COMPARITIVE STUDY OF METAL ANALYSIS IN FRESH WATER SAMPLES USING SURFACTANT ASSEMBLIES

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Abstract—Fresh water comprises of water from River, ponds and well. Contamination of this water by metals, namely, Calcium, Magnesium, Copper, Iron, Zinc and Manganese were evaluated in the samples of fresh water. The analysis was done complexometrically in the presence of surfactant. The distribution of metals in Water samples analysed were in the order of magnitude as by Ca>Mg> Cu > Fe > Zn > Mn. The highest concentration level of copper was observed in pond water. The lowest concentration levels of Manganese were observed in shivnath river sample. These levels of heavy metals of five freshwater samples exceeded the maximum permissible limits values. These levels of heavy metals might be due to the increase in agricultural influx waters, domestic wastes and some anthropogenic activities

Keywords— Fresh water, Complexometric titration, surfactant.

I. INTRODUCTION

Water quality assessment is one of the prime concerns and a major challenge in all over the world. Seasonal variation study of water quality parameters provides information about the health of the water over a period of time. Water is vital to health and it influences in socioeconomic development of human being. Increasing population growth, agriculture advancement, urbanization as well as industrialization made water pollution a great problem and depleting the availability of potable water. Many parts of the world face such a scarcity of water [1]. Concentrations of all kinds of pollutants have an influence on the water quality and also determine the use of water. It is, therefore, necessary to monitor water quality, understand the chemical characteristics and provide a reliable assessment of water quality [2]**.** Rivers and ponds are very important part of our natural heritage. They have been widely utilized by mankind over the centuries, to the extent that very few, if any, are now in a natural" condition. One of the most significant manmade changes has been the addition of chemicals, containing a lot of heavy metals, to the waters [3]. Such inputs to water can be derived from a variety of sources, some of them are obvious and others less so. They can be varied so that the concentrations of chemicals in water are rarely constant. Contaminated sediments are significant water pollution. Water is also a vital resource for agriculture, manufacturing and other human activities. In urban areas, the careless disposal of industrial effluents and other wastes in river and lakes may contribute greatly, to the poor quality of river water [4, 5, 6, and 7]. Among environmental pollutants, metals are of particular concern due to their potential toxic effect and ability to bioaccmulate in aquatic ecosystems [8]. Heavy metals including both essential and non-essential elements have a particular significance in ecotoxicology, to be toxic to living organisms [9].

The main objective of the work is to compare the status of water pollution in lotic and lentic ecosystems. It is done by metal identification with the help of chelating agents in the presence of surfactants.

II. Why surfactant

Anionic surfactants (AS) are broadly utilized as a part of family units, beautifiers and modern creations. Surfactants have likewise been utilized as a part of pharmaceutical Mining oil recuperation polymers,

paints, materials, strands, nourishments and mash ventures. The ASs speak to roughly 70% of the aggregate surfactant showcase because of the vast utilization of surfactants, it is essential to precisely determinate their fixations for quality control (business items), process control etc. micellzation property of AS is used for metal detection in this paper. Physiochemical properties also show positive and negative effects.

$C_{12}\ H_{25}\ SO_4^-\ Na^+$ + metal (M) → $C_{12}\ H_{25}\ SO_4^-$ --M^+
(Surfactant assemblies)

III. Materials and method

Description of the study area

The study area undertaken is durg district. River water samples were taken from Shivnath River which is considered as the heart line for Chhatisgarh. Pond water and well water was collected from durg main city.(Fig 1,2)

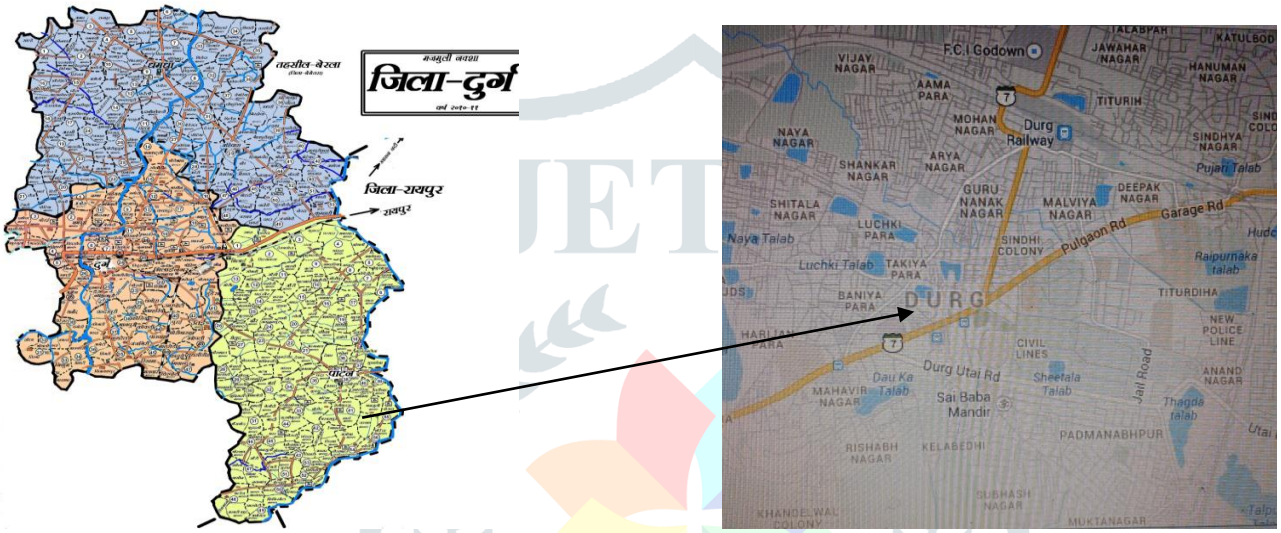


Fig.1,2—Chhatisgarh state, Durg district --pond sampling site

Fig 3 –

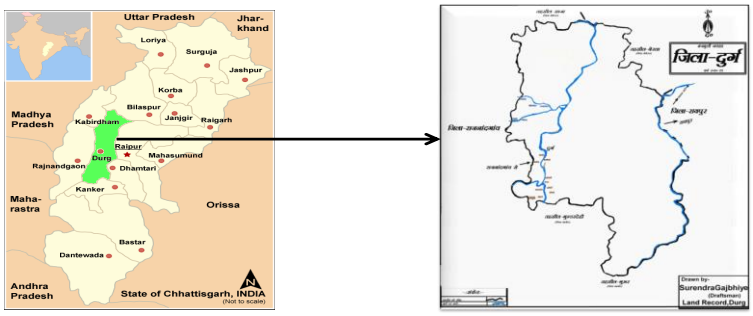


Fig 3 – River sampling site

Collection of Water samples

Water samples were collected from four ponds, wells and four different locations of Shivnath River by grab sampling, Durg. The Water collected in sampling bottles were pre-conditioned with 5% nitric acid and later rinsed thoroughly with distilled de-ionized water. Before sampling was done, at each sampling site, the polyethylene sampling bottles were rinsed at least three times. Pre-cleaned polyethylene sampling bottles were immersed at each sampling site and sampling was done. Samples were acidified with 10% HNO_3,

placed in an ice bath and brought to the laboratory. During whole study AR grade chemicals were used. The analysis is based on APHA for examination of water.

Analysis of metals.

Aliquot preparation: Two sets of sample were prepared, one for standard reading (without surfactant) and with Surfactant. The surfactant used was Anionic surfactants (AS) named Sodium laurel sulphate (SLS). All the data was correlated to the standard data (Table 1.).Metals were analyzed by Complexometric method Table 2 and The Mean concentrations and associated standard deviations of Ca,Mg, Cu, Ni, Fe, Zn and Mn in water and were presented in Table 3 and 4

TABLE-1 standards data of physiochemical parameters

Parameters	WHO Standards	
	HDL	MPL
pH	7-8.5	6.5-9.5
Ec	nil	nil
TDs	500	1000
Acidity	nil	nil
Alkalinity	nil	nil
temperature	nil	nil
CO2	nil	nil
Ca	75	200
Mg	30	150
Cu		
Ni		
Fe		

TABLE 2-Analysis of parameters

s/no.	parameters	Method for analysis
1	pH Value	Electrometric Method
2	Hardness	EDTA Titration Method
3	Alkalinity	Neutralization Titration
4	Conductivity	Conductivity meter
5	TDS	Online calculation
6	Iron	Titrimetric Method
7	Ca Mg	Complexometric method
8	copper, nickel,	Complexometric method
9	Acidity	Titrimetric Method
10	Salinity	Instrumental method

Table 3: Mean Concentrations of metals in Water (plain) in mg/L

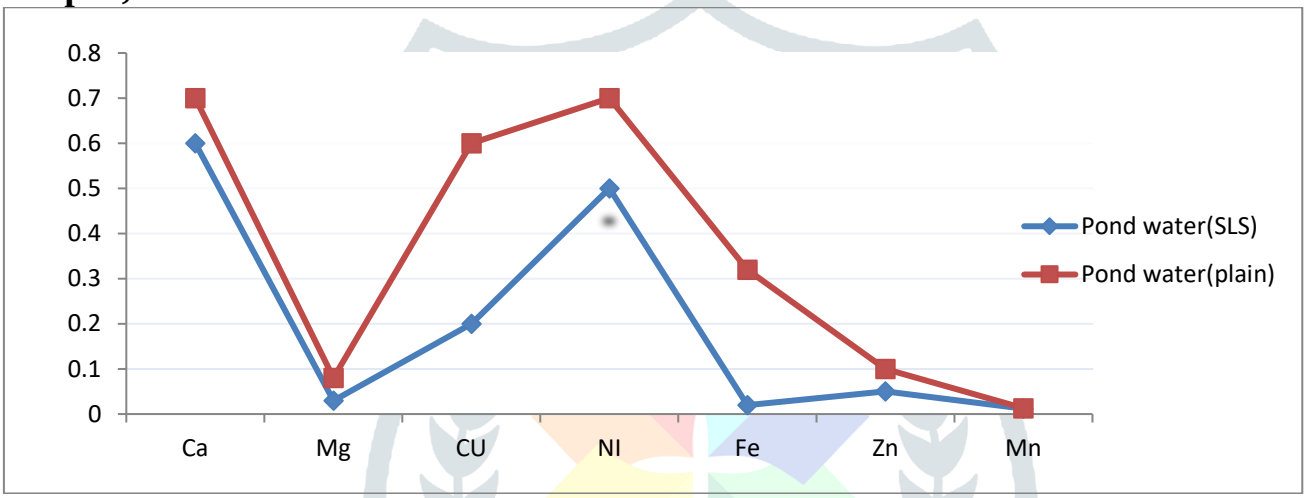
Samples	metals						
	Ca	Mg	Cu	Ni	Fe	Zn	Mn
Pond water	0.70	0.08	0.60	0.70	0.32	0.10	.013
River water	0.94	0.18	0.50	0.46	0.32	0.20	.002
well water	1.46	1.64	0.40	0.38	0.34	0.18	.023

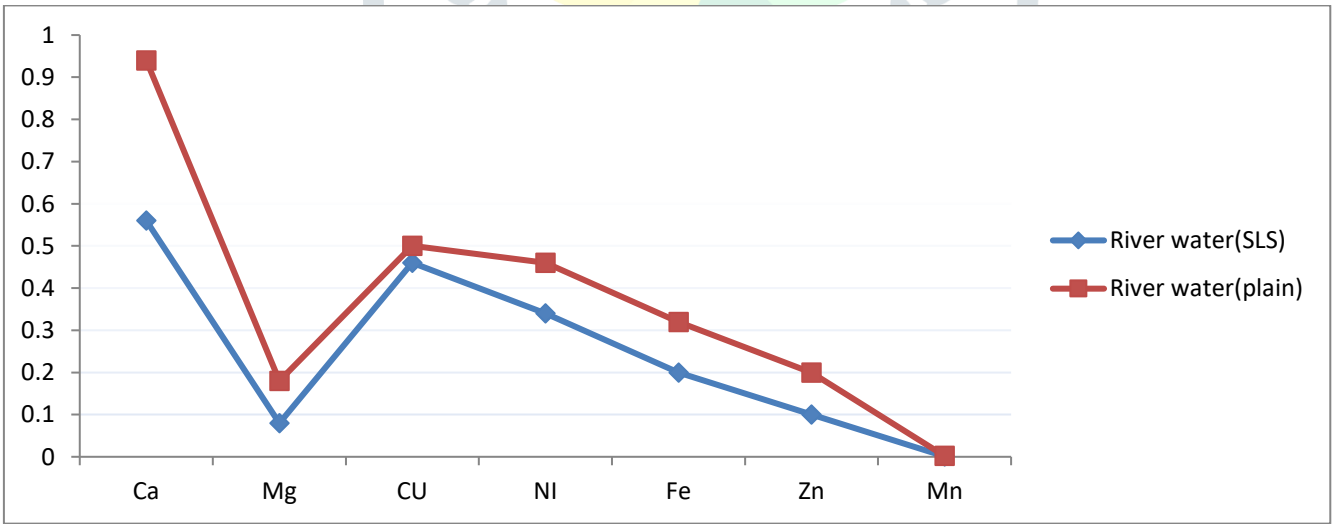
Values are expressed as mean + S.D of six observation

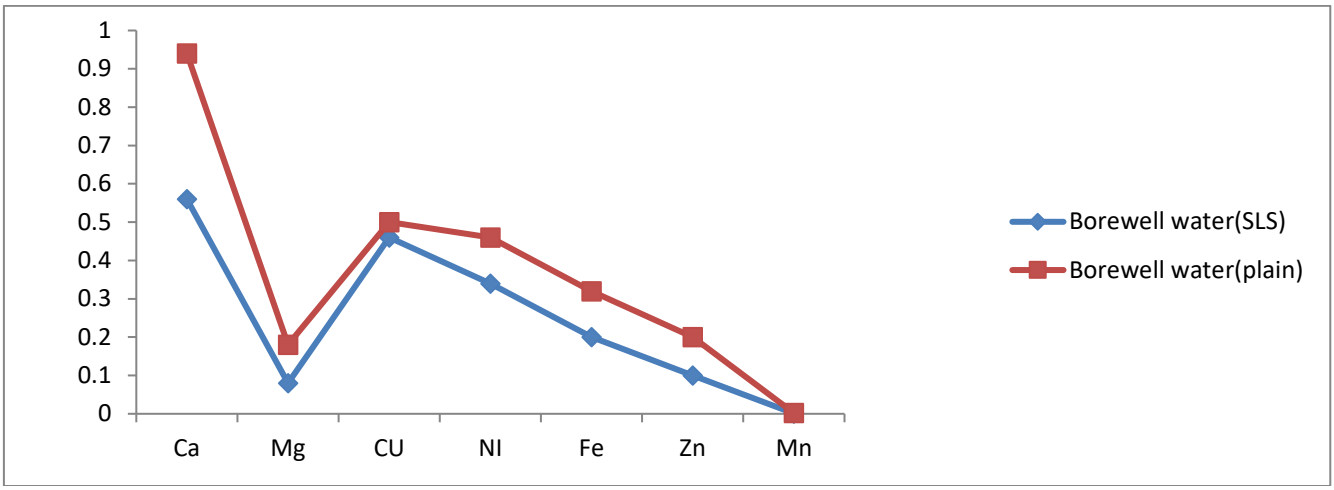
Table 4: Mean Concentrations of metals in Water with surfactant in mg/L							
Samples	metals						
	Ca	Mg	Cu	Ni	Fe	Zn	Mn
Pond water	0.6	0.03	0.2	0.5	0.02	0.05	0.012
River water	0.56	0.08	0.46	0.34	0.2	0.1	0.001
well water	0.65	0.34	0.2	0.2	0.2	0.1	0.021

Values are expressed as mean + S.D of six observation

Graphs;







Results and Discussion

Calcium was maximum found in well water and minimum was in pond water. Concentration of calcium in well water may be due to calcium salts present. Magnesium was maximum in well water and minimum was in pond water. Copper, was maximum in pond water and minimum was in well water. Iron, was maximum in well water .Zinc was maximum in river water and minimum was in pond water and Manganese was maximum in well water and minimum was in river water were evaluated in the samples of fresh water. The analysis was done complexometrically in the presence of surfactant. When the analysis was done with the addition of surfactant there was reduction in the data which proposes that surfactant SLS has formed the assemblies with the metal ions and so they were not available for the complex formation with EBT and EDTA. The distribution of metals in Water samples analysed were in the order of magnitude as by Ca>Mg> Cu > Fe > Zn > Mn. The highest concentration level of copper was observed in pond water. The lowest concentration levels of Manganese were observed in shivnath river sample. These levels of heavy metals may be due to the increase in agricultural runoff in waters, domestic wastes and some anthropogenic activities. Graphs were plotted between metals and their concentration for all the three types of water samples. ie. Pond, River and well water

CONCLUSION

A comparative study of each variety of Ground water and surface water was administrated by taking metals as parameters. The study shows that the quality of water varies from locations to locations. It was seen that on adding surfactant the quality of water improved as metal ions concentration decreases and micellzation of surfactant wit metals takes place (Fig.2) and comes below the WHO standards. The anionic surfactant used is sodium laurel sulphate. Surfactant is added to the polluted aqueous solution containing metal ions and/or organic solutes. Graphs were also plotted between sampling sites and parameters and the effect was seen.

Mechanism:

Surfactant at cmc ---- metals in water-----surfactant starts to form micelle or aggregates-------- micellzation….

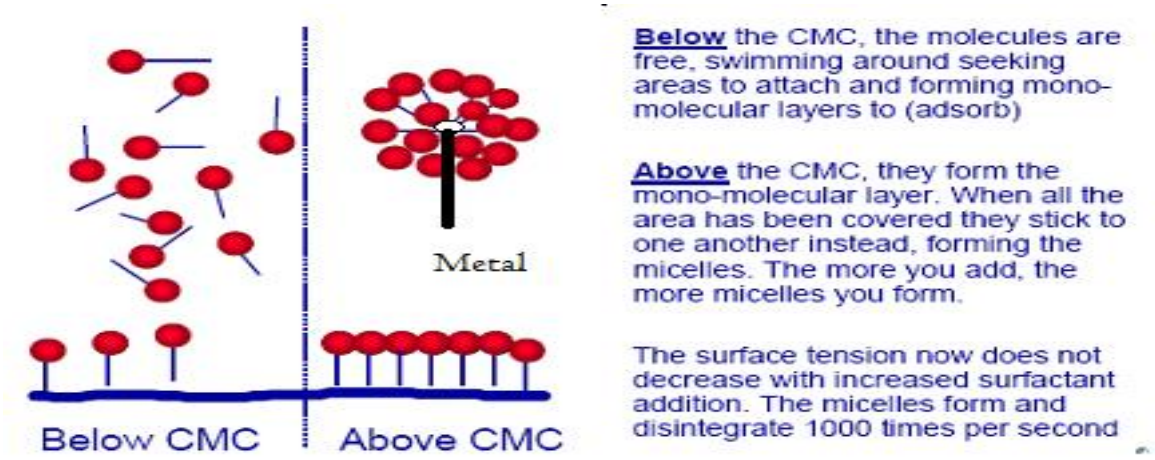


Fig.4 micellzation of surfactant

The surfactant forms micelles at a concentration higher than its critical micelle concentration (cmc). The metal ions are adsorbed on the surface of the oppositely charged micelles by electrostatic attraction (Fig.3). Surfactants above their critical micelle concentration starts to form micelles and they trap the metal ions form the water sample, [10].They adsorbs and help in mobilization of ions and this process is cross checked by complexometric titration. Metal analysis can be done by surfactants and this method can be used for the metal extraction. Surfactants played an important role for determination of aluminium from pharmaceutical samples in the form of Al –alumion complex and have created better conditions to enhance the sensitivity of the method [11].

This method has the following advantages: simple operation; environmentally safer; low-energy requirement; high removal efficiency; easy to recover metal ions; less expensive; separation can be carried out at room temperature [12].

Higher values of certain parameters at certain location indicate that the water of those locations is not suitable for drinking as such. In the present situation, few water sources are not safe for use in respect to total hardness, higher magnesium and calcium content which may lead to poor drinking water quality. It is suggested that freshwater should be analyzed to check potability so that it become suitable for domestic purposes. It can reveal from the present study that contamination problem is not alarming at present but ground water quality may deteriorate with time. Therefore, periodical monitoring can help to avoid contamination of fresh water of the region.

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