Long-term environmental impact of plastic contamination produced during COVID-19

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Abstract

Majority of the million tonnes of plastic manufactured each year is discarded after single use. Plastic food containers ,bottles, gloves and cups that end up in landfills and the environment could survive hundreds of years. Moreover the widespread use, fabrication and disposal of personal protective equipment during COVID 19 has resulted in further increase of plastic trash posing a serious threat to the environment. Every month, approximately 129 billion face masks and 65 billion plastic gloves are used and discarded aro und the world. Plastic can infiltrate the animal and human food web after breaking down into micro and nanoscopic fragments as a result of physical. Chemical or biological activities in the environment. As a result, plastic management programmes must be more robust, with a focus on preventing the entry of m icro and nanoplastics into the environment.In the present article we have discussed how worldwide plastic production increased during COVID-19 and how this contributed to short and long-term environmental repercussions .Improper disposal of the plastic in oceans and on land would jeopardise marine creatures and, as a result, human lives. This review will aid individuals in comprehending plastic usage and its environmental repercussions in the event of a pandemic such as COVID-19.

Keywords : Personal protective equipment's , COVID19 , Plastic waste

Introduction

Plastic is a type of polymer made up of long carbon chains . Plastic is widely employed in both industrial and domestic settings due to its good physicochemical features and economic feasibility (e.g., lightweight, flexibility, low production cost, and availability). Synthetic polymers such as polyethylene (PE), polypropylene (PP), polystyrene (PS), polyethylene terephthalate (PET), polyvinyl chloride (PVC), and polyurethane account for 90% of global plastic output (PUR) .The widespread usage of synthetic plastics, combined with their intrinsic resistance to disintegration, poses a severe environmental threat. Though biodegradable plastic is an alternate for the synthetic plastic but there is no evidence that these plastic would be able to break down in natural atmosphere. The worldwide production of plastic is approximately 300 million tons per year and an increase is noted in this day by day. Moreover use of plastic made materials and as a result of this use production of plastic waste are rising at a very alarming rate.

Several actions have been developed around the world to avoid plastic leakage and reduce plastic's environmental effect. The usage of reusable bags and the prohibition of SUPs (single-use plastics) has been identified as one of the most effective preventive approaches for reducing plastic waste. The SUPs like plastic cups ,water bottle , plastic bags etc are used once and then discarded .The recyclability rate of these SUPs is very poor (approx.12 %). However, COVID-19 pandemic, caused by a novel virus SARS-Cov-2 has recreated the SUPs .The SUP personal protective equipment (PPEs) such as face masks, face shields and surgical

masks both for the frontline health workers and common citizens have been adopted to stop the contamination and spread of virus.

The use surgical masks once and then discarding them during COVID-19 adds to the global polymer load. As a result, the COVID-19 pandemic's use and mismanagement of medical waste is contributing to rising plastic contamination. Meanwhile, PPE depositions from the COVID-19 epidemic will most likely be a common plastic trash item that has persisted in the environment for decades.

Most of these PPEs are made from PVC , PC ,PP which can not be recycled easily. This will definitely increase the already existing plastic contamination in atmospheric , terrestrial and aquatic environment. Furthermore lockdown during the pandemic period has influenced the plastic recycling facilities resulting in the illegal disposal of plastic waste in the ocean and on land . As a result, a large number of non-biodegradable polymers, including PPE, are now widely used in various forms and purposes all over the world. As a result, a massive amount of macro-plastics and their fragmented particles are discarded into the environment, with the risk of environmental pollution tripling or more than double year after year. Due to the possibility of biohazards, this PPE plastic handling has undeniably become a major worry. Furthermore, the varied content of PPE waste makes efficient sorting and recycling difficult. Once littered in the environment, these plastics are vulnerable to abiotic and biotic breakdown processes. The macro plastic (size more than 25mm) and meso plastic (size 5-25 mm) gets degraded into micro (size less than 5 mm) and nano-scale (size less than 100 nm) plastics with time .Researches have shown that micro and nano plastics gets penetrated into both aquatic and land environments . Recent research have confirmed that medical face masks are potential sources of microplastic contamination in water systems, and that they will represent an environmental issue in the COVID-19 scenario. When enter in human food chain these micro and nano plastics become a serious threat to human health. The toxicity caused by plastics includes oxidative stress ,metabolism disorders and inflammatory reactions to humans and other organisms.

Increase in plastic garbage during Covid -19

While governments around the world fight the COVID-19 pandemic, there are substantial drawbacks in how plastic is used and managed. The widespread usage of gloves, masks, protective medical suites, and hand sanitizer bottles is contributing to an unanticipated problem. Syringes, catheters, tubes, saline solution containers, respirators, and thermometers, all of which are partially composed of plastic, contribute to this plastic pollution. Improper disposal of these potentially life-saving plastic components might overload city waste management systems around the world, particularly owing to garbage collection activities being short-circuited during the lockdown. Because of the risk of SARS-CoV-2 spreading in operation centres, certain countries suspended their recycling programmes.

***Increase in the use of single use plastic** : Due to the pandemic lockdown and a new hyper-hygienic style of life, the use of SUP has expanded substantially . Furthermore, panic buying and stockpiling as a result of changes in consumer behaviour increased the need for plastic-based packaging materials . There is currently no feasible alternative to SUP for preventing viral transmission. Furthermore, as the popularity of online shopping and takeaway grows, so does plastic manufacturing and usage.

* **Increase in plastic waste generation** :During the COVID-19 pandemic, increasing plastic pollution was caused by overflowing medical waste, the need for suitable PPE, an increase in online food delivery and shopping, and a prohibition on reusable bags, among other factors. Because of the increased biohazards generated during the pandemic and the closure of recycling facilities it is projected that medical waste recycling would decline in the coming year

Change in plastic waste management during the COVID-19 epidemic

Household and medical plastic waste has increased as a result of the pandemic, exacerbating the present plastic pollution. Mechanical recycling, incineration, and landfilling are the three most widely employed methods of

plastic waste disposal around the world. Burning or incineration, on the other hand, can produce toxic chemicals such as furans and dioxins, as well as enhance greenhouse gas emissions into the atmosphere, so contributing to global warming. As a result, it is not an appropriate long-term option. The scientific disposal pyramid places landfill at the bottom. Despite this, some countries dump their waste in landfills. Plastic garbage generated during COVID-19 has increased the load on landfills and waste dumps, causing them to overflow. It would result in severe space limits and toxic chemical leaching.

For the handling of infectious waste, the World Health Organization recommends high-temperature burn incineration or deep burial. Gloves, masks, goggles, and a fluid-resistant apron must be collected and stored in clearly marked lined containers, preferably on-site, prior to treatment and safe disposal, according to WHO. Autoclaving or high-temperature burn incinerators should be used to treat these wastes.

Long-term impacts of the plastic pollution outbreak on the environment

Even before the COVID 19 period, managing plastic garbage had always been a difficult task. It had accumulated earlier in aquatic, terrestrial, and atmospheric environments. Hygiene concerns and an increased reliance on fast food exacerbated the plastic pollution problem during COVID-19. The most often used plastic waste management procedures around the world include recycling, burning, and landfilling. However, a significant increase in plastic trash generation and lockup has caused in a global drop in plastic recycling. Inappropriate incineration, clandestine dumping, and landfill capacity overflow would all arise from poor plastic waste management.

* **Plastic in water and wastewater treatment plants at the micro and nanoscale :** Wind, rainfall runoff, drainage systems, and wastewater transport discarded plastic masks and gloves to the oceans and surface waterways. Although the majority of earlier research has concentrated on plastic pollution in the marine environment, more recent research has shown that these plastics can also end up in freshwater and on land. Over time, discarded plastic debris in freshwater degrades to micro and nano particles through mechanical, chemical, and biological processes such as biodegradation, UV photodegradation, and hydrolysis. Micron-sized plastic fibres from clothing washing and plastic polymer microbeads used in personal care products such as facewash or toothpaste also infiltrate wastewater treatment plants (WWTPs) through drainage systems and end up in surface water.

* **Greenhouse Gas emission :** Greenhouse Gas emissions from landfills, such as CO2 and CH4, are a major source of concern. Dioxins, heavy metals, PCBs, dioxins, and furans, which are categorised as dangerous compounds and directly associated to health hazards such as respiratory problems, are released when plastic garbage is burned improperly.

* **Marine plastic pollution** : Plastic garbage has destroyed the marine ecology, posing a major threat to marine life. Plastic items are often mistaken for jellyfish, a favourite meal of sea turtles, and so kill roughly 0.1 million marine animals and turtles each year. The problem of marine plastic contamination has gotten worse as a result of COVID-19. SUP PPEs and their fragmented debris ingestion by such marine wildlife might have a long-term influence on their food chain due to misidentification. Plastic waste leakage could come from improper cremation, unlawful dumping, and inappropriate landfilling, potentially causing microplastic pollution in marine ecosystems.

* **Plastic poisoning in humans and marine life:** Because of their small size, micro and nanoscale particles can pass through the human cell membrane, causing cytotoxicity and metabolic disorders. Ingestion, inhalation, and skin absorption from plastic products, primarily micro and nanoscale plastic, could have a negative impact on human health. Ingestion of plastic-contaminated seafood or drinking water is the most common way for plastic to enter the human body. Nanoparticles generated from polystyrene plastic polymers were shown to produce reactive oxygen species (ROS) in human liver cells, affecting epithelial cell function and physiological processes. Microplastics may be consumed by humans through seafood, sea salt, sugar, honey, and beer, as their existence has been proven in these foods. Because these compounds are carcinogenic and mutagenic, absorbing them via the skin can be detrimental to humans. Microplastics in the marine environment also affect aquatic organisms' nutrition, growth, spawning, and survival. These effects, however, vary according on their size, concentration, exposure period, and other factors.

Conclusions

People should be conscious of the future repercussions of their plastic usage and disposal, since the COVID-19 epidemic has increased the plastic pollution problem. The COVID-19 epidemic has generated a massive amount of plastic. During the pandemic, poor plastic waste management and unlawful dumping will have both acute and long-term repercussions on biological, ecological, and human health. Plastic trash is currently damaging the marine and terrestrial environments, but it will also degrade in the future into micro and nanoscale plastics. These micro and nanoscale plastics have the potential to harm humans and the environment even more irreversibly. Innovative technology are required. To deal with this plastic overload, innovative solutions in plastic waste management are needed, as present methods are becoming overburdened. As a result, it is critical to establish plastic usage laws and to educate people on how to minimise, reuse, recycle, and manage plastic trash. Emergency preparations for future plastic pollution and plastic waste management in critical scenarios should be the focus of future effort.

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