

ON THE MOBILIZATION OF IRON, MANGANESE AND COPPER IN LAKE MARYUT ECOSYSTEM

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Lake Maryut is a contaminated lagoon of the Nile Delta. It is very shallow having 120 cm water depth and receives $107 - 277 \times 10^6 \text{ m}^3 \text{ y}^{-1}$ waste waters from industrial, domestic, and agricultural sources. Contaminated lake water is continuously pumped into the neighboring Mediterranean environment.

Iron, manganese, and copper were studied in the different phases of the ecosystem in order to understand some of the processes concerning their mobilization. For further explanation, the pH, dissolved oxygen, organic matter, and ammonia concentrations were also studied.

The results showed that the pH of surface and bottom waters is neutral to slightly alkaline (7.2 - 8.4), and that of sediments is slightly acidic to neutral (6.7 - 7).

The dissolved oxygen concentration is low being depleted in bottom water (0.0 - 1.2 mg / l), where, at two localities sulfidic conditions were developed.

The water and pore water are enriched by ammonia (66 - 270 μg at/l) and organic matter. The content of sedimentary organic materials is also considerable (12 - 25 %).

The mean concentration values of Fe, Mn, and Cu in surface water are 89, 1.3 & 2.1 ; in bottom water are 100, 5.7 & 1.5 ; and in pore water are 119, 1.4 & 8.3 μg / l respectively. In sediments the element concentrations become 1.6 % Fe, 0.53 % Mn, and 0.50 % Cu.

Iron and manganese concentrations in surface water show a sudden drop off the dumpsite immediately comparing to their initial contents in the waste waters, where, their values drop from 1500 μg / l Fe and 340 μg / l Mn to 280 μg /l and 1.4 μg /l, respectively. However copper does not show the same behaviour, its concentration is 2.8 μg /l in waste water and 2.3 μg /l in the nearby lake water. This may indicate that the lake climate may drive iron and manganese to the solid phase and copper to the dissolved phase. Such behaviour can be explained by the formation of iron and manganese hydroxides in this pH range and their consequent polymerization and sinking to the bottom (Stumm and Morgan, 1981), while, copper tend to form dissolved complexes with NH_3 or to form dissolved CuCO_3 .

In the bottom layer of water showing partial anoxia the Fe and Mn concentrations increase, while, the Cu concentration decrease. This is explained by mobilization of sedimentary iron and manganese through their transformation to higher valent oxides which can adsorb copper and consequently remove it from the bottom layer (Sigg et al, 1984).

Iron concentration in pore water is similar to that in bottom water. Manganese and copper behave differently. In comparison with their concentrations in bottom water, manganese is lowered and copper increased. This behavior is related to their geochemical properties when manganese tends to coordinate with O groups and copper tends form sulfides (Stumm and Morgan, 1981). Moreover, copper may catalyze manganese mobilization.

In sediments the iron concentration is relatively low and more or less homogeneously distributed. On the other side, manganese and copper concentrations are high being almost doubled at the two reduced localities, indicating their mobilization towards the solid phase. The mechanism suggested by Forstner and Wittmann (1981) that aminoacids having a pH-dependent amphoteric character can adsorb or desorb cations may be responsible for that. Thus, such increased concentrations are subjected to changes

The net results indicate that the basin is considerably contaminated by manganese and copper and may impact the neighboring Mediterranean waters.

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BACTERIAL COMMUNITY STRUCTURE AS A MEASURE OF POLLUTION IN COASTAL WATERS OF ISRAEL

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The present study was designed to investigate effects of industrial and domestic pollution on the biomass, activity and structure of microbial communities in the coastal waters of Israel. Microbial analyses were performed on water samples taken periodically at the following four sites: (1) a domestic sewage outfall near the city of Akko; (2) near the chemical factory Frutarom in Haifa Bay; (3) control station, about six miles offshore from Tel-Shikmona, Haifa; (4) coal unloading dock, Hadera coal operated power station. Biomass of microorganisms was determined by direct count using epifluorescence microscopy, colony forming units on MA and PCA plates and by ATP determination. The average values for direct count were 3.35×10^6 , 1.08×10^6 , 2.8×10^5 and 5.05×10^5 in surface waters of sites 1, 2, 3 and 4, respectively. Average ATP concentrations were: 0.417, 0.458, 0.050 and 0.104 $\mu\text{g l}^{-1}$ at sites 1, 2, 3 and 4, respectively. Heterotrophic activity of microorganisms as determined by the uptake and respiration of ^{14}C -labelled amino acids was also found to be higher by more than 10 times in the two polluted sites compared with the control site. The average uptake rates of amino acids by the bacterial populations at sites 1, 2 and 3 were 2.817, 2.500 and 0.064 $\mu\text{g l}^{-1} \text{ h}^{-1}$, respectively. At the coal power station site, heterotrophic activity was found to be about four times higher than that of the control site in the first phase of operation of the unloading of coal in the sea ($0.265 \mu\text{g l}^{-1} \text{ h}^{-1}$), whereas after about two years of operation the heterotrophic activity increased to a level of an order of magnitude higher than that of the control site ($0.741 \mu\text{g l}^{-1} \text{ h}^{-1}$). At station 5, where domestic sewage was dumped until three weeks prior to sampling, heterotrophic activity was very low, falling within the range measured at the control station. Total coliforms in surface waters at sites 1, 2, 3 and 4 were (per 100 ml) 514, 9, 1.3 and 2.6, respectively. In 14 cruises, 928 strains were isolated for numerical taxonomy analysis. The isolates were characterized by 69 morphological, physiological and biochemical characters. By using TAXAN 6 program, clusters were obtained, and succession of the microbial community at the four different sites was demonstrated. Heterotrophic activity measurements were both sensitive and reliable. Also, the results of such measurements could be obtained within 24 hours after sampling. Results of ATP analyses correlated well with data on heterotrophic activity.