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Microplastics in salt and drinking water: A threat to living organisms

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ABSTRACT

Microplastics are major unwanted pollutant distributed widely throughout the marine and freshwater are posing a detrimental risk to living things. The microplastics tends to occur in the sea salts. The microplastics from the various sources move to sewage and then it enters in to the lotic environments while it results in the pollution of the lotic systems. This inturn pave the way for the movement of microplastics to the oceans. The study finds that 93% of the bottled water found to have microplastics. The microplastic particles can initiate inflammation and immune response in the body but the long term or overall health impact is currently a mystery in addition chemicals in the environment can adsorb to plastics and may be released after consumption. Suspected carcinogenic chemicals such as PCBs (polychlorinated biphenyls) and PAHs (polycyclic aromatic hydrocarbons) are used during plastic manufacturing and may contribute to hazard risks to the living things present in the environment.

Keywords: Microplastics, Polymers, Salts, Drinking water

INTRODUCTION:

Microplastics are major unwanted pollutant distributed widely throughout the marine and freshwater are posing a detrimental risk to living things. The organisms are getting microplastics either directly through ingestion or indirectly by contaminated food chain and web. Microplastics (MPs) are particles of predominantly synthetic polymeric composition in the micro scale and while a consensus on size range has not been reached, the typical range is between 1 µm and 5 mm. The effects of microplastics that are currently being investigated arise from the plastics' primary components (polymers) or the additives used to enhance their attributes (plasticizers), such as bisphenol A, which has already been proven] to be toxic to humans. microplastics can also act as transporting vectors. Plastic has been shown to adsorb and absorb persistent, bio-accumulative and toxic substances which can later be leeched from it. Finally, microplastics have proven to be a good substrate to be colonized by

microorganisms, effectively transporting them and dispersing them into new environments.

MICROPLASTICS IN SALTS:

The microplastics tends to occur in the sea salts. The microplastics from the various sources move to sewage and then it enters in to the lotic environments while it results in the pollution of the lotic systems. This inturn pave the way for the movement of microplastics to the oceans. Then from the oceans the low density microplastics such as poly ethylene and poly propylene floats in the upper surface of the oceans while the PET settle in the bottom leads to biofouling and eaten by the filter feeders. The microplastics floating in the oceans pave their way to salt pans and remains in the sea salt. The pacific sea salt shows maximum 806 particles/ kg followed by the himalayan rock salt with 367 particles/kg while the silician sea salt contains 220 particles/kg.

The celtic sea salt and atlantic sea salt has the microplastics of about 187 and 180 particles/kg respectively. On comparison with Baja sea salt and Mediterranean sea salt Baja sea salt possess high amount of microplastics of 173 particles/kg while Mediterranean sea salt has 133 particles/kg followed by Utah sea salt with the amount of 113 particles/kg. The North sea salt and Hawaii sea salt contains lower amount of microplastics with the value of 66.6 and 46.71 particles/kg. The WHO daily salt recommendation was about 5,000 mg/day. The daily uptake of the salts leads to increased uptake of the microplastics.

MICROPLASTICS IN DRINKING WATER:

There was a study all over the world on the microplastics and drinking water. The bottled water containing microplastics are as follows (Table 1). The study finds that 93% of the bottled water found to have microplastics.

Table 1. Microplastics in water

Sl. No	Bottled water Brands	Amount of MP (Particles L^{-1})
1.	Aqua	**4,713**
2.	Aquafina	2-1,295
3.	Bisleri	**0-5,230**
4.	Dasani	2-335
5.	Epura	0-2,267
6.	Evian	0-256
7.	Gerolsteiner	**9-5,160**
8.	Minalba	0-863
9.	Nestle (Pure life)	**6- 10,390**
10.	San pellegrino	0-74
11.	Wahaha	1-731

The microplastics tend to occur in tap water. The tap water in Indonesia contains microplastics of 10.8 particles/L followed by United States of America (9.24 particles/L) while England, Cuba and Lebanon has th microplastics content o 7.73, 7.17 and 6.64 particles/L respectively. The Indian tap water shows the range slightly lower than Lebanon with the average of 6.24 particles/L followed by Ecuador, Uganda and Slovakia of the values 4.2, 3.92, 3.83 particles/L respectively. The Switzerland, France and Ireland tap waters found to be contaminated with the microplastics with the value of 2.74, 1.83 and 1.82 particles/L respectively. From all the tap water samples taken for analysis the tap water from Germany was least contaminated with the microplastics of 0.91 particles/L.

IMPACT OF MICROPLASTICS ON HUMAN HEALTH:

Human health affected by microplastics through table salt, drinking water, and inhalation were estimated to be (0–7.3)×104, (0–4.7)×103, and (0–3.0)×107 items per person per year, respectively. The intake of microplastics via inhalation, especially via indoor air, was much higher than those via other exposure routes. Moreover, microplastics in the air impose threats to both respiratory and digestive systems through breathing and ingestion.

According to the World Health Organization, the daily consumption of sodium should be less than 2000 mg of sodium, which is roughly equivalent to 5 g of salt for adults (>16 years old) and adjusted downwards for children according to their energy needs. The European Food Safety Authority] recently agreed that an intake of 2000 mg should be the daily intake limit. Similarly, the U.S. Department of Health & Human Services adopting the 2015–2020 Dietary Guidelines for Americans published by the U.S. Department of Health and Human Services and U.S. Department of Agriculture recommends that adults should consume less than 2300 mg of sodium daily. However, according to WHO, actual consumption is estimated to be twice that level (9–12 g of salt per day). For the purposes of illustration, we have calculated yearly MP intake from salt of different origins using both the WHO daily recommendation of 5 g and an estimate of 10 g for the actual daily consumption.

Based on the 10 g estimate for daily consumption, the largest potential MPs uptake for human adults comes from salt of well origin (507.35 MPs/year), followed by sea, lake and rock (214.26, 137.42 and 67.49 MPs/year, respectively), according to the reported MP contamination. According to the statistical summary based on a 10 g daily salt consumption, human exposures from the consumption of salt intended for human consumption are estimated to be in the range 0–6110 MPs per year. Note that in the statistical summary the well samples have been consolidated with the rock samples.

Health related issues pertaining to microplastics are in limited resource and the plastics are not considered highly toxic materials; Eventhough, the high rate and frequency of exposures has concerned by the scientists. Based on the study of European Food Safety Authority on microplastics in seafood, 90 percent of the non-digestible particles likely pass through the gut. Other materials may deposit in the intestines or spread to the blood, kidneys, liver, pancreas and other vital organs. Some scientific report says that the microplastic particles can initiate inflammation and immune response in the body but the long term or overall health impact is currently a mystery in addition chemicals in the environment can adsorb to plastics and may be released after consumption. Suspected carcinogenic chemicals such as PCBs (polychlorinated biphenyls) and PAHs (polycyclic aromatic hydrocarbons) are used during plastic manufacturing and may contribute to hazard risks to the living things present in the environment

CONCLUSIONS

The potential effects of microplastics on human health, salt are added in a huge array of foodstuffs, raising the nuisance of microplastics being transferred to different foods and acting as transport vehicles for the distribution of microplastics. Almost more

than 90 percent of the non digestible particles likely pass through the gut, intestines or spread to the blood, kidneys, liver, pancreas and other vital organs and it can initiate inflammation and immune response in the body but the long term it affects the living things by producing cancer and various hazardous risks to the living creatures present in the environment.

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