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Study of physico-chemical parameters of ground water in Tribal area of Pali block, Umaria district, Madhaya Predesh, India

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Abstract
Ground water is the major source of water for drinking, agricultural desires in villages. The present study is focused on the determination of physico-chemical parameters, such as Temp, pH, Total Alkalinity(TA), Electrical conductance (EC), calcium hardness (CH), Magnesium hardness (MH), Total hardness (TH), Total dissolved solid (TDS), Fluoride content, DO, BOD,COD of water samples which were collected from different sampling point Open well(OW), Bore well(BW), Hand pump (HP), Lakes, Ponds of 5 tribal villages of Pali Tehhsil district of Umaria, Madhya Pradesh.
Each parameter was compared with its standard permissible limit as prescribed by WHO. The study reveals that the ground water of area needs some degree of treatment before consumption it also needs to be protected from the perils of contamination.

Keywords: physico-chemical parameters, dental fluorosis, WHO

Introduction
Water is the most important and essential natural resource for life on earth. Ground water is the potential source of drinking water for rural population in India, it is also used for domestic, irrigation and industrial, purpose as well as (infrastructure) construction propose, unplanned development of township, colonies and rapid urbanization are the major cause which affects the availability of ground water [1-2]
The quality of ground water is badly affected by unplanned growth of industries near township, effluent from sewage water, infiltration of irrigation water, septic tank, and solid waste are the main cause of quality of water [3]
According to World Health Organization waterborne diseases account for an estimated 3.6 % of the total DALY (disability-adjusted life year) global burden of disease, and cause about 1.5 million human deaths annually. The World Health Organization estimates that 58 % of that burden is attributable to lack of safe drinking water supply, sanitation and hygiene so water quality has acquire as much importance as water quantity [4-5]
India is heading towards a fresh and pure water crisis, it is estimated that around 37.7 million Indians are affected by waterborne diseases annually. It is mainly due to improper management of water recourses and environmental degradation, it is vital to regularly monitor the quality of ground water and to device ways and means to protect it [6]
The Tribal area of Madhya Pradesh is still away from development in various field like education, sanitary, water supply, health etc. than other part of country, in some of tribal villages of coal mines area of MP water bodies *viz*, falls, lakes, hand pump, open well, and bore well are contaminated with domestic, and industrial waste by overburden dump, surface impoundments, waste disposal, mine drainage and likely to cause water related diseases [7]
In the present study, physico-chemical parameters are determined to draw a conclusion on the quality of water whether it is good or unfit for drinking purpose.

The main objectives of the study are
- Collection of ground water samples from open wells, bore wells, hand pumps, lakes and ponds, from tribal villages of Pali Tehsil Umaria district,
- Analysis of quality parameters such as pH, Total alkalinity EC, TDS, Hardness, Fluoride etc.

Salient features of the study area
Umaria is an important and newly formed Tribal district in Shahdol division in Vindhyan region of Madhya Pradesh, it is geographically situated between 23^0 38' N latitude to 24^0 20' N latitude and 80^0 28' E longitude to 82^0 12' E longitude. It is surrounded by Dindori in south, Satna in the north, Shahdol in the east and Katni in west.
Umaria district consist of five tehsil, *viz* – Pali, Nowrozabad, Bandhogarh, Manpur and Chandia. The present study area Pali (Birsinghpur) is situated on the Umaria- Shahdol road, at a distance of about 36 km from Umaria. Umaria district experiences a temperate climate characterized by a hot summer (Aver. max. temp.: 46.2^0C), well distributed rainfall during the south-west monsoon (Aver. rainfall: 1293 m.m.) and mild winter (Aver. min. temp.: -0.1^0C). The winter season commences from December and lasts till the end of Feb, followed by summer from March to middle of June. The south-west monsoon continues from middle of June to September.
The month of May is the hottest month with mean daily maximum temp at $42\cdot 4^0$ and daily minimum temp at $25\cdot 5^0$. The normal average rainfall of Umaria district is 1293 mm [8]

Experimental
A. Water sampling
The Water samples were collected from 15 locations of 5 tribal villages of Pali Tehsil of Umaria district, during (post

monsoon) from October 2019 to Dec. 2019. The samples were collected in pre washed clean bottles without any air bubbles and tightly sealed after collection and labeled in the field. The temperatures of the samples were measured in the field on the spot at the time of sample collection. The samples were analyzed just after sampling in the chemistry lab [9].

B. Analytical methods

Analysis was carried out for various water quality parameters pH meter (Systronics Digital Model) was used to determine the hydrogen ion concentration. Electrical conductivity calculated by using conductivity meter. Total alkalinity (TA) was estimated by neutralizing with standard HCl acid.

Salinity and Total dissolved solids (TDS) were estimated using Systronics water analyzer. Total hardness (TH) and calcium hardness (CH) as $CaCO_3$ were determined Titrimetrically, using standard EDTA. The calculation of Magnesium hardness (MH) was done by subtracting the CH from TH value. The DO and Fluoride was estimated as per standard procedures [9]

Result and Discussion

For the purpose of revealing the water quality of samples covering the study area the Physico-Chemical parameters have been listed systematically and presented in Table -1. The parameters *viz*, pH and Total dissolved solids show the *physical characteristics* of the ground water under the study The *chemical characteristics* of the groundwater under the study area are known by the parameters *viz*, Total hardness, Calcium hardness, Magnesium hardness, Fluoride, Alkalinity and Dissolved Oxygen.

The importance of temperature in water quality is derived mainly from its relationship with other water quality parameters, the sweetness of water is to some extent dependent on temperature, the Temp mean value of water samples was 27.6^0 C of villages of Pali tehsil.

It is obvious that the samples collected from bore well were found to have higher temp than hand pump, open well, lake and falls. The increase in temp decreases to potability of water due to unpleasant taste produced by CO_2 and other gases. Thus the taste of samples differ from place to place [10]

The pH value of water samples was 7.43 this approves that the nature of ground water is slightly alkaline. The mean total alkalinity (TA) of the water sample of villages of Pali block was 271.5. The Salinity The mean value of EC 524.26 is an index to represent the total concentration of soluble salt in water ranged from 152.1 to 281.6.

Summary of basic statistics for different water quality parameters is given in Table -2

Table 1

Palace	Source	Temp	pH	EC	TA	Salinity	CH	MH	TH	TDS	DO	Fluoride
Amiliha	OW	25	7.46	249	215.1	281.6	78.6	19.4	98	283	1.33	0.66
Amiliha	HP	30	7.55	271	256.3	152.1	80.6	14.6	94	285	2.13	0.46
Amiliha	Pond	23	6.89	616	359.7	185.3	98.5	29.5	128	240	2.33	0.51
Kholkhamha	OW	24	7.48	711	250.3	200.8	210.5	131.5	342	356	3.89	0.37
Kholkhamha	HP	31	7.60	786	245.7	188.6	168.6	14.4	183	314	1.97	0.36
Kholkhamha	Lake	23	7.87	375	253.6	212.3	265.4	54.6	320	245	2.82	0.26
Shahpur	Pond	24	6.98	442	265.1	164.5	195.3	19.7	215	269	2.12	0.23
Shahpur	HP	31	7.44	596	332.5	256.2	164	69	233	300	2.21	0.34
Shahpur	BW	36	7.63	723	250.8	243.8	148.2	92.8	241	267	2.36	0.89
Raugarh	OW	27	7.53	568	239.1	194.6	162.8	9.2	172	341	4.30	0.40
Raugarh	HP	32	7.22	512	368.7	245.7	165.9	46.1	212	276	1.36	0.85
Raugarh	BW	33	7.09	458	326.6	163.9	101.2	27.8	129	298	1.15	0.99
Malachuaa	Fall	23	7.85	519	257.1	169.0	119.4	18.6	138	269	2.10	0.29
Malachuaa	HP	28	7.38	627	237.3	197.5	100.5	52.5	153	333	1.06	0.59
Malachuaa	OW	25	7.53	411	215.6	201.6	113.2	15.8	129	397	1.23	0.46

[All the values are expressed in mg/L, Temp ^{0}C, EC (µS/cm),]

Table 2

Parameter	Min	Mean	Max
Temp	23	27.6	36
pH	6.89	7.43	7.87
EC	249	524.26	786
TA	215.1	271.5	368.7
Salinity	152.1	189.2	281.6
CH	78.6	144.8	265.4
MH	9.2	41.0	131.5
TH	94	185.8	342.0
TDS	240	298.2	397
DO	1.06	2.15	4.30
Fluoride	0.23	0.51	0.99

Units are in mg/L, except pH and EC (µS/cm), Temp in ^{0}C

Conclusion

In the present investigation, an attempt was made to evaluate the ground water quality of tribal villages of Pali Tehsil, Umaria District, MP India. The water samples were found to be moderately hard, the hardness of water caused by the presence of Calcium and Magnesium study reveals that all the villages have hardness within the desirable limit prescribed by WHO. The TDS Values of water samples of certain villages is higher but overall it is in the permissible range. Fluoride promotes dental health if it is between 0.5-1.5 mg/l but when it exceeds 1.5mg/l it causes dental fluorosis. In the area where the fluoride content of water is lower than the desirable limit of 0.5mg/l (WHO) the fluoridation has to be done and supplied to the children and public. The water samples are slightly alkaline in nature. The values of various parameters such as EC, TA, Salinity and DO shows the ground water of area needs some degree of treatment before use. The study helps us to understand the quality of the water as well as to develop suitable management practices to protect the ground water resources.

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