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Seasonal Study of Physico-Chemical Characteristics of Ground Water of Rahata Area, M.S.

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Abstract- The physical and chemical properties were calculated for water samples collected from different places in Rahata area; which is one of the talukas of Ahmednagar district and belongs to Nasik division. The present paper expresses the parameters like temperature, pH, Electrical Conductivity, TDS, turbidity, salinity, TH, chloride contents, alkalinity. Correlation co-efficient 'r' was calculated for these parameters.

Keywords: Rahata; Physico-Chemical properties; seasonal; correlation co-efficient.

I. INTRODUCTION

As water is one of the most essential components required for survival of life and living things as well as environment, these things cannot be survived without non-polluted water; it became crucial to have estimation of water quality. The feature of water depends upon different chemical constituents and their concentration generated by agricultural compost, manufacturing waste, rubbish or household waste. The ground water analysis for physical and chemical properties is very important for public health studies. These studies are also main part of pollution studies in the environment [1].

Ground water is about 20% of the global resource of fresh water and broadly used for different purposes. Only about 1% of all of fresh water is available from rivers, ponds, lakes etc. [2]. It is estimated that one third of the world's population use groundwater for drinking as well as for all domestic purpose [3]. Thus it becomes necessary to pay concentration on study ground water quality and create awareness amongst the society.

Besides canal water, the main source of drinking in rural and urban area is ground water. The modern culture, industrialization, urbanization and increase in residents have laid to the fast degradation of our ground water quality [4].

II. STUDY AREA

Literature survey reveals that limited studies have been carried out for water quality analysis in surrounding region of river pravara. But no research on water quality parameters has been reported so far. Therefore five sampling stations were selected in and around Rahata town Table 1.

Rahata is one of the talukas in Ahmednagar district, Maharashtra state in India. Rahata city is located on the Nagar-Manmad road, just 5 km from holy place Shirdi and is famous for agriculture implements. It is located 84 KM towards North from District head quarters Ahmednagar 218 KM

from state capital Mumbai towards west. The city Rahata has geographical coordinates of Latitude and Longitude 19043'0''North and 74029'0''East respectively.

III. EXPERIMENTAL

Water samples from the selected locations were brought from April-2010 to March-2011. Samples were taken in 2 liter capability well cleaned polythene bottles.[5-6]. Collection and investigation of samples was carried out monthly for the parameters like temperature, pH, Electrical Conductivity (EC), total dissolved solids (TDS), total hardness (TH), total alkalinity, turbidity, Chloride contents and Salinity. Data exploration was further done and results are generated for pre-monsoon and post-monsoon seasons. Out of five samples, two were municipal samples (from Rahata town and Sakuri village respectively), and three were samples collected from dug well. All samples were properly labeled as S_1, S_2, S_3, S_4 and S_5 and record was set as indicated in Table1

A multiparameter water testing kit "PCS Tester 35" (Eutech make) was used for the purpose of temperature, pH, EC, TDS and salinity measurements. Turbidity measurements were done with the help of Nephelometer (A Labtronics make, Model No. 34).The range of the turbidity meter used was 0-200 NTU. Total hardness was calculated by EDTA (Ethylene diamine tetra acetic acid) technique which is the precise method[7] in which EBT (Erichrome black-T) is used as an indicator. Chloride contents were calculated by a titrative Mohr's technique. Titrative method was also used to estimate the values of Total alkalinity in which methyl orange and phenolphthalein were used as indicators. All the chemicals used for the analysis were of AR grade.

IV. RESULTS AND DISCUSSION

Table 2 gives the standard data of different physic-chemical parameters of water quality [8-9] and their units.

In current study the physico-chemical parameters were calculated for five dissimilar water samples. The estimated data were separated into pre-monsoon and post-monsoon groups as shown in Table3.

4.1 Temperature

The temperature was found to be in the range between 24.9^0C and 30.9^0C. The higher values of temperature are noticed especially for pre-monsoon measurements. (Table3)

4.2 pH

pH value is the logarithm of reciprocal of hydrogen ion activity. Industrialized waste may be highly acidic or basic and this causes effect on the pH value of water which receives it. The pH serves as a measure to indicate the extent of contamination by acidic or basic waste. The pH values were found between 7.09 and 8.7 (Table3). The pH values are found with wide variation.

4.3 EC

Electrical conductivity is a measure of water's capacity to transmit an electric current. This property is correlated with the total concentration of ionized substances in water. More are the dissolved salts in water, the large is current flow and thus higher the EC. In short, EC of water increases with increase in salt contents i.e. salinity.

In present study EC values were found within the range of 45 µSiemens to 1390 µSiemens and 40 µSiemens to 895 µSiemens for pre-monsoon and post-monsoon seasons respectively (Table3).

4.4 TDS

Total Dissolved Solids specify the salinity behavior of groundwater[10]. TDS of ground water is mainly due to vegetable decomposition, evaporation, removal of waste matter and chemical weathering of rocks.

In the present investigation the TDS was found up to 990 mg/lit and 864 mg/lit for pre- and post-monsoon season respectively (Table3).

4.5 Turbidity

Turbidity in water is the lessening of clearness due to the presence of particulate matter such as clay or slit, finely divided organic substance etc. These can cause light to spread or absorb rather than transmitted in straight lines through the sample. In present study turbidity was found between 4.12 and 4.7 NTU for pre-monsoon and 4 to 5.4 NTU for post-monsoon measurements. (Table3). Turbidity of S_1, S_3, S_4 and S_5 was found with high values than that prescribed by IS:10500(In the absence of alternate source turbidity up to 10 NTU is permissible, Table2).

4.6 TH

Hardness of water is the capacity of water to react with soap, hard water requiring considerably more soap to produce lather. Hardness is one of the significant properties of ground water from utility point of view for dissimilar purposes [11]. For potable water the TH should be limited up to 300 mg/lit and maximum permissible value is 600 mg/lit (Table2). The TH values were found within permissible range except for S_1.

4.7 Chloride Contents

The maximum permissible value of chloride content is 1000mg/lit (Table2). Except S_1, all samples were found to be having concentration of chloride within limit.

4.8 Total Alkalinity

The desirable limit of alkalinity is 200 mg/lit and maximum permissible limit is 600 mg/lit (Table2). The alkalinity values were found within permissible range for all samples.

4.9 Salinity

The salt content of water is termed as salinity. TDS and EC are directly proportional to salinity. In present study, salinity was found between 102 and 879 mg/lit.

4.10 Statistical Analysis

Interrelationship studies between unlike values are very supportive tools in promoting investigations and opening new frontiers of information. The study of correlation reduces the range of uncertainty associated with decision making [10, 12].

Correlation is the mutual relationship between two variables. Direct correlation exists when increase or decrease of the value of one parameter is related with analogous increase or decrease in the value

of the other. The correlation is said to be positive when increase in the one parameter causes the increase in the other factor and it is negative when increase in one parameter causes the decrease in the other factor. The correlation coefficient has a value between +1 and -1[13].
The correlation co-efficient 'r' was calculated using the equation

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$$

Where $x=X-\bar{X}$ and $y=Y-\bar{Y}$, X and Y represent two different parameters
$\bar{X}$= Mean value of X; $\bar{Y}$= Mean value of Y
The values of correlation co-efficient 'r' for different parameters for pre-monsoon and post-monsoon seasons are as shown in Table4 and Table5 respectively.

CONCLUSION

It has been estimated that there is wide deviation in water quality parameters for different samples. All water samples were found with alkaline trend and with slightly higher values of TDS than desirable value. Water containing TDS more than 500mg/lit is not considered desirable for drinking. Such water causes gastrointestinal irritation [14]. The water sample S_1 was found unfit for drinking due to high values of EC (WHO standards [10]), TH and chloride contents. It is recommended that the water of S_1should be used after proper treatment.

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Table 1:Area, Source and distance from central place

Sampling Station No.	Area	Source	Approximate distance(Km) (From first station as a central place)
S_1	Behind primary school, Sakuri	Dug Well	03
S_2	Sakuri village	Municipality Supply	02
S_3	Rahata	Municipality Supply	00
S_4	Nandurkhi	Dug Well	06
S_5	Pimplas	Dug Well	04

Table 2:Parameters, Units and Standard values[15]

Parameter	Unit	Standard values guided by ICMR		Standard values as guided by IS: 10500		
		Desirable Concentration	Maximum permissible Concentration	Requirement (Desirable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source
Temp.	^{0}C	-	-	-	-	-
pH	-	7.0-8.5	6.5-9.2	6.5-8.5	Water will affect the mucous membrane and or water supply system	No relaxation
EC	µS	7.1×10^2	6.0×10^2	-	-	-
TDS	mg/lit	500	1500	500	Potability decreases and may cause gastro intestinal irritation	2000
Salinity	mg/lit	-	-	-	-	-
Turbidity	NTU	-	-	5	Consumer acceptance decreases	10
TH	mg/lit	300	600	300	Encrustation in water supply structure and adverse effects on domestic use	600
Chloride	mg/lit	200	600	250	Taste, corrosion and potability are affected	1000
Total Alkalinity	mg/lit	200	600	200	Taste becomes unpleasant	600

Table 3:The physico-chemical parameters of various samples for pre-monsoon and post-monsoon seasons

Parameter		Temperature	pH	EC	TDS	Turbidity	TH	Chloride Content	Tot. Alkalinity	Salinity
Pre-monsoon	S_1	27.9	7.78	1390	990	4.7	1230	1225	82	720
	S_2	29	8.3	954	745	4.32	213	192	125	535

	S_3	28.8	8.7	922	750	4.6	150	198	229	523
	S_4	30	8.01	6.52	341	4.2	227	185	81	102
	S_5	30.9	8.21	45	290	4.12	213	181	81	150
Post-monsoon	S_1	25	8.04	895	870	5.4	990	1175	86	879
	S_2	24.9	7.6	290	864	5.15	202	185	161	347
	S_3	25.2	7.57	255	840	5.1	299	154	152	250
	S_4	26	7.09	40	310	4	275	171	96	150
	S_5	26	8.04	44	300	4.25	241	215	95	230

Units: EC-µSiemens, TDS-mg/lit, Turbidity-NTU, TH, Chloride content, Tot. Alkalinity, Salinity -mg/lit

Table 4: Correlation matrix for water quality parameters (Pre-monsoon)

Parameter	Temperature	pH	EC	TDS	Turbidity	TH	Chloride	Alkalinity	Salinity
Temperature	1.00	0.1201	-0.9494	-0.9739	-0.9289	-0.6571	-0.6962	-0.3122	-0.9358
pH		1.00	-0.0335	-0.0687	-0.0034	-0.7273	-0.6743	0.8859	-0.0143
EC			1.00	0.9957*	0.8945	0.6328	0.6741	0.3308	0.9990*
TDS				1.00	0.9155	0.6559	0.6967	0.3205	0.9911*
Turbidity					1.00	0.6479	0.7018	0.4446	0.8880
TH						1.00	0.9970*	-0.3866	0.6227
Chloride							1.00	-0.3159	0.6648
Alkalinity								1.00	0.3398
Salinity									1.00

*Highly significant correlation between EC & TDS, EC & Salinity, TDS & Salinity, TH & Chloride

Table 5: Correlation matrix for various water quality parameters (Post-monsoon)

Parameter	Temperature	pH	EC	TDS	Turbidity	TH	Chloride	Alkalinity	Salinity
Temperature	1.00	-0.8334	-0.7065	-0.9854	-0.9651	-0.4015	-0.4155	-0.5538	-0.6079
pH		1.00	0.9463*	0.8349	0.9290	0.7902	0.8054	0.0551	0.9134
EC			1.00	0.7040	0.8012	0.9301	0.9345	-0.1891	0.9816*
TDS				1.00	0.9750*	0.4147	0.4059	0.5610	0.5870
Turbidity					1.00	0.5426	0.5470	0.4156	0.7151

TH	1.00	0.9891*	-0.5194	0.9471
Chloride		1.00	-0.5240	0.9709*
Alkalinity			1.00	-3201
Salinity				1.00

*Highly significant correlation between EC & TDS, EC & Salinity, TDS & Turbidity, TH & Chloride, Chloride & Salinity

