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Assessment of physico-chemical status of ground water samples of Paranda area of Marathwada Region, India

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ABSTRACT

In the present study efforts has been made to assess the extent of water pollution due to the excess use of fertilizers and pesticides in agriculture and its impact on ground water Quantity of three different dug wells in Paranda area of Osmanabad, India. The different Physico chemical parameters like pH, Temperature, TDS, Conductivity, Nitrate, Sulphate, Phosphate, Dissolved oxygen Hardness, Chlorides, Carbon dioxide, Sodium, Potassium and chemical oxygen Demand were determined The present study reveals that water quality of the selected sampling station ere within the limit prescribed by WHO and can used for domestic purpose.

Key Words: Groundwater, Physico-chemical, Paranda, sampling sites.

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INTRODUCTION

Water is extremely essential for survival of all living organism. The quality of water is vital concern for mankind since it is directly linked with human welfare. In India, most of the population is dependent on groundwater as the only source of drinking water supply. Groundwater is believed to be comparatively much clean and free from pollution than surface water[1]. But prolonged discharge of industrial effluents, domestic sewage use of fertilizers and pesticides, waste dump causes the groundwater to become polluted and creates health problems.[2] The problems of groundwater quality are much more acute in the areas which are densely populated, thickly industrialized, excess use of pesticides and fertilizers in rural area and shallow ground water tablets. The rapid growth of urban areas has further affected groundwater quality due to overexploitation of resources and improper waste disposal practices. Hence there is always a need for concern over the protection and management of groundwater quality.[3]

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Considering the above aspects of groundwater contamination, the present study was undertaken to investigate the possible impact on the groundwater quality of some dug wells of Paranda town of Osmanabad district of Maharashtra. Thus, in this paper an attempt has been made to assess the physical and chemical properties of groundwater.

MATERIALS AND METHODS

Paranda is in Osmanabad district of Maharashtra and its geographical co-ordinates are $18^o 16^{'}$ 2.4096" North. People with basic occupation agriculture utilizes groundwater for farming, domestic and for drinking purpose. Literature survey reveals that no water quality management studies has been carried in this region, hence the present study was planned and undertaken. The Physico-chemical analysis of three dug wells water samples like Temperature, pH, Conductivity, Total Dissolved solids Dissolved oxygen, chemical oxygen demand, Nitrate, Sulphate Phosphate, Chloride, Hardness, Sodium and potassium were carried. The analyzed data was compared with standard values recommended by WHO.[4]

All the samples were collected in three liter capacity polythene bottle having doubly stopper. Prior to the collection, the well cleaned sample bottles were rinsed thoroughly with the sample water to be collected. After collecting the samples, the bottles were immediately closed tightly. In case of open wells the samples were collected from a depth of about one meter from the upper surface of water. Each sample bottle was clearly labeled with a glass marker and relevant details were recorded. All the sample bottles were sealed and brought to the laboratory as soon as possible after protecting them from direct sunlight during transportation. The so collected from wells in and around the area of investigation for monthly interval from December 2009 to November 2010. All the water samples were analyzed within 12 to 24 hrs after collection.

The Physico-chemical analysis of groundwater samples are carried by instrument and non-instrumental method. Temperature pH, conductivity, TDS were determined by using water analysis Kit. Hardness, DO, Chloride, CO_2 and all parameters were analyzed by standard procedure mentioned in APHA[5].

The elemental analysis carried out by digital Flame Photometer. All the reagents used for the analysis were AR grade and double distilled water used for preparation of solutions.

RESULTS AND DISCUSSION

The Physico-chemical analysis of the groundwater samples of three sampling sites of Paranda were carried and their average values of seasonal variation is presented in Table no.1

Temperature: Temperature is basically important for its effect on chemical and biological reaction in the organisms living in water[6]. A rise in the temperature of water leads to the speeding up of the chemical reactions in water, reduces the solubility of gases and amplifies the taste and adours.[7]

In the present study maximum and minimum were recorded at S_1 in summer and minimum at S_1 in winter. The average temperature varied within the range of 22.67 to 30.00^0C. Our finding is in good agreement with Murhekar.[8]

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pH: pH is measure of intensity of acidity or alkalinity of water[9-10]. All chemical and biological reactions are directly dependent upon the pH of water system.[11] In our finding pH varied between 7.05 to 7.81. Maximum pH was recorded at S_3 in winter and minimum at S_2 in rainy season; which was well within the permissible limit prescribed by WHO[4}.

Total Dissolved Solids (TDS): Total dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, phosphates and Nitrates of Calcium, Magnesium, Sodium, Potassium, Manganese, organic matter salt and other particles.[12] In the present finding TDS value varied from 0.830 ppm to 3.62 ppm. Maximum TDS recorded at S_1 in winter and minimum at S_4 in summer.

Conductivity: The conductivity of water depends upon the concentration of ions and its nutrient status. Based on electrical conductivity values the water quality can be classified as poor, medium or good.[13] In the present investigation maximum conductivity was observed at S_1 in winter and minimum at S_2 in summer.

Dissolved Oxygen: Dissolved oxygen is important parameters in water quality assessment and reflects the physical and biological process prevailing in the water. The DO values indicate the degree of pollution in water bodies.[8] DO values in the present finding varied from 3.69 to 4.39. Maximum and minimum recorded at S_3 in rainy and S_1 in winter season.

Chemical Oxygen Demand (COD): Chemical oxygen Demand determines the oxygen required for chemical oxidation of organic matter. COD values may be attributed to the amount of dissolved oxidisable organic matter including the non-biodegradable matter present in it.[12] In our present investigation COD varied in the range of 13.33 to 48.00 ppm, maximum COD recorded at S_1 in summer and minimum at S_3 in winter season.

Chlorides: Chloride contents in fresh water is largely influenced by evaporation and precipitation. Chloride ions are generally more toxic than sulphate to most of the plants and are best indicator of pollution.[11] In present finding maximum chloride concentration were recorded at S_4 in winter and minimum at S_1 in summer season. Chloride concentration in water samples varied from 62.00 ppm to 170.19 ppm.

Sulphate: Sodium and Magnesium sulphate exert cathartic action and hence their concentration above 250 ppm in potable water is objectionable[11]. Maximum value of sulphate in the present study was recorded at S_4 in summer while minimum at S_2 and S_4 in summer and rainy season respectively.

Nitrate: Nitrate concentration in reservoir water depends upon geochemical conditions such as the extent to which nitrogenous fertilizers are used in agriculture[9]. Nitrate value in our findings ranged between 0.0011 ppm to 0.0027 ppm. Maximum was recorded at S_4 in rainy and minimum at S_3 and S_4 in summer season.

Phosphate: Phosphate may occur in groundwater as a result of domestic sewage, detergents and agricultural effluents with fertilizers.[8] At S_3 in summer season maximum value and S_4 in rainy minimum value were recorded.

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Carbon dioxide: Carbon dioxide content varied from 3.696 ppm to 9.184 ppm. According to Henry's law the gaseous dissolution has been determined by partial pressure of gases, soluble salt content and ambient temperature[14]. Increase in CO_2 content may be attributed to high dissolved salt contents also due to degradation of DOC (Dissolved organic carbon)

Hardness: Hardness is the property of water which prevents lather formation with soap and increases the boiling point of water[7]. Hardness of water mainly depends upon the amount of calcium or magnesium salt or both[8]. In our findings hardness value varied from 91 ppm to 216 ppm which were in permissible limit as prescribed by WHO.

Sodium: Sodium concentrations were found to be in the range between 109.33 ppm to 283.00 ppm. S_4 recorded maximum in winter and S_1 recorded minimum in winter season.

Potassium: The major source of potassium in natural fresh water is weathering of rocks but the quantities increase may be attributed to excess of use of fertilizer and disposal of waste water[7]. In our findings potassium at S_1, S_2, S_3 and S_4 in summer and S_3, S_4 in rainy and winter season found to be negligible. Maximum potassium content was recorded at S_3 in winter.

Table 1: Physico chemical parameters of ground water at Paranda, (Average values)

Parameter	Average values of S_1			Average values of S_2			Average values of S_3			Average values of S_4		
	Winter	Summer	Rainy	Winter	Summer	Rainy	Winter	Summer	Rainy	Winter	Summer	Rainy
Temperature ^{0}C	22.67	30.00	24.67	23.33	29.33	24.67	23.00	29.67	24.00	23.67	29.00	24.33
p^H	7.53	7.21	7.05	7.16	7.43	7.23	7.57	7.24	7.13	7.81	7.50	7.16
TDS gms / lit	2.349	0.830	1.927	1.743	0.871	1.363	3.257	1.595	1.267	1.767	3.620	1.095
Conductivity milimhos/cm	0.754	0.551	0.369	0.514	0.368	0.371	0.608	0.455	0.467	0.438	0.751	0.511
NO_2 mg/lit	0.0019	0.0013	0.0022	0.0017	0.0021	0.0023	0.0020	0.0011	0.0020	0.0017	0.0011	0.0027
SO_4 mg/lit	0.4918	0.2941	0.7843	0.1961	0.0981	0.4412	0.2951	0.2941	0.6226	0.3431	0.8824	0.0981
PO_4 mg/lit	0.00042	0.00068	0.00051	0.00046	0.00048	0.00048	0.00048	0.00070	0.00053	0.00053	0.00061	0.00033
DO mg/lit	3.69	4.16	4.24	4.02	4.35	4.34	4.17	3.73	4.39	3.97	3.93	3.70
Hardness (as $CaCO_3$) mg/lit	207.33	140.00	132.00	214.00	139.00	152.67	216.00	91.00	168.67	213.33	151.00	126.00
Chlorides mg/lit	134.15	62.06	126.13	118.13	74.08	151.50	139.49	81.09	156.17	170.19	86.10	108.12
CO_2 ml / lit	4.517	9.184	4.891	5.115	6.888	7.616	3.696	7.253	8.288	4.891	5.376	6.832
MPN per 100ml	34.67	0.67	54.33	77.00	17.00	35.00	68.67	109.67	44.33	53.00	64.00	46.00
Na^+ mg / lit	109.33	110.00	225.00	169.33	172.00	197.33	189.33	233.00	261.00	283.00	281.00	197.33
K^+ mg / lit	0.67	0.00	0.33	0.33	0.00	0.67	2.67	0.00	0.00	0.00	0.00	0.67
COD mg / lit	22.67	48.00	28.00	24.00	41.33	25.33	13.33	18.67	26.67	18.67	17.33	36.00

CONCLUSION

The study was undertaken to assess the impact of excess use of fertilizers and pesticides on potability and quality of ground water samples of Paranda of Osmanabad District.

A physico chemical analysis of groundwater samples were carried monthly, considering certain important parameters like Temperature, pH, TDS, Conductivity, DO, COD, Cl^-, SO_4^{--}, NO_3^-, PO_4^{3-}, K^+, Na^+, CO_2 and Hardness.

The present study reveals that maximum parameters of the study area Sample do not exceed the permissible limit prescribed by WHO. The groundwater satisfies the need of the villager's in the vicinity of study area.

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