L-III3

Impact of sewage pollution on some chemico-physical characteristics of the Eastern Harbour of Alexandria

T.-A. ABOUL-KASSIM and N.-M. DOWIDAR

Department of Oceanography, Faculty of Science, University of Alexandria, Moharam Bey, Alexandria (Egypt)

In recent years, the problem of sewage pollution of Alexandria coastal waters has become a point of national concern. The coastal water of Alexandria receives annually about 183X10⁶ m³ of untreated sewage. About 20% of this amount is discharged to the Eastern Harbour (E.H), rendering it highly fertile. The effect of waste water and sewage discharge on some chemico-physical characteristics of the harbour water were carefully studied and discussed.

The study area is a semi-circular shallow bay, surrounded by Alexandria city, connected to the Mediterranean through two openings. The basin is subjected annually to about 35X10⁶ m³ of unprocessed sewage, rendering its flushing time to be 5 months.

Regular bimonthly sampling during the period 1985-1986 indicated that seasonal variations in water temperatures were directly affected by solar radiation and seasonal changes in air temperature. Thermal stratification was rarely detected. However, in period of calm weather , thermal stratification may occur to a limited extent. The occurrence of a homothermal water column is a general character, particularly in winter. This is mostly related to the effective mixing processes in this basin. The annual average temperature is 22.2°C (Table 1), with an amplitude of 11.9°C.

The transparency of the E.H was relatively high. The annual average being 2.65±0.67m. The remarkably high values at station III (Table 1) is mostly due to its low chl a and total suspended matter (TSM) as well as being relatively subjected to the direct effect of waste water discharged inside the harbour.

The TSM values in the E.H were remarkably high. The annual average amounted to 34.49±21.83 mg/l (Table 1). This high average are normal in such a semi-closed fertile basin, receiving large amounts of raw sewage, demonstrated by the high inverse correlation between TSM and salinity in the harbour (P<0.001).

The average Chl a biomass in the harbour water amounted to 5.14± 4.71 mg/m³. This indicates that the environment of the harbour is highly eutrophic. The high Chl a is undoubtly due to the rich supply of nutrient salts discharged with the untreated wastes and sewage discharge disposed to the harbour as well as other sources, i.e. 402 Tons nitrogen/yr (El-Nady et al, 1990) and 1.094 Tons phosphorus/yr (Dowidar et al., 1990).

The salinity of the E.H is mostly controlled by the amount of sewage water discharged into the basin and the rate of mixing and exchange of the harbour with the adjoining coastal waters of the Mediterranean Sea. During the last 10 years, salinity values of the harbour were decreasing gradually by more than 4% due to nearly doubling the amount of sewage and waste water discharged to the harbour. The distribution of salinity reveals that surplus water from the harbour flows outward as a mixed surface layer through the main openings (stations II and III), while undiluted Mediterranean water flows into the harbour as a subsurface layer near the bottom. The effect of sewage discharged into the Southern region of the harbour was clear as it lowered the values of salinity at stations I (average 36.89‰), V (36.94‰) & to a less extent station VI.

L

The pH of the harbour water always lies on the alkaline side. The absolutes surface values fluctuated between 7.80 & 8.58, while for bottom samples, the minimum and maximum values varied between 7.56 and 8.43, respectively. The higher surface values than those near the bottom was due to the high photosynthetic activity at the surface and relatively high organic load of the bottom water & surface sediments. Variations in total alkalinity are controlled by physical and chemical processes taking place in the water body. The annual average amounted to 2.42±0.14 meq/l. The average specific alkalinity values calculated for the E.H, i.e. 0.117±0.009 (Table 1) was slightly low compared with 0.126 accepted for oceanic water (Koczy, 1956; Morcos, 1970). The relatively high pH and total alkalinity values recorded in warm months are mostly correlated (P<0.001) with the rise in water temperature. The significant correlation, between chl a content and pH may indicate that the pH of the environment could be used as a good indicator for production levels.

Table 1: Annual averages of some chemico-physical parameters in surface and bottom water layers in the Eastern Harbour during 1985-1986.

St. No.	Max. Dep.	Depth of sample	Water Temp. (°C)	Transp. (m)	TSM (mg/l)	Chl a (mg/m³)	S‰	pH	T.Alk meq/l	sp. Alk.
I	S	0.0	22.20	2.43	47.83	13.82	36.89	8.15	2.47	0.121
	B	3.5	22.21		32.50	3.06	38.01	7.98	2.38	0.118
II	S	0.0	21.83	2.71	27.83	4.15	37.25	8.17	2.45	0.119
	B	5.0	22.50		31.20	3.51	37.84	8.22	2.42	0.116
III	S	0.0	22.15	3.79	27.50	4.35	37.48	8.22	2.43	0.117
	M	5.0	21.92		26.67	2.60	37.69	8.12	2.42	0.115
	B	8.5	21.73		24.17	1.66	38.62	8.08	2.35	0.110
IV	S	0.0	22.17	3.13	28.17	5.18	37.07	8.26	2.46	0.120
	M	3.0	21.00		18.00	2.80	38.04	8.11	2.41	0.114
	B	6.0	21.83		22.67	2.97	38.22	8.04	2.40	0.114
V	S	0.0	22.47	1.73	70.17	13.03	36.94	8.19	2.47	0.121
	B	3.5	22.37		27.50	4.07	37.38	8.12	2.40	0.116
VI	S	0.0	22.20	1.93	36.00	6.01	37.04	8.18	2.47	0.121
	B	2.0	22.67		47.67	4.07	37.03	8.19	2.45	0.119
VII	S	0.0	22.30	2.81	31.67	4.16	37.53	8.24	2.44	0.117
	B	5.0	22.10		29.83	2.33	38.40	8.06	2.37	0.117
	S		22.20	2.65	38.45	7.24	37.17	8.20	2.46	0.120
	SD±		4.60	0.67	27.55	5.98	0.91	0.16	0.15	0.009
Average										
	B		22.10		30.52	3.05	37.92	8.08	2.39	0.114
	SD±		4.20		15.87	1.55	0.42	0.07	0.15	0.008

*S=surface, M=middle, B=bottom.

REFERENCES:

Dowidar, N.M., A.R. Abdel-Moati, T.A. Aboul-kassim and F.E. El-Nady (1990). Rapp. Comm. Int. Mer Medit., CIESM (in press).

El-Nady, F.E., T.A. Aboul-Kassim, N.M. Dowidar and A.R. Abdel-Moati (1990). Rapp. Comm. Int. Mer Medit., CIESM (in press).

Koczy, F.F. (1956). Deep-Sea Res., 3(4):279-288.