

WATER QUALITY ANALYSIS AND GROWTH ASSESSMENT OF MICROORGANISMS IN PAZHAYAR RIVER OF KANYAKUMARI DISTRICT, TAMILNADU

S. Alci Rani^{1,2*} and B. Christudhas Williams²

¹Department of Botany, Scott Christian College (Affiliated to Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli – 627 012, Tamil Nadu, India), Nagercoil, Tamil Nadu, India – 629 003.

²Department of Botany, Nesamony Memorial Christian College (Affiliated to Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli – 627 012, Tamil Nadu, India), Marthandam, Kanyakumari, Tamil Nadu, India.

***Corresponding author: ranialci@gmail.com**

ABSTRACT

A systematic study has been carried out to assess the water quality index of river Pazhayar in kanyakumari district. The pH of the water samples from three stations varied from 6.8 in winter to maximum of 8.70 in summer. The total dissolved solids of the river water samples analysed during monsoon-I varied 11.00mg/l at Manakudy (St-III), in winter season to maximum 910.0 mg/l at Manakudy (St-III) in summer season. The temperature, pH, total dissolved solid, total alkalinity, total hardness, calcium, magnesium, sodium, potassium, chloride, Dissolved oxygen were also studied at different station in different season. Bacterial populations in different stations were studied in Pazhayar River of Kanyakumari District, Tamil Nadu. Bacterial Population in river water showed a minimum of 32×10^{-3} CFU (colony forming unit) in station - I during summer to a maximum of 198×10^{-3} CFU in station – II during summer season. The statistical analyses reveals the dependency of physico chemical and biological factors. Correlation coefficient for bacterial population were compared with variables showed positive and negative correlation at 0.01 and 0.05 level of significant. The quality of water was found to be determined by the environmental conditions, physiochemical parameters, biological factors and the anthropogenic activity.

INTRODUCTION

Water is the precious gift of nature to mankind and millions of aquatic species living on the earth. Only 3% of the waters in the universe are fresh water. Among the fresh waters, only about 5% is available for beneficial use. The healthy aquatic ecosystem is depended on the physico-chemical and biological characteristics (Venkatesharaju *et al.*, 2010). Various parameters like temperature, PH, TDS, alkalinity, calcium, magnesium, nitrite, choloride and oxygen were analysed. The preservation of aquatic ecosystems needs special attention because water quality, plant and animal biodiversity, industrial activities and human health rely on it.

In India, 70% of the available water is polluted by any means. According to a WHO estimate about 80% water pollution in developing countries like India is caused by domestic wastes. In our land pollution of the rivers is caused by garbage, human wastes and excreta disposal, effluent from industries, motor garages and mechanical shops, agricultural activities in the basin (Agarwal *et al.*, 2010). Human contact and use of the water for bathing, washing, swimming, irrigation and

gardening are intense in the basin. These situations have resulted in siltation, pollution and prevalence of water associated diseases like bilharzias, enteric infections and intestinal worms in the area. Industrial wastes from fruit processing factories and other industries are discharged into the river. The maintenance of a healthy aquatic ecosystem is dependent on the physicochemical properties of water and the biological diversity. The physico-chemical means are useful in detecting effects of pollution on the water quality. Water pollution is a major problem in the global context (Mishra *et al.*, 2007; Sukumaran and Jeeva, 2011).

Polluted river waters contain a large variety of pathogenic micro-organisms: viruses, bacteria and protozoa. Rivers have always been the most important fresh water resources, and most developmental activities are still dependent upon them. Rivers play a major role in assimilating or carrying industrial and municipal waste water, manure discharge and runoff water from agriculture fields, road ways and streets which are responsible for river pollution (Ward and Elliot, 1995).

Pazhayar river is the southernmost river in Travancore India. Many small streams combine to form this river. The Pazhayar flows through the Taluks of Thovalai and Agastheswaram in a south easterly direction and falls in to the Manakudy Estuary after a course to 23 miles, passing the towns of Boothapandi, Ozhuginasery, Nagercoil, Suchindram, and Manakudy. This river is very useful for irrigation in Nangil Nagar. The early kings also constructed about 11 check dams along the course of the river. The Pazhayar off Nagercoil has 3,000 units of pathogenic bacteria of *Escheria coli* (www.the hindu.com July 2012).

MATERIALS AND METHODS

River water was collected and analysed at seasonal intervals from the three stations of the river water. Three liters of water samples were collected in a sterile container, which were kept inside the thermo cool to maintain the temperature and transported to the laboratory to evaluate the bacterial population, environmental and physicochemical parameters. In the Pazhayar river course viz. Derisanamcope, Succindrum, Manakudy stations were taken for the study.

Physico-Chemical analysis

On the basis of analytical tests, pollution parameters have been classified as physical, chemical and biological. Physical parameters include temperature, pH, total dissolved solid, total alkalinity, total hardness, calcium, magnesium, sodium, potassium, chloride, DO.

Bacterial analysis

To analyses the total bacterial population, the samples were collected in sterile plastic can and immediately transported to the laboratory. Bacteria were enumerated as Colony Forming Units (CFU) employing the standard pour plate technique described in APHA (2005). Plate count agar medium was used for enumeration purposes and the agar medium was autoclaved prior to use. The collected samples were serially diluted using sterile distilled water and inoculated into sterile Petri dishes and the plates were incubated at 30°C in an incubator. After 24 hours of incubation, colony counts were made using a colony counter. The statistical analysis was carried out.

RESULT AND DISCUSSION

The present investigation reveals that physico chemical and biological parameters varied with seasons and stations. pH of the river water samples varied from the minimum of 6.800 ± 0.008 at Derisanamcope (St-I) in winter to the maximum of 8.70 ± 0.070 at Succindrum (St-II) in summer. PH regulates most of the biological processes and bio-chemical reactions. Fluctuations in pH values mostly depend upon ingredient input in the water bodies (Ali, 1991).. The pH of the river water samples varied from pH of Mukkadal Reservoir of Kanyakumari ranges from 6.8 to 7.7 (Mercy and Williams, 2011). The pH value ranges from 6.51 to 8.42 and are within the range of the internationally accepted standard for portable water (WHO, 1971).

The total dissolved solids of the river water samples analysed during monsoon-I varied from $11.00\pm 1.58\text{mg/l}$ at Manakudy (St-III), in winter season to maximum $910.0\pm 8.17\text{mg/l}$ at Manakudy (St-III) in summer season. Total alkalinity of the river water samples varied from the minimum of $12.0\pm 1.87\text{mg/l}$ at Derisanamcope (St-I) in winter to the maximum of $92.00\pm 2.54\text{mg/l}$ at in monsoon-II. Calcium values are ranges between 40.1 to 165.1 mg/lit and it is found that the all values are in the Permissible limit of I.S (Nagarnaik *et al.*, 2012). In Kosiriver the calcium ranged from 4.9 to 58.6 mg/l (Bhandari *et al.*, 2008). However calcium content in river water sample varied from $4.00\pm 2.000\text{mg/l}$ at station-I in winter in and monsoon-I to the maximum of $27.00\pm 0.707\text{mg/l}$ at Succindrum in summer.

The magnesium ion varied from 1.00 ± 0.70 to $18.6\pm 0.707\text{mg/l}$. Sodium concentration is higher in station III in summer and lower in st-I in mon-II. Sodium is important for both agricultural and domestic purposes. But High concentration is harmful to persons suffering from cardiac, renal as circulatory disease. Potassium content is higher than the permissible limit.

Chloride content of the river water samples varied from 10.0±1.58at station-I in monsoon-I to the maximum of 235.0±0.07 at station-II (Succindrum) in summer. The Narmada river chloride range is observed to be 30.5 mg /l to209.79 mg /l (Shraddha Sharma *et al.*, 2008). The chloride content was not high in the Sabarmati River. High Chloride concentration in the water indicates the presence of organic waste, primarily of animal origin (Thresh *et al.*, 1949). Therefore, river water from station - V is contaminated, due to more organic sediments. Tidy’s test (O₂) of river water ranged from 0.02±0.031in station - II to 0.36±0.01 at station - V. The concentration of dissolved oxygen in the river water samples is high when compared to WHO and the oxygen level is due to high amount of organic wastes. Correlation co-efficient shows both positive and negative correlation between bacterial populations.

Bacterial Count in Percentage (%)

For the microbial analysis a standard MPN method was followed. Bacterial Population in river water showed a minimum of 32×10⁻³CFU (colony forming unit) in station - I during summer to a maximum of 198×10⁻³CFU in station – II during summer season.

In the present investigation the pollution status of the river Pazhayar is based on physico chemical parameters and microbial count. Analysis and interpretation of the data on

Organism	winter			Summer			Monsoon I			Monsoon II		
	I	II	III	I	II	III	I	II	III	I	II	III
<i>E. coli</i>	10	40	20	14	37	25	30	35	15	6	6	10
<i>Enterobacter</i>	3	25	2	10	11	2	8	5	10	5	5	7
<i>Klebsiella</i>	2	22	7	15	23	15	15	10	10	7	7	7
<i>Shigella</i>	3	24	5	17	20	21	15	20	5	5	5	3
<i>Salmonella</i>	4	25	2	10	21	12	15	7	10	5	5	5
<i>Proteus</i>	4	10	5	14	23	9	15	10	5	10	10	8
<i>Pseudomonas</i>	2	20	17	11	13	27	10	15	2	5	5	8
<i>Streptococcus</i>	4	16	6	5	20	7	2	5	15	4	4	4
<i>Vibrio</i>	0	18	2	0	30	8	3	20	8	1	1	3

micro- organism and water quality parameters provided the necessary information to assess the impact of pollution source. So it is essential to check the entry of contamination (polluted water) from the villages and agricultural fields to improve the water quality of Pazhayar river and nearby villages. The result showed that high volume of coliform bacteria in river water samples concludes that the river water was highly contaminated and not good for domestic purpose. So, a proper step has to be taken to control the above mentioned factors in the river.

ACKNOWLEDGEMENT

The authors are grateful to the Management, Department of Botany & research center of Scott Christian College for Providing necessary Research facilities to carry out this research work.

REFERENCE

- Ali J. 1991. An Assessment of the water quality of Ogunpa river Ibadan, Nigeria. M.Sc. Dissertation. University of Ibadan, Nigeria.
- Agarwal Ashok, K. and Rajwar Govind, S. 2010, Physico-Chemical and Microbiological Study of Tehri Dam Reservoir, Garhwal Himalaya, India, *Journal of American Science*, 6(6):65-71.
- APHA: Standard methods for the examination of water and wastewater analysis 21st Edn; Washington. D.C. (2005).
- Mercy Leelavathy, D and Christudhas Williams, B. 2011. Limnological study of Mukkadai Reservoir in Kanyakumari District, Tamil Nadu, India. *Journal of Theoretical and Experimental Biology*, 7(3): 71-75.
- Mishra, B.P., Kiruba, S., Jeeva, S., Venugopal, N., Das, S.S.M. and Laloo, R.C., 2007. Assessment of the impact of tsunami on status of water quality of manakudy estuary. *Ecology, Environment and Conservation*, 13(4), 731.
- Shraddha Sharma, Savita Dixit, Praveen Jain, K.W.Shah, Rakesh Vishwakarma. 2008. Statistical evaluation of hydrobiological parameters of Narmada river water at Hoshangabad city, India. *Environ Monit Assess*. 143:195-202.
- Sukumaran, S. and Jeeva, S., 2011. Angiosperm flora from wetlands of Kanyakumari district, Tamilnadu, India. *Check List*, 7(4), pp.486-495.
- Thresh, J.C., Beale J, F .and Suckling E.V.(1949). The examination of water and water supplies (Ed:E.W.Taylor), London.
- Venkatesharaju. K ., Ravikumar.P., Somashekar. R.K., Prakash. K.L., (2010), Physico - chemical and Bacteriological Investigation on the river Cauvery of Kollegal Stretch in Karnataka, *Journal of science Engineering and technology*, 6 (1), pp 50-59.
- Ward A.D, Elliot W.J (1995). *Environmental Hydrology*. Lewis Publishers. Boca Radittaton, Florida.
- WHO (World Health Organisation): 1971, *International Standards for Drinking Water*, II ed., Geneva, Switzerland.