



Research Article

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Physico-chemical study of ground water of some areas of Imphal City, Manipur

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ABSTRACT

Eight(8) ground water samples from Imphal City (5 belonging to Imphal East District and 3 belonging to Imphal West District) were analysed for physico-chemical parameters such as colour, odour, temperature, pH, conductivity, TDS (total dissolved solids), total hardness, calcium (Ca), magnesium (Mg) and chloride (Cl). Out of these eight samples, only one sample has parameters within desirable limits of BIS standards and fit for drinking purpose. However, in case of remaining seven samples, some parameters are within desirable limits while some other parameters are within permissible limit of BIS standards, showing that further treatments are required for these seven samples so as to keep the parameters within desirable limits for drinking purpose mainly though all the samples are fit for other domestic and irrigation purposes.

Keywords: Groundwater, physico-chemical parameters, drinking, domestic and irrigation.

INTRODUCTION

With the increase of population day by day, there is rapid increase of urbanization. As a result, the quantity of surface water decreases, which leads to the more demand of ground water which is about 0.6% of total global water resources and out of this 0.6%, only 0.3% is economically extractable[1]. Therefore, researchers all over the world study the quality of ground water to examine the suitability for drinking, domestic purpose, irrigation, industries and for other purposes.

In India also, there is increasing demand of ground water for drinking, domestic, irrigation, industries etc. and many researchers carried out the study of ground water quality in many states such as Tamil Nadu, Bihar, Karnataka, Maharashtra, Rajasthan, Assam [2,9]. Similarly, in Manipur also E.J.K. Singh et al reported the findings of the study of ground water quality of some parts of Imphal West district recently [10]. But still, many areas of Imphal West district and Imphal East district, are there where many hand pumps (tube wells) are installed to meet the requirement of increasing demand of the ground water for the people of such areas for drinking and other domestic purpose mainly. For such areas also, it is very much needed to examine the quality of ground water periodically.

With a view to this objective, the present aim of this research work is to study the physico-chemical parameters of ground waters of some selected sites of Imphal city (24°48'N, lat. and 93°57'E, long.)(Imphal East district and Imphal West district) where the local inhabitants are mainly dependent on such ground water.

EXPERIMENTAL SECTION

All the chemical reagents were of AR grade and were used as received. The ground water samples were collected in well sterilized polythene bottles (of 1 litre capacity each) from 7 a.m. to 11 a.m. from 8 (eight) sampling sites (as shown in table- 1)

Table – 1: Sampling sites (locations) of ground Water

Sample Code No.	Sampling Sites	Districts
S-1 (Hand Pump)	Near Kwakeithel Girls' High School, Imphal	Imphal West
S-2 (Hand Pump)	Kwakeithel Moirang Pural Leikai, Imphal	Imphal West
S-3 (Hand Pump)	Keishamthong Elangbam Leikai, Imphal	Imphal West
S-4 (Hand Pump)	Chingmeirong Mamang Leikai, Imphal(1) (Near Estern Motors)	Imphal East
S-5 (Hand Pump)	Chingmeirong Mamang Leikai, Imphal (2)	Imphal East
S-6 (Hand Pump)	Tangkhol Avenue, Imphal	Imphal East
S-7 (Hand Pump)	Chingmeirong Kabui Khul, Imphal	Imphal East
S-8 (Hand Pump)	Near Sangakpham Bazar, Imphal	Imphal East

Sampling and analyses of various physico-chemical parameters were carried out at sampling sites as well as in laboratory from the middle of January, 2013 upto the middle of February, 2013, which is winter season (a dry season).

The parameters such as temperature, pH and TDS (total dissolved solids) were recorded at sampling sites while others were determined at laboratory (as shown in table- 2) using standard methods [11].

Table – 2: Instruments/methods used for the measurement of various physico- chemical parameters of ground water samples.

Parameters	Instruments/Methods
Temperature	TDS Meter (TDS-3) (TDS/Temp) (HIMEDIA)
pH	pHep® Pocket -sized pH Meter(HANNA instruments)
Conductivity	Conductivity - TDS Meter 307 (SYSTRONICS, India)
Total Hardness	EDTA Titrimetric Method(using EBT indicator)
TDS (Total Dissolved Solids)	TDS Meter (TDS-3) (TDS/Temp) (HIMEDIA)
Calcium (Ca)	EDTA Titrimetric Method (using Murexide indicator)
Magnesium (Mg)	Calculation Method
Chloride (Cl)	Argentometric Method (using K ₂ CrO ₄ indicator solution)

RESULTS AND DISCUSSION

The various experimentally found data of the 8 (eight) samples are shown in table- 3 given below:

TABLE – 3: Values of various physico – chemical parameters of different ground water samples

Sample Code No.	Colour	Odour	Temperature (°C)	pH	TDS (mg/l)	Conductivity (µ S/cm)	Total hardness (mg/l, as CaCO ₃)	Ca (mg/l)	Mg (mg/l)	Cl (mg/l)
S-1	Colourless	Odourless	20.9	7.4	259	510	78	10.4	12.7	28.4
S-2	Colourless	Odourless	20.6	7.1	716	1400	280	34.4	47.3	29.8
S-3	Colourless	Odourless	21.6	7.7	659	1300	172	26.4	25.9	142
S-4	Colourless	Odourless	22.8	7.6	503	1170	370	62.4	52.2	208.7
S-5	Colourless	Odourless	22.6	7.4	400	780	316	54.4	43.9	98
S-6	Colourless	Odourless	22.6	7.5	548	1080	296	52	40.5	159
S-7	Colourless	Odourless	22.5	7.3	441	890	364	66.4	48.3	100.8
S-8	Colourless	Odourless	22.0	7.1	459	920	288	46.4	42.0	112.2

Colour and Odour:

All the 8 (eight) samples are found to be colourless and odourless.

Temperature:

Waters at lower temperatures has more dissolved O₂ and has good taste than that at higher temperature [12].

The temperatures of the 8 samples (S-1 to S-8) are in the range 20.6°C to 22.8°C (table 3). S-4 has the highest temperature (22.8°C) while S-2 has the lowest temperature (20.6°C).

pH Values:

The pH values of the 8 (eight) samples (S-1 to S-8) range from 7.1 to 7.7 showing that they are slightly alkaline in nature. All the pH values of the 8 samples are within the desirable limit (6.5 – 8.5) of BIS standards [13].

TDS (Total dissolved solids):

The TDS values of the 8 samples (S-1 to S-8) range from 259 mg/l to 716 mg/l (table 3). Only S-1, S-5, S-7 and S-8 have TDS values within desirable limit (500 mg/l)while that of remaining ones are within permissible limit (2000 mg/l) of BIS standards[13].

Conductivity:

The conductivity values of the 8 (eight) samples (S-1 to S-8) are found to be in the range 510 μ S/cm to 1400 μ S/cm showing that such water may also be used for irrigation purpose.

Total hardness:

The total hardness values (mg/l, as CaCO₃) of the 8 (eight) samples (S-1 to S-8) are in the range 78 to 370 (as shown in table 3). S-1 is moderately hard while S-2, S-3, S-6 and S-8 are hard but S-4, S-5 and S-7 are very hard [14-15]. The values of total hardness of S-1, S-2, S-3, S-6 and S-8 are within desirable limit (300) while that of remaining ones are within permissible limit (600) of BIS standards[13].

Calcium (Ca) and Magnesium (Mg):

The values of Calcium (Ca) of the 8 (eight) samples are in the range 10.4 mg/l to 66.4 mg/l (table-3) showing that all of them are within the desirable limit (75 mg/l) of BIS standards [13].

The values of magnesium (Mg) of the 8 samples range from 12.7 mg/l to 52.2 mg/l (Table-3) For S-1, the value of Mg (12.7 mg/l) is within desirable limit (30 mg/l) while that of remaining 7 samples (S-2 to S-8) are within permissible limit (100 mg/l) of BIS standards[13]. Such similar types of high values of Mg, were reported by E.J.K. Singh et al [10]. As Ca and Mg are also very much essential for plants' growth, such high values of Mg indicate the suitability of such ground waters for irrigation purpose also [15].

Chloride (Cl):

In Case of chloride contents of such ground water samples (S-1 to S-8), the values are in the range 28.4 – 208.7 mg/l (table –3) and they are within the desirable limit (250 mg/l) of BIS standards [13].

CONCLUSION

From the above discussions of experimental results, it may be concluded that ground water (represented by S-1) near Kwakeithel Girl's High School) is of good quality and may be used for drinking, other domestic and irrigation purpose. But in case of ground waters of other remaining 7 locations (represented by S-2 to S-8) some suitable treatments are necessary so as to keep their qualities within desirable limits of BIS standards.

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