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ANALYSIS OF SHIVNATH RIVER WATER USING SURFACTANT ASSEMBLIES

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ABSTRACT

Surfactants are the surface active substances and they have wide range of application .In the Present work assessment of physico-chemical parameters of water samples of shivnath river at Durg has been done in the year 2014 to 2015 in pre monsoon, monsoon and post monsoon seasons. Statistical studies have been carried out by calculating correlation coefficients between different sets of parameters. The observed values of various physico-chemical parameters of water samples were compared with standard values recommended by WHO. An appreciable significant positive correlation was found between the parameters.Perason correlation was used for method justification. Minitab software was used for graph plotting.

Keywords *– Surfactants, Physico-chemical parameters, Statistical analysis, Pearson correlation, Minitab software.*

1. INTRODUCTION

The access to safe drinking water plays crucial role in the public health. In India most of the ponds, rivers and ground water are used for domestic and agricultural purposes. The quality of water may be described according to their physico-chemical and micro-biological characteristics. For effective maintenance of water quality through appropriate control measures, continuous monitoring of large number of quality parameters is essential. However it is very difficult and laborious task for regular monitoring of all the parameters even if adequate manpower and laboratory facilities are available. Therefore, in recent years an alternative approach based on statistical correlation, has been used to develop mathematical relationship for comparison of physico-chemical parameters [1,2,3]. The present study deals with study of physico-chemical parameters of Shivnath river water in Durg, Chhatisgarh in the presence of surfactant named Sodium laurel sulphate. The analyzed data were compared with standard values. Systematic calculation of correlation coefficient between water quality parameters has been done with the objective of minimizing the complexity and dimensionality of large set of data. The significant correlation has been calculated. In this paper surfactants are utilized in river water analysis. surfactant used is Sodium laurel Sulphate (SLS).[4]Shar G.A, have explained that surfactant along with chelating agent can from stable complex with the metals and so the metals present in various concentration can be determined. Increasing population and its necessities have lead to the deterioration of surface and sub surface water[5] .All metabolic and physiological activities and life processes of aquatic organisms as well as human beings are generally influenced by such surface water. According to Central Pollution Control Board, 90% of the water

supplied in India to the town and cities are polluted, out of which only 1.6% gets treated. Therefore, water quality management is fundamental for the human welfare.[6,7.]

Durg is part of Chhatisgarh situated at 13°4' N and 80°5'latitude with surplus lentic water ecosystem lying on the middle. Underground water and pond water is the only source of water for the Rural areas of Durg district. The pond water quality of durg is continuously degrading due to Domestic activities. Therefore, pond water analysis is done so, that some remedies for the improvement could be possible. Fig.1 and 2 shows the study area and sampling locations.

2. EXPERIMENTAL

Water samples were collected from Eight different locations of shivnath river, Durg during the in pre monsoon, monsoon and post monsoon seasons. Borosilicate glassware, distilled water and AR grade reagents were used throughout the testing. Samples were collected in sterilized screw-capped polyethylene bottles of one litre capacity and analyzed in laboratory for their physico-chemical parameters. Samples collected from study sites were properly labelled and a record was prepared. The various physiochemical parameters were analyzed .Total alkalinities of the water samples were determined by titrating with N/50 H_2SO_4 using phenolphthalein and methyl orange as indicators. The conductivity of the water sample was measured using the conductometry method. The total hardness of the water samples was determined by Complexometric titration with EDTA using Erichromebalck-T as an indicator[8,9]. Other parameters were determined according to Ademoroti, 1996 and ICMR Standards (1985). Karl-Pearson correlation coefficient (r) was calculated. Obtained data was compared with standard data [10-14].

Aliquot preparation: Two sets of sample were prepared, one for standard reading (without surfactant) and with Surfactant. The surfactant used was Sodium laurel sulphate (SLS).

Fig.1 : Map of Chhatisgarh

Fig. 2 : Shivnath river

3. RESULTS AND DISCUSSION

Table 1 respresents methods of analysis used for evaluation of various parameters. The standard and observed values of physico-chemical parameters of experimental water samples are presented in Table 2. The observed pH values ranging from 6.9 to 8.4 without adding surfactant and 7.3 to 8.9 on addition of surfactant and this shows that the present water samples are slightly alkaline which increased on addition of surfactant. These values are within maximum permissible limit prescribed by WHO. The calcium (75-345 mg/L) and 67 to 338 mg With surfactant, hardness (120-375 mg/L) and 108 - 296,with surfactant, TDS (131-195 mg/L) and 152-205 mg/L values of water samples are within the highest desirable or maximum permissible limit set by WHO. Since no prescribed standards are suggested by WHO for parameters like electrical conductivity, for drinking purpose. So, no comparison can be made from observed values. In the present study all the parameters have strong significant positive correlation with each other that shows any fluctuation in the parameter directly affect the property of water.

Table 1 : Methods of analysis used for evaluation of various parameters

S.No.	Parameters	Method for analysis
1	pH Value	Electrometric Method
2	Hardness	EDTA Titration Method
3	Alkalinity	neutralizationTitration
4	Conductivity	Conductivitymeter
5	Total Dissolved Solids	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 2: The standard values of physico-chemical 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

HDL: Highest desirable Limit; MPL: Maximum permissible limit, EC in dsm-1; **Turbidity in NTU*

Table 3 : Correlation analysis of parameters without adding surfactant

Parameters	pH	Cond.	Alkalinity	Acidity	TH	TDS	Temp.	Free CO_2	Ca	Mg	Cu	Ni	Iron
pH	1												
Cound.	0.70	1											
Alkalinity	0.62	0.24	1										
Acidity	0.28	0.05	0.30	1									
TH	0.37	0.24	0.34	0.32	1								
TDS	0.70	0.99	0.23	0.04	0.24	1							
Temp.	0.34	0.14	0.88	0.38	0.38	0.13	1						
Free CO2	0.54	0.06	0.58	0.61	0.38	0.06	0.44	1					
Ca	0.33	0.29	0.19	0.22	0.98	0.29	0.23	0.66	1				
Mg	0.39	0.14	0.56	0.46	0.94	0.14	0.62	0.83	0.87	1			
Cu	0.53	0.17	0.18	0.49	0.32	0.17	-0.14	0.708	0.32	0.34	1		
Ni	0.14	0.34	0.32	0.45	0.66	0.33	0.57	0.31	0.62	0.69	-0.05	1	
Iron	0.87	0.56	0.63	0.44	0.01	0.56	0.35	0.432	-0.05	0.139	0.57	0.002	1

Table 4 : Correlation analysis of parameters with adding surfactant

Parameters	pH	Cound.	Alkalinity	Acidity	TH	TDS	Temp.	Free CO_2	Ca	Mg	Cu	Ni	Iron
pH	1												
Cound.	0.37	1											
Alkalinity	0.68	0.41	1										
Acidity	0.006	-0.0006	0.22	1									
TH	0.63	0.35	0.39	0.21	1								
TDS	0.36	0.99	0.40	0.004	0.34	1							
Temp.	0.58	0.07	0.88	0.29	0.400	0.07	1						
Free CO2	0.57	0.25	0.56	0.41	0.80	0.24	0.46	1					
Ca	0.58	0.36	0.24	0.13	0.98	0.36	0.24	0.72	1				
Mg	0.67	0.29	0.61	0.32	0.94	0.29	0.63	0.88	0.87	1			
Cu	0.31	0.91	0.39	0.24	0.39	0.91	0.01	0.46	0.39	0.35	1		
Ni	0.33	0.18	0.34	0.48	0.71	0.18	0.55	0.41	0.67	0.72	0.15	1	
Iron	0.59	0.57	0.68	0.24	0.04	0.57	0.41	0.21	-0.02	0.14	0.59	0.03	1

Table 5 : Correlation analysis of the data without and with surfactant

S. No.	Parameters	r value	S. No.	Parameters	r value
1	pH	0.81	8	Free CO2	0.958
2	Cound.	0.55	9	Ca	0.99
3	Alkalinity	0.99	10	Mg	0.99
4	Acidity	0.963	11	Cu	0.914
5	TH	0.99	12	Ni	0.99
6	TDS	0.547	13	Iron	0.99
7	Temp.	1			

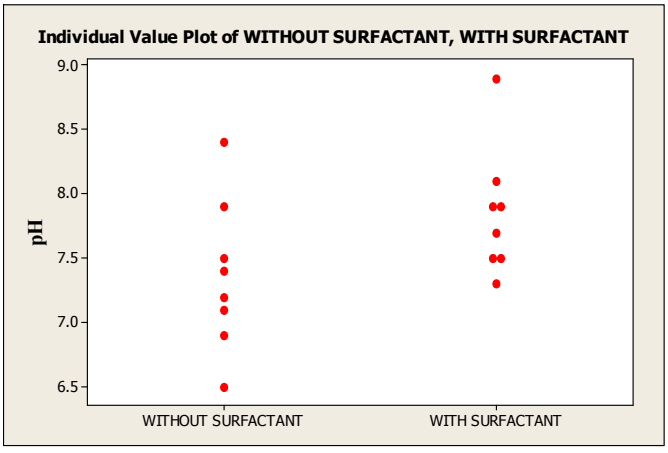

Fig. 3 : Graph for pH

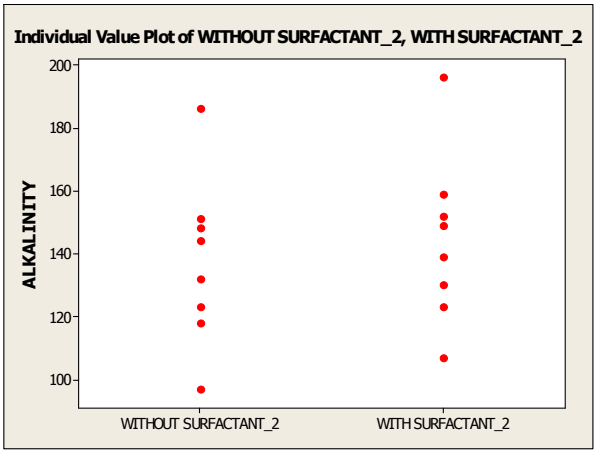

Fig. 5 :Graph for Alkalinity

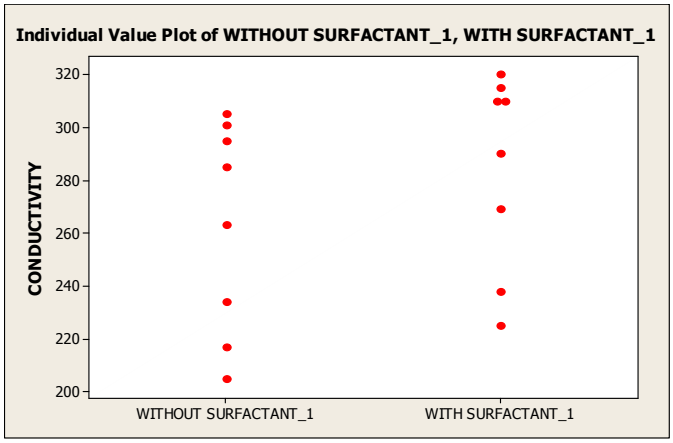

Fig. 6: Graph for conductivity

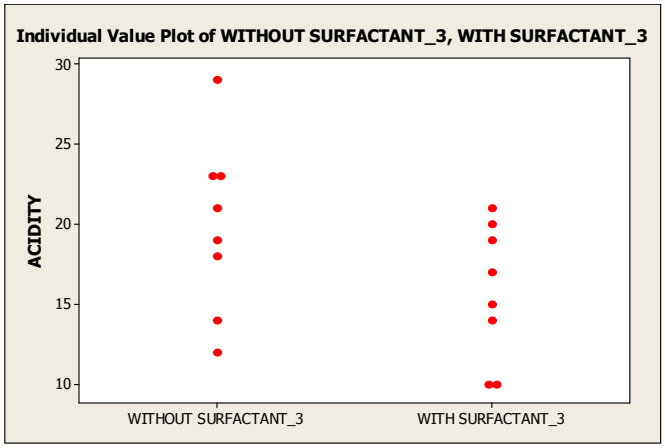

Fig. 7 : Graph for acidity

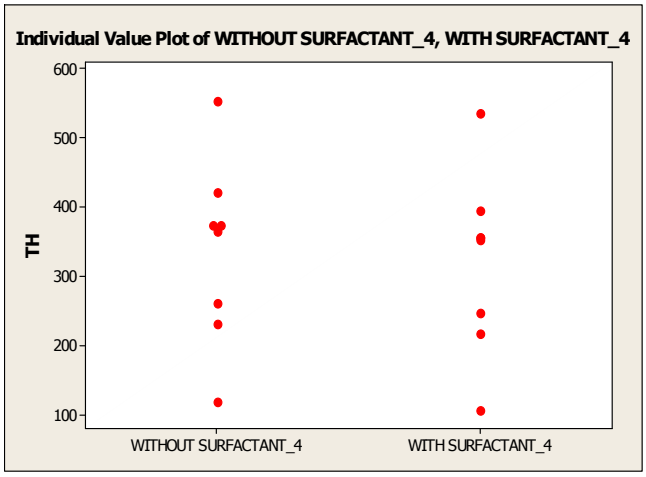

Fig. 8 : Graph for Conductivity

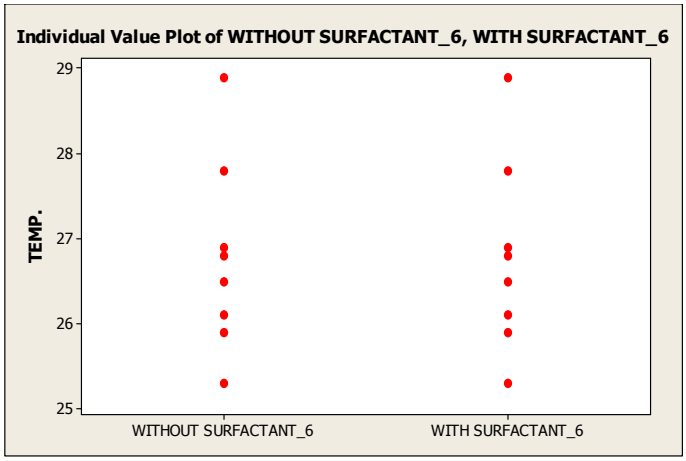

Fig. 9 : Graph for Temperature

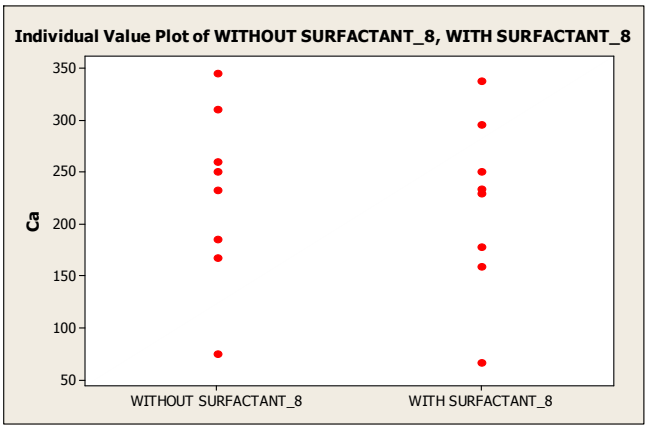

Fig.10 : Graph for Calcium

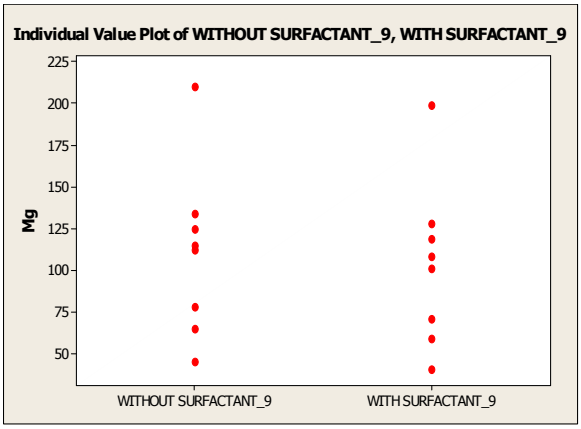

Fig. 11 : Graph for Magnisum

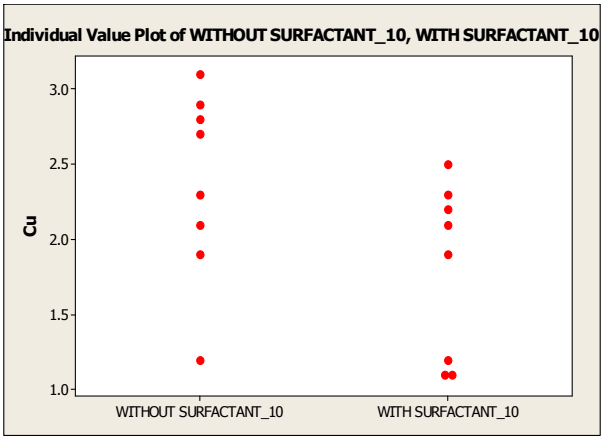

Fig. 12 : Graph for Copper

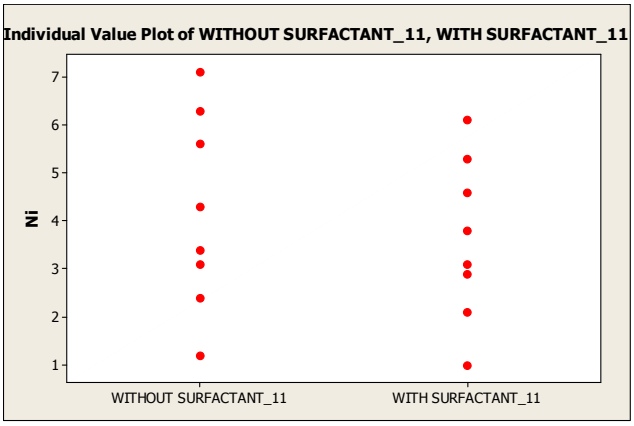

Fig. 13 : Graph for Nickle

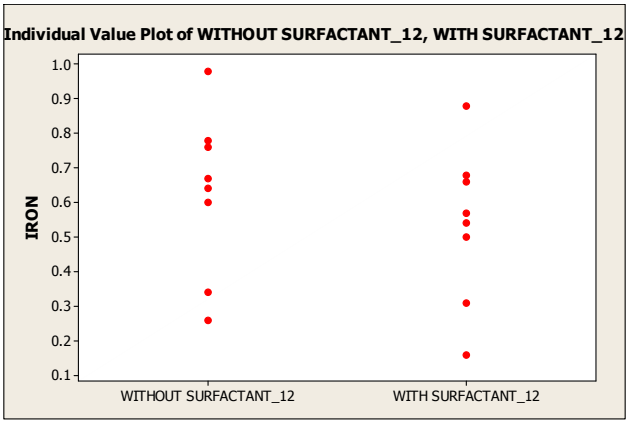

Fig. 14 : Graph for iron

4. CONCLUSION

The work presented here is only to study the chemical quality of the river water, with the help of surfactant. The anionic surfactant used is sodium lauryl sulphate. Surfactant is added to the polluted aqueous solution containing metal ions and/or organic solutes. The surfactant forms micelles which are charged spherical aggregates containing 50 to 150 surfactant molecules 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. Surfactants above their critical micelle concentration starts to form micelles and they trap the metal ions form the water sample, 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. 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.

It can be concluded that river Shivnath is polluted and rapidly turning toward eutrophication. Its Water has become unsuitable for human consumption. Proper biological and chemical treatment of Domestic sewage and industrial effluents before discharge to river is suggested. All the physico-chemical variables of Shivnath river water at Durg are within the highest desirable limit or maximum permissible limit set by WHO Shivnath water recorded higher values of Mg than Ca. Soil erosion, Agricultural practices, farming in sand can be attributed to high values of magnesium than the calcium in the river water. A large number of factors and geological conditions influence the correlations between different pairs directly or indirectly. An appreciable significant positive correlation have been recorded pH, Mg, hardness and TDS ,hardness, EC.A significant negative correlation was found between calcium iron and copper and Nickel.

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