EVALUATING THE ROLE OF GREEN INFRASTRUCTURE IN REDUCING TRANSPORT-RELATED MICROPLASTICS FOR STRENGTHENING URBAN ENVIRONMENTAL HEALTH

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Tire and road wear microplastics (TRWMPs) are among the most significant non-exhaust pollutants emitted by motor vehicles, leading to serious environmental and health problems [1]. Among the many sources of microplastics (MPs), the contribution of traffic-related MPs has become a significant problem due to their widespread dispersion by atmospheric circulation. Each year, approximately 6.1 million tons of TRWMPs are emitted into the environment [2]. Consequently, the inhalation of these particles is a significant exposure route to humans, resulting in some serious health issues. The health risk of atmospheric MPs depends upon their abundance and other physiochemical properties such as size, shape, and chemical composition [3].

The study aimed to assess the potential of green space proximity to high-traffic streets in mitigating the presence of MPs and associated human health risks. In Kaunas City, Lithuania (54°51'00.7"N 24°01'46.5"E), a hedge of Thuja occidentalis (0.6 m in width, 1.5 m in height, and a length of 19 m), situated between street and residential houses, was selected to imitate green space. Airborne MPs samples were collected using passive deposition onto Petri dishes with 8 cm diameter glass fiber filters at varying distances (0, +1, +2 meters) from the street over a 24-hour period. The MP samples were collected every month from June to October 2023. Microscopic techniques were employed to quantify the abundance, morphology, and colour of the MPs particles. The chemical composition of MP particles was measured by the LUMOS II spectroscope.

The results indicate a variation in MPs levels, ranging from 2.8 to 0.25 MP/cm^2, based on the proximity to streets. The predominant forms observed in the samples are fragments and black-coloured particles, constituting 90-100% of the total. Analysis reveals that the MPs particles primarily consist of polypropylene and polyurethane (40.9%), both of which are commonly present in vehicle tires.

[1] Liu, Meixuan et al. Chemical composition and potential health risks of tire and road wear microplastics from light-duty vehicles in an urban tunnel in China. Environmental Pollution 330 (2023) 121835.
[2] Ly, Alfonse, and Zeinab El-Sayegh. Tire wear and pollutants: An overview of research. Archives of Advanced Engineering Science 1.1 (2023): 2-10.
[3] Bakand, Shahnaz, Amanda Hayes, and Finance Dechsakulthorn. Nanoparticles: a review of particle toxicology following inhalation exposure. Inhalation toxicology 24.2 (2012): 125-135.