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Tea Microplastics: Behavior, Attributes and Sources

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Introduction

Products and packaging made of plastic are used in a lot of places, including healthcare, agriculture, and everyday life. In 2060, there will be between 155 and 265 million tons of plastic waste worldwide, according to estimates. Plastic waste is not biodegradable, but mechanical wear, heat, and UV oxidation break it down into smaller and smaller particles. Thompson et al. were the first to propose the idea of microplastics, in which plastic particles with a diameter of less than 5 mm were considered to be micro plastics. Microplastics are able to persist in the environment because they are extremely chemically stable and have half-lives of hundreds of years.

Description

There are two types of microplastics: primary and secondary pollutants. The former are plastic fragments and fibers formed by the action of external forces like weathering, light, and physical friction on plastic products and plastic waste, while the latter are plastic fragments and fibers produced for man-made industrial plastic products like cosmetics that enter the environment through sewage discharge and other means. Due to their small size, microplastics are highly migratory, in contrast to typical solid plastic waste. They can be ingested by marine life and enter the human food chain through seafood consumption, posing potential health threats such as cytotoxicity and oxidative stress. They spread globally through the water and atmospheric cycles. The population of China consumes approximately 512–898 microplastics per person per day on average, according to estimates. Inflammation, oxidative stress, cell damage, and other physiological effects are all caused by ingesting microplastics. Importantly, heavy metals, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) adsorb to the surface of microplastics, exposing organisms to carcinogenic and neurotoxic pollutants.

Bottled water, milk, salt, seaweed, honey, and other foods have recently been found to contain microplastics.

Tea isn't exempt. Tea is generally regarded as safe to consume. It has polyphenols, theanine, caffeine, and other substances; bioactive substances that have anti-aging effects (through antioxidants), lower heart disease risk, increase mental acuity, and treat other diseases and their effects. In line with consumers' pursuit of health and high quality of life, tea drinking is widely regarded as a healthy lifestyle habit. China consumed 2301.900 tons of tea in 2021 and produced 3063.200 tons of tea. However, tea plants can contain a variety of pollutants, including microplastics, due to exposure to plastic during processing and storage as well as the soil in which they are grown. Hernandez discovered that plastic tea bags released microplastics during brewing, with as many as 11.6 billion microplastics released from each bag. Qinglan Li and colleagues in the same year discovered a contamination of tea garden soil with up to 740 microplastics per kilogram of soil. The majority of the white, blue, and red fibers and fragments that were detected were between 20 and 250 micrometers in size. Yinan Li found that green tea, black tea, dark tea, and white tea contained a lot of fibrous microplastics. They can weigh up to 5000 pieces per 20 grams [1-5].

Microplastics are currently categorized as emerging pollutants because it is difficult to determine the progressive effects of their presence. The adsorption of microplastics by tea leaves raises a significant environmental issue for the tea industry. The field of study is still in its infancy. Only 25 research papers on microplastics were in the Web of Science (WOS) core collection database by January 2023 and their volume of annual publications indicates an increasing trend. These papers deal with topics like environmental engineering, water resources, food science and technology, the study of microplastics in tea beverages, the identification of microplastics from tea, and plastic pollution in commercially available tea bags. They discovered an abundance, shape, and size of microplastics in tea, but the source is not discussed in detail. Although micro plastic stress has been linked to plant growth and development in tobacco and vegetables. Tea microplastics research has been moving forward, but it hasn't been systematically sorted out because of the scattered nature of the research. The distribution, abundance, sources, and morphological characteristics of tea microplastics are all examined in this review of the most recent research on the characteristics of micro plastic pollution in tea. Because there aren't many studies on microplastics in tea gardens or tea leaves, this study combined the findings of previous studies on microplastics in farmland, orchards, and vegetable gardens to conduct a comprehensive comparison in order to fully comprehend the state of micro plastic pollution in tea gardens at the present time. It is anticipated that research on tea microplastics will ultimately provide a scientific foundation for risk estimation, management, and control of tea microplastics.

Conclusion

In conclusion, environmental science research has become increasingly focused on micro plastic pollution and the ecological effects it causes. This study conducts a systematic review of the state of the art regarding the pollution caused by microplastics in the tea industry. It comes to the conclusion that the only area of research that is currently being studied is the detection of microplastics in finished tea products. Tea microplastics are mostly fragments and fibers, and PE and PET are the most common materials. The growth stage and the processing stage are the primary sources of micro plastic pollution in tea fields. During cultivation, organic fertilizers, agricultural plastic film, and plastic packaging of tea garden inputs are the sources of exposure to microplastics. During processing, exposure comes from atmospheric deposition, wear on plastic-containing tools, and plastic containers used to store tea. The data are not comprehensive because the global research on tea micro plastic pollution is still in its early stages. In addition, there is no specific threshold for comparing and measuring the degree of micro plastic pollution in agriculture, food, or tea production. In addition, there is a lack of uniformity and standardization in the research methods used to analyze and identify microplastics in food, which makes it difficult to compare data from different papers.

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Conflict of Interest

None.

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