Fragrances as new contaminants in polar environments: local and long-range sources

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Fragrance Materials (FMs) are ubiquitous components of household and Personal Care Products (PCPs), whose environmental fate is still largely unknown. Even less information is available about the environmental distribution of PCPs in polar regions: beyond local human contamination, these fragile ecosystems are also threatened by long-range atmospheric transport (LRAT) of contaminants.

We chose 17 among the longest-lasting and most stable fragrance ingredients that are commercially available (Givaudan®: Amberketal, Ambrofix, Amyl Salicylate, Benzyl Salicylate, Bourgeonal, Dupical, Hexyl Salicylate, Isobutavan, Lemonile, Mefranal, Myraldene, Okoumal, Oranger Crystals, Pelargene, Peonile, Tridecene-2-Nitrile, Ultravanil) to assess their persistence, distribution and transport in the ecosystem.

The selected fragrances were initially found as contaminants in the Venice Lagoon: urban sewages largely emit these FMs into the surface seawater, reaching total concentrations higher than 10 µg/L in the innermost urban canals (Vecchiato et al., 2016). This pilot study reported the first detection in environmental samples for most of the selected FMs. These compounds were later detected in open sea areas of the Mediterranean, highlighting the role of mesoscale hydrodynamics and LRAT as key factors (Vecchiato et al., 2018a).

The distribution of these FMs in polar environments was studied in the coastal seawater of the Ross Sea, Antarctica (Vecchiato et al., 2017) and in seawater and snow samples from the Svalbard Islands (Vecchiato et al., 2018b). Local emission of FMs from both the Arctic and Antarctic research bases was revealed, together with evidences of LRAT of these substances. In particular, the snow deposition is likely to play a major role, constituting a possible secondary source of contamination during the seasonal snowmelt.

In each of the investigated environments the allergenic and oestrogenic Salicylate compounds resulted in general the most abundant and widespread components, probably due to their large global consumption. These findings support the hypothesis of the environmental persistence of the selected FMs, highlighting future research priorities.