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Study on detection of terrestrial and marine fractions in marine organic molecules by spectrophoto- and spectrofluorometric methods

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The sea surface is a highly productive and active interface between the sea and the atmosphere. Sea surface films are created by organic matter from sea and land sources and they dissipate due to loss of material at the sea surface, including microbial degradation, chemical and photo chemical processes, and loss due to absorption and adsorption onto particulates. However the surface microlayer is almost ubiquitous and cover most of the surface of the ocean, even under conditions of high turbulence. Surface active molecules (surfactants) present in the surface microlayer (SML) may modify the number of physical processes taking place there: among others they affect the depth of penetration of solar radiation and gas exchange. Therefore, research on the influence of surfactants on the sea surface properties become an important task, especially in coastal waters and in vicinity of the river mouths.
Surfactants comprises a mixture of organic molecules rich in lipids, polymeric and humus whose proportions determine the various properties of the SML. A unique structure of the energy levels of the organic molecules results in a unique spectral distribution of the light intensity absorbed and emitted by the molecules. Hence, the absorption and fluorescence spectra of organic compounds may allow the identification of the sources of organic matter. Additionally, several absorption (E2:E3, S, SR) and fluorescence (fluorescence intensities at peaks: A, C, M, T, the ratio (M+T)/(A+C), HIX) indices help in describing the changes in molecular size and weight as well as composition of organic matter during the humification processes and caused by photobleaching and biodegradation.
Investigations included the region of Gulf of Gdańsk, along a transect from the Vistula River outlet to open sea. The fluorescence and absorption measurements of the samples collected from a surface films and a subsurface layer (SS, a depth of 1 m) during three research cruises in Gulf of Gdańsk, the Baltic Sea, as well as hydrophysical studies and meteorological observations allowed to assess (i) the contribution of two terrestrial components (A and C) decreased with increasing salinity ($\sim$1.64% and $\sim$1.89 % in SML and 0.78 and 0.71 % in SS, respectively), while the contribution of, in-situ, in the sea produced components (M and T) increased with salinity ($\sim$0.52% and $\sim$2.83% in SML and $\sim$0.98% and $\sim$1.87 % in SS, respectively), (ii) the biggest relative changes of the FDOM component composition, along the transect from the Vistula River outlet to Gdańsk Deep, were recorded for component T, both in SML and SS (about 18.5 % and $\sim$12.3 %, respectively), (iii) the ratio E2:E3 points to discrete changes in molecular weight/size, effected by photobleaching, while (iv) HIX index reflects the humification/condensation processes more sensitively and effectively in SS. The organic molecules included in the SML can specifically modify the physical processes associated with the sea surface microlayers. It should be necessary to continue a study on the physical properties of surface microlayer in the future, especially in less urbanized and more natural and pristine region, like Arctic.