



## Review Paper

# Review on face masks – source of microplastics and its impact on ecosystem

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## Abstract

*Covid-19 has changed the world upturned. The pandemic not only affected the humans but also the environment due to the plastic pollution generated from the improper disposal of covid -19 protective measures like a face mask, gloves, PPE kit, etc. The use of Face masks has become an inevitable preventive measure against coronavirus disease. The study has found that the remarkable increase and improper disposal of face masks are going to be the next pandemic in the future. The studies reveal the face masks have the potential to release micro-sized fibers known as micro plastics which is a menace to the flora and fauna of numerous ecosystems. The study provides an insight into the impact of illegitimately disposed face masks on the biotic and abiotic components.*

**Keywords:** COVID-19, face masks, micro plastics, environment.

## Introduction

Ecosystems are highly complex networks consisting of biotic and abiotic components. The biotic and abiotic counterparts are linked by the flow of energy and the cycling of nutrients<sup>1</sup>. Every entity in the ecosystem interacts with its surroundings influencing the ecosystem. The unusual change in the environment affects every organism and disturbs the ecological balance of the entire ecosystem. The ecosystem's imbalance could be driven by several sources, including species and population variations, natural risks, or anthropogenic cause<sup>2</sup>.

According to the first Earth Summit 1992, it was identified that human behavior was destroying the Earth's ecosystems at an alarming rate, wiping out species, genes, and biological features. In the 21<sup>st</sup> century, plastics have taken the role of villain on Earth. Plastic pollution is defined as the accumulation of plastic products in the environment that endangers flora, fauna, and humans<sup>3</sup>. According to a survey conducted by the United Nations Environment Programme, 9 percent of all plastic trash has been repurposed and 12 percent has been incinerated, and the remaining ended up in landfills, dumps, or the natural environment<sup>4</sup>.

As the Covid-19 spreads in the entire world, plastic products such as face masks, PPE kits, gloves, etc. have turned into plastic pollutants due to the reckless nature of humans. In these pandemic days, the face mask has become inevitable for humans of many countries. According to many researchers, a Facemask has the potential to release a micro-sized fiber known as micro plastics which is a menace to biotic and abiotic components.

Micro plastics are microscopic bits of plastic that are discovered in water and the environment as an outcome of plastic litter. They act as a significant waste in the effluent that can only be

eliminated in part by wastewater treatment plants<sup>5</sup>. There is a reasonable amount of micro plastics that still escape the treatment processes. These micro plastics which evade treatment at the Waste Water Treatment Plants pose a danger to aquatic and terrestrial life. Most Waste Water Treatment Plants need a tertiary treatment process for the removal of micro plastics.

Plastic has the potential to harm the biotic and abiotic components. Mechanical effects, challenges associated with the digestion of plastic trash, or exposure to substances in plastics that interfere with the physiological processes can have an impact on marine organisms. Plastic pollution has an impact on humans as well, for instance, by disrupting numerous hormone mechanisms<sup>6</sup>. The goal of the study was to see how the covid-19 pandemic affected those who chucked their facemasks away recklessly.

## Covid -19 and face masks

The severe respiratory syndrome corona virus is to account for the Covid-19 outbreak<sup>7</sup>. Despite the emergence and detection of Covid-19 in Wuhan, the WHO declared the disease as a pandemic and various actions have been taken in diverse nations throughout the world to halt the disease's spread<sup>8</sup>. The put-on of face mask combined with good cleanliness is thought to be a useful way to avoid Covid-19 transmissions<sup>9</sup>. These face masks which are often used by those who engage in social activities provide virus protection<sup>10</sup>. Wearing face masks has become a part of people's daily routine as a result of the expansion of the Covid -19 outbreak<sup>11</sup>. The face masks have two functions: One, they protect the individual wearing them, and two; they reduce disease transmission from one person to another. The excessive use of face masks resulted in a global scarcity of face masks<sup>12</sup>.

As per the WHO, roughly 89 million surgical masks were required in the case of Covid – 19 every month. This implies an aberrant increase in worldwide facemasks manufacture<sup>13</sup>. As a whole, the output of face mask manufacturing industries expanded. China, the world's largest manufacturer of face masks, raised daily mask output to 14.8 million in February 2020<sup>14</sup>. As of April 2020, a monthly supply of roughly 600 million facemasks has been required (METI, 2020). As several nations loosen lockdown measures, the demand for face masks is growing day by day, culminating in the next phase of infection<sup>15</sup>. Because of the expensive cost of disposable face masks and the scarcity of surgical face masks, Individuals have been forced to use cotton face masks or reuse them, which have increased the number of instances<sup>16</sup>. The erroneous usage of face masks raised the possibility of Covid-19 transmission<sup>17</sup>. The plastic woven material is used to make the disposable face masks<sup>18</sup>, which are made from polymers<sup>19</sup>. Three layers make up the face mask: An inside layer of soft fibers, a middle layer of melt-blown filter, and an exterior layer of water-resistant non-woven fibers<sup>20</sup>.

The global increase in face mask manufacture and usage has turned into a new environmental concern<sup>21</sup>. The rise in worldwide single-use facemask production has begun to pose a significant threat to biodiversity<sup>22</sup>. When facemasks are thrown away, they are fragmented into micro plastics as a consequence of environmental conditions, culminating in micro plastic contamination<sup>23</sup>. Micro plastics come from two sources: synthetically created micro-sized plastics and the breaking down of macro plastics into micro plastics due to environmental causes<sup>24</sup>. Face masks that end up in the environment will be a new source of micro plastic pollution in 2020<sup>25</sup>. In the lithic and lentic ecosystems, there have been several research on micro plastic detection, measurement, and identification<sup>26</sup>.

According to the National Geographical Society, Micro plastics are small fragments of macro plastics. They are the plastic fibers that can fragment/degrade/break down into smaller sizes of particles under 5mm in environmental conditions<sup>27</sup>. The plastic items including Polyethylene, Polystyrene, Nylon, or PVC can degrade by heat, UV light, mechanical action, and bioremediation<sup>28</sup>. The yield of these processes increases and results in the formation of microplastics<sup>29</sup>. The deterioration of face masks was researched using a plastic-specific library from PerkinElmer in the United States. According to spectral research, face masks have the potential to greatly enhance the accumulation of micro particles in the environment in a short period of time<sup>15</sup>.

### Impact of Micro plastics on the environment

The first habitat in which plastics are conveyed is the soil<sup>30</sup>. Currently, 32% of all current plastics are devoured by the soil<sup>31</sup>. WHO predicts the pandemic will persist for at least another year. As a corollary, the usage of face masks will prolong, and the dangers of micro plastics in the soil expand<sup>24</sup>. Micro plastics

impacted the microorganisms as well as density of soil, retention capacity of water, and rate of evaporation, among other things<sup>32</sup>. The mask's micro plastics end up littering the land and marine environments<sup>33</sup>. As a consequence, ecosystems, and animals are tame<sup>34</sup>.

Once the micro plastics get emancipated from micro plastic, it can travel through waterways and ends up in the aquatic ecosystem<sup>35</sup>. According to UN estimates, 75% of all plastics which is related to corona virus might wind up in the oceans as garbage. Catherine Mckenna, Federal Environmental Minister claimed; that plastic will outweigh fish in our oceans by 2050. The most serious type is a danger to aquatic life, which accounts for a large amount of the food web<sup>21</sup>. Mechanical impacts, difficulties connected to the digestion of plastic debris, or exposure to compounds inside plastics that impede their physiological processes can all affect marine species<sup>36</sup>. The presence of micro plastics has an impact on phytoplankton growth and development<sup>37</sup>. Micro plastic concentrations in the surface water of the oceans have increased significantly, according to the United Nations and Environment Programme (UNEP). Previous research suggests that micro plastic pollution might disrupt the aquatic system's natural carbon sequestration mechanism.

The decimation of face masks will result in the emission of greenhouse gases and other emissions. Changing climate caused by emissions of carbon from micro plastics has proven to be a larger threat to ecosystems<sup>38</sup>. Plastics will produce potent greenhouse gases such as methane and ethane as a response to sunlight and heat<sup>39</sup>. Micro plastics from discarded face masks can spread microorganisms like invasive pathogens, which serve as a breeding ground for disease epidemics<sup>21</sup>. Biofilms are formed by bacterial colonies adhering to living or non – living surfaces<sup>40</sup>. Microorganisms might thrive on micro plastics because of this property. Micro plastics not only aid adhesion but also serve as a disease reservoir. Wind, waves, and currents may transfer these pathogens over great distances<sup>41</sup>.

The release of micro plastics will have an impact on the food chain and lead to chronic health issues in people<sup>42</sup>. The plastic particles can contaminate foods intended for human consumption raising concerns about global food safety<sup>15</sup>. Micro plastic pollution has an impact on humans as well, for instance, the disruption of numerous hormonal mechanisms<sup>6</sup>.

Toxic chemicals are both source and a sink for microplastics<sup>43</sup>. Because of the hydrophobic nature, organic contaminants that float in the water in low quantities can accumulate on the surface of microplastics<sup>44</sup>. When the micro plastics got fed by the Marine animals mistakenly, the chemicals get accumulated in the animal tissues, and the concentration increases as the pollutants transfer up the food chain<sup>45</sup>. The micro plastics ingested by the organisms can lead to digestive blockages or internal damage from abrasion<sup>46</sup>.

## Impact of Micro plastics on Human

Since micro plastics are micro size in nature, it is easy to enter the human body in various ways<sup>47</sup>. Micro plastics accumulated during the usage and reuse of face masks might cause respiratory issues due to micro plastic inhalation through breathing<sup>48</sup>. The micro plastics can be inhaled from the air also<sup>49</sup>. 15 grams of street dust collected from Iran, 900 micro plastics, and 250 micro-rubbers of different sizes and shapes were discovered<sup>50</sup>. A newly discovered phenomenon known as “The Plat sphere”, is the term used to denote the indirect impact of Micro plastics on human health<sup>51</sup>. The disinfection of face masks can be done through washing, ultraviolet, alcohol disinfection, air blower disinfection, and sunlight exposure<sup>52</sup>.

## Conclusion

The Face mask functions a great role in the protection and reduction of disease spread during the covid-19 pandemics. The studies are showing that improper disposal of a single face mask can generate a lot of micro plastics which are dangerous to the biotic and abiotic components. Thus, in the 21<sup>st</sup> century, face masks are becoming a source of micro plastics. To minimize the number of abandoned face masks in the environment, measures should be adopted. Even though there are no international regulations on plastics and pollution due to the pandemic situations, several countries are trying to put strict measures to reduce plastic pollution.

Collection of face masks that stick out in the environment and its proper destruction followed by proper sanitation. Face mask waste management can be done using physical and chemical valorization methods. Encourage the researchers to invent new methods for the degradation of plastics. Proper awareness about face mask disposal to societal people of the world can eradicate the environmental issue. The illegitimate dealings of plastic usage will lead to Plastic as the future pandemic.

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