

Assessment of Ground Water Quality Parameter in Jaunpur City

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Abstract— In this research paper assessment of physical and chemical properties of ground water sample, taken mainly from 10 stations are included. Water samples were collected from different bore wells intended for domestic as well as irrigation purposes. Various parameters of water like; pH, Turbidity, TDS, electrical conductivity, alkalinity, total hardness, calcium, chromium, manganese, Copper which indicates the quality of water examined. The greater value more than the permissible limit of salinity, sodium absorption ratio (SAR), residual sodium carbonate (RSC), and permeability index makes unfit for drinking and irrigation purpose in some area of Jaunpur city. Humans are contaminating ground water at an alarming rate, which is leading to a serious problem. So water quality analysis is more important for conservation of ground water. The research paper targeted an assessment of water quality index (WQI) related to ground water of Jaunpur city. The ground water samples are taken from all the marked locations in the area and gathered for the physical and chemical properties analysis.

Keywords: Physical-Chemical Properties and Water Quality Index

I. INTRODUCTION

Water is considered as one of the most basic component on the blue planet, comprising 71% of total earth surface; but water reading available for human consumption is in scarcity and due to rapid industrialization and development activities in an unsustainable manner has led to deterioration and exploitation of the ground water resources; which is only an mere 0.61% of entire world's water. In India ground water resources are the primary source of water for irrigation and various basic human activities in past few decades population explosion and rapid industrialization has laid excess stress on resource and contaminated it too hand in hand.

According to W.H.O a plethora of diseases are caused due to consuming unfit water. It is easy to analyse various pollutants parameters in ground water but to restore it to normal is a gruesome process. Water quality index (WQI) is one of such measure which can reveal the health of water resources, and can thus help in assessing the level of pollution in water and coupling activities which leads to its deterioration. Guidelines pertaining to drinking water have been published by IS: 10500-2012. Various soluble constituents such as calcium, sodium, bi-carbonates, and sulphate ions; and in lesser fractions constituents such as nitrates are present.

Any subtle increase in that parameter may lead to hazardous consequences for the dependent population. I have gone through many research papers on Assessment of ground water quality parameter for community and domestic bore wells of various locations. I performed analytical work of physical and chemical properties of ground water of Jaunpur (UP). The study reveals, ground water resources is the

primary source of water for domestic as well as irrigation and other commercial activities. This has led to rapid decline in the ground water level and at the same time loads of pollutants in form of sewage, hospital waste, runoff from agricultural fertilizers contribute, to the contamination of water beyond the permissible limits leads to severe health problems and various water born disease.

II. STUDY AREA AND METHODOLOGY

Jaunpur is a city and a city board in Jaunpur region in the Indian territory of Uttar Pradesh. It is found 228 km southeast of state capital Lucknow.

Jaunpur is situated toward the northwest of the region of Varanasi in the eastern piece of the North Indian Territory of Uttar Pradesh. Demographically, Jaunpur takes after the remainder of the Purvanchal zone in which it is found. The water tests were gathered from chosen inspecting stations at an interim of 30 days and pH, electric conductivity, disintegrate oxygen were examined quickly at the testing destinations utilizing standard hardware. Different parameters like Total break up solids, Total suspended solids, biological oxygen request, Total alkalinity, Total hardness, Chloride, Nitrate and Sulfate were broke down in the research center according to the standard methodology of Seems to be 10500 (2012).

III. WQI EQUATION

A. Calculation of Sub Index of Quality rating (qn):

The estimation of qn is determined utilizing the following articulation.

$$qn = 100[(V_n - V_{io}) / (S_n - V_{io})]$$

Where: qn = quality rating for the nth water quality parameter.
V_n = estimated estimation of the nth parameter at a given inspecting station.

S_n = standard allowable estimation of the nth parameter.
V_{io} = perfect estimation of the nth parameter in unadulterated water.

B. Calculation of Unit Weight (Wn):

Calculation of unit weight (W_n) for different water quality Parameters are conversely relative to the prescribed principles for the comparing parameters.

$$W_n = K / S_n$$

Where: W_n = unit weight for the nth parameters.

S_n = standard incentive for the nth parameters.

K = constant for proportionality.

The general water quality record was determined by conglomerating the quality rating with the unit weight straightly.

$$WQI = \sum q_n W_n / \sum W_n$$

C. Classification of WQI values for human consumption

WQI Range	Water Quality Type	Possible Usages
0-25	Excellent Water Quality	Drinking, Irrigation and Industrial
26-50	Good Water Quality	Drinking, Irrigation and Industrial
51-75	Fair Water Quality	Irrigation and Industrial
76-100	Poor Water Quality	Irrigation
101-150	Very Poor Water Quality	Restricted use for Irrigation
Above 150	Unfit For Drinking	Proper treatment required before use.

D. Water Quality Parameters & Units According to IS: 10500

Sr. No.	Parameters	Units	Limits as per IS:10500
1	pH at 25°C	-	6.5-8.5
2	Electrical Conductivity	µs/cm	Not Specified
3	Turbidity	NTU	5
4	Total Dissolved Solids	mg/l	500
5	Total Hardness as CaCO ₃	mg/l	300
6	Total Alkalinity as CaCO ₃	mg/l	200
7	Chloride as Cl	mg/l	250
8	Sulphate as SO ₄	mg/l	200
9	Fluoride as F	mg/l	1
10	Nitrate as NO ₃	mg/l	45
11	Iron as Fe	mg/l	0.3
12	Ammonia as NH ₃	mg/l	0.5
13	Phosphate as PO ₄	mg/l	Not Specified
14	Sodium as Na	mg/l	Not Specified
15	Potassium as K	mg/l	Not Specified
16	Calcium as Ca	mg/l	75
17	Magnesium as Mg	mg/l	30
18	Hexavalent chromium as Cr ⁶⁺	mg/l	0.05
19	Copper as Cu	mg/l	0.05
20	Dissolved Oxygen (D.O.)	mg/l	Not Specified

IV. RESULTS

A. Water Quality Parameter Testing

1) Badalapur (S1) & Kerakat (S2) Water Sample

Sr. No.	Parameters	Units	Limits as per IS:10500	S1	S2
1	pH at 25°C	-	6.5-8.5	7.30	7.67
2	Electrical Conductivity	µs/cm	Not Specified	478	499
3	Turbidity	NTU	5	0.9	0.8
4	Total Dissolved Solids	mg/l	500	305	297
5	Total Hardness as CaCO ₃	mg/l	300	204	185
6	Total Alkalinity as CaCO ₃	mg/l	200	106	101
7	Chloride as Cl	mg/l	250	109	96
8	Sulphate as SO ₄	mg/l	200	47	32
9	Fluoride as F	mg/l	1	0.54	0.43
10	Nitrate as NO ₃	mg/l	45	18.0	22.5
11	Ammonia as NH ₃	mg/l	Not Specified	<0.05	<0.05
12	Phosphate as PO ₄	-	Not Specified	0.04	0.05
13	Sodium as Na	mg/l	Not Specified	23	32
14	Potassium as K	mg/l	Not Specified	1.5	1.7
15	Calcium as Ca	mg/l	75	32.01	53.16
16	Magnesium as Mg	mg/l	30	7.89	9.83
17	Iron as Fe	mg/l	0.3	0.13	0.15
18	Hexavalent chromium as Cr ⁶⁺	mg/l	0.05	< 0.05	< 0.05
19	Copper as Cu	mg/l	0.05	< 0.05	< 0.05
20	Dissolved Oxygen (D.O.)	mg/l	Not Specified	4.3	4.1

2) WQI Calculation for Water Sample-1 & 2

Parameter	Observed value (S1)	Observed value (S2)	Standard value (S _n)	q _n (S1)	q _n (S2)	K _n (S1 & S2)	W _n =K _n /S _n (S1)	W _n =K _n /S _n (S2)	q _n .W _n (S1)	q _n .W _n (S2)
pH at 25°C	7.30	7.67	6.5-8.5	35.32	29.33	0.023437	0.00312	0.00312	0.11019	0.0915
Electrical Conductivity	478	499	Not Specified	-	-	0.023437	-	-	-	-

Turbidity	0.9	0.8	5	11	12	0.0234 37	0.00468	0.00468	0.05148	0.05616
Total Dissolved Solids	305	297	500	47	57.3	0.0234 37	0.000046	0.000046	0.00216	0.00264
Total Hardness as CaCO ₃	204	185	300	45.6 9	57.78	0.0234 37	0.000078	0.000078	0.00356	0.00451
Total Alkalinity as CaCO ₃	106	101	200	67	59	0.0234 37	0.000117	0.000117	0.00784	0.0069
Chloride as Cl	109	96	250	23.7	17.7	0.0234 37	0.000093	0.000093	0.0022	0.00165
Sulphate as SO ₄	47	32	200	13	3.2	0.0234 37	0.000117	0.000117	0.001521	0.00037
Fluoride as F	0.54	0.43	1	25	37	0.0234 37	0.023437	0.023437	0.5859	0.8672
Nitrate as NO ₃	18.0	22.5	45	17.9	82.27	0.0234 37	0.000520	0.000520	0.00931	0.04278
Iron as Fe	<0.05	<0.05	0.3	31.6 7	26.66 67	0.0234 37	0.078123 3	0.078123 3	2.4742	2.0833
Ammonia	0.04	0.05	0.5	-	-	0.0234 37	0.046874	0.046874	-	-
Phosphate	23	32	Not Specified	-	-	0.0234 37	-	-	-	-
Sodium	1.5	1.7	Not Specified	-	-	0.0234 37	-	-	-	-
Potassium	32.01	53.16	Not Specified	-	-	0.0234 37	-	-	-	-
Calcium	7.89	9.83	75	52.4 2	67.24	0.0234 37	0.000312	0.000312	0.01636	0.02097
Magnesium	0.13	0.15	30	25.5 9	33.73	0.0234 37	0.000781 2	0.000781 2	0.01999	0.02635
Hexavalent chromium	< 0.05	< 0.05	0.05	-	-	0.0234 37	0.46874	0.46874	-	-
Copper	< 0.05	< 0.05	0.05	-	-	0.0234 37	0.46874	0.46874	-	-
D.O.	4.3	4.1	Not Specified	-	-	0.0234 37	-	-	-	-
							$\sum W_n=0.1$ 259	$\sum W_n=0.1$ 259	$\sum q_n W_n=3.$ 285	$\sum q_n W_n=3.2$ 043

$$WQI (S1) = \frac{\sum q_n W_n}{\sum W_n} = 26.09, WQI (S2) = \frac{\sum q_n W_n}{\sum W_n} = 25.45$$

sample 1 & sample 2 and therefore can be categorized into - Good water quality as per Table.

V. CONCLUSION

The pH remained slightly alkaline in nature in every site and the values were ranged between 7.30 to 7.67. The electrical conductivity and TDS were also found high. Sample wise it is high during any season. The present investigation indicates that the concentration of Dissolved oxygen fluctuated in between 4.3 mg/l and 4.1 mg/l.

Descriptive statistics for all water quality parameters examined are shown in Table. It was observed from the computed WQI that the average value is 26.09 & 25.45 for

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