Analysis of Physico-chemical Parameters of Ground Water in and around Kaptanganj of District Basti in Utter Pradesh – India

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Abstract

Water pollution in India is a serious problem. In recently few years due to urbanization and industrialization in India, this problem has been found in dangerous form. Pollution free water is the necessary for the healthy life. The polluted water is the root cause of a large number of diseases. There are a number of causes responsible for polluting the water. Polluted water doesn't come from a single source. The Present study deals with the analysis of different physico-chemical parameters of ground water of different locations of Kaptanganj during June - July 2017. The total ten water samples from hand pumps at different locations were collected by using standard methods and observed the results for pH, turbidity, chloride, total hardness, nitrate, fluoride, iron, and free chlorine. The observed results shows that the ground water from all sampling locations is very hard and beyond permissible limit suggested by WHO and BIS. Thus quality of nearly all water samples of Kaptanganj is very poor and non suitable for drinking purposes.

Keywords: Industrialization, Kaptanganj, Physico-chemical, WHO, BIS

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Introduction

Water is one of the basic components of life, without it life can't exist at any places. The use of water is multipurpose. The main source of water on earth is river, ponds, lakes, sea, and ground water. Out of these ground water is the only source of drinking water in Indian villages. But due to excess use of fertilizers and pesticides in the modern farming techniques, urbanization, industrialization and agricultural activity affecting the ground water quality for mainly drinking purpose[1-2]. Polluted water is the main cause of a number of diseases. The effect of this water on human life remains for a long time[3]. In recent years, water pollution has become a serious problem across the country, mostly due to the presence of untreated effluents, chemicals and pesticides in it. Due to urbanization, modern farming techniques and heavy industrialization the ground water of our country becomes unpleasant for drinking [4-5]. So the Present study deals to assess the some physicochemical parameter of ground water in and around Kaptanganj in district Basti .In the present study, water samples were collected from hand pumps of different areas in and around Kaptanganj. Various physicochemical parameters were determined and the results were compared with the values of various water qualities standards such as world health organization (WHO[6]), Bureau of Indian standard (BIS[7]). The main aim of the study was to report on the assessment of physicochemical parameters of ground water in and around kaptanganj.

Material and Methods

Study Site

Kaptanganj is a small town area in district Basti of Utter Pradesh , India. It belongs to Basti division. The study area Kaptanganj is located between district headquarter Basti and world religious place Ayodhya of UP, India. It is located between 26.92N latitude and 83.72E longitude. It is 17 km away from District head quarter Basti in West and about 40 km away from world religious place Ayodhya in East along NH-28.

Sample Collection

The total 10-samples (4-samples in and 6-samples around the Kaptanganj) taken from different places which were about one Kilometer between one and another location. The samples were collected in plastic bottles which were cleaned with acid water, followed by rinsing twice with distilled water[8]. The analysis of water was done by using Himedia water testing kit.

Sampling Locations

The location of Kaptanganj are given in the following figure.

Figure 1- Location of India in World

Figure 2- Location of U.P.in India

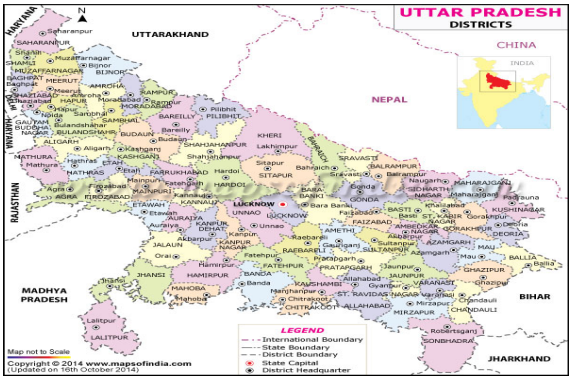

Figure 3 – Location of Basti in U.P

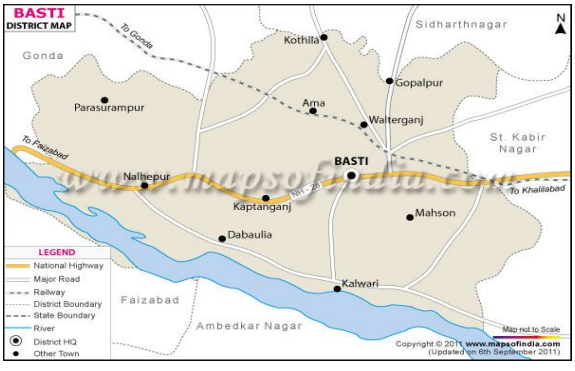

Figure 4 – Location of Kaptanganj in Basti

Table-1: Sampling locations in the Kaptanganj

S.N.	Sampling Locations	Sampling Area	Water Source	Sample Number
1	Pokhara	Village	Hand Pump	L_1
2	Jasaipur	Village	Hand Pump	L_2
3	Bhawanapur	Village	Hand Pump	L_3
4	Rakhia	Village	Hand Pump	L_4
5	Ramwapur Kala	Village	Hand Pump	L_5
6	Khajhuwa	Village	Hand Pump	L_6
7	Bas Stand	City	Hand Pump	L_7
8	PHC	City	Hand Pump	L_8
9	IGI College	City	Hand Pump	L_9
10	SKI College	City	Hand Pump	L_{10}

Table-2: Physico-chemical parameters of Kaptanganj

S.No.	Sample Number → / Parameters ↓	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}
1	pH	7.4	7.6	7.1	7.3	7.5	7.1	7.7	7.4	7.3	7.2
2	Turbidity (NTU)	5	8	10	10	5	8	10	7	12	5
3	Chloride (mg/lit.)	260	350	50	180	230	300	425	220	240	210
4	Total Hardness (mg/lit.)	400	675	350	500	530	460	650	600	550	250
5	Nitrate (mg/lit.)	20	80	35	50	90	30	85	80	40	60
6	Fluoride (mg/lit.)	0.7	1.5	0.6	0.8	1.2	0.4	1.1	0.9	0.4	0.5
7	Iron (mg/lit.)	0.8	0.9	0.4	0.6	1.2	0.3	1.1	0.8	0.5	0.4
8	Free Chlorine(mg/lit.)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL

Table- 3: Different physico-chemical parameters of hand pump water in and around Kaptanganj, Basti (U.P.) and their comparison with WHO and BIS standards

S.N.	Parameters	WHO	BIS	Range		Mean	SD
				Max.	Min.		
1	pH	6.5-8.5	6.5-8.5	7.7	7.1	7.36	0.17
2	Turbidity (NTU)	10	10	12	5	8.0	1.75
3	Chloride (mg/lit.)	250	250	425	50	241.5	99.94
4	Total Hardness mg/lit.)	300	300	675	250	496.5	101.25
5	Nitrate (mg/lit.)	50	45	90	20	57.0	54.08
6	Fluoride (mg/lit.)	1.5	1.5	1.5	0.4	0.79	0.34
7	Iron (mg/lit.)	0.3	0.3	1.3	0.3	7.0	0.3
8	Free Chlorine(mg/lit.)	-	-	-	-	-	-

The variation of Physico-chemical parameters shown in the following charts.

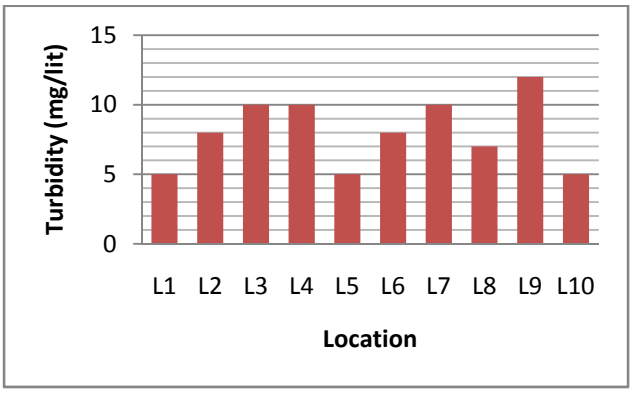

Chart 1-Variation of pH

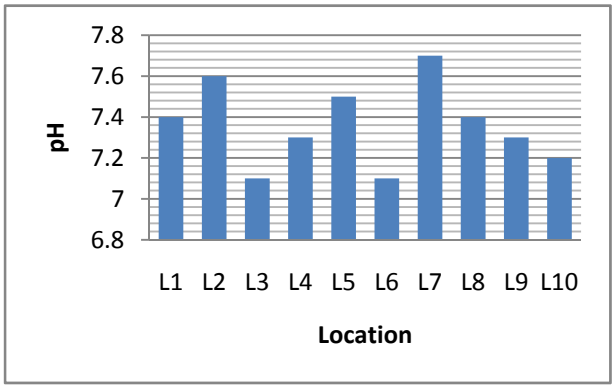

Chart 2-Variation of Turbidity

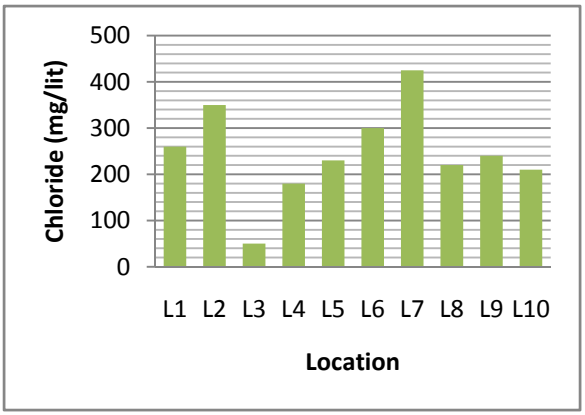

Chart 3-Variation of Chloride

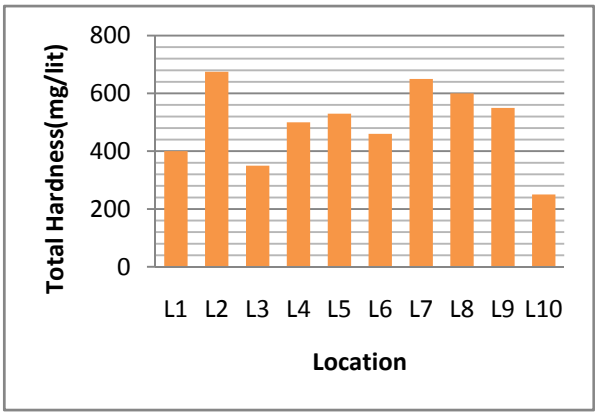

Chart 4-Variation of Total Hardness

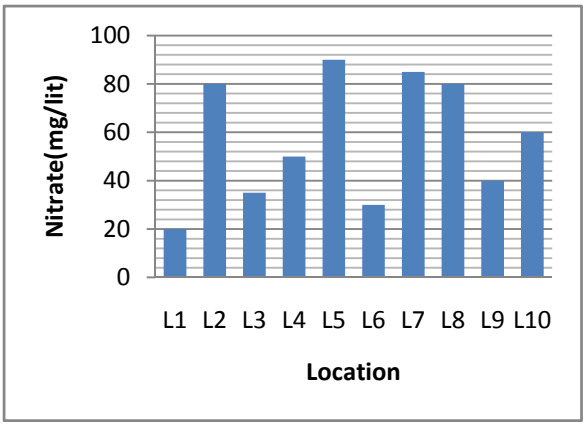

Chart 5-Variation of Nitrate

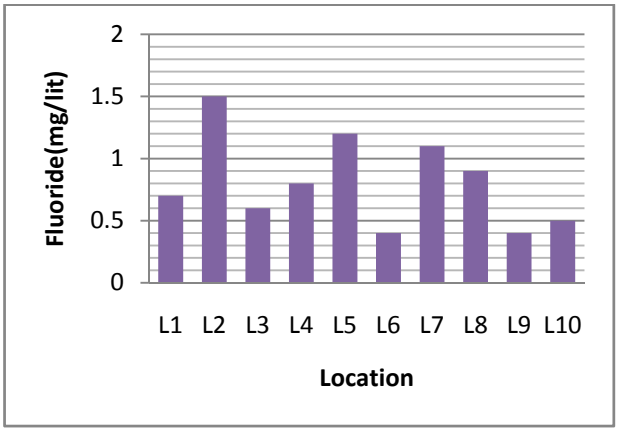

Chart 6-Variation of Fluoride

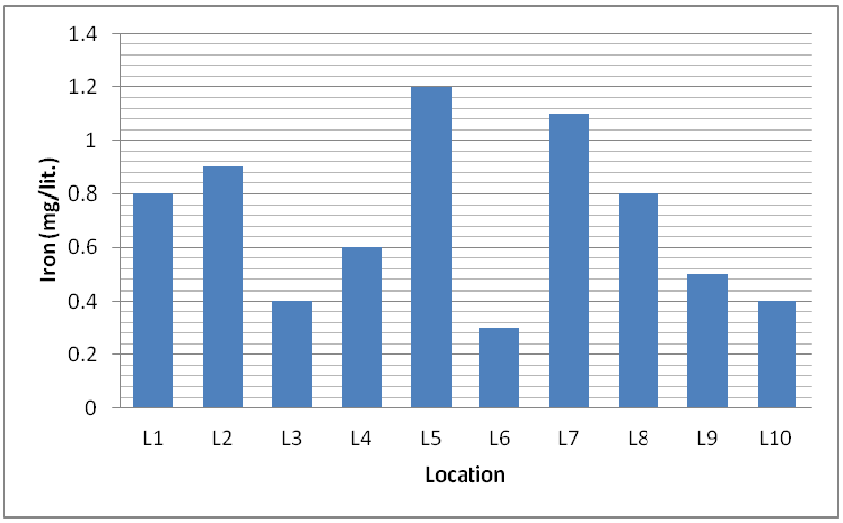

Chart 7-Variation of Iron

Results and Discussions

The different physico-chemical parameters determined for the water samples are given in table-2. From the observed results it is clear that the quality of water considerably varies from location to location. The findings and their comparison with WHO and BIS health based drinking guidelines are given in table-3. The data showed a considerable variation in the water samples with respect to their physico-chemical composition.

pH varies from 7.1 to 7.7, which are under permissible limit of WHO and BIS. The water samples were found to be slightly basic in nature[9-12].The variation of pH shown in the Chart-1.

Turbidity varies from 10 to 12 NTU, which are higher than the permissible limits as standard value of WHO and BIS is 5 NTU. It is may be due to presence of some dissolved particles in water. The variation of turbidity is shown in the Chart-2.

Chloride ion occurs in form of elemental chlorine and highly stable in natural water[13]. It's excess conc. (>250mg/lit.) provide a softy taste to water[14].Chloride varies from 50-425 mg/lit. Nearly fifty percent of the samples are under the permissible limits as of WHO[6] and BIS. While the sample no. L_1, L_6 and L_7 are exceeds the maximum permissible limits of 250 mg/lit. of WHO and BIS. The variation of Chloride is shown in the Chart-3.

Total hardness varies from 250-675 mg/lit. It is considered as the major character of drinking water. Hardness is defined as the concentration of calcium and magnesium ion. According to Durfor and Backer's[15] classification of total hardness, water was very hard at all the locations and exceeds the maximum permissible limits of 300 mg/lit. of WHO[6]. The variation of Total hardness is shown in the Chart-4.

Nitrate varies from 20 to 90 mg/lit. Most of the samples are under permissible limits but sample no.L_2 L_5, L_7, L_8 and L_{10} are exceeds the maximum permissible limits of 50 mg/lit. of WHO and BIS. The variation of Nitrate is shown in the Chart-5.

Fluoride varies from 0.4 to 1.5 mg/lit. The fluoride ion concentrations of most of the samples are fall well within that expected for good quality potable water[16]. The higher or lower concentration of fluoride in drinking water cause health problems related to teeth and bones. High fluoride concentration causes dental fluorosis and skeletal fluorosis whereas the absence or low concentration of fluoride in drinking water results in dental caries in children particularly. When the fluoride concentration is less than

0.5 mg/lit[17-20]. The concentration of fluoride ion in study area is within permissible limit. The variation of fluoride is shown in the Chart -6.

The iron concentration varies from 0.3-1.3 mg/lit. It is generally present as Fe^{+2}, $Fe^{+3}$and $Fe(OH)_3$ in suspend or filterable forms[21]. Iron is the more frequent contaminants in the water supplies. The excessive concentration causes some health problems like rapid increase in respiration, hypertension and drowsiness[22]. Generally all samples are exceeds the permissible limit. This may be due to soil origin and age old iron pipes used in the area. The shortage of iron causes a disease called "anemia" and long term consumption of high iron contaminated drinking water may be lead to liver disease called as haermosiderosis[23]. The variation of iron is shown in the Chart -7.

The free chlorine was found to be absent in all samples.

Conclusions

Table-3 and above discussion shown that some of the parameters have the concentration level greater than the permissible limit. The observed standard deviation for the parameters shows that the deviation in the total hardness (110.75), chloride (99.83) and nitrate (34.09) are of moderately high range. From this it is concluded that various parameter concentration are varying highly in different location of Kaptanganj.

Our results suggest the following points:

The hand pump attached study area should be with filter based on activated alumina adsorption might be solution for filtering drinking water. Water should be filter by iron remover resin. Environmental awareness of the health implication of fluoride is emphasized through education of public aid community participation. Plastic pipes should be used for the boring of hand pumps.

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