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Microplastic Pollution and Human Body: Cause and Effect

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Abstract

All fashion has an environmental collision. The obsessive demand for polyester in fashion markets accelerates its production. The demand for polyester crosses the limit margin throughout the chain of the global fashion market. It has been developed that synthetic polymers in the ocean would be observed as destructive waste. The microfibres from synthetics are complicated because they do not biodegrade. Microfibres pollution is creating a problem for not only our rivers and oceans but also in surface water. Because it mixes with the plankton which is found in large bodies of water, including oceans and surface water systems and also our insignificant level of the food chain, which is then consumed by fishes, making its way up to the food we eat. The study provides a review of the literature that has been conducted, a summary of the sources of microplastic pollution, and provides an evaluation of the methods by which and how microplastics are detected. The study also provides a review of the dwelling of the long-term effect of microplastic in human bodies like malignant and benign changes in tissue level. The result of the review shows the toxic effects of this pollution on the human body.

Keywords: *Cancer; human body; microplastic; malignant; toxic.*

Introduction

The long-chain synthetic polymers-polyester, acrylic, lycra, spandex, nylon, etc. release microfibres into wastewater in every wash cycle. So, all fabrics release microfibres in the wash. Though the microfibre doesn't biodegrade, it is very dangerous for water and the environment. Instead, they add to the ever-rising problem of microplastic pollution in the world's oceans and other bodies of water, even in the atmosphere. Marcus (2014) study provided us the plastic pollution levels between oceans and across four size classes: 0.33–1.00 mm (small microplastics), 1.01–4.75 mm (large microplastics), 4.76–200 mm (mesoplastics), and >200 mm (macroplastics) [1]. Polyester is nonetheless a plastic material synthesized from crude oil and natural gas. And, like other plastics, polyester is a long polymer chain, making it non-biodegradable in any practical human scale of time, especially in the ocean because of the cooler temperatures [2]. In fact, as long ago as 2011, we have learned that microfibres from laundry have been washing up on the world's beaches. According to Mosko (2011), a single polyester item can produce more than 1,900 fibers in one washing. Every article tested produced more than 100 microfibres per liter of wastewater [3]. The researchers also provided strong indications linking polyester from laundering to ocean pollution. They found that every one of 18 shorelines sampled across the globe was polluted with microplastic fibers, principally of polyester. The more densely populated beach areas or where sewage is discharged were the most infected. Microplastic pollution is a problem in our oceans because it mixes with plankton, which is then consumed by fish, making its way up the tour food web. Plastics are synthetic polymers that also contain other chemicals to improve their performance [4]; the durability of plastic makes it highly resistant to degradation, and therefore, disposing of plastic waste is a big challenge [5]. Plastics are entered into the water environment due to their disorganized disposal and harmfully affect the oceanic and surface water. During the last few decades, this is an issue of major concern as the marine ecosystem has maximum contribution towards global primary productivity [6]. One enters the environment, these plastic materials are degraded by various means and lost their structural rigidity [7]. The extensive degradation of plastics finally results in powdery fragments and microscopic-sized plastics, called microplastic [8]. These are microparticles having proportions ranging between few micrometers to 500 μm (0.5 mm). Nowadays, pharmaceuticals and cosmetic manufacturers are using microplastic in various daily used products and polluting the environment via wastewater, ultimately transferred along the food chain and impacting oceanic ecosystem after reaching into the sea and human food affect the human body.

Objectives

Here, the review of the literature has been conveyed with the following objectives: (1) to develop the synopsis of the sources of microplastic; (2) to confer the routes by which microplastic enter the environment; (3) to evaluate the methods by which microplastic are detected in the environment; and (4) to discuss the environmental impact of microplastic as well as human health.

Microplastics

According to another study, Microplastics found both on land and in the sea, the problem of plastic debris has been the focus of environmental issue during the last few years, but recently plastic particles termed as microplastic have been materialized as harmful contaminant due to their impact on marine animals and human health [9]. Pursuant to Browne et al. (2015), microplastics are semi-synthetic plastic polymers particles with a size lower than 5 mm [10]. In accordance with Carpenter and Smith (1972), the first evidence of microplastic fragments in the environment was reported in the 1970s, and both primary and secondary microplastics were found in the environment [11]

Convey of Microplastic to The Food Chain

In conformity with Mato et al. (2001) and Thompson et al. (2007), microplastic is composed of toxic additives and monomers which have a reasonably large area to volume ratio and thus are effective in absorbing hydrophobic pollutants from the water bodies [12, 13]. Microplastic is ingested by an array of marine biota because of their micro size as well as their presence in both pelagic and benthic ecosystems [14, 15]. The high concentration of microplastic by corals, mesenterial tissue within the coral gut cavity were found to be the most affected area, which ultimately damages the coral's health [16]. The photosynthetic phytoplankton fixes carbon from CO_2 and energy from sunlight. Microplastics penetrate cell walls and membranes of planktons and reduce chlorophyll concentrations in the green algae [17]. The heterotrophic plankton ciliates up take microplastic through phagocytosis [18]. The zooplankton consists of a group of free-floating heterotrophic invertebrates and has a significant role in marine ecosystems because this group of marine organisms serves as key members of the marine food chain [19]. Not only marine aquatic life consume microplastic and microbeads and appealing their toxins, but also a wide range of surface water and animals getting affected as well as affect human health.

Microplastic We Eat and Drink

Microplastic pollution is everywhere and has a negative impact on all levels. Since microplastics are present in ocean water and they filtered tap water. Humans also consume microplastic contaminated fish and marine foods and from surface water. According to recent research, the problem may be even bigger than ingesting plastics for animals and humans: the microplastic act as carriers by absorbing and concentrating chemicals present in the environment that is Persistent, Bioaccumulative Toxic, known as PBT compounds (These PBT chemicals are of particular concern not only because they are toxic but also because they remain in the environment for long periods of time, are not readily destroyed, and build up or accumulate in body tissue) [20]. This means, on top of the damage caused by the microplastic particles themselves, harmful chemicals can be carried and released into the body of animals and people. Scientists also detected microplastic particulates in seafood sold for human consumption, such as mussels, oysters, and sea salt. Microplastic pollution may prove to be even more dangerous in the long term than plastic pollution because it is invisible, and we have yet a lot to study about its long-term impact.

Environmental Effects

When plastics or synthetic textiles get littered, they start to break down into smaller pieces. These broken-down plastic particles get swept by rain into lakes, rivers, sewers, etc. Eventually, it can get into the ocean. Microplastics have also been found in the air we breathe. The main sources of polymeric microplastic and nano plastic in marine habitat are synthetic clothes, cosmetic products, kinds of toothpaste, hand cleansers, and a variety of cleaning products, which enter the water channels via household and industrial drainage systems as domestic and industrial effluents [21-23]. In accordance with Derraik (2002) the domestic, industrial, and coastal activities are the prime routes for the entry of plastic litter into the marine habitat. Land-based sources of microplastics and microbeads, which are tiny plastic particles of size < 2 mm waste contribute approximately 80% of the total plastic litter in the marine ecosystem [24]. Marine and surface environments are mostly contaminated by spilling of tiny plastic pellets, and resin powders from the air-blasting process, coastal tourism, commercial fishing, etc. activities and plastics generated from these origins enter into the water bodies via wastewater, rivers, or by wind currents [25].

Effects on Human Body

Food, cosmetics, and clothing are the main sources of microplastic that can lead to human exposure. Some sea fish contains polychlorinated biphenyls. Fish contains mercury and microplastics, which are dangerous for human health (**Fig. 1).**

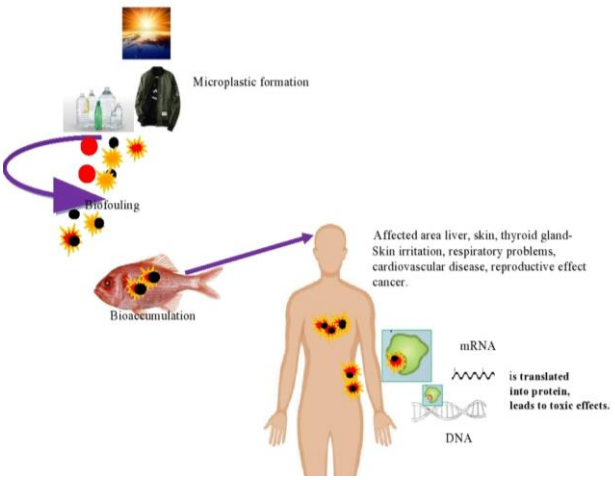

Fig. 1. Microplastic effects on the human body.

Air-water and soil during manufacture, use, and disposal, burning of the electric transformer, released to environment from waste side is the main source of environmental entry. Its mechanism of action -binds to nucleophilic macromolecules (DNA, RNA) and induces

DNA strands to break and DNA repair. Its target organs are the liver, skin, thyroid gland, and kidney.

Microplastic is a potential carcinogen. It can cause carcinoma of the liver, anemia, acne, severe neurological deficit and motor skill deficiency in baby, lower thyroid hormone level, and decrease resistance to Epstein Barr Virus. The alternate ingestion of microparticles can cause alteration in chromosomes which leads to infertility, obesity, and cancer [26]. In the case of women, estrogenic mimicking chemicals can cause breast cancer. It is evident that humans are exposed to microplastic through their diet, and the high ratio of microplastic pollutants in seafood creates a major risk to food safety [27].

Conclusions

The prospective increase of microplastic in seafood also has consequences for the health of humans. Microplastics have been revealed to be ingested by several viable sea varieties such as crab, lobster, salt, and fish and convey along with the food web. Microplastic can be as small as 1 nanometer. As it is not biodegradable, it gets smaller and smaller. The effect of microplastic on the human body is not clear due to limited research. But this microplastic can cross biological barriers, so it can cause tissue damage. Some of these are considered hormone disruptors. Plastic contamination in the ecosystem is in alarming condition because they are ubiquitous in the natural surroundings, have harmful effects on the human body. Plastic pollution in the environment is in alarming condition because they are everywhere in the atmosphere, has harmful effects on water and surface animals, even in the human body, which is a concern of alarm. There is an urgent need to take rigid actions to address the problem at national and local levels.

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