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The Impact of Festival Idols Immersion on the Quality and Characteristics of Coastal Waters of Visakhapatnam, East Coast of India

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Abstract: ***The impact of festival idols immersion was studied on coastal waters during July to November 2012 at three stations along the coast of Visakhapatnam. The pH of the coastal waters remained alkaline with slightly higher values after immersion. The dissolved oxygen was low during immersion period. The biological oxygen demand was increased slightly during immersion period. The nitrite and phosphate were decreased during post-immersion periods. Very high silicate levels occurred after immersion. The productivity was high in post immersion and immersion periods than the pre-immersion period. The above results indicated that this water exceeded the coastal water standards during immersion and post-immersion periods of idols.***

Keywords: Coastal water, immersion, marine ecosystem, nutrients, productivity.

1. Introduction

Two major festivals in India that are involved in idols immersion are Ganesh chaturdi and Dussehra during August and October months of every year. Huge chunks of debris caused by the remains of the idols and worship materials were seen littering the sea shore. The idols were immersed at Ramakrishna beach, Jodugullapalem beach, Rushikonda beach and Pudimadaka beach of Visakhapatnam coast. The size of the idols normally varied from smaller to larger (from one feet to sixty feet). The numbers of idols are in thousands and the number is increasing year after year. Most of the debris comprised of flowers, plastic bags, garlands, sweet offerings, fruits, leaves, wooden materials and color powders. The idols are made up of clay, cement and plaster of paris and painted with toxic dyes containing mercury and lead. All the immersed material float on the surface for sometime finally settles down at the bottom, get dissolved and lead to significant changes in water quality (Dhote *et al.*, 2001) It disturbs the ecological balance by eutrophicating the coastal waters and adversely affecting the flora and fauna present in it, ultimately altering the food chain of the marine ecosystem.

The objective of the study was to evaluate the quality and characteristics of inshore water before, and after immersion of the idols during Ganesh chaturdi in August/ September and Dussehra in October and to find out their effect on primary productivity of Visakhapatnam coast. No such findings were reported earlier from the coast, so this is a new step for further investigation. In future, the ecosystem management surveys should be conducted at various immersion sites of Visakhapatnam for biological variables and sediment samples.

2. Materials and Methods

Three sampling Stations were selected along the coast line of Visakhapatnam, within the city range. The Station I is located at Ramakrishna beach, Station II at Visakhapatnam Urban Development Authority Park beach and Station III at Jodugullapalem beach. The samples for the sea water analysis and macroalgal biomass estimation were collected from July to November 2012 during the low tide periods. The festivals of idols immersion are Vinayaka Chaturdi and Dussehra which are celebrated during August/September and in October of every year. The sea water temperature was measured by using a standard centigrade thermometer. Salinity was measured using a refractometer and pH with a digital pH meter. The dissolved oxygen and biological oxygen demand was estimated by Winkler's method (APHA, 1971). The nutrients were measured by analytical method. The primary productivity was estimated by using a quadrate of 0.5 x 0.5 m size. Thus, the data obtained was calculated and subjected to statistical analysis. The correlation coefficient analysis was performed to find out the relationship between various water quality parameters within the sampling site. The statistical analysis was done by using SPSS software version 16.0.

3. Results and Discussion

The physico - chemical characteristics of sea water of the study sites are depicted in figure 1. The sea water temperature ranged from 28 to 31 ◦C with a maximum in August and October and minimum in November 2012. The salinity ranged from 24 to 32 ppt (parts per thousand) with maximum in August and minimum in November. The pH remained alkaline in all the stations during the sampling period. The pH ranged from 7.9 to 9.2 with a maximum in November and minimum in August. The pH of the coastal water standard is 6.5 to 9.0. The pH of the November samples slightly exceeded the standard values of coastal water. Similar trend in coastal waters after immersion of idols was also reported from Mumbai (Rupinder Kaur, 2012). The fluctuation of hydrogen ion concentration has directly affected the marine biota (WHO, 1989). The dissolved oxygen ranged from 4.0 to 6.4 mg/l with a maximum in July and August and minimum in September and October 2012. The BOD

ranged from 0.4 to 2.08 mg/l with a maximum in Station I in October and minimum in November. The narrow range of variation in BOD values indicate that the water is well mixed in the study area. The nitrite values ranged from 0.22 to 2.2 µmole/l with a maximum in September and minimum in November 2012. The nitrite value of unpolluted coastal water is 0.4348 µmoles/l. The nitrite value of present study in November was far lesser than the standard coastal water. The inorganic phosphate ranged from 0.15 to 3.6 µmole/l. The maximum was found at station I in October 2012 and minimum value in November 2012. The phosphate of unpolluted coastal water is 1.052 µmole/l. Lower levels of nitrite and phosphate in November were also reported earlier by Archana and Ramesh Babu (2013). The silicate content ranged from 1.38 to 59.8 µmole/l with maximum in October and minimum value in July 2012. Higher levels of silicate with 59.8 and 13.06 µmole/l were recorded in stations I and II respectively in October 2012. The silicate level of unpolluted coastal water is 3.27 µmole/l. The higher levels of silicate occurred at Station I may be due to the thousands of idols immersed after the festival. Increased level of BOD at this station also indicates the pollution during the immersion period. The excess rate of solid particles in aquatic environment caused various stresses such as increasing oxygen demand, low nitrification rate and reduces light penetration (Klontz *et al.,* 1985).

The correlation coefficient matrix showed a positive correlation of pH with BOD, silicate with phosphate. A negative correlation was observed between salinity and silicate at $P < 0.05$ level in Station I, whereas in Station II, a negative correlation between pH and temperature, salinity and silicate at $P < 0.05$ level. In Station III, a positive correlation occurred between salinity and DO, BOD and nitrite and negative correlation between salinity, pH and temperature and silicate at $P < 0.05$ level. These results are in agreement with the earlier reports on the coastal waters of Visakhapatnam (Sarojini *et al.*, 2000)

4. The Primary Productivity

The occurrence of total biomass of marine macroalgae was high at Station II in September and November 2012 and for the other three months it was high at Station III. The biomass of Station I ranged from 56.020 to 170.08 g/m2 with maximum in November and minimum in July 2012. At Station II the biomass ranged from 147 to 291.7 g/m2 with maximum in November and minimum in July 2012. At Station III the biomass ranged from 164.4 to 247.9 g/m2 with maximum in August, November and minimum in September 2012. So, the primary productivity was high in immersion and post immersion periods than the pre-immersion period along the coast line of Visakhapatnam. The life supporting process in the sea requires an array of inorganic substances but the role of nitrogen and phosphorus are considered vital in marine ecosystem (Gouri *et al*., 2012).

5. Conclusion

The study plays a crucial role for ensuring coastal quality management and provides prevalent information regarding the imbalance of marine ecosystem. This problem is applicable to the entire Indian coast. So, the Government must implement some strict effective regulations regarding the immersion of festival worshiping material. Creation of environmental awareness programs among the people can also minimize the contamination of natural aquatic ecosystems.

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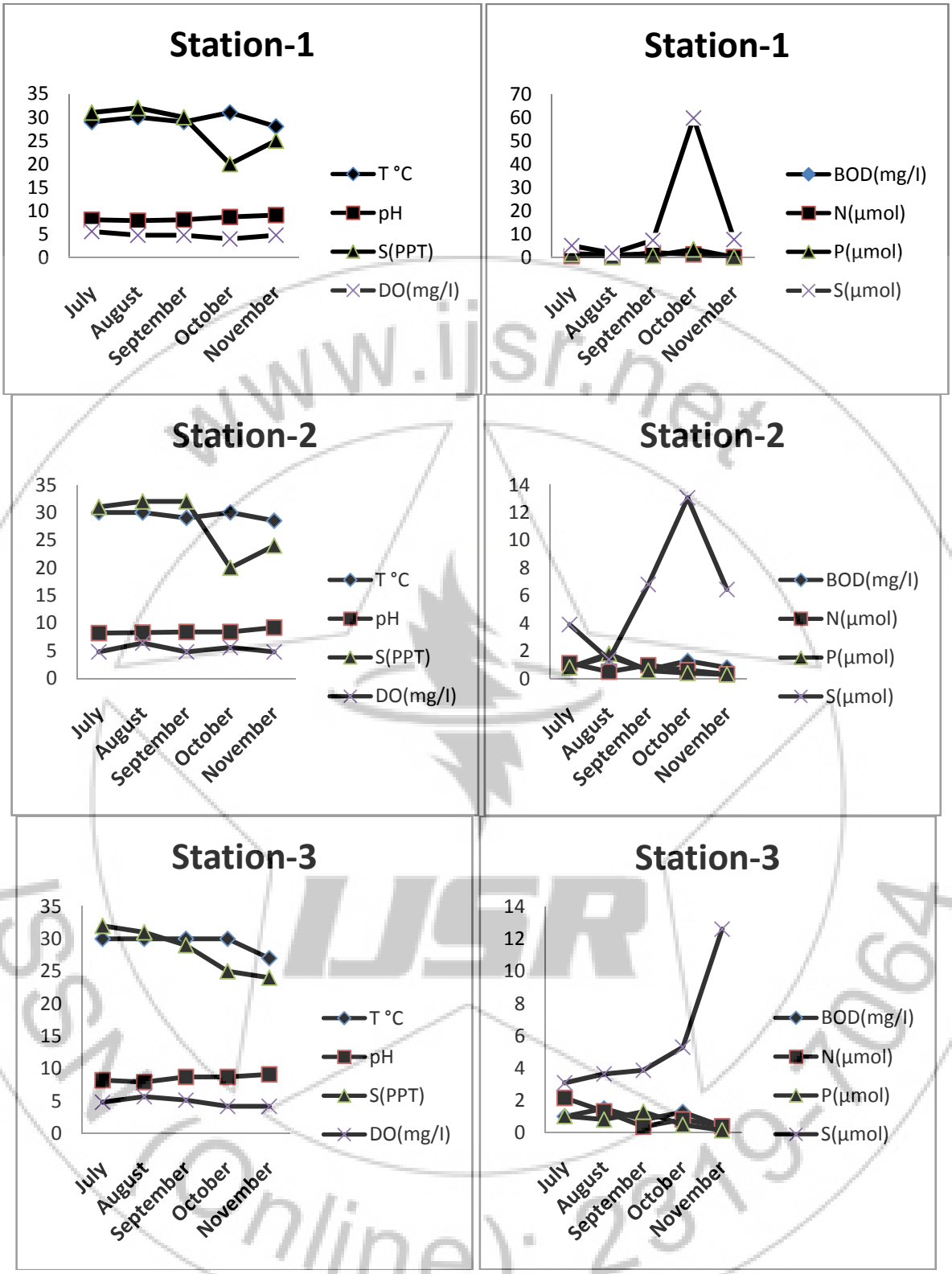

Figure 1: Physico -chemical parameters of coastal waters at study sites