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Analyse spectrophotométrique des surfactants sur la côte Egéenne

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RESUME

Cette étude porte sur l'action nocive des surfactants sur la côte Egéenne. Les prélèvements trimestriels proviennent de 10 stations.

Les résultats obtenus ont montré que les concentrations varient de 0.20 à 3.30 mg/l en fonction des saisons et des rejets domestiques.

INTRODUCTION

Les recherches précédentes (1, 2) portaient sur les effets nocifs sur l'écosystème marin et les variations des paramètres physico-chimiques et des sels nutritifs.

La pollution par les détergents anioniques était nocive chez certains organismes au niveau des activités biologiques et des transports d'oxygène (3).

MATERIEL ET METHODES

Les prélèvements ont été effectués trimestriellement en surface et à une distance de 5 m de la côte, de mars 1985 à décembre 1985. Le dosage quantitatif a été effectué par la spectrophotométrie et qualitatif par la méthode de la chromatographie TLC et le solvant Chloroforme : Méthanol : Eau pour 8 cm de Silicagel (4, 5). Les teneurs moyennes apparaissent sur la Figure 1.

Selon nos travaux, les teneurs en détergents sont indicatrices pour les déchets domestiques et liées à celles des PO_4-P dans les eaux côtières. A la station 5, choisie dans le golfe intérieur d'Izmir, en saison hivernale, nous avons trouvé 1.35 mg/l pour les détergents contre 4.00 µg.at/l pour les PO_4-P. D'après les analyses qualitatives, les détergents principaux sont le Dodésyl Benzène Sodium Sulfanate et, en plus faible quantité, le Sodium Lauril Ether Sulfate.

Sur les 72 prélèvements effectués autour de l'île Karantina, dans le golfe d'Izmir, il a été trouvé une teneur moyenne en détergents de 2.76 mg/l contre une valeur de 7.10 µg.at/l PO_4-P aux sorties d'émissaires d'eaux domestiques. Au même endroit, à la sortie des rejets de blanchisserie : 4.53 mg/l de détergents et 5.00 µg. at/l PO_4-P.

D'après les statistiques concernant ces résultats, il existe une forte corrélation significative (99 %) entre les détergents et les PO_4-P : de 0.60 à 0.84 (1).

Cependant, ne négligeons pas l'effet sur les larves, à des taux très bas (entre 100 ppb), et sur la fertilité et la reproduction, chez les adultes, dans l'écosystème benthique et pélagique (6).

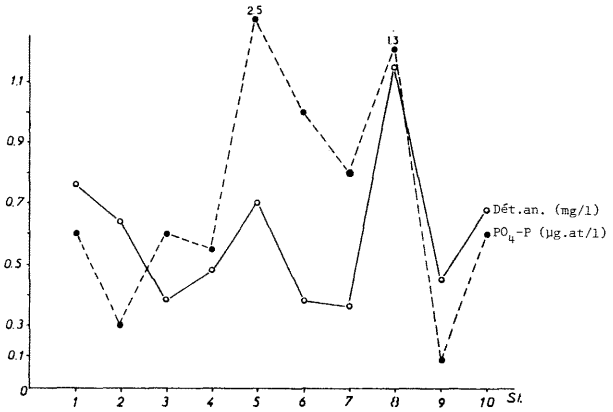

Fig.1.Teneurs moyennes en détergents anioniques et PO_4-P.

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Experimental model for testing the action of LAS on osmoregulation activity of Carcinus mediterraneus

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The first aim of this work is to find an experimental model for keeping crabs in laboratory under polluted conditions for prolonged periods. Crabs, of course, must be fed, and water continuously filtered: but, while filter removes organic matter, it removes the pollutant as well. The pollutant chosen in the present work is LAS (linear-alkilbenzenesulphonate), which is the major anionic surfactant used in laundry products. Once solved the question of obtaining a concentration as constant as possible of LAS in aquaria equipped with powerful filters, it is possible to use the treated crabs for the most varied physiological determinations, e.g. survival, osmolality and protein content of serum, oxygen consumption, transepithelial potential difference, Na-K-ATPase activity and ^{22}Na flux in gills. The analysis by High Performance Liquid Chromatography allowed to know the actual concentration of LAS in sea water of aquaria, while the crabs were living in the water and the filter was working. For the analysis, water was purified through a small scale preparative C18 reversed phase silica column. The column was rinsed with a methanol/water solution followed by elution with pure methanol. The analysis of LAS in the eluate was by HPLC with UV(224 nm) detection of the benzene chromophore group. The various LAS homologs were separated by a water acetonitrile/sodium perchlorate system, and the concentration of LAS quantified by the use of a commercial standard. Three experiments have been performed by using natural sea water at 17‰S, dosed with LAS. The aquaria were equipped with powerful biological filters made up by a layer of shell fragments through which water flowed, by means of an aerator set under the layer.

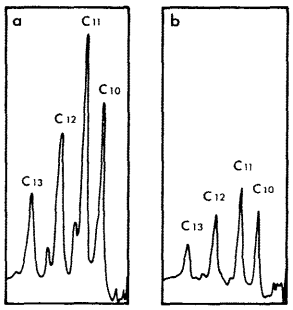

Fig.1. Chromatograms of a nominal 3mg/l LAS sea water solution, taken from 18 l aquaria, equipped with biological filters and each containing 5 crabs. a) first day; b) third day.

(Nominal)	Concentration (mg/l) Actual 1st day	Actual 3rd day
(3.00)	2.29	0.99
(6.00)	n.d.	2.48
(9.00)	n.d.	4.04

Table 1. Values of concentrations of LAS calculated on the basis of chromatograms reported on the left.

Time (days)	Nominal conc. mg/l	% Composition of LAS C_{10}	C_{11}	C_{12}	C_{13}
1st	3.00	28.6	37.2	21.4	12.8
3rd	3.00	28.6	34.9	23.8	12.7
3rd	6.00	29.0	35.4	21.7	14.0
3rd	9.00	31.6	36.3	21.5	10.5
-	pure LAS	20.1	32.0	26.0	21.9

Table 2. Percentage composition of LAS in sea water solution (in the above described conditions), in comparison with the percentage composition of pure LAS, dissolved in distilled water.

Groups of five crabs, randomly chosen from an acclimation aquarium, were transferred into as many as 18 l aquaria. In the first experiment an amount of 6 mg/l LAS was added only at the start; in the second and third experiment, the quantities of 3 mg/l, 6 mg/l and 9 mg/l were initially added; then, every second day, half of the initial quantity was added to the water, on the basis of the results reported in table 1. In such a way the actual concentration of LAS fluctuated, with a period of two days, between the nominal concentration and half of it. In fig. 2 it is reported only the second experiment, because it is the most significant. The other two experiments confirm this trend. The abscissa represents the level of water osmolality, during the experiment (that is 0.5 Osm/kg) and reports LAS concentrations. In the ordinate it is reported the average elevation - on medium osmolality - of serum osmolality (± s.e.), which represents the osmoregulation capability, of the groups of experimental crabs. In all three experiments the elevation of serum osmolality in crabs, kept for one week in LAS treatment, is higher than in controls. This unexpected result could be explained assuming that these organisms react to this pollutant either by activation of Na pump, or by production of low molecular products, such as amino acids, sugars, and organic acids, all contributing to the osmotic pressure. In both cases we plan to make investigations in the next future.

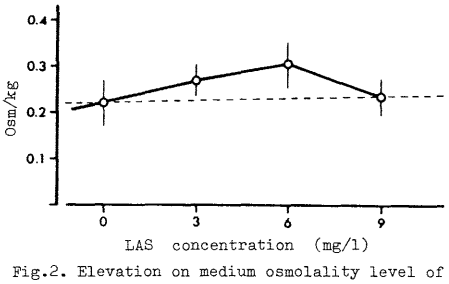

Fig.2. Elevation on medium osmolality level of serum osmolality of groups of five crabs, kept for one week in LAS solution. Bars are s.e.

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