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Assessment of ground water quality of Jagdishpur industrial area of district CSM Nagar (U.P.)

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Abstract
The present research study was focused to evaluate the physico-chemical characteristics of ground water at district CSM Nagar (U.P.). The ground water samples were collected from ten sampling sites, of which three from residential area, three from market area, two from agricultural area and two from solid waste dumping sites. The analysis of ground water samples was done by using the procedure of standard methods (APHA, 1995). The findings of present investigations were compared with standards for drinking water (BIS, 1998). Present research findings revealed that values of several parameters cross their permissible as well as excessive limits and pointing out to the necessity of proper treatment before disposal of municipal waste, industrial waste and domestic waste in the study area.

Keywords: Ground water quality assessment, Jagdishpur (U.P.).

1. Introduction
Water is a greatest natural resource, which is essential to all forms of life. Nothing could survive on earth without water conservation and keeping up of the good quality of water area prime importance, since water is a natural resource "limited" in a sense. Man has polluted much of this limited quantity of water by sewage, industrial wastes and wide array of synthetic chemicals. Pollution of fresh water is one of the most serious environmental problem in India. It is increasing tremendously due to rapid population growth, industrial proliferations urbanization, increasing living standards and wide spheres of human activities. In India about 12% of people get clean drinking water, the rest 88% quench their thirst from polluted water. The piped water which is available in cities, is mixed with number of impurities causing jaundiece, cholera, typhoid and gastroenteritis. Sometimes in cities the less dose of bleaching powder invites some diseases due to non-oxidation of the essential constituents of the bacterial cell while excess bleaching powder may cause lung diseases and dysentery. Improper dumping of sewage effluents and industrial effluents are very serious problem, causing pollution in ground water. Besides industrial wastes, the use of pesticides like D.D.T. has posed a serious water pollution problem and a potential hazard to human beings and other animals. In this paper an effort has been made to know the quality of water whether it is suitable for drinking purpose or not.

2. Material and Methods
2.1 Collection of Samples
Sampling of ground water was done during October 2011. High grade plastic bottles of one litre capacity were used, which were thoroughly cleaned prior to filling, were rinsed with the water being sampled. Ten samples were collected from public hand pumps after running from 15 to 20 minutes, so as to avoid errors due to water contained within the pipes.

2.2 Analysis of Samples:
For the analysis of water sample using procedure of standard methods [2] and to analyse the water samples, which are very essential to know the water quality for drinking purpose. The findings of the present investigations are summarised in Table-1 and it has been made with [3], drinking water standards in Table-2, which provides comprehensive picture of physico-chemical characteristics of ground water in the study area.
The parameters like pH, Electrical conductivity and Total Dissolved Solids were measured in the field at the time of sample collection, using water analysis kit (ELICO). Turbidity of water samples were measured using Nephalometer. Total hardness, Calcium, Magnesium and Alkalinity by the titrimetric method,

Thus, Sulphate and Phosphate by Spectrophotometric method [2].

3. Observation and Discussion

The total of ten numbers of water samples were taken from different locations of Jagdishpur industrial area. Three samples were taken from residential area (S_1, S_2 and S_3); three samples were taken from market area (S_4, S_5 and S_6) and two each from agricultural fields (S_7 and S_8) and solid waste dumping sites (S_9 and S_{10}).

The **pH** values of ground water of the study area are in-between 6.8 to 7.4 and are well within the permissible limits prescribed for drinking water standards. However, higher values of pH hasten the scale formation in water heating apparatus and reduce the germicidal potential of chlorine [8].

The values of **Electrical Conductivity** of the samples were observed and recorded as 580 to 1720 µmhos/cm. It also shows that all the water samples collected for present observation fall well within the excessive limit (750-2000 µmhos/cm.). It is indicating high mineralization in that area and also the presence of higher concentration of acid, base and salts in water, higher will be the electrical conductivity [6].

The values of **Total Dissolved Solids** of the ground water samples of the study area are in between the 510 to 1310 mg/l and are well within the excessive limit (1000 mg/l) except the sample number S_9 and S_{10}. These two sampling stations are at the solid municipal dumping area. Here the local municipal authority adopted a common method for the disposal of solid municipal wastes by deposition on land. During percolation process, leachates from solid waste dumping sites may reach the ground water table and alters the quality of the water. The amount of dissolved solids increase with the depth and with time and distance, the water has traveled in the ground [5]. Landfills can be any area of land used for the deposition of mainly solid wastes and they constitute important potential sources of ground water pollution**4**. It is also reported that the ground water pollution from refuse leaches in the vicinity of dumping sites detectable through increased TDS of water [11]

In the present study the values of **Turbidity** varies from 2.6 to 19.2 NTU. Here all water samples are well within the desirable limit. Generally ground water is less turbid since sand is a good filtering media. If an aquifer receives a leachate from the domestic solid waste and industrial waste water points which may result in increasing turbidity in ground water [7].

The values of **Total Hardness** varies from 460 to 890 mg/l, only 4 samples (S_1, S_2, S_3 and S_4) were found to be well within excessive limit and rest all samples cross their excessive limit (600 mg/l). The values of **Calcium** varies from 68.4 to 154.2 mg/l and it shows the all samples are well within the desirable limit prescribed for drinking water quality standards. The values of **Magnisium** ranges between 80.2 to 133.2 mg/l, and are well within the desirable limit of ground water standards (150 mg/l).

The more amount of total hardness, and magnesium contents are may be due to the ground water of the region presenting the low natural quality, in other words depth of the well and the nature of the geological materials with which the ground water comes in contact may influences the quality of water. The ground water chemistry is controlled by the composition of its recharge components as well as by geological and hydrological variations [10]. The hard water causes a toughening of some vegetables, notably beans and peas and in textile finishing. However, excess amount of total hardness, calcium, magnisium accounts on scale formation in boilers, pipelines, utensils and consume more detergents in washing process [12].

The values of **Alkalinity** ranges between 226 to 560 mg/l. All samples were found to be well within the desirable limit. When alkalinity of water exceeds the excessive limit, it is likely to produce incrustation sediment deposits, difficulties in chlorination, certain physiological effects on human systems etc.

The **Chloride** levels are found to be 91.4 to 680 mg/l. Here all samples were well within the desirable limit except the 2 samples S_9 and S_{10}. These sampling stations are to be located on the solid waste dumping sites. The contamination of chloride in ground water is usually attributed to improper dumping of municipal exereta particularly urine contain chloride in an amount about equal to the chloride consumed with food and water. Chloride in excess imparts the salty taste to water and people are not accustomed to high chloride are subjected to laxative effect [13].

The present investigation data reveals for **Sulphate** values ranging between 36 to 186 mg/l, which were well within the permissible limit for drinking water standards. Sulphate in ground water takes place the breakdown of organic substances in the soil. However, geological, hydrological and geomorphological characteristics shows remarkable variations and also the human influences [1].

The **Phosphorus** is also an essential elements for sustained primary productivity in the ecosystem. The form of phosphorus discussed is ortho-phosphate. The amount of phosphorus in natural water is very low. Domestic wastes, industrial effluent and agricultural runoff is major sources of phosphorus in water. Hence its high concentration is indicative of pollution. In the present study the value of phosphate varies from 0.11 to 0.24 mg/l, which were well within the permissible limit for drinking water standards.

4. Conclusion

Present investigation is a step in the direction to observe the size and extent of the problem of ground water quality in Jagdishpur industrial area of district CSM Nagar (U.P.). The reason for higher values of physico-chemical parameters at certain sampling locations is due to unscientific disposal of urban solid wastes and landfill. Here the leachate percolates through solid wastes and contaminates the ground water. The depth of well and nature of the geological materials which comes in contact may also influence the quality of the water. Concerned with the study area, there is no proper drainage system and due to a regular addition of large amount of sewage and detergents from the residential localities and market area, the water quality is getting from bad to worse. These contain both sanitary and non-sanitary components. It can be concluded that the ground water of study area in some localities like agricultural area and solid waste dumping sites are not suitable for drinking purpose. The need of a suitable dumping site and the proper management of solid waste in this area is suggested on the basis of present study and pointing out the necessity of proper treatment of ground water before use as drinking water.

Table 1: Physico-chemical characteristic data of Ground water of Jagdishpur industrial area of District CSM Nagar (U.P.)

S. No.	Physico-chemical Parameters	Sample Numbers									
		S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}
1.	pH	6.8	6.9	6.9	7.1	7.0	7.0	7.2	7.3	7.4	7.4
2.	EC	1180	920	840	580	1270	1210	1630	1720	1330	1420
3.	TDS	720	730	510	760	780	760	810	790	1230	1310
4.	Turbidity	3.2	2.8	2.6	4.5	3.7	5.8	6.0	9.6	16.6	19.2
5.	TH	460	510	490	570	760	780	650	880	790	890
6.	Ca^{2+}	69.4	80.2	68.4	90.1	88.4	154.2	111.4	86.3	116.4	130.2
7.	Mg^{2+}	98.2	92.6	80.2	132.6	128.2	171.6	89.4	122.4	118.6	133.2
8.	Alkalinity	340	330	370	232	226	236	326	460	490	560
9.	Cl^-	110	120.0	112.0	94.0	132	170	570	568	674	680
10.	SO_4^{2-}	44	36	47	112	92	87.0	80.0	134	162	186
11.	PO_4^{3-}	0.11	0.14	0.15	0.14	0.16	0.18	0.17	0.19	0.22	0.24

Note: All the parameters are expressed in mg/l, except pH, Electrical conductivity (µmhos/cm.) and Turbidity (NTU).

Table 2: Comparison of Ground water quality data with drinking water standards (BIS, 1998)

S. No.	Parameters	BIS, 1998		Observed Values	
		Permissible limit	Excessive limit	Range	Mean ± SD
1.	pH	6.5 - 8.5	< 6.5 - > 8.5	6.8 - 7.4	7.1 ± 0.22
2.	Electrical conductivity	750	2000	580 - 1720	1210 ± 352.36
3.	TDS	500	1000	510 - 1310	840 ± 242.26
4.	Turbidity	5	25	2.6 - 19.2	7.4 ± 5.94
5.	Total Hardness	100	600	460 - 890	678 ± 164.95
6.	Calcium	75	200	68.4 - 154.2	99.5 ± 27.88
7.	Magnesium	500	100	80.2 - 133.2	116.7 ± 27.30
8.	Alkalinity	200	600	226 - 560	357 ± 115.03
9.	Chloride	200	600	91.4 ± 680	323 ± 261.43
10.	Sulphate	200	400	36 - 186	98.0 ± 50.74
11.	Phosphate	0.25	0.40	0.11 - 0.24	0.17 ± 0.04

Note: All the parameters are expressed in mg/l, except pH, Electrical conductivity (µmhos/cm.) and Turbidity (NTU).

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