

Anionic surfactant linear alkylbenzene sulphonates (LAS) in sediments from the southern Baltic Sea and its environmental implications

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Introduction: Linear Alkylbenzene Sulphonates (LAS) are the most commonly employed surfactants in the formulation of laundry and dish washing agents, with an annual global production rate of 4 million metric Tons.

Due to its molecular characteristics, LAS tends to be sorbed onto suspended particles and bottom sediments once discharged into receiving waters. Even if in waste water treatment plants (WWTP) LAS is removed in up to 99%, due to its high consumption volumes and the absence of adequate sewage treatment in many cases, important amounts of this compound may reach rivers and coastal waters, and finally the sediment. The Baltic Sea, due to its natural features – a long water residence time of around 30 years, a large catchment area with a population of nearly 85 million people (of which about half lives in Poland) and brackish-water environment is particularly sensitive to contamination and harmful effects caused by hazardous substances like LAS. Studies of LAS concentrations in the Baltic Sea are very scarce and are limited to northern Baltic Sea and Danish shipping ports. This study reports for the first time LAS concentrations, a global indicator of anthropogenic pressure, in this site specific area of the southern Baltic Sea – the Gulf of Gdańsk.

Methods: Surface sediments were taken from 10 sampling stations in the Gulf of Gdańsk (southern Baltic) during r/v “Oceania” cruises in 2003 and 2004. The extraction of LAS from sediment was carried out according to the procedure proposed by Cavalli et al. (2000). After purification, the resulted extracts were subjected to HPLC/UVF analysis as described by León et al. (2000) to determine LAS homologues concentrations. Risk assessment has been carried out, basing on available acute and chronic toxicity data in representative sediment dwelling organisms.

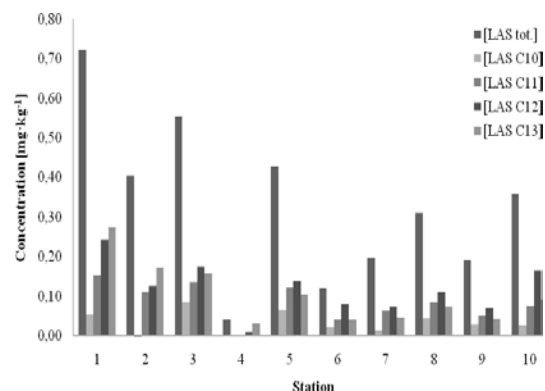


Fig. 1: Total LAS and individual homologue (C10-C13) distribution in the sediments from the 10 sampling stations

Results: Obtained total LAS and individual homologue concentrations were comprised between 0,04 and 0,72 mg·kg⁻¹. dry weight. Highest LAS concentrations were found in suspended matter collected from the Vistula River (largest polish river), sediment collected close to the Vistula river mouth and from the Gdańsk Deep known as the depositional area.

Discussion: Based on the LAS concentration values obtained for the sediment samples of the Gulf of Gdańsk, the Vistula river was identified as the main source of pollution by LAS in this area. The relatively high population of cities located on the coast including the large TriCity agglomeration does not seem to be an important source of pollution by this contaminant. Like in the case of other organic contaminants, LAS is transported to and deposited in net sedimentation area - the Gdańsk Deep, characterized by anoxia below the halocline and muddy, rich in organic matter sediments. Risk evaluation, applying worst-case scenario assessment, imply a relatively low risk of LAS for the existing sediment dwelling organisms in the study area.

References: [1] Cavalli et al. (2000) Proceedings 5th World Surfactant Congress, 1457–1467 ; [2] León et al. (2000) J. Chrom. A. 889, 211-219.