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Carbon Fractionation and Balance in the Coastal Water of Alexandria Region

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Carbon is the most important metabolic element in sea water. IT occurs in water as a result of precipitation containing increased amounts of CO_2 produced through fuel combustion, CO_2 fixation by aquatic plants, from agricultural drainage as organic matter or as major element of waste and sewage discharge. The knowledge of distribution of dissolved organic carbon (DOC) and coexisting particulate organic carbon (POC) is essential for understanding of carbon cycle in sea water. The present work is an attempt to assess the relative importance of land run-off on different carbon species and its contribution to the total carbon budget in a coastal bay off Alexandria falling under sewage stress.

The study area (2.5 Km^2) is a semi-circular shallow bay, surrounded by the city, connected to the Mediterranean through two openings. The basin is subjected annually to about $35X10^6 m^3$ of unprocessed sewage rendering its flushing rate to be 5 months.

Regular bimonthly sampling during 1985-1986 indicate elevated surface levels of POC reaching 6 mg C/l coinciding with maximum discharge periods as indicated by low salinities. Detrital POC constitutes about 28% of POC. Particulate inorganic carbon (PIC) constituted between 45-49% of total particulate carbon with an average of 4.62 mg/l. On the other hand, the DOC values recorded in the coastal water of Alexandria (average 13.95 mg/l) reflect the highly eutrophic characteristics of water. The organic forms of carbon thus could be used as index for organic pollution derived from sewage discharge.

Generally the dissolved organic fraction exceeds the inorganic by three. The average DOC/POC i.e. 2.4:1 is normal compared with other coastal waters.

The discharged sewage not only affect the carbon in water but raised carbon-sediment levels to 9.11% at areas directly affected by discharge.

The outstanding features of the carbon balance (Figure 1) are:

1. About 325 tons of organic carbon reaches the bay annually through land sources; 70% of which are in particulate form.

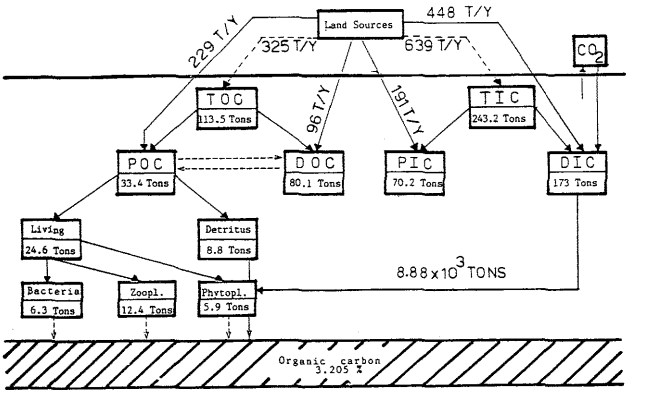

Figure 1. Schematic diagram of carbon input to the Eastern Harbour.

2. The bay receives 639 tons/y of inorganic carbon of which the particulate fraction forms only 30%.
3. About 15% of POC influx existed in the water column as living (74%) while about 37% of PIC influx is retained in suspension.
4. 85% of the inflowing DOC exists in the water column. The equilibrium shift of POC$\rightleftharpoons$DOC towards DOC may substitute the loss in DOC during oxidation processes.
5. About 8.88 X 10^3 tons carbon are fixed annually by phytoplankton. Atmospheric CO_2 input 4.4 X 10^3 tons/y could substitute a significant part of this uptake rate.
6. The short residence time of the bay water (5 months) leads to a mismatch between the inflowing carbon and that actually present in the bay as well as a considerable differences in the proportionality of different carbon species.