

Study of Physico-Chemical Parameters and Heavy Metals in Ground Water of Some Villages of Purna River Basin

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Abstract:

Water plays a vital role in the development of communities, hence a reliable source of water is essential for the existence of both human and animals. In the present study, the physicochemical characteristic such as pH, hardness, conductivity and TDS of groundwater from five villages of Purna River basin area were assessed. Metal ion content of one sample also assessed. Results were compared with WHO, USPH, ICMR and European and standards. The results of this study reveal that TDS and Total hardness of almost all samples are crossing the maximum permissible limit laid down by all standards. It also reveals that some metal ion like Cd, Ni, Cr, Fe, and Mn are also found in excess.

Key words: Purna River basin, ground water physico-chemical parameters

I. Introduction:

Water is, literally, the source of life on earth [1]. Ground water has been traditionally considered to be pure form of water because of its filtration through soil and its long residence time on the ground. However ground water is not as pure as traditionally assumed as water is an excellent solvent and it can contain lots of dissolve chemicals[2]. The rapid growth of urban areas, domestic and irrigation uses have further affected the ground water quality due to over exploitation of resources and improper waste disposal practices. The ground water quality of Purna River Basin, has been altered due to many natural and anthropogenic activities. Therefore, it is essential to protect and manage the ground water quality. Consequently, number of cases due to water pollution, water borne diseases have been seen, which cause health hazards.

During last few years, it is reported that the patients affected by water pollutants are facing serious health problems like kidney failure, hair loss and cardiovascular damage. The population of this region is drinking untested and untreated water which could be the probable cause of so many water borne diseases[3]. The present work deals with the study of contamination of ground water in some villages of the saline track of Buldana District.

II. Material & Method:

Study area:

Purna River rises in Satpuda Hills in Baitul District of M.P and meet Tapi River near Muktainagar of Jalgaon District of Maharashtra. The elliptically shape Purna basin is about 170 Km east-west and about 55 km north-south. Its geographical area is about 7500 square Km. The basin lies in Akola, Amravati and Buldana District of Vidarbha region. Out of 7500 Sq. Km area of basin, some 2700 Sq.Km has severe problem of salinity. This belt is called "KharpanPatta"[4] (Meaning track of saline water). This track has a major problem of poor quality and insufficient drinking water. The Fig. 1 shows the location of the present study area.

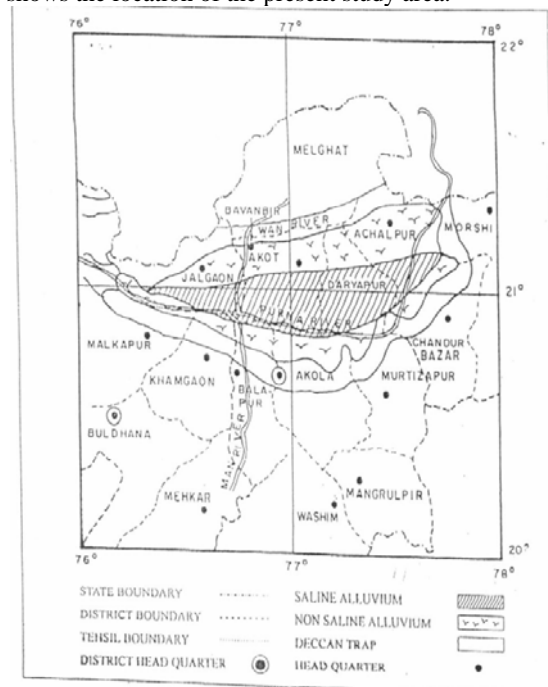


Fig. 1

Sampling: Samplings of ground water were done by standard methods [5].

Five villages where kidney failure patients are reported and the main source of drinking water is ground water were selected as target area. Those villages are Khandavi, Manegaon, Asalgaon,

Jalgaon and Pimpalgaon kale (from Jalgaontahsil of Buldana District). The parameters will be determined at research laboratory and metal ion at Central Instrumentation Cell S.G.B. Amravati University Amravati.

Table 1 [Methods employed for determination of physico-chemical parameters]

Sr. No	Parameters	Methods employed
01	Ph	pH metry
02	Total dissolved solids (TDS)	Evaporation
03	Hardness	EDTA titration

Samp le No.	Temp eratur e (0C)	pH	Cond uctom etry(mohs/ cm	Total dissolve d solids (TDS) mg/l	Har dnes s(pp m)
1	30	7.20	1.38	900	600
2	26	7.45	2.78	2020	1300
3	22	7.70	2.33	1940	1420
4	29	7.10	1.84	1180	660
5	30	7.35	2.01	1320	440
04	Conductivity		Conductometry		
05	Metal ions		Atomic Absorption Spectrophotometry(AAS)		

Analysis of water ground Sample:

The ground water sample were analysed for various parameter like TDS, Hardness, pH, conductivity and dissolve metal ion[6]. TDS was determined by weighing water sample before and after evaporation of water on hot pot on electronic balance with accuracy of $\pm 0.1\text{mg}$. Hardness of water is caused by presence of Ca, Mg and other heavy metals. Hardness determination is very important as far as metal concentration concern. The total hardness of water was determined by EDTA method. pH of the solution was determined by pH meter, Equip-tronics, model no. 610. Electrical conductivity was measure by conductivity meter, Equip-tronics, model no. 660A. The chemicals used were of AR grade. Utmost care was taken during sampling to avoid any kind of contamination. Temperature and pH were measured at the time of sampling itself. Metal ion determined by Atomic Absorption Spectrophotometry. The methods employed for determination of physico-chemical parameters are given in the Table 1.

The standard limits of water quality parameters in drinking water prescribed by ISI,

ICMR, European and WHO are shown in the Table 2.

Table 2

Water Parameters	ISI	ICMR	European	WHO
pH	6.5-8.5	6.5-8.5	6.5-8.5	6.5-9.2
Total dissolved solids (TDS)	500-2000	500-1500	500	500
Hardness	600	300	500	500
Conductivity	-	300	400	300

ISI (Indian Standard Institute), ICMR (Indian Council of Medical Research), WHO (World Health Organization)

III. RESULTS AND DISCUSSION

As water plays an important role in the development of communities, a reliable source of water is essential for the existence of human[7]. Physico-chemical parameter like TDS, Total hardness, electrical conductivity, metal ion content and pH are important in assessing the water quality and finding its suitability was drinking purpose [8]. The result are tabulated in Table 3 and are compared with water quality standards laid down by WHO and other agencies [9].

Table 3: Physio-chemical parameters of ground water samples of Purna river basin

1. pH of the collected water sample

The lower values of pH may cause tuberculation and corrosion while the higher values may produce incrustation, sediment, deposition and difficulties in chlorination for disinfections of water[10]. In the present study the pH values in all the collected water samples ranges from 7.0 to 7.5 which are all within the limit.

2. Temperature (0C)

The water temperature is an important factor which influences the chemical and bio-chemical characteristics of water body. The maximum temperature of 30 °C was recorded and minimum of 22 °C[11].

3. Conductivity:

Conductivity is the measure of capacity of a substance or solution to conduct electrical current through the water [12]. The measured conductivity present in permissible limit.

4. Total Dissolved Solids (TDS)

The quantity of TDS is proportional to the degree of pollution[13-14]. The value of TDS in the collected water samples varies from 600 mg/L to 2020 mg/L. Which crosses the maximum permissible limits.

5.Total Hardness

The total hardness in all the collected water samples of Purna River basin was found in the range of 440 mg/L to 1420 mg/L. which also crosses the limits laid down by standards.

6. Heavy metals

Metal plays a vital role as structural and functional components of protein and enzymes in cell. Each mineral play a number of different functions in the body. Some metals such as Ca, Mg and Zn have been reported to be essential for human health, whereas other such as Pb, Cd, and Al identified as toxic [15].

The obtained results of heavy metals detected from Khandavi sample are tabulated in Table 4. The results are compared with standard values.

Table 4

Sr. No	Metal Elements	Observed in ppb	WHO Standard	
			Higher Desirable Limit (ppb)	Max Permissible Limit (ppb)
1	Cd	288	3	30
2	Pb	178	400	400
3	Ni	463	10	20
4	Cr	144	50	50
5	Fe	4911	1000	3000
6	Al	72	1 to 50	500 to 1000
7	Cu	750	500	2000
8	Mn	761	400	400
9	Zn	640	1000	3000

It was observed that the Sample of Khandavi station have shown accumulation of some metal ions like Cd, Ni, Fe, Cr and Mn beyond the permissible limit laid down by WHO. The accumulation of the metal ions in groundwater sources, this may lead to serious concerns in future, if accumulation of the metal ions continues and remedial measures are not brought into practice [16].

IV. Conclusion

The result obtained from the various parameters shows that pH, Temperature and Conductivity values are well within the permissible limits. Total Dissolved Solids (TDS), Total Hardness and dissolve metal indicate considerable variations. The result of study shows that, quality of water is not good for domestic and drinking purposes. The ground water needs treatments to minimize the contaminations especially the Hardness, dissolve metals and dissolved solids.

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