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Assessment of Heavy Metals in Water Samples of Cauvery River and Kallanai Kalvaai around Kallanai Dam in Tamil Nadu

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ABSTRACT : Heavy metals usually present in trace amounts in natural water. Some metals are essential to human and animals but they are toxic when their limit exceeds. Their concentration increase in water due to addition of industrial wastes, sewages and domestic wastes, Iron concentrations in the sewages are very low than the permissible limit which was analysed here. Water quality of Cauvery River and Kallanai Kalvaai analysis helped to get the information's of chemical, physical, biological, and radiological characteristics of water. Water quality of these river and dam are used to measure of the condition of water relative to the requirements of one or more biotic species and or to any human need or purpose.
KEYWORDS– Cauvery river, Heavy metals, Kallanai Kalvaai

I. INTRODUCTION

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 reduces the use of water for domestic and industrial application. Frequent use of heavy metal contaminated water in the agricultural fields 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, Hg reduce soil fertility and agricultural 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 asheavy metals can leach to underlying groundwater [1-3]. Occurrence of heavy metals in ground water are directly related to soil characteristics that determine the rate of water movement. Samples have been selected from surface of river and ground in and around areas of Kallanai Dam at two different season.

Aggarwal, T.R., Singh, K.N. and Gupta reported that the detection of lake water quality could be linked to nutrient loading from domestic sewage [4]. The raw sewage is the source of phosphorous and nitrates of water. Heavy metals are those having a density more than five times that of water. They are usually present in trace amounts in natural water but many of them are toxic even at very low concentrations. Their concentrations increase in water due to addition of industrial wastes and sewage. Some of them get biomagnified in water and get accumulated in higher topic levels e.g., fish, crabs and other aquatic organisms. Some of heavy metals are extremely essential to human, like Cobalt, Copper and Molybdenum but large quantities of them may cause physiological disorders, many of them quite serious. Metals such as Arsenic, Lead, Cadmium, Mercury and Selenium are highly toxic even in minor amounts [5-7].

II. HEAVY METAL ANALYSIS

The heavy metal analysis of water samples have been determined by Atomic Absorption Spectroscopy. The elements arsenic, cadmium, copper, iron, lead, manganese, molybdenum, vanadium and zinc have been analysed. Flame spectroscopy is an analytical technique used for the qualitative and quantitative determination of the element in a sample. In this method , samples are introduced in the form of a homogenous liquid, into a flame where thermal and chemical reactions create 'free' atoms capable of absorbing, emitting or fluorescing at a characteristic wavelength.

In atomic absorption spectroscopy majority of free atoms in the commonly used flames are in the ground state. A light source emitting a narrow spectral line of the characteristic frequency is used to excite the free atoms in to the flame. The decrease in energy of the light is then measured. The absorbance is proportional to the concentration of free atoms in the flame, given by Lambert-Beer's Law[8].

Absorbance = $\log (I_o / I_t) = k\,C\,l$

Where, I_o = Intensity of incident radiation emitted by the light source

I_t = Intensity of transmitted radiation (amount not absorbed)

C= Concentration of sample (free atoms)

k= Constant (molar extinction coefficient) can be determined experimentally
l = Path length.

This is the most common method where interference effects are known to be absent. Usually at least three standards and a blank are used to cover the range of 0.1 to 0.8 absorbance. The blank solution is used to calibrate the instrument. The standards are then analysed with the lowest concentration first, and the blank run between standards, to ensure that the baseline (zero point) has not changed [9-11]. Samples are then analysed and their absorbance recorded. A graph of absorbance versus concentration is plotted. The calibration can be performed in the concentration mode in which case the concentration of the sample is read off directly. In atomic absorption spectroscopy the wavelength(nm) and flame type for different heavy metals are listed in Table 1.

III. SAMPLE COLLECTION

The heavy metals analysis was performed for Kallanai Dam river samples (mainly from Cauvery river and Kallanai Kalvaai) collected from six stations A1 to A3 and B4 to B6 ((from Cauvery river and Kallanai Kalvaai). Water samples were examined to detect and to estimate the concentration of heavy metals. Water samples were collected twice in a year from April 2013 to October 2014.

(Note: Arsenic is converted to its hydride and aspirated into argon-hydrogen flame.)

IV. FIGURES AND TABLES

Table -1 The wavelength(nm) and flame type for different heavy metals

Element	Wavelength (nm)	Type of Flame
Iron (Fe)	**248.3**	**Air acetylene**
Lead (Pb)	**283.3**	**Air acetylene**
Zinc (Zn)	**213.9**	**Air acetylene**
Manganese(Mn)	**279.5**	**Air acetylene**
Copper (Cu)	**324.7**	**Air acetylene**
Cadmium (Cd)	**228.8**	**Air acetylene**
Arsenic (As)	**193.7**	**Argon-Hydrogen**
Vanadium (V)	**318.4**	**Nitrous Oxide Acetylene**

Month & Year	A1	A2	A3	B1	B2	B3
April 2013	0.022	0.224	0.162	0.270	0.044	0.052
October 2013	0.037	0.183	0.064	0.172	0.032	0.023
April 2014	0.031	0.258	0.021	0.210	0.021	0.028
October 2014	0.045	0.211	0.043	0.250	0.031	0.017
Range	0.045-0.022	0.258-0.211	0.187-0.021	0.250-0.172	0.044-0.021	0.052-0.017

Table 2 Iron (Fe) in mg/L of Cauvrey river and Kallanai Kalvaai stretch

To ensure a high-quality product, diagrams and lettering **MUST** be either computer-drafted or drawn using India ink. The high value of iron 0.258 mg/L is observed at A2 in April 2014 and the low value is 0.017 mg/L at A3 in October 2014 [12]. The maximum permissible limit is 0.3 mg/L. It is observed that the values are slightly higher than in summer. The high value in summer may be due to the industrial waste water exposed to the water system and high concentration of industrial effluent and domestic sewages. The concentration of metals in the surface of a river may increase according to the effluent discharged from nearby industries.

V. CONCLUSION

The water quality of Cauvery River and Kallanai Kalvaai, Thanjavur District, Tamil Nadu t is observed that the heavy metal values in summer are high. It may due to the low flow rate of water and high concentration of industrial effluent and domestic sewages. The purpose of the study of Kallanai dam was to divert the waters of the Kaveri across the fertile Thanjavur delta region for irrigation via canals.

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