IMPACT OF EFFLUENT DISCHARGE FROM TUTICORIN THERMAL POWER STATION, TUTICORIN ON THE HYDROLOGICAL CONDITIONS OF TUTICORIN BAY

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ABSTRACT

The fly ash discharge from Tuticorin Thermal Power Station caused various changes in the hydrographic parameters of Tuticorin Bay water. The studies conducted during 1999 indicated that, the fly ash discharge did not conspicuously affected the temperature, salinity and pH of the bay water, as there was no marked variation in these parameters among the five stations studied. While, the low dissolved oxygen content of the bay water coupled with the high turbidity might have attributed the cause for the moderate net productivity of the Bay water.

INTRODUCTION

Tuticorin Bay situated in the Gulf of Mannar, South India, is continuously being threatened by pollutants from the industrial and sewage effluents. Among the industrial pollution sources, Tuticorin Thermal Power Station (TTPS) which was commissioned with three units in 1980, plays a major role. The effluent discharge, mainly the fly ash, from T.T.P.S., has already resulted in filling up of, an extensive portion of the Bay, that has caused irreversible damages to the ecosystem. Presently each of the five units produce about 210 MW of electricity, consumes 2800 tonnes of coal per day. The production of huge quantities of ash as waste contrary to the originally proposed viz. filling up of the first dyke of 200 hectares with in the first 20 years (D.C.V. Easterson (1998) has far exceeded.

In addition to the ash containing slurry, it also discharges heated water effluents, used for cooling the boilers, into the bay. Studies have been carried out on different aspects of thermal pollution and the present one is conducted, for a period of one year, since Feb' 99 to find out the impact of fly ash discharge from TTPS on the hydrological conditions of the bay water.

MATERIALS AND METHODS

To study the extent of ash pollution on the hydrology of Bay water, water samples for parameters like temperature, pH, salinity, turbidity, dissolved oxygen content and primary productivity, were collected from four stations at Karapad Bay and compared them with the one collected from the open sea every month. (Fig. 1)

Station-I located at about 300 m away from the shore, inside the ash laden III dyke. Station-II located opposite to St-1 on the northern side of the III dyke. Station-III is located at the northern tip of the former island, Station IV was the open sea and Station-V located close to CMFRI field laboratory. All the water samples were brought to the laboratory and analysed according to the standard procedure. (Strickland and Parsons, 1968). The light and dark bottle oxygen technique (Gaardner and Gran, 1927) was followed for the estimation of primary production.

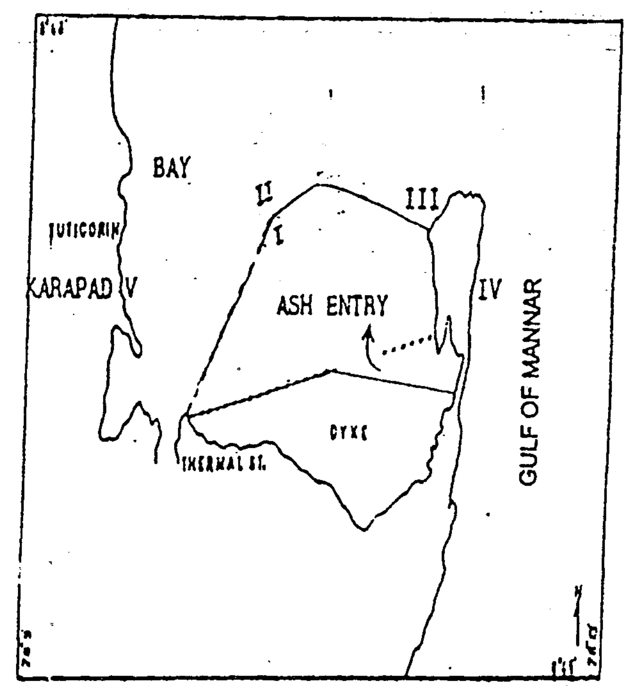

Figure-1 **Sampling Stations**

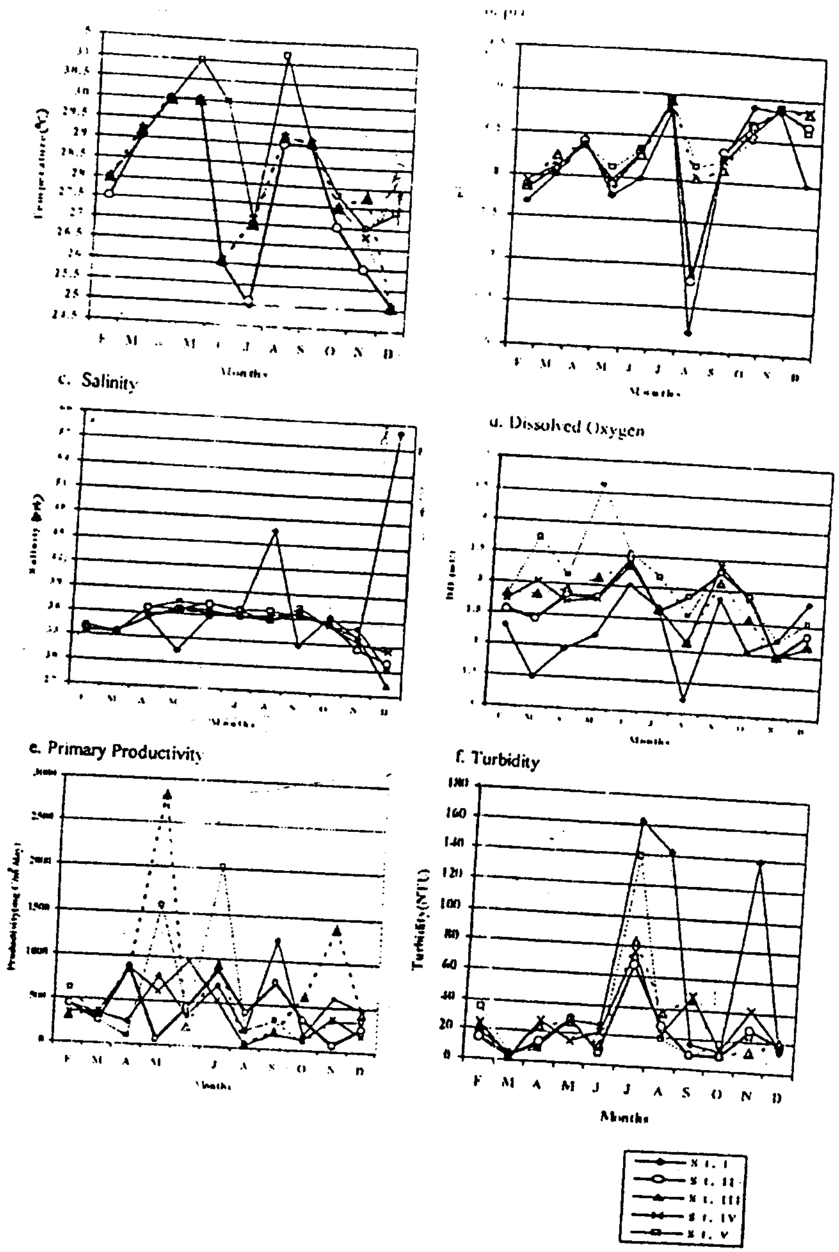

Figure-2 Variations in the Hydrological Properties of the Bay water

RESULTS

Temperature

There was not much variation in the water temperatures among the five stations studied, except in the shallow waters of the V station, where a comparatively higher temperature observed throughout the period (Fig: 2a). There was a bimodal oscillation in the course of the year corresponding to the seasonal difference could also be observed. Temperature was generally high during April, May, August, September and decreased during June and July. Due to the on set of North East Monsoon, coupled with the cool weather, the temperature was again lowered during the rest of the period, i.e. October to December.

pH

As in the case of temperature, the pH also did not show much variation among the stations studied (Fig: 2b). At all the stations, the pH values were comparatively lower, i.e. less alkaline during the month of February and May, and was highly alkaline during July, October, November and December. During August, it became neutral at stations II, IV and a lowest value of 6.22 observed at the I station.

Salinity

Salinity was normal at four stations, during the study period. Associated with the North-East monsoon, it became less saline during November and December. Only in the I station, a wide fluctuation in the salinity was observed. A less saline condition prevailed during May and August with a minimum of 31.4ppt and an extreme high saline condition during November and December with a maximum of 59.1ppt during December (Fig: 2c).

Dissolved Oxygen

There was not much variation among the dissolved oxygen content of II, III and IV stations during the study period and the value ranged between 1.98 to 3.4ml/l. The prominent fluctuations observed were, the highest value in the shallow waters of V station during May, and the lowest value, during August in the I station (Fig: 2d).

Primary productivity

The net productivity was more or less uniform at all the stations during the period. However, a lower productivity noticed at all the stations during August, with a minimum of 32.99mg C/m³/day in the open sea (IV). An extraordinary high value of productivity recorded at the station I (1230.83 mgC/m³/day) during September, at the station III (2813.5 mgC/m³/day) during March and (1382.45 mgC/m³/day) during November and at the station V (2022.21 mgC/m³/day) during July attributed to the possibility of eutrophication (Fig. 2e).

Turbidity

Turbidity varied seasonally at all the stations. Before the onset of South West and the North East monsoon, the water became clearer at all the stations followed with a turbid condition. Water was more turbid at the I station during July, September and November and showed a maximum of 163 NTU during July. Such a peak turbidity was observed in station V during July (Fig.2f).

DISCUSSION AND CONCLUSION

The results of the study indicated that the fly ash discharge did not conspicuously affect the bay water temperature. The sea surface temperature was observed to be mainly influenced by climatic variation (Marichamy, et al., 1992). But, water temperature was mainly affected at the area where the bay was receiving the hot water effluent from TTPS, where it went up to 38.9°C at the discharge point and it equalized the ambient within 2.5km from discharge point (Easterson, et al., 2000). The deposition of ash caused greater damage by entombing the benthic flora and biota and impaired the use the bay as nursery ground.

Presence of ash did not cause much variation in the bay water pH. However, the mild variation in the pH to the slight acidic condition observed at the I station during August, indicated the role ash pollution, even to a minimum level.

Salinity of the bay water was mainly influenced by North East monsoon at all the stations except at the first station during August and December, where an extreme variation indicated. This has to be correlated with the possibility of the impacts ash pollution.

There is a considerable reduction in the dissolved oxygen content of bay water in the I station, when compared to other areas, confirms the impacts of ash pollution as indicated in the earlier works. (Gopinathan et al., 1995)

The turbidity of the bay water is mainly influenced by the ash expelled and the wind force prevailed (Merlin, 1997). The high turbid condition of the water inside the dyke indicated the effect of ash pollution, on the diversity of the phytoplankton community.

The preliminary survey did not indicate a marked variation in the physico-chemical characteristics of the bay water, subjected to the fly ash discharge from Thermal Power Plant. Due to the shallowness and poor water circulation inside the bay, the fly ash dumping activities, resulted in an alarming damage to its sediment biota, the benthic flora and fauna. This has clearly been indicated by the stunted and poor growth of *Avicennia* in and around the bay water due to the blanketing effect of fly ash (Santhanam, et al., 1993) and the considerable reduction in the barnacle nauplii along Tuticorin coast during the last ten years (Santhanam, et al., 1999) The periodic stranding of dolphins observed in the coastal waters (Santhanam, 1995) and the recolonization of *Acropora formosa*, (Santhanam, et al 1996) attributed to the increased turbidity caused by the ash discharge. The over dominance of dinoflagellates and abundance of phytoflagellates, indicators of pollution inside the bay water (Gopinathan, et al., 1995), the decreased biomass of macro benthos nearer to the Thermal Plant (Srinivasan, et al., 1995), absence of biota up to 1.5 km from the hot water discharge and the presence of dead shells in the bottom samples of bay water along its course (Easterson et al., 2000) indicated various damages caused by the effluent discharge from the Thermal Plant.

At present, there is no data available on the magnitude of damages, caused by the fly ash discharge to the bottom communities and the existing biodiversity of the bay water. Hence it is necessary to carry out studies on this aspect and remedial measures are to be urgently initiated.

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