater treatment plants, runoff from agricultural fields, and stormwater runoff.

### Impact of Micro Pollutants on the Environment

Micro pollutants can have a significant impact on the environment. They can accumulate in the soil, water, and air, and can be absorbed by plants and animals, causing damage to their biological systems. Some micro pollutants can also persist in the environment for a long time, leading to long-term exposure and accumulation in the food chain.

Micro pollutants can also have a significant impact on the aquatic ecosystem. They can alter the pH of water, interfere with aquatic organisms' ability to reproduce, and cause changes in behavior and physiology. Fish and other aquatic animals can also ingest micro pollutants, which can accumulate in their tissues, leading to health problems and even death.

### Impact of Micro Pollutants on Human Health

Micro pollutants can also have significant health impacts on humans. They can enter the body through various pathways, including ingestion, inhalation, and dermal absorption. Exposure to micro pollutants can lead to a range of health problems, including cancer, reproductive problems, and developmental disorders (Campanale *et al.*, 2020)<sup>[8]</sup>

The most significant source of exposure to micro pollutants for humans is through the consumption of contaminated food and water. Fish and other seafood can accumulate high levels of micro pollutants, making them a significant source of exposure for humans who consume them.

### Reducing Micro Pollutants

Reducing micro pollutants requires a multi-faceted approach that involves reducing the use of chemicals that are known to be harmful, improving wastewater treatment processes, and increasing public awareness of the issue.

Governments and industry can take steps to reduce the amount of micro pollutants that are released into the environment. This can include improving industrial processes to reduce chemical use and implementing stricter regulations on the use and disposal of chemicals. It can also involve upgrading wastewater treatment plants to remove micro pollutants from the effluent before it is discharged into the environment.

Individuals can also play a role in reducing micro pollutants by making conscious decisions about the products they use and disposing of chemicals in a responsible manner. This can include using environmentally friendly cleaning products, properly disposing of prescription drugs, and using alternative forms of transportation to reduce emissions.

### Conclusion

Micropollutants are a serious environmental and public health concern. They are present in the environment in low concentrations but can have long-term impacts on living organisms. Reducing micro pollutants requires a concerted effort from governments, industry, and individuals to reduce the use of harmful chemicals, improve wastewater treatment processes, and increase public awareness of the issue. By taking steps to reduce micropollutants, we can protect both the environment and human health for generations to come.

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