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Research Article

EVALUATION OF WATER QUALITY INDEX BY USING PHYSICOCHEMICAL PARAMETER FROM GROUND WATER OF JHANSI INDIA

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ABSTRACT

A Study was Conducted to monitor the ground water quality of Jhansi City by analysing Physicochemical and biochemical parameters like PH, turbidity, alkalinity, DO, BOD, measured at five different areas in triplicate. It was found that water quality of station 1-3 is good and safely used for drinking purpose but water quality index of station 4, 5 is inferior as TDS, Chloride, Hardness as well as alkalinity is above the permissible limit.

INTRODUCTION

Among all renewable resources of all the planets, water has a unique place. It is essential for sustaining all form of life, food production economic development and for general well being. It is impossible to substitute for most of its uses as it is a basic need for survival of human, animals and plants. Energy and matter are carried through various spheres of the environment by water and depends upon the various chemical species in water. Substantial changes in the distribution of these chemical species in water depends on the various physicochemical as well as biochemical parameters. Any shift in the naturally dynamic equilibrium exiting among environmental segments hydrosphere, atmosphere, lithosphere or sediments give rise to change of water quality. According to WHO (1993), about 80% of all the diseases in human beings are caused by inferior quality of water. So there in a need to regular monitoring of water bodies with required numbers of parameters to prevents out break of diseases and occurrence of other hazardous material to check water from further deterioration The national sanitation foundation created and designed standard index called water quality index and is a mathematical means of calculating a single value from multiple test results by statistical method.

The water that is flowing in aquifers below the water table is called ground water. In urban areas about 54% of global population has access to water supply. Yet the dependence on ground water by hand pump and submersible pump increased day by day in rural in as well as urban areas (Dutta, 2005). Considering the dependence on ground water we have assessed the ground water quality of Jhansi city in the present paper.

Salient feature of Study area

The study area Jhansi city gateway of Bundelkhand is located in U.P. The climate of the city is of various tropical nature and temperature varies from 60c to 45o c. The normal annual rainfall of the land area is 14 sq Km. The area of Jhansi city within municipal limit is approximately 35.22 sq Km and altitude is 294 m sea level.

MATERIALS AND METHODS

Sampling Site

Five sampling site have been selected for sampling in the present study to evaluate the water quality index of ground water of Jhansi city (Fig-1)

1. Govind Chouraha , Khushipura, Manik Chouk Jhansi
2. Sadar Bazar, Army Area Jhansi
3. Sipri Bazar, Sangam Vihar, Nandanpura Colony Jhansi
4. B.K.D Chouraha, C.P. Mission Compound, Jhansi
5. Medical Campus, Shivajinagar, Veerangana Nagar, Jhansi

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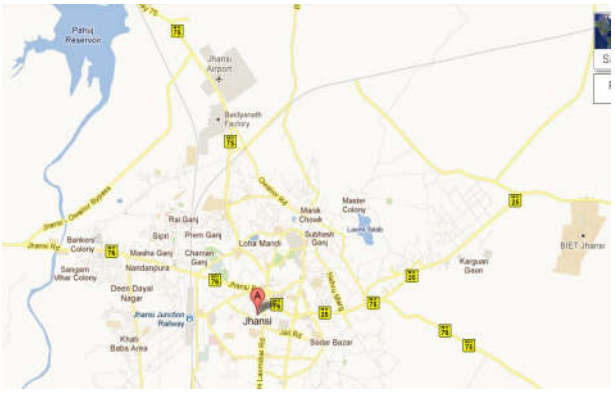

Map of Jhansi City **Fig. - 1**

Samples for analysis were collected in sterilized bottle from hand pumps in triplicate in month of June 2015.

pH was recorded by using pH meter (Sistronic Model). The DO of water samples were analysed in the laboratory by Wrinkler's modified-azide method and analysis of BOD by incubating samples at 25-30oc for 5 days. Turbidity was recorded by turbidity meter. Hardness, TDS, Chloride, alkalinity, acidity were estimated by titrimetrically by standard method maintained by APHA (1998) and microbial colonies of water samples was recorded by plating method and counted by colony counter.

RESULTS AND DISCUSSIONS

Physicochemical & Biological parameters of grounds water at different station were recorded in Table - 2PH range was recorded from 6.5 - 7.8, at different sites and within acceptable limit for drinking purpose, Since human body consist of 50-60 % of water the pH level has profound effect on all body chemistry, health and diseases (Manjare, *et al*., 2010).

Table -1 Rating Scale of Water Quality

		Parameters Range of Value				
1	PH	7.0-8.59	8.6 - 8.7 6.9	8.8 - 8.9 6.8	9.0 - 9.2 6.5 - 6.7	>9.2 <6.5
2	TDS	< 500	500-700	701-900	901-1000	>1000
3	Turbidity	<5	5-10	10.1-17.5	17.5-25.0	>25.0
4	DO	>7.0	5.1-7.0	4.1-5.0	3.0-4.0	<3.0
5	BOD	0.0-1.0	1.1-3.0	3.1-4.0	4.1-5.0	>5.0
6	Hardness	<300	301-400	401-500	501-600	>600
7	Alkalinity	<300	300-500	501-700	701-900	>900
8	Chlorides	0-50	51-100	101-150	151-250	>250
9	Microbial Colonies	< 1	2-4	5-7	8-10	>10
10	Rating qi	100	80	60	40	0
11	Extent of Pollution	Good	Slight	Moderate	Excessive	Severe

TDS is a measure of the solid materials both organic and inorganic dissolve in water samples (Gangavarapu *et al.,* 2015). This includes a wide range of things from nutrients to toxic materials. The TDS ranges in study area from 200-600 mg/l. The maximum value 600 mg/l was recorded in station 5 indicate moderate nature of ground water and in rest of the sample the rating scale is permissible. The turbidity of water fluctuate from 1.9 NTU to 3.8 NTU and within the permissible limits. The value of hardness varies from 198-395mg/l and is within the permissible limit except the station 5, and suggested slightly inferior quality of water and indicate appreciable amount of calcium and magnesium ions. (Pandey and Tiwari 2009). In the present study alkalinity varies from 300-550 mg/l and slightly higher as compare to permissible value. Natural water with high alkalinity have been generally rich in phytoplankton. Contributor of alkalinity are bicarbonate, carbonate, hydroxide ions and ammonia. Acidity is a net effect of the presence of several constituents including dissolved CO2, dissolved multivalent metal ion, strong mineral acids & weak organic acid.

Table -2 Parameters in Different Areas

	Parameters	Station 1	Station 2	Station 3	Station 4	Station 5
1	PH	7.72	7.08	6.95	6.83	6.97
2	TDS	200	500	400	300	600
3	Turbidity	2.3	2.2	1.9	2.7	3.8
4	DO	2.4	2.0	3.0	2.6	1.8
5	BOD	2.0	1.4	0.2	0	1.6
6	Hardness	198	367	380	360	395
7	Alkalinity	300	400	450	350	550
8	Acidity	357.5	412.5	350	325	400
9	Chlorides	29.8	89.4	149.1	104.3	208.9
10	Microbial colonies	0	0	0	0	0

Chloride in natural water arises from weathering of chloride minerals, irrigation drainage and industrial waste water. Chloride is not sorbed to soil and move with little or no retardation. Chloride is the most abundant anion in human body and is essential to normal electrolyte balance of body fluids. In present study the value ranged from 29.8 to 208.9 mg/l. The higher Concentration of chloride at station 5 indicates contamination by septic system, fertilizer and animal wastes. (Prasad *et al.,* 2009). There is a good Co-relation observed between chloride, alkalinity. Hardness and TDS in station 5.

Table -3 Water Quality Index

	Water Quality
Station 1	76.30
Station 2	74.00
Station 3	79.40
Station 4	68.60
Station 5	66.20

DO and BOD are the two important Biochemical parameters to assess water quality. The DO measures the amount of life sustaining oxygen dissolved in water. The DO ranges from 1.8 to 3mg/l in study area. The low DO values are associated with heavy contamination by organic matter. (Parmar. and Parmar 2010). Although temperature is main factor influencing dissolved oxygen (Baillie *et al.,* 2015). The BOD reflects the amount of oxygen consumed through carbonaceous and nitrogenous decomposable matter (Norizan *et al.,* 2011). The BOD ranged from 0-3 mg/l.

In drinking water microorganism can cause sensory defects (odour, colour taste). Various health related problems due to Contaminated water are diorrhoea, abdominal cramp, vomiting cholera, infection of lungs due to mycobacterium. (Eugene 2000) In the present investigation no colonies are developed in the 24 hours as prescribed by WHO.

Water Quality Index

The water Quality index was determined according to the method prescribed by National sanitation foundation. The water quality index uses scale from 0 to 100 to the quality of water, with 100 being the highest possible score (Cude 2001, Pandey and Sundaram 2002)

Nine main problematic chemical constituents that best established the water quality have been investigated and transferred to a weighting curve chart where a numerical value (θ) is obtained. This θ value is multiplied by a weighting factor (w1) which assigned according to its relative importance for drinking purpose. The maximum weight 4 has been assigned to parameter PH. DO and microbial colonies due to its importance in water quality assessment. The unit weight w1 for ith (a) parameter is calculated from.

$$\text{Unit } W1 = \frac{W1}{\sum W1 \text{ of all nine parameter}}$$

∑ θ1 W1 is the water quality index. The water quality index of all five stations presented in table. -3

CONCLUSION

Water of good drinking quality is the basic need for human being. The station 1,2,3 is although not excellent but good for drinking purpose. But the water of station 4, 5 is inferior quality of water as the station has been found to be higher value of TDS, Hardness, Chloride, and alkalinity.

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