CURRENT STATUS OF WATER QUALITY PARAMETERS IN THE ESTUARINE WATERS SUBJECTED TO EFFLUENT DISCHARGE FROM THE NTPC POWER STATION, KAYAMKULAM, KERALA

The Final Report of Minor Research Project in Science, November, 2O12

Submitted to UGC, Bangalore

By Dr Padma. P., M.Sc., M.Phil., PhD., Associate Professor, Department Of Chemistry, SSV College, Valayanchirangara, Perumbavoor, Kerala

SUMMARY

The present study aimed at determining the impact of discharge from a National Thermal Power Corporation at Kayamkulam in Kerala, India on the status of dissolved nutrients. The main objectives of the present paper are to quantify the concentrations of dissolved nutrients, determine their spatial patterns, compare their concentrations with the survey carried out in 1995, just before the commissioning of the Power Plant and evaluate the changes. The study is important for developing water management and conservation strategies for the estuaries of Kerala.

Field experiments were conducted over a three-month period in the vicinity of the power plant, with six experimental sites near to effluent areas. The present water quality of the Kayamkulam estuarine system close to NTPC, in Kerala have been investigated during the summer months of February, March and April in the year 2011. Samplings and analyses were carried out twice in each of these months and the premonsoon averages were calculated so as to compare with the values analysed during the same periods of the year 1995 just before the Commissioning of NTPC at Kayamkulam.

The analyses carried out in this survey have exposed precise information on the concealed factors influencing the water quality pattern of the estuary. Chemical components are related to temperature reflecting the biochemical and hydrographical importance of water system. Environmental alteration occurred for certain chemical species of nutrients as well as for physico chemical parameters. Effluent discharge from the NTPC Power Station plays a major responsibility in such observations.

Effluent cooling water is perceptibly warmer than the environment. In the context of thermal power station, the incidence of the cooling system increased the temperature. The temperature of the water was high upto 2 km from the discharging point. Turbidity was observed at the discharge point. pH averaged around 7.0 in all six basins. The dissolved oxygen was high at the second and third stations and decreasing towards the region of power station.

The analyzed parameters of nitrite-N, nitrate-N, ammonia-N, urea-N, phosphate-P and silicate-Si are not essential elements but these are evaluated as nutrients for the estuarine life since this cause eutrophication in excess amounts. Phosphorus limits in freshwater systems while nitrogen limits in marine systems. As a result, in estuarine systems both nitrogen and phosphorus play obvious roles. Nitrate is often used as a key of water quality. Biological controls makes it highly mobile. Nitrate concentrations measured at the six sites are all below the desirable limit showing limited pollution. High standard deviations of the mean NO_3^- and PO_4^{3-} concentrations put forward a seasonal variation in these parameters. NO_3^- was the dominant form of dissolved

nitrogen at the mid-region of station 4 in 1995. The NO_3^- and NH_3 profiles demonstrated that and NH_3 dominated in the northern end. Oxic conditions were overlying in the northern sector towards power station. Vertical stratification of nitrate and ammonium within the estuarine water was the result of nitrogen oxidation at the top of the water table where oxygen is intermittently available, and so at the lesser measured levels of dissolved oxygen in the aquifer, nitrification of the N source produced higher nitrate concentrations. Urea-N showed analogous patterns in both years of 1995and 2011. Nitrogen assimilation by aerobic organisms was less significant in the system due to the largely anaerobic subsurface discharge. Denitrification from NO_3^- to nitrogen gas in anaerobic conditions may lessen nitrate concentrations and would be indicated by a corresponding decrease of total nitrogen. Dissimilatory nitrate reduction to ammonia could decrease the NO_3^- concentrations, by reducing the nitrogen to NH_3 under anaerobic conditions without any net loss of total nitrogen. Supply of dissolved silica to estuaries is large owing to river inflow. Linear dissolution of silicate with time and temperature and diatom decline, accounts for the remarkable fall in concentration of silicate from the year 1995 to 2011.

The existence of the National Thermal Power Corporation has increased the thermal standing of the estuarine system at Kayamkulam slightly disturbing the status of dissolved oxygen and certain nutrients. But this situation has not become grave and it can be concluded from the micronutrient values obtained in the years of 1995 and 2011 that the waters of Kayamkulam estuary are not at the peril of pollution to the extent that the concentration of nutrients are taken into account. But the consequences of increased temperature and decreased dissolved oxygen must seriously be accounted. The survey peeks into the present environmental status of the estuarine waters of Kayamkulam. The observations makes us on our guard that more significance needs to be placed in budding techniques to improve the water quality and control pollution especially through effluent release. Estuarine management, in global levels must take such environmental aspects in to consideration. Society should delve into factors such as nutrient deposition and nitrogen fixation in the natural, yet, human-dominated ecosystems so that industrial revolutions turn as a gift for life on earth.