MARINE RISK ASSESMENT: LINEAR ALKYLBENZENESULPONATES (LAS) IN BLACK SEA, BOSPHORUS AND MARMARA SEA

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Abstract
The concentrations of the LAS in the Turkish marine environment were determined. The results showed that the LAS concentrations in the Black Sea, Bosphorus and Marmara Sea waters within the range of 4.14 to 107.37, 3.32 to 204.86 and 8.07 to 243.99 μg l^{-1}, respectively. The mean LC_{50} values were calculated to be 9.25, 3.75 and 9.75 mg l^{-1} the crustacea, mussel and fish species after 48 h, respectively.
Keywords : Detergent, Ecotoxicology, Black Sea, Bosphorus, Sea Of Marmara.

LAS is not a homogeneus compound. It is composed of a linear alkyl chain consisting of 8-16 atoms, a benzene ring and sulponate group. Nowadays, the wastewater treatment facilities are limited in Turkey and detergents are often discharged directly to the marine environment . For this reason, one of the biggest culprint in marine pollution is detergent phosphate. In a previous study, the phosphate concentration of the tested stations originates mainly from laundry detergents [1]. At the same time, it is well known that detergents can adversely affect marine organisms. Some studies have been investigated on the ecotoxicology of LAS [2-4].
The aims of the present study were: (a) to determine the concentration of LAS detergents in different stations in Bosphorus, Black Sea and Marmara Sea of the Turkish marine environment in 2004 and 2005 (b) to examine the acute toxicity of some commercial detergent powders in different marine organisms under laboratory conditions.
The seawater samples were collected from surface and bottom of the 18 stations from Turkish marine environment in 2004 and 2005 (Fig. 1). LAS concentrations were determined use of MBAS method. The standard curves of LAS was plotted in a concentration of 0.2-2 μg ml^{-1}.

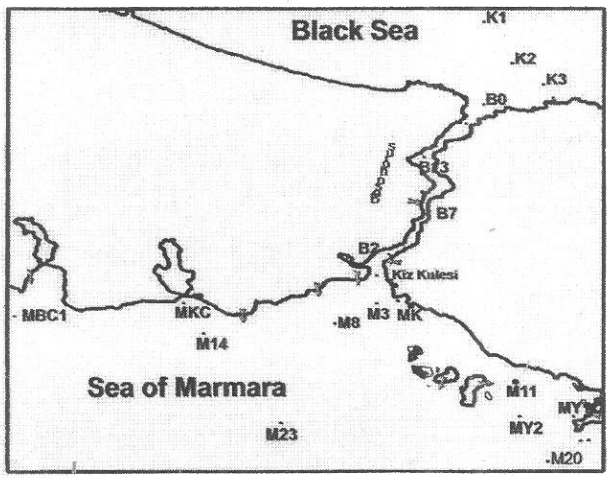

Fig. 1. Sampling sites

A mixture of four commercial detergents has been used as surfactant. These commercial LAS detergents, according to the Turkish regulation have the following percentage composition: LAS 25; sodium tripolyphosphate 23; sodium carbonate 25; sodium bicarbonate 13; sodium sulphate 8; sodiun perborate 5; carboxymethyl cellulose 1; fluorescent whitening agents 0.1 and perfume 0.1. Stock solution was prepared by dissolving 1 g of the surfactant mixture in a 1 liter of bidistilled water. The toxicology experiments were carried out use of a crustacea (*Crangon crangon*), mussel (*Mytilus galloprovincialis*) and fish (*Proterorhinus marmorathus*) species in a temperature controlled room (13$\pm$2). LAS concentration was kept at constant level in the experiment due to biodegradation. For this, the water of the test basin was changed each day. Lethal concentration values (LC_{50}) for each definite time were calculated use of dosage-mortality curve method. Each experiment repeated twice.
The concentrations of detergent (LAS) found in the Turkish marine environment during the two sampling periods ranged between 4.14 and 243.99 in surface and 4.05 and 149.68 μg l^{-1} in bottom samples. The detergent concentrations not changed during the sampling periods. The high degree of detergent pollution determined in Marmara Sea. In general, the data showed that the detergent concentrations in the Black Sea are lower than Bosphorus and Marmara Sea.
Measurements showed that 1 ppm detergent mixture contained 0.139 ppm LAS. The ecotoxicological results is given in Table 1. The results showed that there was no significant differences between the mean LC_{50} values of crustacea and fish species for short time acute tests. On the other hand it appeared that the sensitivity among the tested organisms were significantly different during long time acute chronic tests.

Tab. 1. Mean acute (LC50) values (mg l^{-1}).

Time (hours)	Crustacea	Mussel	Fish
48	9.25	3.75	8.75
96	3.10	2.50	7.10
120	2.00	2.10	5.75
192	0.45	1.15	4.10

The present study has characterized the risk of LAS in the water column of the Turkish marine environment. The minimum LC_{50} values were found to be 3.75 and 0.45 mg l^{-1} for short and long term acute tests. The measured maximum concentration of LAS in this marine environment are 15.4 and 1.8 times lower than that these ecotoxicological values. As a consequence, it is apparent that the risk of LAS in the Turkish marine environment is low.

References

1 - Topcuoglu, S., Güngör, N., Kirbasoglu, Ç. 1999. Physical and chemical parameters of brackish water lagoon, Küçükçekmece Lake, in northwestern Turkey. *Toxicol. Environ. Chem.*, 69, pp. 101-108.
2 - Koç, H., Güven,K.C. 2002.Toxicity and identification of LAS in tissue of rainbow trout (Oncorhynchus mykiss). *Turkish J.Mar.Sci.*, 3, 197-208.
3 - Topcuoglu, S., Ünlü,M.Y., Bulut, A.M. Sadikoglu, N. 1992. Pollution of anionic detergents in Küçükçekmece Lagoon and its toxicity. Turkish VIIth National Symposium on Chemistry and Chemical Engineering, 7-11 September 1992, Istanbul: pp. 183-187 (in Turkish).
4 - Ünlü, M.Y.,Topcuoglu, S. 1977. Determination of LC and estimation on safe level of LAS detergent s for larvae of two fish species in Küçük Çekmece Lagoon. ÇNAEM., Report No:171.