

The western harbour of Alexandria is the main trade harbour of Egypt. It receives about 6 x 10 million cubic meters daily of untreated industrial, agricultural and domestic effluents. The harbour basin is considerably contaminated by various organic and inorganic pollutants. It covers an area of about 31 km<sup>2</sup>, comprises shallow inner and outer basins and has an average depth of 7m.

The aim of this work is to elucidate the pollution level with detergents in the very important Egyptian harbour and their relations with the hydrographical parameters such as salinity and nutrients.

#### Material and Methods

Water samples were collected monthly during the year 1989 from surface, 5m depth and near the bottom at eight localities representing the different regions of the harbour (Fig.1), using a plastic Ruttner sampler. Anionic surfactants were determined according to the Methylene method (APHA),1980).

#### Results and Discussion

The anionic surfactants showed pronounced temporarily variations, mostly coincided with the rate of allochthonous effluents discharge into the harbour. Low values were recorded during autumn months, moderate concentrations were detected in winter and spring while the highest contents were in August (Fig. 2). COSVIC *et al.*, (1979) observed high seasonal increase of detergents during phytoplankton blooms, what is in a good agreement with the present finding. One of the consequences is that the amount of detergents is concentrated mostly in the surface water layer, sometimes doubled the bottom value.

With regard to spatial variations, relative high amounts of detergents, up to 1.21 mg/l were estimated in the inner harbour in the vicinity of the sewers. The sheltered area in the outer harbour, st. 5, comprised the maximum value of 1.47 mg/l, these two high values were measured in the surface samples of August. At the Coal-Quay ; st. 7, the water column, on the other hand, exhibited the lowest amounts of detergents during most of the year where the values reached sometimes (<0.10 mg/l).

Based on regression analysis, a significant inverse correlation coefficient between detergents with salinity ( $r = -0.505$ ,  $p < 0.001$ ) and a positive coefficient with silicate ( $r = 0.452$ ,  $p < 0.001$ ) were calculated whose indicate the allochthonous origin of detergents in the harbour (sewage). This suggestion is much confirmed from the significant positive correlations between the detergents contents and each of ammonia ( $r = 0.250$ ,  $p < 0.001$ ) and oxidizable organic matter ( $r = 0.191$ ,  $p < 0.001$ ).

Statistic correlations were also calculated between detergents and different forms of phosphorus (total dissolved ; TDP, dissolved inorganic ; DIP, dissolved organic ; DOP, particulate ; PP and total phosphorus ; TP are summarized as follows :

$$\begin{array}{cccccccc} & \text{TDP} & > & \text{DIP} & > & \text{DOP} & > & \text{PP} & > & \text{TP} \\ r = & 0.403 & & 0.311 & & 0.252 & & 0.156 & & 0.058 \quad (p < 0.001) \end{array}$$

These coefficients explain the relation between the concentration of methylene blue active substances in the harbour and phosphorus content particularly its dissolved forms.

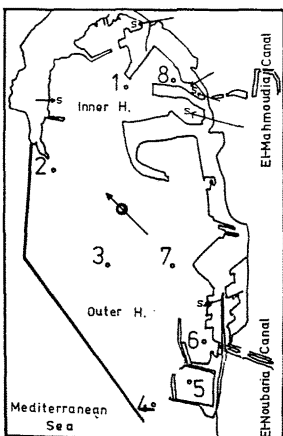


Fig. 1. Alexandria western Harbour ; Sampling Locations & Sewers (s)

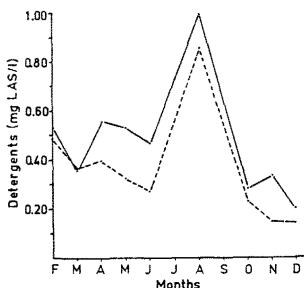


Fig. 2 Monthly averages of detergents in surface . — . and bottom waters . - - - . during the year 1989.

Compared with the mean value of anionic surfactants in El-Agami area (a reference unpolluted open water, ABOUL-KASSIM, 1990) the western harbour exhibits average being 16 folds. According to the finding of MAHMOUD and BELTAGY, 1988, in lake Borollos the present average is nearly doubled or closely similar to that obtained in abu-Qir Bay ( SAID *et al.*, 1991).

On the basis of the frequency distribution of anionic surfactants content, most of the samples (> 60%) exhibited 0.25 - 0.50 mg/l. The values > 1.00 mg/l did not exceed 5% of the samples. This indicates that the western harbour is still far from strong pollution with anionic detergents what is in agreement with the finding of ABOUL-KASSIM, 1990 in Alexandria coastal waters .

#### REFERENCES

- ABOUL-KASSIM T., 1990. - *Rapp. Comm. int. Mer. Médit.*, 32 : 124 .  
 APHA 1980. - American Public Health Association, New-York, 1193 pp.  
 COSVIC B., ZUTIC V., VOJVODIC V. and NOVASKOVIC T., 1979. - *Rapp. Comm. int. Mer. Médit.*, 25/26 , 9 : 55-60.  
 MAHMOUD T.H. & BELTAGY A.I., 1988. - *Rapp. Comm. int. Mer Médit.*, 31, 2: 72.  
 SAID M A. NESSIM R.B. and EL-DEEK M.S., 1991. - Coastal transport of pollutants in Abu-Qir Bay , Alex., Egypt. Final Report submitted to IOC, 102 pp.