

“HEAVY METAL TAXATION OF THIRUVALLAM BACKWATER-A CASE STUDY, THIRUVANNATHAPURAM, KERALA.”

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ABSTRACT

Thiruvallam is one of the largest backwater systems in the southern region of Kerala coast. Once this backwater system is highly enriched with different kinds of fishes, clams, prawns, oysters etc. Now days this backwater system is facing the threat from sand mining, sewage disposal and other anthropogenic activities from the adjacent city. The present study was carried out to evaluate the heavy metal concentration of this backwater system from six different stations are presented in this paper. Observations revealed that heavy metal concentration were slightly fluctuated and are under the standard limit.

Key words: Heavy metal, nutrients, Pollution, Sand mining

INTRODUCTION

Water is an essential and vital commodity for the existence of living beings. The quality of water source may vary due to changing sources of pollution, increasing draw off of good quality water, natural depletion of the resource and changing pattern of land use, etc. Therefore, the proper monitoring of the system is highly essential for the judicious management of the precious resources. The physical and chemical characteristics of water also influence the nature and distribution of the flora and fauna in an estuary or backwater. It is thus clear that hydrological study is a prerequisite for the assessment of potentialities and realities between trophic levels and food webs.

In Kerala, ecology of Paravur backwater has been studied earlier (Azis and Nair, 1980; Shibu, 1991; Santhosh, 1999,2002). Shibu (1991) reported that Paravur Kayal was comparatively less polluted temporary estuary of Kerala, which support a moderately good resource of fin fishes, prawns, crabs and clams. Regarding the Karamana river basin, Sinha Roy (1979) has made an attempt to characterize the fluvial landforms of the basin. Anilkumar (1994) made an effort to study the landscape characteristics of the Karamana river basin. Krishnakumar (1999) has studied the hydrochemistry and drinking water potential of the Vellayani Lake (Karamana basin). Krishnakumar (2002) studied the environmental degradation of Karamana river basin. Increasing anthropogenic degradation of water quality has become a cause of great concern in the present context of growing population, intensive industrial development and diversification of human activities with the consequent ever

increasing uses and abuses of these vital natural resources. There arose a challenging task for prevention of water pollution. Proper maintenance and management of the aquatic systems would become difficult owing to the lack of sufficient base line information. The present study of Thiruvallam backwater is a pioneer attempt to study the heavy metal concentration of this backwater.

MATERIALS AND METHODS

Thiruvallam backwater is one of the important backwaters of southern Kerala. This backwater is situated 6 kilometers from Thiruvananthapuram city. It lies between $76^{\circ}54'$, $76^{\circ}56'$ North latitude and $8^{\circ}26'$, $8^{\circ}31'$ East longitude. (Fig.1). This serene backwater stretch enroute to Kovalam. It is the meeting point of two rivers – Killi and Karamana. For the purpose of present investigation, water samples were collected from five stations of this backwater. First station, Madhuppalam is in one of the branch of this backwater – Karamana river, second station, Keezharannoor, is in another branch – Killi Ar, third station – Pallathukadavu, the meeting place of these two rivers (Karamana and Killi), fourth station at Thiruvallam and the fifth station at Thottumukku pozhi – the region where the backwater joins the Arabian sea. Majority of the land near the shore of this backwater is reclaimed for coconut plantation. The samples were analysed as per standard methods of APHA (1985), Golterman et al. (1978) and Trivedi and Goel (1984).

RESULT

The variations in heavy metal concentration at different stations are given in Table 1 and are depicted in Fig. 2. The concentration of iron varied from 16.0g/l to 48.7g/l . The highest concentration was noted in Station III and lowest in Station I. The cadmium content was in trace concentrations ranging from 0.0067g/l to 0.1204g/l at different stations. Chromium was found below detectable level in all the stations. Copper was also found in trace quantities ranging from 0.004g/l to 0.0767g/l at different stations. Comparatively higher concentration of lead (4.07g/l) was found in Station III and lower concentration (1.951g/l) was found in Station II. The concentration of zinc showed minor fluctuations below detectable level to 0.025g/l at different stations. The concentration of nickel was found to be below detectable level in all

stations except Station III that showed a concentration of 0.0089g/l .

DISCUSSION

Heavy metals are intrinsic components of earth's crust and are released to the aquatic environment from natural sources and human activities. The natural input of metals in river environment is essentially from the catchments as suspended particulate phase. Heavy metals can also reach from industrial and domestic sources, as well, because rivers are considered as the convenient pathways for disposal of such wastes. In the water body, these metals are partitioned amongst its various components, i.e., water, sediment and biota. So, the quantification of metals in these phases can provide insight into its prevalence and dispersal pattern.

Iron is an essential trace element, required for both animals and plants. In some waters it may directly or indirectly limit the growth of algae. It is also an essential component in the oxygen transfer mechanisms of the circulating systems of all vertebrates and some invertebrates. Although iron has little direct toxicological significance, it often controls the concentration of other elements, including toxic heavy metals, in surface waters. The present study shows only trace quantity of this metal, which is below the permissible limit. Iron exhibits a decreasing trend towards the estuarine regions, due to the adsorption to particulate materials like detritus, plankton and suspended sediments, and assimilated by living organisms.

The decreasing concentrations of iron with distance downstream in the freshwater indicate that iron is being removed from solution even before the river water meets saline water in the estuary.

Cadmium is the 64th most abundant element, occurring in the earth's crust at an average concentration of 0.2mg/kg . Cadmium is routinely detected in most surface waters, both in dissolved phase and in particulate

phase. The maximum permissible concentration of cadmium in water is 5 µg/l as per the W.H.O guidelines. In the present investigation, cadmium was also found in trace amounts ranging from 0.0067^og/l to 0.1204^og/l. Chromium occurs in the earth's crust at an average concentration of 100mg/kg. The primary sources include domestic wastewater, manufacturing processes involving metals, and the dumping of sewage sludge. Chromium is generally detected at low concentration in freshwaters. In the present study, the concentration of chromium was found below detectable level in all the stations studied.

Copper occurs in the earth's crust at an average concentration of 50mg/kg, principally as sulphides. Effluents from electroplating plants constitute one of the important sources of heavy metal pollution and normally contain objectionable quantities of copper, lead, zinc, cadmium, chromium, cyanides, oils, grease and BOD (Ramaswamy and Somasekhar, 1982). Stations I and V shows a marked decrease in the content of copper, in the present investigation.

This may be due to the mixing of saline water with fresh water. Generally speaking, the concentration of copper was found below the standard permissible levels. Lead is the 36th most abundant element in the earth's crust, with an average concentration of 15mg/kg. In the present study, lead is also found below the standard permissible levels in all the stations studied.

Zinc is an essential micronutrient, which is the 24th most abundant element. There are several major sources of zinc discharge including the discharge of domestic waste water, manufacturing processes involving metals and atmospheric fall outs. A relatively higher concentration of zinc may be toxic to aquatic life (Kothandaraman and Viswanathan, 1986). Estuarine regions where salt water mixes with the freshwater are

markedly showing lower values of Zn. Nickel constitutes about 0.008% of the earth's crust. It is shown to be essential for some microorganisms and animals but not to plants. The concentration of nickel was found to be below detectable limit in all the stations except Station III. In this station also, the concentration was observed below the standard permissible limit.

Zinc, copper, cadmium, lead and chromium are of particular relevance in freshwaters. The increased circulation of toxic metals in recent times resulted in the inevitable build up of such toxic substances in the human food chain (Moore, 1991). The effects of heavy metals on air, water and soil were well documented. Since metals are rapidly adsorbed to particulate materials (e.g. detritus, plankton, suspended sediments) and assimilated by living organisms, the concentration of metals dissolved in the water may give a highly vague picture of the degree of metal pollution. The present observation clearly indicates that the water is not polluted by heavy metals.

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Figure1. Location Map Of The Study Area

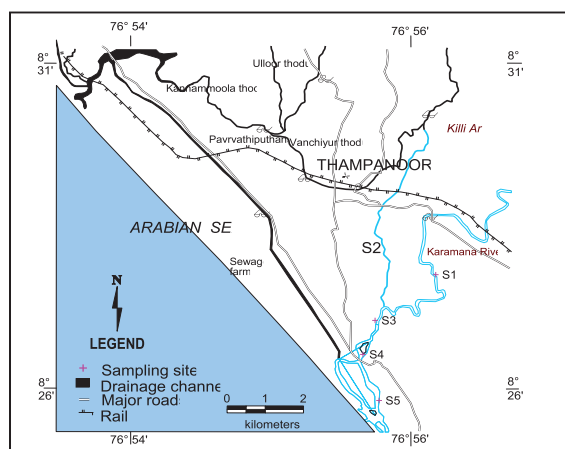


Table. 1. Variations in heavy metal Concentrations at Stations I, II, III, IV & V

Heavy metal	Station I	Station II	Station III	Station IV	Station V
Iron (µg/l)	16.7	32.4	48.7	26.9	18.6
Cadmium (µg/l)	0.1204	0.0136	0.0067	0.012	0.0577
Chromium (µg/l)	BDL	BDL	BDL	BDL	BDL
Copper (µg/l)	0.004	0.0546	0.0767	0.0159	0.0088
Lead (µg/l)	2.102	1.951	4.07	3.21	2.8
Zinc (µg/l)	0.009	0.002	0.025	0.001	BDL
Nickel (µg/l)	BDL	BDL	0.0089	BDL	BDL

Fig. 2. Variations in heavy metal concentrations at Stations I,II,III, IV and V.

