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Study on Quality of Groundwater of Silvassa City

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***Abstract*— Water is essential natural resources life and environment but over the last few decades the water quality is deteriorating due to it's over exploitation. Water quality is essential parameter to be studied when the overall focus is sustainable development keeping making at the focal point. Groundwater is the major sources of drinking water in rural as well as in urban area and over 90% of drinking water demand is met by groundwater. The study was carried out to assess the ground water quality and is suitability for drinking purpose in the area silvassa of district dadra and Nagar haveli, India. For this purpose, 15 water samples collected from hand pumps, open wells and bore wells of villages of study area were analysed for different physico-chemical parameters such as pH, electrical conductivity, total alkalinit, total hardness , calcium, magnesium hardness , chloride nitrate , and total dissolved solids. The study reveals that almost allparameters were exceeding the permissible limits. As per the desirable and maximum permissible for fluoride, nitrate, total dissolved solids and chloride in drinking water, determined by WHO BIS and ICMR standards, 44%, 14% , 24% and 42% of groundwater sources are unfit for drinking purpose respectively .**

***Keywords*— water quality, groundwater, open well and bore well, pH, total hardness, alkalinity, calcium, magnesium, chloride, nitrate, parameter.**

I. INTRODUCTION

"Water quality" is a term used to express the suitability of water to sustain various uses or processes. Any particular use will have certain requirements for the physical, chemical or biological characteristics of water; for example limits on the concentrations of toxic substances for drinking water use, or restrictions on temperature and pH ranges for water supporting invertebrate communities. Consequently, water quality can be defined by a range of variables which limit water use. Although many uses have some common Efforts to improve or maintain a certain water quality often compromise between the quality and quantity demands of different users. There is increasing recognition that natural ecosystems have a legitimate place in the consideration of options for water quality management.

This is both for their intrinsic value and because they are sensitive indicators of changes or deterioration in overall water quality, providing a useful addition to physical, chemical and other information.. Human intervention also has significant effects on water quality. Some of these effects are the result of hydrological changes, such as the building of dams, draining of wetlands and diversion of flow. More obvious are the polluting activities, such as the discharge of domestic, industrial, urban and other wastewaters into the watercourse (whether intentional or accidental) and the spreading of chemicals on agricultural land in the drainage basin.

Water quality is affected by a wide range of natural and human influences. The most important of the natural influences are geological, hydrological and climatic, since these affect the quantity and the quality of water available. The effects of human activities on water quality are both widespread and varied in the degree to which they disrupt the ecosystem and/or restrict water use a single influence may, therefore, give rise to a number of water quality problems, just as a problem may have a number of contributing influences. Eutrophication results not only from point sources, such as wastewater discharges with high nutrient loads (principally nitrogen and phosphorus), but also from diffuse sources such as run-off from livestock feedlots or agricultural land fertilised with organic and inorganic fertilisers. Pollution from diffuse sources, such as agricultural runoff, or from numerous small inputs over a wide area, such as faecal pollution from unsewered settlements, is particularly difficult to control.

II. STUDY AREA

The area of Dadra and Nagar Haveli spread over 191 sq.km its population density is 698 sq.km though landlock between Gujarat to the north and Maharashtra to the south it is closed to the western coast of india between 20º0' and 20º25'N latitude and between 72º50'and 73º15' E longitude .Environmental quality of the area deteriorates mainly as a result of the increasing industrial activities.

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In order to find out the current status of the pollution in the area, due to the increasing trend in the industrial activities, it is very much essential to identify the various sources of pollution. All segments of environment are being polluted by various ways. However, the study of water pollution is selected as it is not an ordinary liquid but is the elixir of life.

III. PARAMETERS

1. pH: pH is the negative log of hydrogen ion concentration in a water-based solution. ... pH is an abbreviation for "power of hydrogen" where "p" is short for the German word for power, potenz and H is the element symbol for hydrogen.

2. TDS: Total dissolved solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates) and some small amounts of organic matter that are dissolved in water.

3. Turbidity: Turbidity is the measure of relative clarity of a liquid. It is an optical characteristic of water and is a measurement of the amount of light that is scattered by material in the water when a light is shined through the water sample. ... Turbidity is measured in Nephelometric Turbidity Units (NTU).

4. Iron: Iron can be a troublesome chemical in water supplies. Water containing ferrous iron is clear and colorless because the iron is completely dissolved. ... When exposed to air in the pressure tank or atmosphere, the water turns cloudy and a reddish brown substance begins to form.

5. Nitrate: Nitrate is a compound that is formed naturally when nitrogen combines with oxygen or ozone. Nitrogen is essential for all living things, but high levels of nitrate in drinking water can be dangerous to health, especially for infants and pregnant women.

6. Sulphate: Sulfate is one of the major dissolved components of rain. High concentrations of sulfate in the water we drink can have a laxative effect when combined with calcium and magnesium, the two most common constituents of hardness. Bacteria, which attack and reduce sulfates, form hydrogen sulfide gas (H_2S).

7. Fluoride:Water fluoridation is the controlled adjustment of *fluoride* to a public *water* supply to reduce ... nutrient, yet, due to the beneficial effects of dietary *fluoride* on prevention of dental caries they have *defined* an Adequate Intake (AI) value for it.

8. Chloride: Chlorides are salts resulting from the combination of the gas chlorine with a metal. Some common chlorides include sodium chloride (NaCl) and magnesium chloride (MgCl2). Chlorine alone as Cl2 is highly toxic and it is often used as a disinfectant.

9. Alkalinity: The buffering capacity of a water body; a measure of the ability of the water body to neutralize acids and bases and thus maintain a fairly stable pH level"

10. Hardness: The simple definition of water hardness is the amount of dissolved calcium and magnesium in the water. Hard water is high in dissolved minerals, largely calcium and magnesium. ... When hard water is heated, such as in a home water heater, solid deposits of calcium carbonate can form.

11. Calcium: As water moves through soil and rock, it dissolves very small amounts of minerals and holds them in solution. Dissolved calcium and magnesium are the two most common minerals that make water “hard”. The degree of hardness becomes greater as the calcium and magnesium content increases.

12. Magnesium: Magnesium is mainly present as Mg^{2+} (aq) in watery solutions, but also as $MgOH^{+}$ (aq) and $Mg(OH)_2$ (aq). In seawater it can also be found as $MgSO_4$. *Water* solubility of magnesium hydroxide is 12 *mg*/L. Other magnesium compounds are clearly more water soluble, for example magnesium carbonate (600 *mg*/L).

13.Copper : Copper is a metal that occurs naturally and is used to make many products, including parts for plumbing systems. Copper can get into your drinking water as the water passes through your household plumbing system. Your body needs some copper to stay healthy, but too much is harmful.

14. Zinc: Zinc can be introduced into water naturally by erosion of minerals from rocks and soil, however since zinc ores are only slightly soluble in water. ... High natural levels of zinc in water are usually associated with higher concentrations of other metals such as lead and cadmium.

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Table no. I.
Parameter according to W.H.O

SR. NO	Parameters	Standard values
1.	pH	6.5-8.5
2.	TDS in mg/l	500
3.	Turbidity in NTU	1.0
4.	Iron in mg/l	0.3
5.	Nitrate in mg/l	45
6.	Sulphate in mg/l	250
7.	Fluoride in mg/l	1.0
8.	Chloride in mg/l	250
9.	Alkalinity in mg/l	100
10.	Hardness in mg/l	200
11.	Calcium in mg/l	75
12.	Magnesium in mg/l	30
13.	Copper in mg/l	0.05
14.	Zinc in mg/l	5.0

IV. Equation For Water Quality Index

Weighted Arithmatic Water Quality Index

Step1: To calculate quality rating (Qn):

$$\text{Quality rating (Qn)} = 100 \times \frac{(Vn - Vi)}{(Vs - Vi)}$$

Where,

Vn= actual value of particular parameter in water sample
Vi = ideal value of parameter (0 for all parameters except pH 7 Milligram per liter)
VS= standard value for the parameter

Step2: To find unit weight (Wn):

$$Wn = K / Vs$$

Where, $K = \frac{1}{\frac{1}{Vs1} + \frac{1}{Vs2} + \ldots\ldots + \frac{1}{Vsn}}$

Step3: To calculate water quality index (WQI):

$$WQI = \frac{\Sigma\, QnWn}{\Sigma\, Wn}$$

TABLE NO. II
Water quality Index and Status of Water Quality.

Water quality index	Description status	Category
0-25	Excellent quality	A
26-50	Good quality	B
51-75	Poor quality	C
76-100	Very Poor quality	D
>100	Unsuitable for drinking	E

V. Water Quality Index Analysis

Table III.
detail of the index rate for various sample

Sample	Index rate	Sample	Index rate
S1	9.70	S11	38.71
S2	22.64	S12	42.88
S3	39.22	S13	64.12
S4	64.65	S14	30.92
S5	16.49	S15	28.21
S6	29.13	S16	38.71
S7	56.70	S17	48.26
S8	49.54	S18	65.91
S9	11.30	S19	38.76
S10	16.2`	S20	41.20

VI. CONCLUSION

In The Present Study 80% Water Sample Were Found Good Quality And Only 20% Water Samples Falls Under Moderately Poor Category. The Water Quality Index Ranges From 9.70 To 65.91 . Therefore There Is A Need Of Some Treatment Before Usage And Also Required To Protect That Area From Contamination. The Rain Water Harvesting Structures Should Be Installed To Restore The Ground Water Aquifers For Improvement Of Ground Water Resources In Order To Maintain The Quality And Quality Of Ground Water Reservoirs And Thus Diluting The Higher Concentration Of Chemical Constituents And Dissolved Salts. Public Awareness Program Should Be Begun To Enhance The Knowledge And Awareness To Save Water Pollution On Human Being Around Their Dweller.

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