Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30893

A New Sampling Technique to Monitor VOCs and SVOCs in the Marine Surface Microlayer

AVIYA ZINER, IRINA KUZMENKOV AND YAEL DUBOWSKI

Israel Institute of Technology (Technion)

The marine surface microlayer (SML) is distinct from subsurface water by physical, chemical and biological properties. Due to its location at the air-water interface, the SML significantly affects mass transfer between the ocean and overlying atmosphere. Given that most of the globe's surface is covered by oceans, any alteration in these fluxes can have substantial impacts. Marine emissions of volatile and semi-volatile organic compounds (VOCs/SVOCs) are of special interest due to their potential role in formation of secondary organic aerosols and resulting impact on the Earth’s radiation balance. The chemical composition of SML reflects both biotic and abiotic processes within surface water, as well as interactions with atmospheric oxidants and solar radiation. Hence, climatic changes are likely to affect photo-oxidation processes and the fate of organic compounds in the marine SML. However, despite the importance of SML chemistry, our current knowledge regarding chemical processes within it and the resulting VOCs/SVOCs fluxes is lacking.

SML sampling is technically challenging, especially in high seas and when using large research vessels. These limitations may introduce biases in the available database and resulting scientific conclusions. Here we present a new approach to study SML chemical composition, using water sub-sampling combined with application of membrane filter followed by SPME-GC-MS analysis. Compared to traditional methods, the new approach allows for a more efficient and easier analysis of VOCs/SVOCs profile of the SML, as well as the ability to sample in a variety of sea conditions. Applying this new methodology in multiple field measurements along the Israeli coast, including the Haifa Bay where a busy port is located, revealed clear spatial and temporal variations in the chemical composition of the SML, both on diurnal and seasonal scales. The obtained data indicates that SML composition is affected by both biological and anthropogenic sources. Furthermore, complimentary atmospheric VOCs measurements in the marine boundary layer suggests that its is affected by the chemical composition of the SML.