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ASSESSMENT OF GROUND WATER QUALITY USING WATER QUALITY INDEX WITHIN 4KM RADIUS OF SAFEDABAD DISTILLERY PLANT IN BARBANKI DISTRICT

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ABSTRACT - *Groundwater is a significant piece of the water cycle and it is essential wellspring of drinking water just as quality Farming purposes. The fast industrialization causing difficult issues concerning the appearance of groundwater degradation because of the release of treated or somewhat treated wastewater from industry Thus, it is important to evaluate the groundwater. This research investigates the effect of the sugar industry effluent on the quality of groundwater supported groundwater quality index. The sugar industry is the most significant agro-based production in India. This release of sugar industry passes through the soil which causes the degradation of groundwater as well as surface water and soil which besides people suffer from various health hazards. The general water quality status portrayed by the Water Quality Index (WQI) through which numerical score got from the coordination of complex water quality parameters. In this paper effort has been made for the study of physico-chemical characteristics of sugar industry effluent, the outcome of the sugar industry effluent on groundwater quality, evaluating Water Quality Index for groundwater. For suitability of human consumption.*

Key words: Ground water, water quality index, physico-chemical.

1. INTRODUCTION

Water is an essential natural resource and an absolute necessity for sustenance of life. Water is not only the most important essential constituent of all animals, plants and other organisms, but it is also pivotal for the survivability of the mankind in the biosphere. According to annual report of International maize and wheat improvement centre, in the global water resources about 97.5% is saline water mainly in oceans and 2.5% is available as fresh water. Fresh water is a finite resource and is locked in icecaps and glaciers or lies in deep underground reservoirs. The percentage of freshwater in rivers and lakes is very meager. Most of the surface waters in India, including both rivers and lakes are getting increasingly polluted due to onslaught of human activities of diverse nature. The demand for water has increased over the years and this has led to water scarcity in many parts of the world. The situation is aggravated by the problem of water pollution or contamination. India is heading towards a freshwater crisis mainly due to improper management of water resources and environmental crisis is already evident in many parts of India, varying in scale and intensity [2]. It is estimated that nearly 70% of our water sources are polluted. The growing scales of cultural and technological development pose new threats to water quality. In India, there is clear visible threat to the quality of water. The predicted water demand for future is alarming. Groundwater is the primary source of water for human consumption as well as for Agricultural and industrial uses in many regions all over the world. Due to inadequate availability of surface water, groundwater remains the requirement of human activities. Groundwater remains the only option to supplement the ever increasing demand of water. It is estimated that approximately one-third of the world's population use groundwater for drinking (UNEP, 1999). Groundwater contributes 0.6% of total water resources on Earth. It accounts for nearly 80% of the rural domestic water needs and 50% of the urban water Needs in the developing countries in India. The quality of water resources is being increasingly degraded as consequence of its intensified anthropogenic exploitation. In developing countries like India, around 80% diseases are directly related to poor drinking water quality and unhygienic conditions. Groundwater contamination by different pollutants, natural geological formations and due to the intensive agricultural and urban development has placed the whole environment at greater risk. Poor quality of water adversely affects the human health and plant growth. Groundwater quality monitoring is a tool which provides important information of water management. In this regard, the present study has been focused on quality assessment of groundwater of radius of sugar industry located Rauza gaon village in Faizabad district and its suitability for drinking and irrigation purposes. The details of this investigation are presented in various chapters of this volume

1,1 LITERATURE REVIEW

1.1.1 Shivasharanappa et al., (2011) work carried out on "Assessment of groundwater quality characteristics and Water Quality Index (WQI) of Bidar city and its industrial area, Karnataka State, India the present work is aimed at evaluating the water quality index (WQI) for the groundwater of Bidar town and its industrial zone. In this study collecting the groundwater sample of selected 35 wards for physicochemical examination. For assessing the WQI, the following parameters were analyzed such as pH, total hardness, calcium, magnesium, chloride, nitrate, sulfate, total dissolved solids, iron, fluoride, sodium, potassium, alkalinity, manganese, dissolved oxygen, total solids, and zinc. The result reveals that the water quality index (WQI) comes in the Excellent Range and therefore the groundwater of Bidar town is as considered as Excellent. The investigation reveals that the groundwater of the area, requires a certain degree of treatment before consumption (at least disinfection), and it also needs to be preserved from the risks of pollution.

1.1.2 Srinivas et al., (2013) carried out a study on "Determination of Water Quality Index (WQI) in Industrial areas of Kakinada, Andhra Pradesh, INDIA" the purpose of this study to measure the water quality index of industrial areas of well water samples in Kakinada; Andhra Pradesh, India was observed. The study was carried out at the 10 sampling stations of the industrial areas of Kakinada. For the computation of the water quality index, thirteen necessary parameters were taken. The parameter like pH, Dissolved oxygen, Electrical Conductivity, Total Dissolved Solids, Total Alkalinity, Total hardness, Total suspended Solids, Calcium, Magnesium, Chlorides, Nitrates, Sulphates, Biological oxygen demand. The WQI has been estimated by using the standards of drinking water quality approved by the World Health Organization (WHO), the Indian Council of Medical Research (ICMR) and Bureau of Indian Standards (BIS) have been used for the computation of WQI of the water body. Water Quality Index of this area ranged from 49.52 – 123.54 ppm showing that level of pollution load in the bore waters. This study shows that some bore well waters are the allowable limit. But some are passed the allowable limit. In the paper, the water was not according to drinking standards, and hence it is recommended to take all the important precautions before the waters are conveyed within the municipal distribution system.

1.1.3 Sharma et al., (2013) conducted the study on 'Evaluation of Ground Water Quality in Region of Industries and Along Yamuna River in Yamuna Nagar, Haryana, India'. In this study, to estimate the fitness of groundwater quality for drinking and watering purposes in the neighborhood of three chosen industries sugar mill, paper mill, thermal power plant and along Yamuna River located in Yamuna Nagar District of Haryana state, India. The groundwater samples were gathered from three industries of the selected site and several parameters were examined like pH, Electrical Conductivity, Total Dissolved Solids, Dissolved Oxygen, Alkalinity, Total Hardness, Calcium, Sodium, Potassium, Chloride, Magnesium, Carbonate, Bicarbonate, and Turbidity. The obtained results correlated with the WHO 2004 (World Health Organization) and BIS 2003. It also examined sodium percentage (Na %), Sodium Absorption Ratio (SAR), Residual Sodium Carbonate (RSC), and the Permeability Index (PI) for assessing of groundwater for agricultural plan. This paper exposes that some parameters like electrical conductivity, alkalinity, hardness, potassium, and magnesium of groundwater have passed the allowable limit, showing that this area is characterized by hard water. SAR, Na%, RSC, and PI show that groundwater is fit for irrigation purposes and after proper remedy can be used for drinking and residential purposes.

1.1.4 Agale M.C. et al., (2013) worked on 'Impact of sugar industry effluents on the quality of groundwater from Dahiwad Village, Dist-Dhule, (Maharashtra) in this study, the different parameters of groundwater was considered from the sugar industry. The groundwater samples were gathered in the region of Dahiwad village the groundwater samples were gathered in the region of Dahiwad village during the period of 10 months from Jan to Oct and examined many Parameters like DO, hardness, alkalinity, Magnesium, Nitrate, Phosphate, Chloride, Sulphate, pH, were evaluated to estimate the influence of effluents on groundwater. The outcomes showed that there was a significant variation in the corresponding parameters. When got results correlated with the BIS (1990) Norms for drinking water. Most of the parameters during the present study do not meet the water quality norms as per BIS (1990). Now it is transparent that the groundwater becomes polluted due to sugar industry effluents from enclosed areas. So, it is not fit for drinking purposes without prior treatment. Furthermore, the water is used for irrigation and domestic purposes in that area. In the present investigation, it was observed that the sugar industry effluents affect groundwater quality. On the basis analysis, it can be said that the groundwater in the region of sugar mill was polluted due to a higher concentration of chlorides, nitrates, magnesium and total hardness which was higher than BIS (1990) standards for drinking water.

1.1.5 Kawade and Gadhave, (2015) carried out the study on "Portability of Ground Water from Areas around a Cane- Sugar Industry: A Case Study from Sangamner village, Ahmednagar, Maharashtra, India'. The present

study aims to assess the influences of cane sugar production on its nearby groundwater status. The study includes the examination of eight water samples from tube-wells near to the industry for water quality parameters such as pH, DO, BOD, COD, total dissolved solids, Ca, Mg, Na, Zn, K, Cl, and Fe.the obtained result compare with standard permissible limits prescribed by the Board of Indian Standards (BIS). The result reveals that the groundwater has been significantly affected and is not fit for consumption and cultivation.

1.1.6 Vipin Kumar Swaroop et al., (2018) conducted the study on "Assessment of groundwater quality using water quality index in Unnao Dist, Uttar Pradesh India. The work aimed at assessing the groundwater quality in the Unnao district which is placed in the alluvial plain of River Ganges. Total 11 Physico-chemical parameters were chosen such as pH, Cl^-, NO_3^-, F^-, and SO_4^{2-}, TH, Ca^{2+}, Mg^{2+}, TDS, TA and Fe for determining their concentration in each block of the research area and were Moreover utilized to estimate the Groundwater Quality Index (GWQI) of 16 blocks. Another parameter, Cr (VI) was also considered for determining its fitness of groundwater for drinking purpose, as Unnao district is a center of numerous industries which enhances the probability of percolation of Cr (VI) into groundwater through pores. The study reveals that the groundwater in 4 blocks is extremely unfit for drinking purposes as their similar GWQI values are more than 100. Due to the presence of chromium (VI) in two blocks beyond the allowable limit, it becomes a matter of concern for the safety of the residents in that area as chromium is extremely toxic to human beings. As stated above, just four blocks were in the region of good drinking water, this also arises the necessity for the groundwater authority to take remedial actions in this regard. It can be overall concluded that the drinking water is quite unfit in certain areas but with some satisfactory measures, it can be prevented from moreover deterioration.

2.Characteristics studied and the methods used for analysis of physicochemical Parameters of water.

Under mentioned parameters are analyzed : pH, EC,

Turbidity, TDS, TH, Calcium, MG, Alkanity, Chloride, Sulphate, Nitrate, Iron, Fluoride F.

2.1 pH

pH value in selected study area varied between 7.5 to 7.13 in Pre Monsoon. All values in the prescribed limit given by bureau of Indian Standard the variation of pH different places at the study area.

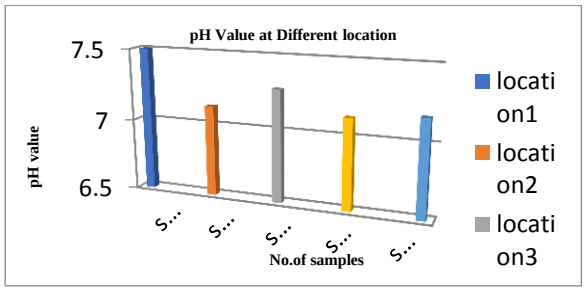

Fig 2.1

2.2 Electrical conductivity

The EC value in selected study area varied between the Ranges 1144 to 691 all the sample of Electrical conductivity exceed the permissible limit High conductivity is due to presence of high amount of dissolved salts.

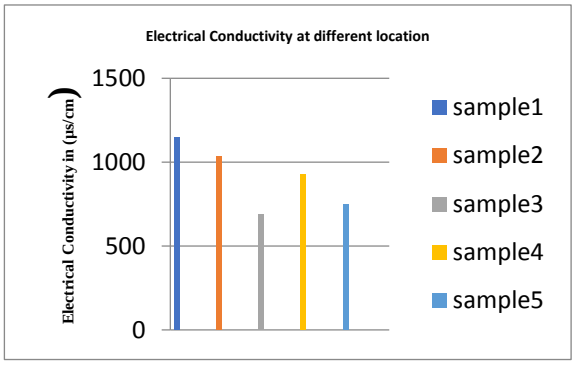

Fig 2.2

2.3 Turbidity

The observed value of turbidity ranges from 0.9 to 3.4 NTU sample No.4 and 5 slightly exceeded the Requirement limit (acceptable limit) prescribed by the IS 10500-2012 high value of turbidity indicate presence of organic matter in water sample.

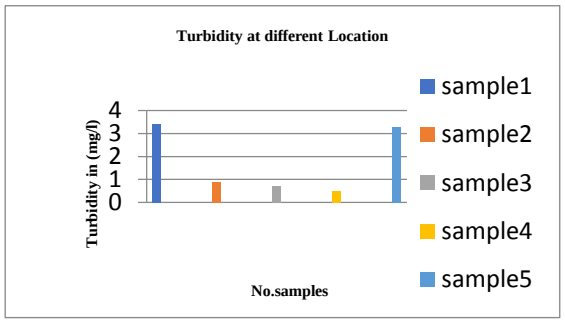

Fig 2.3

2.4 Total Dissolved Solids

The Total dissolved solids concentration ranges from 456 to 744 mg/L sample No. 1,2,and 3 exceeded the Requirement (Acceptable limit) and sample no.3 and 5 within the Acceptable limit Higher concentration of dissolved solids are samples shows poor quality of water predicted to more seepage and movement of ground water in this area.

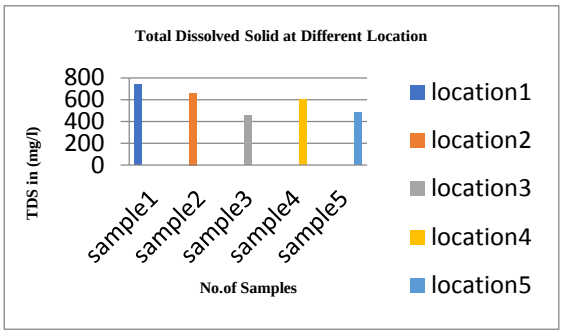

Fig 2.4

2.5 Total Hardness

Observed total hardness varied between 228 to 384 mg /Lground water were found to exceed the acceptable limit of IS 10500-2012 The natural sources of hardness in water are dissolved in the form of polyvalent metallic ions (i.e. calcium and magnesium) from sedimentary rocks, seepage and runoff from soils58. High value of total hardness leads to heart diseases and kidney stone problem81 as human health problems.

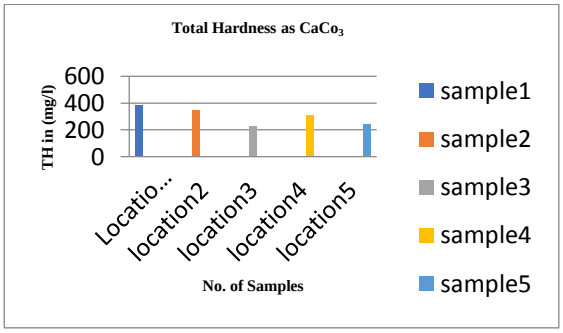

Fig 2.5

2.6 Calcium

The calcium concentration of different sample observed ranges from 32 to 46.5 mg/L all the sample calcium concentration within the Requirement limits (Acceptable limit).

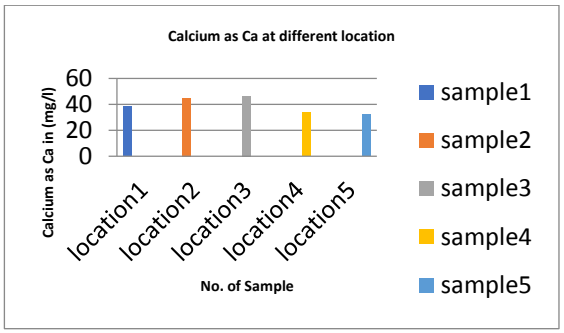

Fig 2.6

2.7 Magnesium

The magnesium concentration observed value ranges from 27.2 to 70 mg/L The only one sample within the Requirement (Acceptable limit) and sample 1,2,4, and 5 exceed the Requirement limit (Acceptable limit).

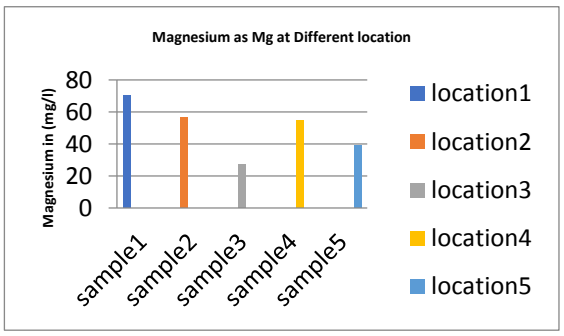

Fig 2.7

2.8 Alkalinity

The alkalinity as (CaCo3) concentration observed in this study ranges from 232 to 364 mg/L The entire sample exceeded the Requirement (Acceptable limit) prescribed by the IS-10500 2012 .

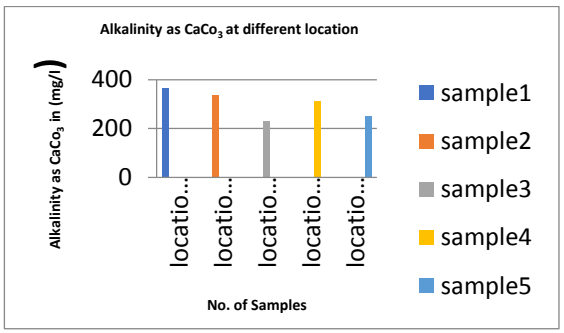

Fig 2.8

2.9 Chloride

Chloride concentration of the groundwater samples in the study area are varied from 12 to 48 mg/L the entire sample within the acceptable limit prescribed by the IS-10500 2012 yet these values are well below the maximum permissible limit (1000 mg/l). Excess of chloride is due to anthropogenic activity like septic tanks effluents, usage of bleaching agents by people nearby bore well.

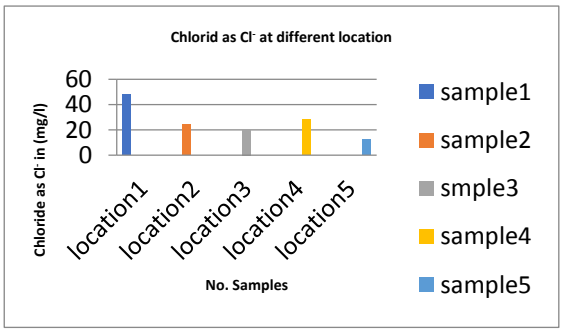

Fig 2.9

2.10 Sulphate

Sulphate on centration of ground water sample observed value ranges from 13.8 to 32.8 mg/L Lesser value of within the Requirement (Acceptable limit) prescribed by the IS-10500 2012.

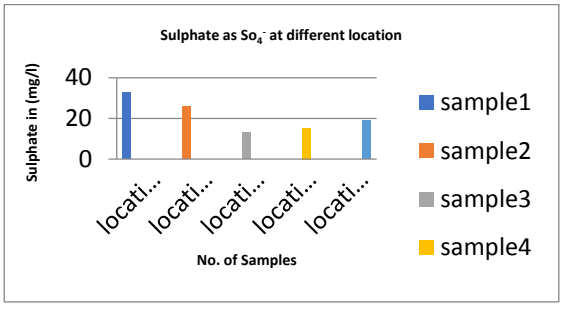

Fig 2.10

2.11 Nitrate

The major natural source of nitrate is atmosphere, legumes, plant debris, and animal excrement nitrate varied from 1.3 to 1.9 mg/L within the acceptable limit prescribed by the IS-10500 2012 High values of nitrate concentrations results are due to solid waste from sewage and septic tanks.

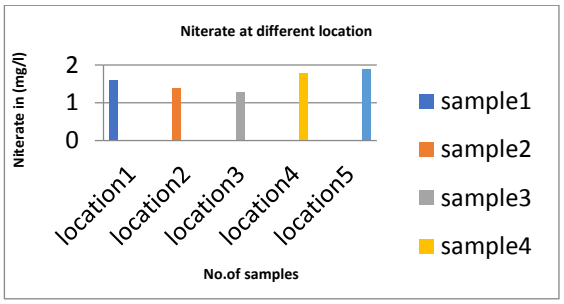

Fig 2.11

3 Water Quality Index

The variation of water quality index first location near rauzagaon village sugar mill 144.82 and second location at 200m.radius water quality index found 130.3 and third location 500 m radius from centre found 88.76 the fourth ground water sample 2km from centre at Tanda khulasa found 118.215 and Fift ground water sample result 4km from the centre at Tanda khulasa village found that 95.59 which show that very poor water quality status and highly polluted ground water.

3.1 Variation of water quality index (WQI)

Rauza gaon three sample the value of (WQI) are 144.8211,130.2978,this is greater than 100 and 88.6635 which is less than 100which show that two sample result very poor quality of water and third result fairly good. Tanda khulasa village (WQI) report maximum 118.215 and min 95.54906 which show that very poor water quality The physic-chemical value like TDS, TH, Magnesium, alkalinity, exceed the requirement (Acceptable limit) the variation of water quality index (WQI).

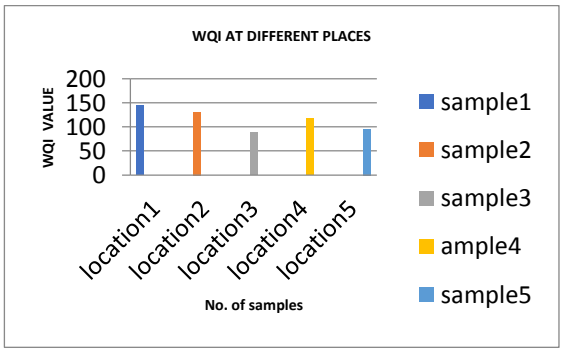

Fig (WQI)

4. CONCLUSION

In the present study, from analysis in March 2020 the first sample result show that the parameter like turbidity TDS, Total, Hardness, Magnesium , alkalinity slightly vary the Requirement (acceptable limit) and remaining

parameter within the acceptable limit The reason can be attributed to increase in concentration as a result of greater leaching and percolation of contaminants and decrease in concentration as a result of dilution. The second sample result show that the parameter like TDS, Total, Hardness, Magnesium , alkalinity slightly vary the Requirement (acceptable limit) and remaining parameter within the acceptable limit The third ground water sample observed that the parameter like Total, Hardness, alkalinity slightly vary the Requirement (acceptable limit) and remaining parameter within the acceptable limit The fourth ground water sample observed that the parameter like TDS, Total, Hardness, Magnesium , alkalinity slightly vary the Requirement (acceptable limit) and remaining parameter within the acceptable limit The fifth ground water sample observed that the parameter like Total, Hardness, Magnesium, slightly exceed the Requirement (acceptable limit) and remaining parameter within the acceptable limit The final output has been given in the spatial representation of groundwater quality in the study area of Rauzagaon village. The analysis indicates that the groundwater of the study area needs some degree of treatment before consumption. The study helps to understand the quality of water as well as to develop suitable management practices to protect the groundwater sources. The water quality status is assessed through Weighted Arithmetic Index method. WQI values of groundwater samples analyzed for pre and post monsoon seasons depict that there exists a narrow change in the WQI values which is not very significant with reference to potability and groundwater quality. Long-term trends In overall index values will be difficult to calculate until a few more years of data Are collected. Trends over a longer period can be assessed for individual water As per WQI scale, the selected groundwater stations are classified from excellent to very poor and in certain areas even unsuitable for drinking. Highest value of WQI (144.8211) is observed at Rauzagaon village and minimum value of WQI (88.76635) at Tanda kulasa village.

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