

LEVELS OF ANIONIC SURFACTANTS IN COASTAL WATERS OF THE EASTERN ADRIATIC

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Abstract

The concentrations of anionic surfactants were determined in the vicinity of urban centers along the Croatian coast, areas which may be affected by untreated municipal and industrial waste waters. The concentrations obtained, determined as methylene blue active substance (MBAS index), were mostly lower than 10 mg/L. Significantly higher concentrations of anionic surfactants (195-620 mg/L MBAS) which could represent a risk for marine organisms have been found in the proximity of untreated waste water outlets.

Keywords: anionic surfactants, MBAS index, Adriatic Sea

Introduction

Anionic surfactants, the main constituents of modern laundry and industrial detergents, have been widely used throughout the world since early 1960s. World consumption of these synthetic surfactants significantly increases every year [1]. The most important sources of anionic detergents in the marine environment are land-based sources. The detergents are introduced into the sea directly from outfalls or through coastal dispersion, and indirectly through rivers, canals or other watercourses. Coastal water and estuaries are acknowledged not only as the most productive but also very sensitive areas of biological activity which could be seriously endangered if the self-depuration capacity of the environment is not high enough to remove anthropogenic pollutants [2]. Therefore, it is important to monitor the level of these widespread contaminants in seawater especially considering that urban coastal areas in Croatia are direct recipients of untreated municipal and industrial waste waters.

Materials and Methods

Study areas and sampling. The Adriatic Sea represents a region in the Mediterranean with significant gradients of physical, biological and chemical oceanographic parameters [3]. Seawater samples used for anionic surfactants analyses were collected at the stations located at 500-1800 m distance from main urban and industrial centers along the Croatian coast, i.e. from Pula (Northern Adriatic) down to Dubrovnik (Southern Adriatic). Sampling was performed seasonally during a one year period from November 1998 until August 1999. All samples were collected using 5 l Niskin bottles at the depths of 0 m and 5 m.

Analytical method. International Standard Method ISO 7875-1:1996 for determination of anionic surfactants by measurement of the methylene blue index (MBAS) was used. Prior to MBAS determination, the concentration and separation of surfactants by a stripping (solvent sublation) procedure was performed.

Results and Discussion

The presence of anionic surfactants in marine environment indicates mostly contamination with modern household detergents. Owing to the relatively scarce data on the level of anionic surfactants in the Adriatic Sea and the increased concentrations of these pollutants noted in municipal waste water of coastal towns, there was an urgent need to perform systematic monitoring of anionic surfactants levels in all urban coastal areas that may be affected by untreated waste waters.

The concentrations of anionic surfactants in the surface layer (0 m) of coastal seawater in the vicinity of main urban and industrial centers are presented in Table 1. It is evident that surfactant concentrations determined as MBAS index in most cases were below 10 µg/L and on some occasions values were slightly higher (10.4-17.3 µg/L). The concentrations of anionic surfactants at 5 m depth were in general lower or similar as those in the surface layer (0 m). Although these relatively low concentrations of anionic surfactants in seawater do not indicate significant pollution of coastal areas by detergents, it is important to note that chronic and sublethal effects of linear alkylbenzenesulfonates (widely used anionic surfactants) in some marine organisms have been reported even at concentrations as low as 5-10 µg/L [4]. Significantly higher concentration levels were observed in seawater near the points of discharge of untreated waste water. This was especially evident in semi-enclosed Sibenik Harbour (240-620 µg/L MBAS) near the main outlet, and in Kastela Bay (195-250 µg/L MBAS) which receives untreated municipal and industrial waste waters from Split, the largest town in the Middle Adriatic. The concentrations observed in the proximity of untreated waste water outlets represent a risk for marine biota. It was also found that anionic surfactants accumulate in sediments close to waste water outlets, a finding which represent a potential danger to benthic communities [4].

Table 1. Concentrations of anionic surfactants in surface seawater along the Eastern Adriatic coast expressed as the methylene blue substance (MBAS index).

Station	Nov 98	Feb 99	May 99	Aug 99
	µg/L MBAS			
PUE 02	8.5	ND	8.7	9.1
PUE 03	8.4	ND	6.8	8.1
PUE 05	9.0	ND	8.3	11.9
RI 20a	4.7	ND	10.6	8.5
RI 10a	ND	ND	13.8	10.4
RI 007	4.3	ND	5.8	8.1
CR 001	4.7	ND	6.0	12.8
ZD 102	ND	4.9	12.5	8.6
ZD 103	8.9	ND	10.5	9.0
ZD 104	5.9	ND	8.8	7.3
SI 103	15.2	15.8	ND	13.3
SI 201	ND	3.7	ND	9.4
SI 203	7.5	5.8	ND	6.6
SI 204	6.8	4.3	ND	ND
ST 101	8.6	11.2	ND	6.6
ST 102	7.3	10.5	ND	8.4
ST 103	7.0	12.8	ND	ND
ST 201	8.2	7.6	ND	11.0
ST 202	7.0	8.7	ND	12.8
ST 203	6.6	5.1	ND	11.9
ST 204	8.3	6.8	ND	8.5
PL 101	3.7	8.2	6.0	8.1
PL 102	3.8	8.1	11.3	8.4
DU 002	3.6	11.8	17.3	8.5
DU 001	8.5	ND	17.1	8.0

Areas of urban centers: Pula (PUE); Rijeka (RI); Crikvenica (CR); Zadar (ZD); Sibenik (SI); Split (ST); Ploce (PL) and Dubrovnik (DU).
ND - not determined.

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