Emission of primary microplastics in mainland China: Invisible but not Negligible

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Abstract:
Primary microplastics are mostly produced as part of the daily plastic product use. The emission process is often invisible but poses potential ecological hazards. Thus, primary microplastics deserve public attention. Due to China's huge population base and its rapid economic development, primary microplastics emissions are of both regional and global significance. This study is the first to establish the emission inventory of primary microplastics in mainland China. It was estimated that the primary microplastic waste from mainland China amounts to 737.29 Gg, and one-sixth of this amount entered the aquatic environment in 2015. The highest proportion of this waste was attributable to tire dust and synthetic fiber, accounting for 53.91% and 28.77% of the total respectively, in mainland China. The primary microplastics emissions mainly depend on the population, followed by the level of economic development. It was roughly estimated that 538 g of microplastics is produced by each person in China. At the grid scale, the spatial difference in the total primary microplastics emissions in mainland China primarily depends on the population density distribution and transportation network. We studied the entire life cycle of several sources of microplastics, from production to discharge into the aquatic environment. We suggested different control measures under different nodes. Increasing microplastics treatment in sewage
treatment plants should be a short-term viable way to achieve some measure of reduction in their entry to the environment in mainland China. Our research can not only raise public awareness about primary microplastics, but can also guide the development of environmental policies to reduce plastic pollution.

**Keywords:** Primary microplastics; Emission inventory; Mainland China; Sewage treatment plants