International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST

Study of Ground Water Quality and Variation in Physico-Chemical Parameters of The Tube -Well of Gandhi Chowk (Chapra Municipality)

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Article Info

Volume 9, Issue 1

Page Number : 480-487

Publication Issue

January-February-2022

Article History

Accepted : 01 Jan 2022

Published : 20 Jan 2022

ABSTRACT

In this paper we studied about the ground water quality and variation in physico-chemical parameters of the tube -well of Gandhi chowk (Chapra municipality). Groundwater is the major source of water supply for domestic purposes in Urban as well as Rural parts of India. There are various reasons for this, which include non-availability of potable surface water and a general belief that groundwater is purer and safer than surface water due to earth mantel covering. Presence of more than 200 chemical constituents in groundwater has been documented including approximately 175 organic and more than 50 inorganic and radio nucleotides. The sources of these chemicals are both natural and anthropogenic.

Keywords : MSW, Landfill, pH, Waste, WQI.

I. INTRODUCTION

In the developing countries, contamination of water supplies by organic compounds is of minor concern or of no concern at all. In such places the major health problems are the result of inorganic chemicals contamination, poor sanitary conditions and illness brought about by pathogenic organisms. Once the groundwater at a site is degraded, it may remain in an unusual or even hazardous condition for decades or centuries. The typically low velocity of groundwater prevents a great deal of mixing and dilution, consequently, a contaminant plume may maintain a high concentration as it slowly moves from points of recharge to zone of discharge (Pattyjohns, 1979) [1-7].

The physical, chemical and biological quality of water may vary within wide limits. It is very difficult to distinguish the origin (natural or anthropogenic) of many water quality problems. Natural quality reflects the type and amount of soluble and insoluble substances with which the water has come in contact. The quality of groundwater is most commonly affected by waste disposal and land use. Another major source of contamination in the storage of waste materials is in excavations, such as pits and mines.

Water-soluble substances that are dumped, spilled, spread or stored on the land surface eventually may infiltrate. Groundwater can also became contaminated by the disposal of fluids through wells and, in lime stone terrains, through sinkholes directly into aquifers. Likewise, infiltration of contaminated surface water has caused groundwater contamination in several places. Irrigation tends to increase the mineral content of both

surface and groundwater. The degree of severity in such cases is related to hydrologic properties of the aquifer, the type and amount of waste, disposal method and climate.

Another cause of groundwater quality deterioration is pumping of groundwater, which may precipitate the migration of more mineralized water from the surrounding strata to the well. In coastal areas pumping has caused seawater intrusion to freshwater aquifers. In parts of West Bengal, arsenic contamination problem has been attributed to excessive pumping of shallow groundwater.

Various studies carried out in the past have reported the presence of excessive Fluoride, Arsenic, Nitrite, Sulphate, Heavy metals, Salinity, Hardness and Pesticides etc. from different parts of the country. It has been reported that 77% of urban population and only 31% of rural population in India has access to portable water supply.

II. SOURCES OF GROUNDWATER CONTAMINATION

2.1. On the land surface problems: -

1) Infiltration of contaminated surface water.
2) Land disposal of solid and liquid materials
3) Mining and Industrial tailings
4) Dumps
5) Disposal of sewage and sludge
6) Fertilizers and pesticides
7) Accidental spills

2.2. Above the water table problems: -

1) Septic tanks
2) Surface impoundment
3) Landfills
4) Waste disposal in excavations
5) Leakage from underground storage tanks and pipelines
6) Artificial recharge

2.3. Below the water table problems: -

1) Waste disposal in wet excavations
2) Agricultural drainage wells and canals
3) Well disposal of wastes
4) Underground storage
5) Mines
6) Exploratory wells and test holes
7) Abandoned wells 38
8) Water supply wells
9) Groundwater development

Seasonal variation of physico-chemical characteristics of groundwater of Saran. In Saran, there are insufficient numbers of collection bins for the waste. The collected waste is very often scattered by cows and other stray animals before Municipal Workers have a chance to clean the surroundings [8-12].

The indiscriminate disposals of solid waste inside the urban area of both the townships are used as land filling. The disposal sites are not well managed and the exposed garbage breeds flies and other disease

transmitting vectors. Both the harmless domestic waste and infectious hospital waste are routinely mixed and dumped together in the disposal site. This put the city sanitation workers at risk of contracting diseases. Rag Pickers as well as general public are also exposed to the risk of disease and the rag pickers are also at the risk of encountering physical harm through contact with discarded sharps.

Such disposals besides the disease risk, possess a potential for ground and surface waters as pollutant leach or run off from unmanaged waste piles. The solid waste generated from both the domestic as well as industry sources are usually dumped on land. Depending upon the characteristic of the substances dumped leaching takes place contaminating the land as well as groundwater due to percolation of leachate. Since the domestic refuse contains some of the objectionable material, which not only has adverse effect over the surface but also the material if leached, can contaminate the groundwater.

There have been many instances of spreading of water borne diseases due to run off as well as leaching of urban refuse at several parts of the globe. Keeping the above in view in order to assess the impact of such open dumping of both domestic as well as hospital waste, twenty locations from different corners of the city were selected mostly by considering either the maximum no of users or in and around the dumping site of municipal solid waste or hospital solid waste or the site where no probability of contamination. The groundwater samples were collected randomly from a number of Tube well, Bore well and Dug well from these areas and the water quality parameters were analyzed [13-17].

The details of the locations of sampling points are presented in table 5.2 and the 39 analyzed physico-chemical parameters of the groundwater samples collected during the year November, 2019to October, 2020 and November, 2020 to October, 2021are presented in table 1 to table 19. Water Temperature, Electrical Conductivity, Turbidity and Fecal and Total coliform expressed as 0 C, µmho/cm, NTU and MPN 1/100 ml respectively. pH value expressed in pH unit. Rest parameters are expressed as mg/l.

3. pH

The pH is a measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water. It has no direct adverse effect on health, however, a low value, below 4.0 will produce sour taste and higher value above 8.5 shows alkaline taste. A pH range of 6.5 – 8.5 is normally acceptable as per guidelines suggested by ISI. In the present study, the fluctuation of pH in the samples was from 5.7 to 9.0. The pH below 7 indicates that the sample water was slightly acidic may be due to the presence of minerals in the groundwater. In the present study, pH < 7 was found in the groundwater samples of Uma Nagar, Bhagwan Bazar, Mouna Chowk, Gandhi Chowk [18-24].

Table 1: Analyzed physico-chemical parameters of the Tube -well of Gandhi Chowk.

Parameters	2019-2020			2020-20021		
	Winter	Summer	Rainy	Winter	Summer	Rainy
Temperature	18	28	26	20	25	24
Ph	6.5	6.8	6.2	6.5	6.8	6.4
Turbidity	2.5	2.7	3.5	2.7	2.9	4.0
TDS	150	158	136	156	156	138
TSS	8.0	12	22	11	12	16
Hardness	98	102	118	110	104	107
EC	279	298	275	295	302	270

Chloride	22	20	18	17	18	20	
Sulphate	102	113	115	109	110	117	
Total Alkalinity		110	112	120	121	116	114
Calcium		16.2	16	14.9	18	15	.6 15
Magnesium	30	30	28	28	29	31	

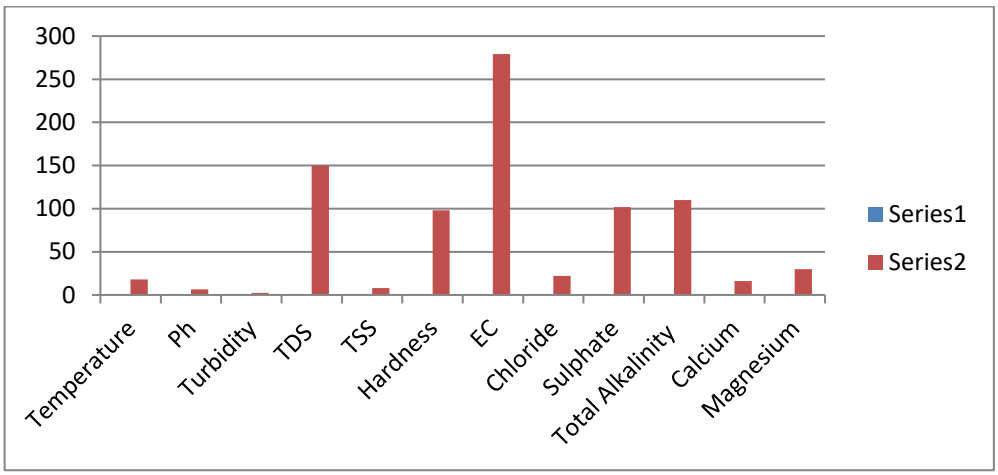

Figure-1: Variation in physico-chemical parameters of the Tube -well of Gandhi Chowk in Winter Season 2019-20

However, it has been seen that the dug well samples of Brahm pur show low pH (5.7 to 6.2) than the prescribed limit throughout the study period [25-30]. Low pH values then the prescribed limit also have been found in the samples of Uma Nagar during Rainy season. Similarly, the samples of Bhagwan Bazar throughout the year of 2019- 2020 showed low pH. Samples of Gandhi Chowk exceeds the prescribed limit of pH. These variations in pH may be due to the condition of earth and minerals present. The condition of earth is greatly affected by the waste dumped.

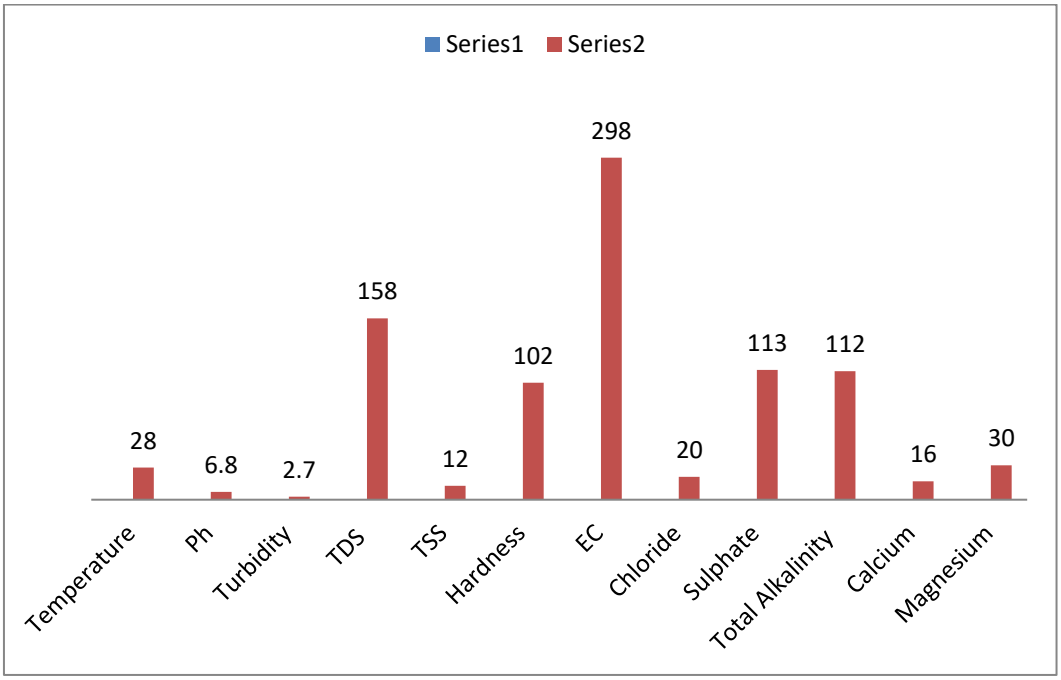

Figure-2: Variation in physico-chemical parameters of the Tube -well of Gandhi Chowk in summer Season 2019-20

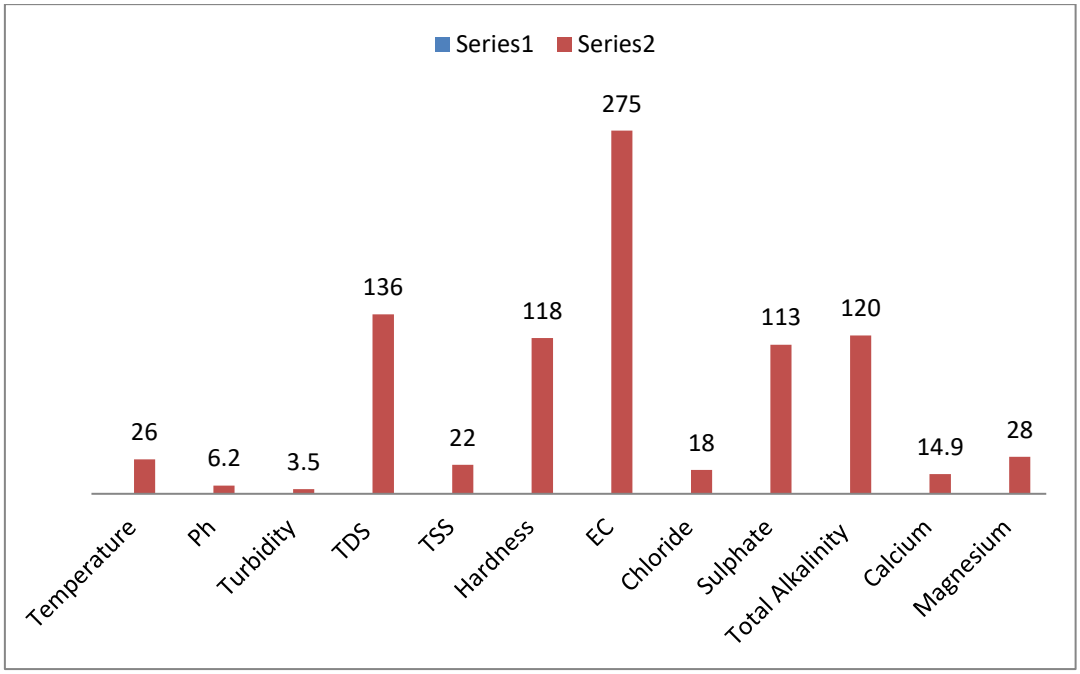

Figure-3: Variation in physico-chemical parameters of the Tube -well of Gandhi Chowk in Rainy Season 2019-20

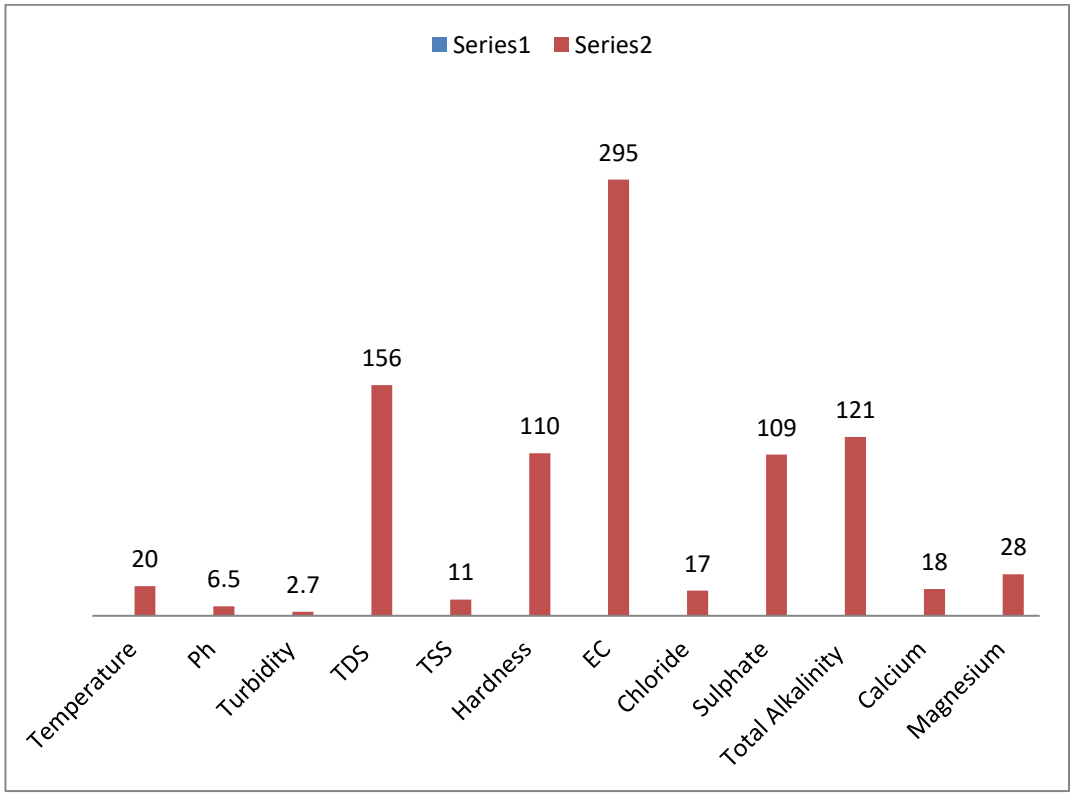

Figure-4: Variation in physico-chemical parameters of the Tube -well of Gandhi Chowk in Winter Season 2020-21

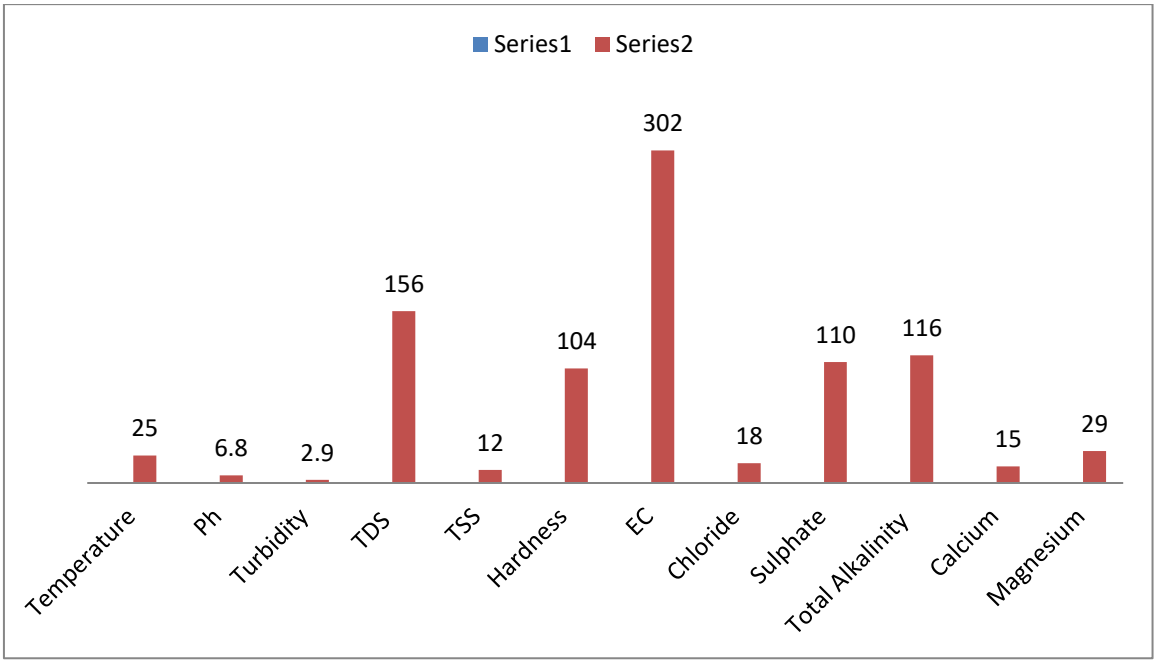

Figure-5: Variation in physico-chemical parameters of the Tube -well of Gandhi Chowk in Summer Season 2020-21

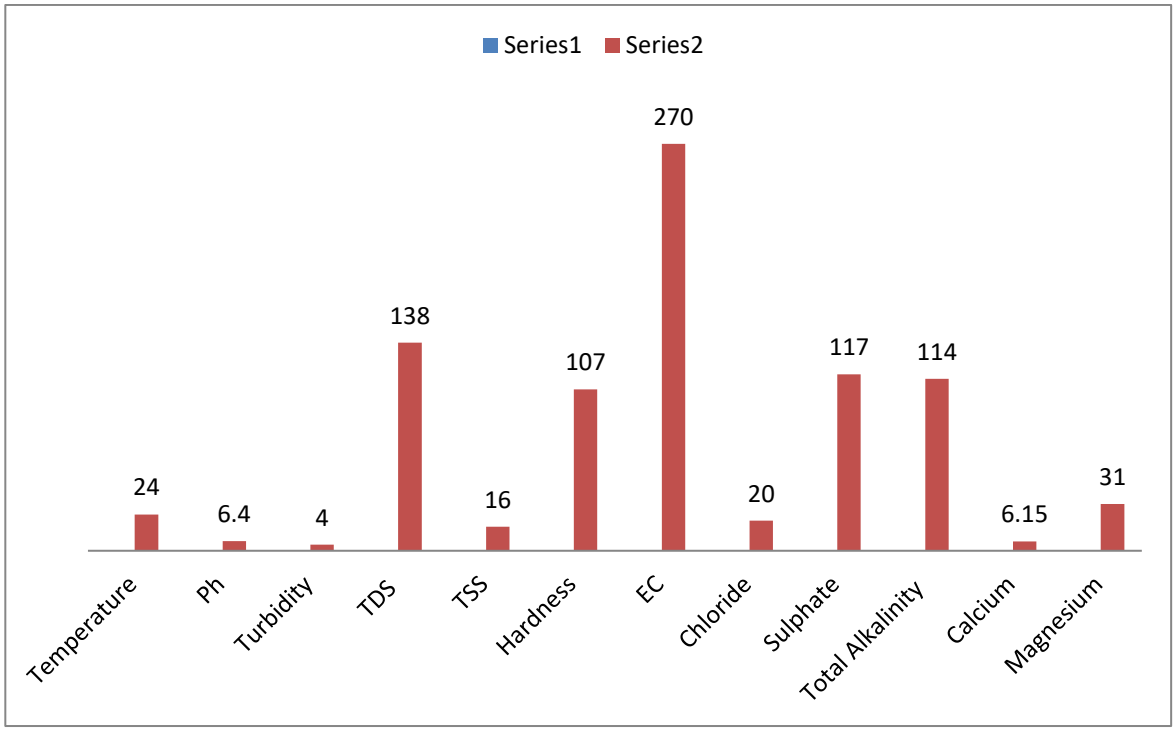

Figure-6: Variation in physico-chemical parameters of the Tube -well of Gandhi Chowk in Rainy Season 2020-21

III. CONCLUSION

The pH is a measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water. It has no direct adverse effect on health, however, a low value, below 4.0 will produce sour taste and higher value above 8.5 shows alkaline taste. A pH range of 6.5 – 8.5 is normally acceptable as per guidelines suggested by ISI. In the present study, the fluctuation of pH in the samples was from 5.7 to 9.0. However, it has

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Cite this Article
Bishal Kumar Singh, Dr. Rabindra Singh, "Study of Ground Water Quality and Variation in Physico-Chemical Parameters of The Tube -Well of Gandhi Chowk (Chapra Municipality)", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 9 Issue 1, pp. 480-487, January-February 2022.
Journal URL : https://ijsrst.com/IJSRST2295195