

Study on the water quality of selected drinking water sources in and around Kallanai area, Thanjavur District, Tamil Nadu

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Abstract— The Kallanai Dam is situated at twelve km north from Tiruverumbur, Trichirappalli of Tamilnadu District. Kallanai Dam belongs to Thanjavur District of the same state. All agriculture land in and around Tiruchirappalli and Thanjavur is being benefited only by Cauvery river. The main reservoir for these lands is Kallanai Dam. Cauvery river is also the main source for drinking purposes for the people living in delta areas. In order to study the water quality of this reservoir, totally 4 samples are collected and analysed. Among 4 samples, 2 from river at two different season and 2 from bore well at same season. The parameters such as pH, EC, total dissolved salt (TDS), biological oxygen demand (BOD), chemically oxygen demand (COD), Total Hardness, Sulphate, Chloride, Nitrate, Calcium, Magnesium, Sodium, Potassium and heavy metals such as Cadmium, Mercury, Iron, Zinc, and Nickel are analyzed by suitable methods.

Key words; BOD, COD, Ground water, Heavy metals, TDS, River water,

I. INTRODUCTION

Water with facial contamination could possibly contain enteric pathogens dangerous to health, and total coli form group of organisms is the principal and reliable indicator used to assess the microbiological quality of drinking water as for as facial pollution is concerned (Evan, 1981) [1]. During recent years there has been an increasing awareness and concern about water pollution all over the world and new approaches towards achieving sustainable exploitation of water resources have been developed internationally[2,3]. The control of water pollution has gained primary importance in developed and a number of developing countries. It has become a point of critical concern in large number of industrialized countries in setting limits for the discharge of hazardous substances with the best available technology.

Heavy metals are environmentally stable and non-biodegradable, toxic to the living beings and tend to accumulate in plants and animals causing chronic adverse effects on human health. Heavy metals are introduced to the environment through a variety of sources such as combustion, extraction, agricultural runoff, transportation etc. Heavy metals are toxic pollutants that severely reduce the use of water for domestic and industrial application. Frequent use of heavy metal contaminated water in the agricultural field's leads to soil pollution and gradually enriched the soil with

heavy metals. Different studies have revealed that the presence of toxic heavy metals like Fe, Pb and Hg reduce soil fertility and agricultural [4]. Though some of the metals like Cu, Fe, Mn, Ni and Zn are essential as micro nutrients for plants and microorganisms, many other metals like Cd, Cr and Pb are proved detrimental beyond a certain limit. The surface water infiltration, soil contaminants such as heavy metals can leach to underlying groundwater. The occurrence of heavy metals in groundwater is directly related to soil characteristics that determine the rate of water movement [5].

In this study, samples have been selected from surface of river and ground in and around areas of Kallanai Dam at two different seasons.

II. EXPERIMENTAL

A total of four water samples (two surface water samples at two different seasons and 2 groundwater samples at corresponding season) were collected from Cauvery river at Kallanai Dam and nearby hand pumps located in and around the area. A portion of water samples were preserved with 2 mL nitric acid to prevent the precipitation of metals. The samples were then concentrated and subjected to nitric acid digestion. Heavy metal analyses were carried out using inductively coupling plasma (ICP) method. The pH of water samples were determined by a pH-meter and other parameters such as Total Hardness (TH), Sulphate, Chloride, Nitrate, Calcium, Magnesium, Sodium, Potassium were analysed by Electrometric, Titrimetric, Turbidimetric, Colourimetric, Flame emission methods.

III. RESULTS AND DISCUSSION

The surface waters exhibited an alkaline pH in the range of 6.45 to 6.83 (Table 1) but the values are well within the safe limit of crop production.

IV. SURFACE WATER

Higher levels of pH and alkalinity tend to reduce toxicity of metals in water. The most influential water quality parameter on crop productivity is the water salinity hazard as measured by electrical conductivity (EC). The primary effect of water having high EC on crop productivity is the inability of the plant to compete with ions in the soil solution for water [6].

The higher the EC, the less water is available to plants, even though the soil may appear wet. Water with EC less than 0.7 mS/cm is considered being safe but when the value is setting in the range of 0.7-3 mS/cm, it may cause little to moderate salinity problems.

Table 1. pH, EC (mS/cm) and concentrations of heavy metals and other parameters

Sample - I and II (River Surface Water)		
Characteristics	Kovilady Grama Panchayat, Kallanai Month of August 2012 and January 2013 (Scale in mg/L)	
	Sample - I	Sample - II
pH	6.45	6.83
EC	0.22	0.21
TDS	468	490
TH	20	200
BOD	1.5	1.7
COD	24	22
Ca	57	65
Mg	4.0	7.0
Chloride	130	150
Sulphate	185	145
Nitrate	0.78	0.8
Na	2.9	2.5
Cd	Nil	Nil
Cu	0.14	0.139
Hg	Nil	Nil
Fe	0.858	0.762
Zn	0.072	0.075

However, in the present study, the conductivity values of waters are in the range of 0.20-0.68 mS/cm and are suitable for crop production. The analysis of surface waters for Cd, Fe, Cu, Hg, Mn, Zn and Ni revealed that all the samples have very low concentrations of these elements and are suitable for irrigation [7,8]. A comparative study on water quality, i.e., the samples collected at two different seasons namely August 2012 and January 2013 shows that no vast variations in its characteristics and in heavy metals concentrations see Table 1.

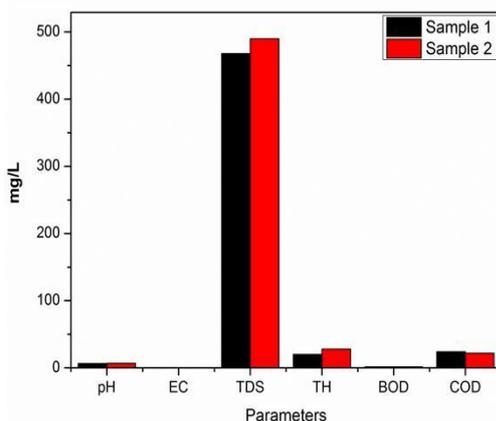


Fig 1 Comparison of sample 1 and sample 2 for the parameter values for river surface water

V. GROUND WATERS

The ground waters also have the alkaline pH ranging from 6.58 to 6.7 and the values are well within the safe limit for drinking. These two water samples have conductivity in the

range of 0.25-0.29 mS/cm. The analyses of heavy metals in these waters have revealed that (Table 2).

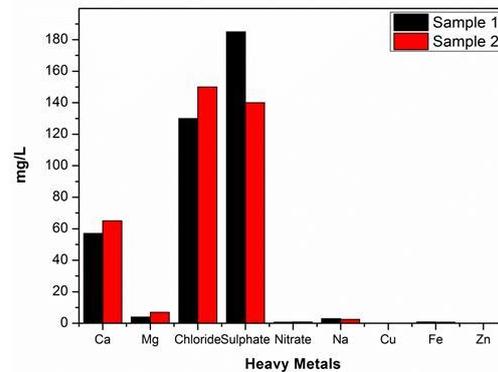


Fig 2 Comparison of the two samples for different heavy metals for river surface water

It can be noticed that the concentrations of all other elements namely Fe, Zn and Ni are within the safe limit for drinking set by BIS [9,10].

Table 2: pH, EC (mS/cm) and concentrations of heavy metals and other parameters

Sample - I and II (River Surface Water)		
Characteristics	Kovilady Grama Panchayat, Kallanai Month of August 2012 and January 2013 (Scale in mg/L)	
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The low concentration of Zn in drinking water could be due to the fact that the pH of water samples is slightly acidic and its solubility is a function of decreasing. Low intake of Zn results in growth retardation, immaturity and anemia. The relative dominance of heavy metals in all samples are in the order Fe > Cu > Zn; the concentration of Fe varied from 0.81 to 0.85 mg/L, Cu from 0.14 to 0.1280 mg/L, and Zn from 0.077 to 0.079 mg/L [11].

Long term consumption of drinking water with high concentration of Fe may lead to liver diseases. However, it can be noticed that all samples have higher Cu concentration and exceeding even the limit of BIS value, 0.05 mg/L for drinking water. Though Cu is not a cumulative systemic poison, large dose (>1.0 mg) is harmful and might cause central nervous system disorder, failure of pigmentation of hair and effects on Fe metabolism [12,13].

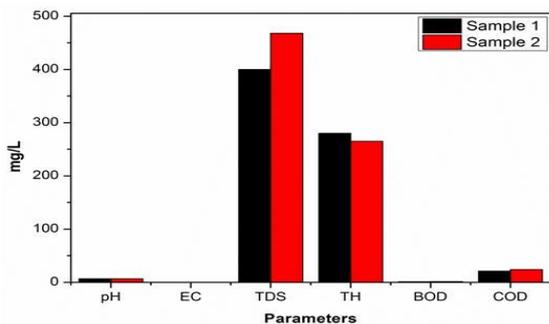


Fig 3 Comparison of two samples for different parameters for bore well water

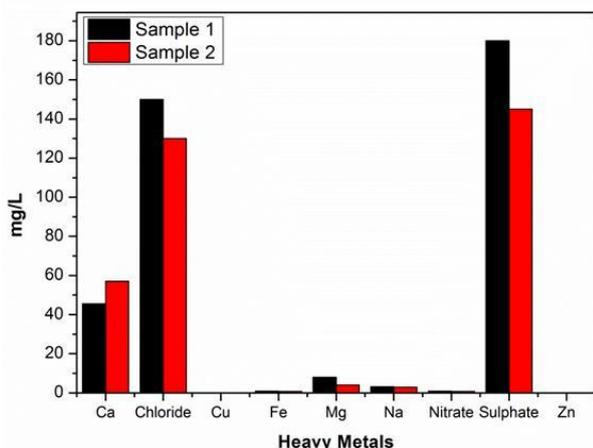


Fig 4 Comparison of two samples for various heavy metals for bore well water

VI. CONCLUSION

All surface and ground water samples have normal concentrations of heavy metals (except Fe or Cu), thereby they are appropriate for irrigation and drinking purposes. The concentration of Zn is very much lower than the prescribed limit. It is also found that the concentration of Fe or Cu is slightly higher which may affect our health and irrigation during long term usage. Based on the data observed from suitable chemical methods the water nearby Kalama (Kovilady panchayat) is useful for both drinking and irrigation purposes.

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