MAHASAGAR
Vol.21, No.3 (September) 1988, pp.183-188

SOME WATER QUALITY CHARACTERISTICS OF THE KARNAFULLY RIVER ESTUARY

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ABSTRACT

The effect of domestic and factory wastes on the water was studied in the Karnafully river estuary. Turbidity of water in the disposal area increased with significant depletion in dossolved oxygen (DO) and substantial increase in biological oxygen demand (BOD_5). Zinc was also found in the water at the disposal site. Maximum deterioration of the water quality was observed during Summer and rainy seasons when there was excessive disposal of wastes and outfall of land washings.

Key-words: Domestic waste, Sewage, Pollution Karnafully, estuary

Karnafully is one of the most important rivers of Bangladesh. There are number of large municipal drains and sewerage systems through which untreated domestic and factory wastes are discharged into the estuary. The seriousness of this waste disposal problem has been realized lately but no remarkable steps have yet to be taken to study the effect of pollution except for a few fragmentary works of Bhouyain (1979) and Paul (1981). The present study deals with the changes in physico-chemical properties of water and to identify the extent of pollution of the Karnafully River estuary.

Monthly Sampling was carried out from April, 11982 to March, 1983 at four stations (Fig.1). Station A was located at Sadarghat area, where a municipal drain opens into the estuary; station B at Mazirghat area, where a canal carries different types of solid and liquid wastes into the estuary. At stations C and D, which are situated on the left bank of the river, there was no waste disposal and were taken as reference stations. Water samples were collected from surface (0-20 cm) during low tide at all stations. For dissolved oxygen, water was collected in 300 ml BOD bottles and preserved in situ (APHA-1976). Water samples for BOD test were collected in clean glass bottles of 1-litre capacity and immediately transported to the laboratory, drained into two BOD bottles of 300 ml capacity - one for initial oxygen demand (IDO) and the other for final oxygen demand (FDO). Temperature was recorded on the spot by a bucket thermometer. A Secchi disc of 30 cm diameter was used for measuring turbidity. The dissolved oxygen (DO) and BOD_5 was determined by the Azide modification of idometric method and the total alkalinity by following APHA (1976). Mohr's titration method

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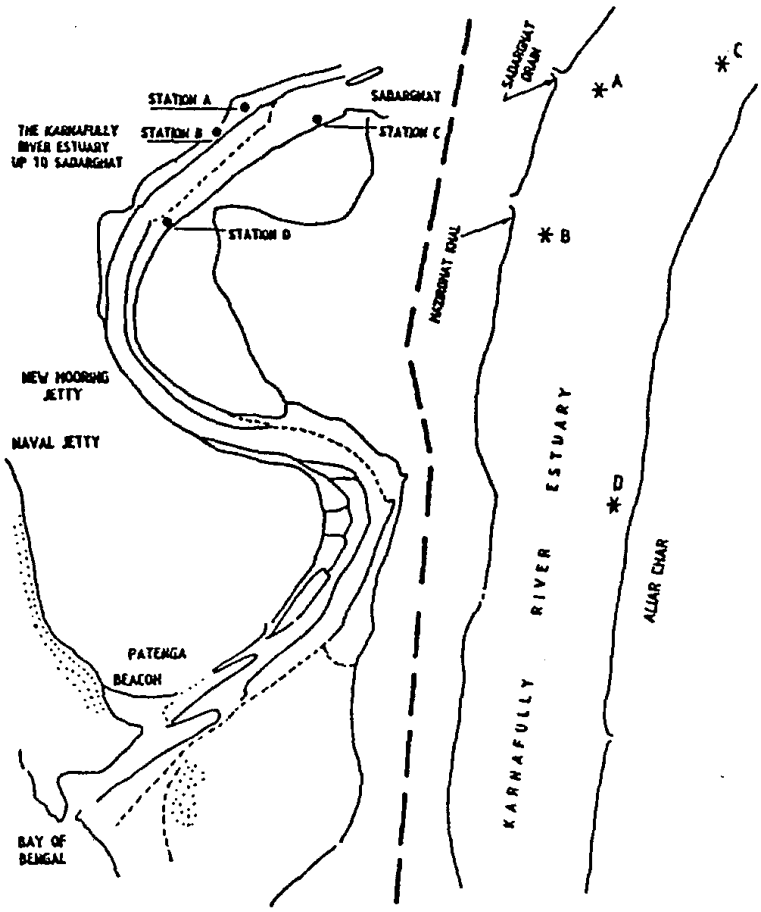

Fig.1. Location map showing sampling stations

was followed for salinity determination (Strickland and Parsons, 1965). Zinc estimation was performed following Zincon method (APHA, 1976). The mean values of different parameters and stations A and B; and C and D have been presented in Figures 2 & 3 respectively.

Water temperature : At stations A and B (Fig.2) temperature varied from 22.85 - 31.25°C. It was observed that with the increase of temperature, dissolved oxygen decreased but the BOD_5 increased.

Total alkalinity : Alkalinity of water ranged from 89 to 195 mg/l at the disposal points where it was 50 to 92 mg/l at the reference stations (Fig.2). Although higher alkalinity was found in the disposal area it was unable to raise the pH to lethal limits. Seth and Bhaskaran (1950) found that alkalinity ranged between 76 to 400 mg/l in the Hoogly River due to disposal of industrial wastes whereas Pahwa and Mehrotra (1966) recorded 76 to 216 mg/l in the river Ganges. Doudoroff and Kartz (1950) stated that none of the strong alkalies were shown to be lethal to fully developed

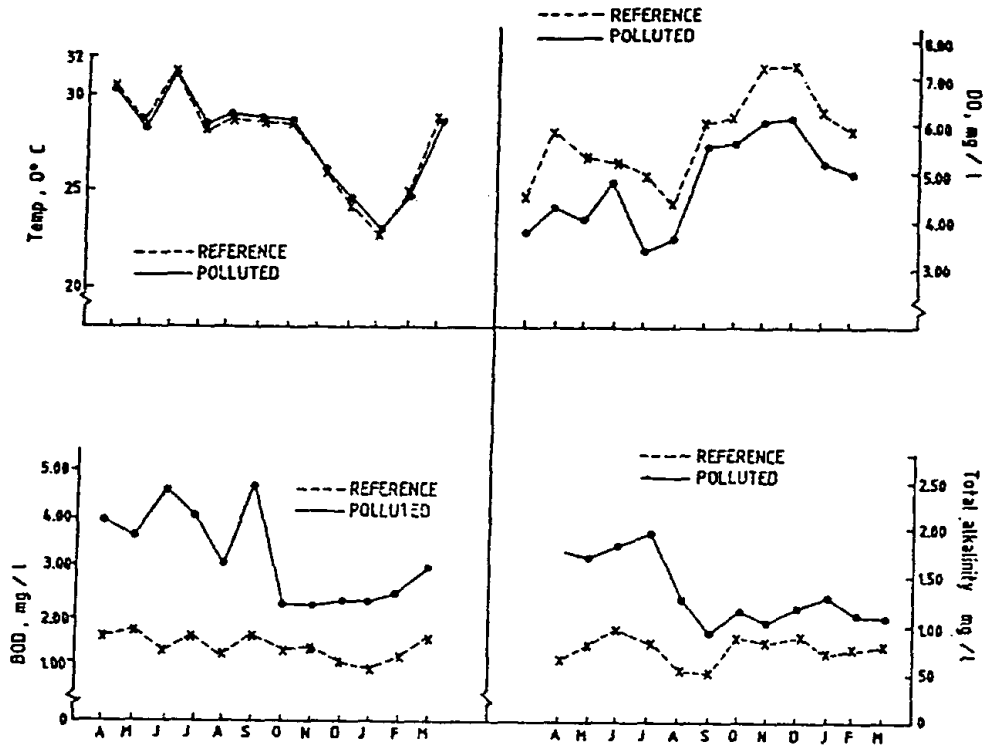

Fig.2. Variation in temperature, DO, BOD and total alkalinity in the Karnafully river estuary

fish and other biota when their concentration was not enough to raise the pH of the water above 9.

Dissolved oxygen: DO varied between 3.33 and 6.20 mg/l in the disposal area whereas in the reference zone it was 4.34 to 7.31 mg/l. DO of the disposal area was always lower than the reference area. This may be due to the large amount of waste discharged by the municipal drains and sewerage system which utilized significant amount of oxygen for bio-chemical degradation.

Biochemical oxygen demand (BOD_5): BOD_5 values ranged between 1.83 and 4.82 mg/l in the wastes disposal and whereas in the reference area it varied between 0.79 and 1.90 mg/l. BOD values were low in winter when oxygen concentration was higher and vice-versa (Fig.2). In the waste disposal area BOD_5 was higher during the summer and rainy seasons. This may be due to the consumption of oxygen for the oxidation of large amounts of wastes discharged from the municipal sewerage and surface runoff due to rainfall. Campbell (1978), in his studies on organically polluted urban stream, showed that BOD values were higher in the spring and summer months due to rainfall which carries a large amount of wastes.

pH value: Maximum pH (7.8) was recorded during the month of January and minimum (6.3) in August at the waste disposal area. At the reference stations, highest pH value (7.3) was observed in the month of January. The

difference of maximum and minimum pH in the disposal area was 1.50 whereas in the reference area it was only 0.5 (Fig.3). Like present investigation, similar occasional low pH was observed due to waste loads and effluents by

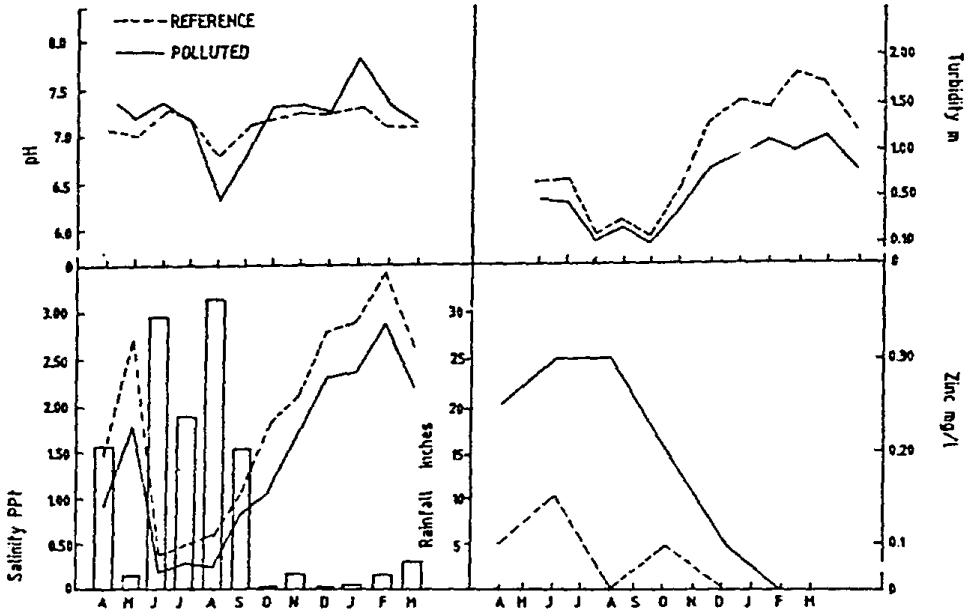

Fig.3. Monthly variations in pH, turbidity, rainfall and zinc concentration in the area of investigation

Verlencar and D'Silva (1977) and Sarma, Raju and Babu (1982) in some Indian esturies. However, pH of the disposal area never attained the lethal value for fish but it may have adverse effects on the microbes and other immature organisms.

Turbidity: The minimum Secchi disc visibility (0.08 m) in the water of waste disposal area was recorded in the month of August and maximum of (1.13 m) in the month of February, while the minimum Secchi depth (0.12 m) was recorded from the reference stations in the month of August and the maximum (1.78 m) in the month of January. Results showed that water in the waste disposal area always remained more turbid than at the reference region (Fig.3). The possible reason may be two large drains and sewerage system with huge quantity of wastes opening into the estuary. Similar observation was also recorded by Bhouyain (1979) in the upper part of the Karnafully River where waste materials from the Karnafully Paper mill and Rayon Complex were discharged regularly. Higher turbidity was recorded in the months of June and August (Fig.3) due to the heavy monsoon rainfall which carried large quantities of waste as well as suspended particles.

Salinity: Different salinity ranges were observed in the four stations during the period of investigation. It ranged between 0.18 to 2.78 ppt at station A and 0.22 to 2.96 ppt at station B; 0.20 to 2.82 ppt at station C

and 0.58 to 4.10 ppt at station D. Variation of salinity was related to seasons. During the winter months, salinity was found to be higher, while during rainy seasons due to large amount of fresh water discharge salinity decreased remarkbly (Fig.3).

Zinc: The maximum concentration of zinc was 0.5 mg/l at station A as compared to 0.2 mg/l at station D. Minimum concentration of Zn at both the waste disposal and reference stations was 0.1 mg/l. Concentration of Zn was found to be always higher at station A due to the discharge from metallurgical workshops and other industries. Walker (1975) stated that toxicity of Zn was extremely variable and concentrations as little as 0.3 ppm are lethal to some snails and fish.

The above observations indicate the deterioration of water quality in the Karnafully River estuary. Karnafully being an estuary with strong tidal currents (Mahmood, Khan and Kabir, 1976), the effect of this pollution is gradually reduced as we move away from the disposal points. Because of the dilution capacity, the pollution, at present, is localized.

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