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A Systematic Review of Airborne Microplastics and Climate Change: Occurrence, Source, and Transport

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ABSTRACT

Introduction: Microplastics (MPs), which are tiny plastic particles with a size of less than 5 mm, have attracted considerable attention due to their destructive effect on the environment. While their presence in oceans and terrestrial ecosystems is well documented, a lesser-known aspect is their role in the atmosphere. Airborne MPs, originating from car tires, clothing fibers, and industrial processes, are increasingly recognized for their potential impact on climate change. Understanding the characteristics of airborne MPs and their interaction with the atmosphere is critical to understanding their implications for climate change mitigation and adaptation strategies. Therefore, investigating the complex relationship between MPs in the air and climate change is one of the critical issues that should be seriously investigated.

Search Strategy: PubMed, Web of Science, Scopus, and Google Scholar databases were systematically reviewed using the keywords "climate change" and "airborne microplastics."

Results: According to the results, the most common polymers found in MPs in the air are Polyethylene terephthalate, Polyethylene, Polystyrene, Polypropylene, Polyvinyl chloride, and artificial silk. Fibers, fragments, films, and pellets are the dominant forms. Studies have shown that 87.4% of these MPs are fragments, and 59% are fibers. The average deposition flux of MPs in the air is estimated to be 24,758.2525 MPs/m²/day, and their average size is 2,098.95 µm.

Conclusion and Discussion: The relationship between climate change and MPs is complex. Climate change can exacerbate MP pollution by altering the distribution and fate of these environmental particles. Additionally, wind and rain patterns play a crucial role in the transportation and deposition of MPs in various regions. Airborne MPs primarily originate from textile abrasion, aging agricultural films, and plastic waste. They exhibit a positive correlation with air pollutants such as SO_2 and NO_2, suggesting a significant impact of human activities. MPs can absorb and transport harmful contaminants, posing risks to ecosystems and entering the food chain. Addressing the intertwined challenges of climate change and MPs necessitates a comprehensive strategy involving reducing greenhouse gas emissions, transitioning to renewable energy sources, improving waste management, and developing sustainable plastic alternatives.

Keywords: Climate change, Environment, Microplastics