

Glass microspheres as a new proxy for the fate and transport of road dust in the environment

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Glass microspheres (glass microspherules/microbeads) are retroreflective man-made materials used as additives to all road markings. They occur typically in the form of individual solid spherules, occasionally ellipsoids, or sporadically composite aggregates averaging 0.15 to 0.8 mm in diameter. Glass microspheres are predominantly translucent and colorless; scarce are colorful microbeads. They also reveal high physical, chemical and heat resistance and thermal stability. These tiny objects show the glassy and smooth surface, homogenous microtextures and a lack of mineral and non-mineral inclusions (Migaszewski et al., 2021).

The study of glass microsphere occurrences in road dust, roadside soils and river/lake sediments has been conducted in the city of Kielce and the neighboring area (south-central Poland). The results have indicated that glass microspheres are common in the built-up area with dense road network. Microbeads also occur in river sediments, but especially near city stormwater discharges, from which they can be carried away at a distance of 25 km from the endmost drains. Roadside soils also show the presence of microspheres at least up to 60 m of roadway shoulders (Migaszewski et al., 2022), whereas lake sediments ~600–700 m off the highway. This suggests that fluvial transport is more effective than wind transport.

Electron-probe microanalysis has revealed that mean contents of As (0.003 wt%), Pb (0.014 wt%) and Sb (0.010 wt%) do not exceed EU current/expected regulatory levels (0.02%/0.015% for each element). Nonetheless, some individual silica-rich microbeads show variations in As, Pb and Sb concentrations reaching 0.129, 0.109 and 0.066 wt%, respectively. Although glass microspheres do not jeopardize biota and man, they can be a good marker of road dust extent.

Reference:

1. Migaszewski Z.M., Gałuszka A., Dołęgowska S., Michalik A. 2022. Abundance and fate of glass microspheres in river sediments and roadside soils: Lessons from the Świętokrzyskie region case study (south-central Poland). *Sci. Total Environ.* 821, 153410.
2. Migaszewski Z.M., Gałuszka A., Dołęgowska S., Michalik A. 2021. Glass microspheres in road dust of the city of Kielce (south-central Poland) as markers of traffic-related pollution. *Hazard. Mater.* 413, 125355.

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