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Systematic Review on Air Pollution and its Adverse Effects

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Abstract: Inhaled microplastics (MPs) can enter deep into our tissues, if the body is unable to remove these MPs. They include phthalates, such as bisphenol, which after inhalation can enter the circulation and cause cardiovascular diseases, brain vessel difficulties as well as immune system and nervous system impairments. Radiation can potentially cause cancer if it is used in large doses. Airborne microplastics pose a higher threat to children than adults. Toxins in the air have become far more difficult for children to breathe. As a result, a baby's physique is much more sensitive than normal man. A long-term negative impact may be caused by contaminants such as microplastics, which disintegrate slowly. In addition, children often crawl and play on the floor, where they might acquire microplastic from dust.

Keywords: Microplastic, Pollution, Cancer, Air pollution, Health impacts

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Introduction

The result of plastic waste (PW) in the atmosphere is MPs which are small fragments of plastic (PL) smaller than 5 mm (0.2 inch) in length (Huang *et al*., 2020). In a range of items, from cosmetics to PL tools and bottles, MPs are present. Many of these items are found readily in rubbish. The MPs include atoms bonded together in polymer chains of carbon (C) and hydrogen (H_2). Often usually present in the MP industry are other contaminants, such as phthalate esters, polybrominated diphenyl ethers and tetrabromobiphenol A, all of which are released from the plastic after it enters the atmosphere (Prata, 2018).

Primary and secondary MPs:

There are two groups of MPs-- primary and secondary. Primary group of MP includes microbeads in personal care materials, plastic pellets or nurdle in agricultural production and plastic fibres (PLF) for synthetic textiles (e.g., nylon) (Chen *et al*., 2020). Primary MPs reach the environment through a variety of sources, such as product use (e.g. washing of personal care items into household waste water system), accidental waste during production or transportation, or waste washing (e.g., laundering of clothing made with synthetic textiles) (Vianello *et al.*, 2019). Secondary MPs are generally derived by breaking

down of large PL. They mostly occur as large plastics are weathered, for example from exposure to wave, wind and ultraviolet (UV) radiation from the sun (Bi *et al.*, 2020). .

Environmental and health impacts:

MPs are non-biodegradable. Primary and secondary MPs degrade and persist in the environment (Enyoh *et al.*, 2019). MPs were detected in a range of habitats, including oceans and coastal ecosystems. Annual PL contamination in the sea alone by all kinds of PLs was measured in the early 21st century between 4 million and 14 million tonnes. The air contamination of MPs causes dust and fibrous particles in the air. There are unexplained health risks of inhaled MPs (Wang *et al*., 2021).

MPs were present in more than 114 aquatic organisms in marine and freshwater environments together (Akanyange *et al.*, 2021). MP products are present in digestive tracts and tissues of various marine invertebrates, crustaceans and mammals (Schwabl *et al*., 2019). Fish and birds eat MPs that float on the surface of the water. Ingestion of MPs can lead to less food intake by aquatic species and thus less energy in life and lead to neurological and reproductive toxicity (Prata *et al.*, 2020a). It has been suspected that MPs are increasing in aquatic food chains, from zooplankton, small fish, to massive predators. In drinking water, beer and food products, including seafood and table salt, MPs were found. MPs were recovered from each participant's stool samples in a pilot project involving eight people from eight countries (Wright *et al*., 2020). MPs in human tissues and organs have also been observed by scientists. The consequences for human health of these MPs are unclear (Cox *et al.*, 2019).

Reducing MPP:

About 6,300 million tonnes of plastic wastes (PW) were produced between 1950 and 2015. The bulk of the waste, almost 4.9 million tonnes, ended up in waste sites and the atmosphere. Based on developments over the same period, scientists predicted that plastic waste would exceed 12,000 million metric tonnes by 2050 in waste sites and the atmosphere. However, governments and policy makers have remained relatively unaware of the possible risks of escalating plastics waste, in particular MP contamination (Gasperi *et al.*, 2018).

Organizations such as the UN Environmental Program Expert Panel, have participated in advocacy programmes in over 100 countries to raise awareness of waste from PL products and encourage recycling and reuse (Stanton *et al*., 2019). Further, international cooperation programmes, including MP emissions, have been developed to fix aquatic wastes. In 2015, the USA passed the Microbead-Free Waters Act which prohibits rinse-off cosmetics products containing PL microbeads. In other nations, microbeads are also banned (Mbachu *et al*., 2020).

Another main element in the reduction of MP emissions is the remediation of MPs. Strategies under study included the use of synthetic MP polymers that can break down (Rist *et al*., 2018). Biodegradation capabilities are present in several species of bacteria and fungi. Such micro-organisms (MOs) can be used in wastewater and other polluted areas (Campanale *et al*., 2020).

How do MPs influence people?

MP enters in humans by the consumption of aquatic animals (O'Brien *et al.*, 2020). The persons who don't consume sea food these MP enters through the drinking water or inhalation of air. Cars and trucks emit tyre dust (which includes PL styrene-butadien) 0.71 ounces every 62 miles (100 km) of road they run (Liu *et al.*, 2019).

MPs are found in 94% of tap water in the US (Van Cauwenberghe *et al*., 2014). These particles, when small, have penetrated many facets of human life, which makes them impossible for the ordinary person to spot or stop. In drinking water, other countries even showed alarmingly high levels--Beirut, Lebanon, 94 per cent; New Delhi, India, 82 per cent; Kampala, Uganda, 81 per cent;

Jakarta, Indonesia, 76 per cent; and Europe 72 per cent.

It has been reported that human ingestions of MPs range from 39,000 to 52.000 particles per year, based on their gender and their age group (Kelly and Fussell, 2020). This figure only improves if we consider factors like MPs and drinking water compared to the intake of filtered water. While we quantify the amount of MPs we consume over one year, this issue gives much less detail than the impact on marine animals (Hirt and Body-Malapel, 2020). Prior reports, including WHO have suggested that MPs have little significant effect on public well-being. Others suggest that what is most important is the kind of plastic consumed or inhaled. Bisphenol A ($C_{15}H_{16}O_2$), for example, is linked to increased blood pressure (Henry *et al.*, 2019). Endocrines, neuro-developmental disease, and liver and kidney damage may be caused by polybrominated diphenyl ethers in humans.

What can we do?

Through reducing the PL use, reduction of MPs may be achieved in soil, atmosphere and in global wastes. Inflow of PL may be reduced by – (i) buying natural fibre clothing/natural fabrics such as biological cotton and wool which are biodegradable instead of remaining as synthetic fibres in the natural world (Xu *et al.*, 2020), and (ii) use wool dryer balls rather than dryer sheets.

Use of recycled materials:

Replace the recycled solutions you can wash and use again from your one-user disposable bottles and straws. PL which cannot be recycled always go to the waste dump so that reused materials are replaced whenever possible (Wright and Kelly, 2017). PL which cannot be reused so it should be recycled in accordance with the local waste management programme (Barboza *et al*., 2018). Any plants would not be allowed to use such PL materials because machines have difficulty sorting and processing them. As described earlier, car tyres add much MP dust to the environment. Use of alternative transport such as cycling or walking can reduce the tyre dust in air. Even cooking with others is considered a step towards an eco-friendly life (Akhbarizadeh *et al.*, 2021).

Organic MPs originate from the air and not just from drinking water or consuming seafood from tainted oceans (Enyoh *et al*., 2020). MPs can be inhaled and can lead to a variety of illnesses, including infectious, cardiovascular and cancer (CA). Annual production of PL is over 300 million tonnes (Zhang *et al.*, 2020). In less than one year, half of the PL turns into garbage. Just 9 per cent of plastics are recycled, while the other 91 per cent are present as wastes in air, soil and water. These are inhaled into lung tissue or penetrate the blood stream because the body cannot get rid of the small PL particles. Babies crawling on the floor are more vulnerable, and more often, infants are more vulnerable because of the development of their respiratory systems (Prata *et al*., 2020 b).

MPP through washing and wearing:

Up to 35% of the PL particles which pollute our oceans are produced from PL wash out from synthetic clothes. An average of 9 million micro-fibers reaches in the wastewater treatment plants that cannot filter them, which means that the fibres end up in the ocean (Abbasi *et al.*, 2019). Furthermore, PL fibres are often emitted into the air only after wearing synthetic clothing. To date all literature has concentrated on the contamination of micro-fiber by the laundry. A new research reveals, however, that wearing polyester garments often pollute the atmosphere, as polyester clothing emits as many MP fibres in the air as washing (Patil *et al.*, 2020).

Does breathing fibers damage health?

In 1990s, scientists studying lung tissue of patients with cancer showed their concerns that PL fibres would lead to a risk of lung CA. The existence of MPs in human lung tissue has now been apparent. Research has shown that in lungs, particularly people with lung disease, PL particles can persist (Wang *et al.*, 2020). These particles are

likely to be there for a long time because they are bio-persistent and can induce inflammation. The length of fibres also matters, since longer fibres seem to be more harmful. Particle contamination causing damage to lung tissue, tumours, asthma and other health conditions, is known for many years (Li *et al.*, 2020). Fabric workers in the manufacturing of nylon and polyester fibres among other things, experienced coughing, breathing and decreased lung capacity, indicating that these workers are related to the health issues experienced by MPI (Ebere *et al.*, 2019).

Concentration of airborne MPs higher in indoor air:

Indoor air MPs arise from fragmenting plastic articles (Toys, chairs, shopping bags, cosmetics, pasta and scrapers) in our homes by pressure, heat or illumination (Yee *et al.*, 2021). The Environmental Audit Committee in Great Britain in January 2019 abolished micro-bead use and claimed that showering with a single corpus scrub will flush 100,000 microplastic beads into the drainage system and into the air following the US, New Zealand and Canadians (Wang *et al.*, 2020). However, the rest of the MPs products contained by indoor air come from synthetic fibres and the textiles used in home furnaces. These MPs fibres are usually longer and toxic when inhaled. Today, about 60% of world garment manufacturing consists of synthetic fabrics, such as acrylic, nylon and polyester (Li *et al*., 2015).

MP fibres are released when they are washed and are finally in waste water. According to a report conducted in 2016 by the Bren School of Environmental Science and Management of the University of California, the washing of a fleece jacket for instance releases up to 250,000 MP fibres into waste water. Unfortunately, most wastewater treatment plants may not provide filters that separate MPs from sewage.

What does the research say?:

The scientists have created a mannequin (as in retail shops that models clothing) that has been engineered to imitate a human body and a glass and aluminium breathing device to precisely demonstrate how MPs impact the respiratory system of humans. The model had the same body temperatures of 98.6 F as a true human being (they developed a heating system even). The breathing mannequin was then put into three separate apartments in the town of Aarhus, Denmark, to breathe indoor air for 24 h each.

The volume of MPs in the air would vary greatly in the same atmosphere between different areas. A portion of the atmosphere could contain air that contains MPs up to 77 per cent. Although the vast majority of airborne MPs come from clothing-conscious synthetic polymers and imported furniture, PL and most airborne MPs is much less than other airborne contaminants such as skin flakes, leaving them more likely to enter the airways.

An analysis conducted in 2012 by a test team in London, England observed that MP amounts in each air sample (two times a week for a month) from a 9 floor building, and found in some specimens up to 1008 MPs per square metre.

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