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ASSESSMENT OF GROUND WATER QUALITY BY USING WATER QUALITY INDEX AND PHYSICO CHEMICAL PARAMETERS: REVIEW PAPER

Jyoti Bansal*[1] & A.K. Dwivedi[2]

*[1]Research Scholar, [2]Professor

*[1, 2] Department of Chemical Engineering, Ujjain Engineering College, Ujjain (M.P.)

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ABSTRACT

Water quality is considered as a big issue in many cities of developing countries. Bore well water is valuable than surface water but due to different activities done by human being this water is contaminated. And now-a-days this is the grave problem. In those areas of Indore city where the door to door garbage pickup vehicle brought their garbage, the assessment of the bore well water was carried out. At assessing the water quality index (WQI) and physico-chemical parameters for the ground water of Indore the present work is aimed. For a physico-chemical analysis, ground water samples of selected location were collected. For calculating the present water quality status the following quality parameters were considered: pH, electrical conductivity, TDS, total hardness, COD, total alkalinity, turbidity, sulphate, chloride. After calculating water quality status of considered parameters, results are compared with IS: 10500-2012. This ground water sample's physico -chemical characteristics suggest that the evaluation of water quality parameters should be carried out periodically.

KEYWORDS Ground water, water quality index, physico-chemical.

I. INTRODUCTION

Water is the most significant overabundant compound of the earth. Water is life. No life can lie without water. Groundwater is employed for domestic and industrial facility and jointly for irrigation purpose. The previous couple of decades, there has been an incredible increase within the demand for water as a result of rise of population and therefore the accelerated pace of industrial enterprise. Per UN agency organization (WHO), regarding eightieth of all the diseases in group of people are caused by water. Once the bottom (ground) water is contaminated, its quality cannot be renovated back easily and to device ways in which and suggests that to guard it. Water quality index is one among the foremost effective tools to speak data on the standard of water to the involved voters and policy manufacturers. It thus, becomes crucial parameter for the assessment and management of bore well water. Water quality standards square measures required to see whether or not bore well water of a precise quality is appropriate for its meant use. Guidelines for potable Water Quality are printed by IS: 10500-2012. WQI is outlined as a rating reflective the composite influence of various water quality parameter. WQI is calculated from the purpose of read of suitableness of bore well water for human consumption. For demarcating groundwater quality and its suitableness for drinking purpose WQI is an important technique. A mere numerical value is computed by WQI to reduce large amount of water quality data. At a certain location and time based on several water quality parameters a mere numerical value expresses the overall water quality. A mathematical equation used in water quality index to remodel range (sizable amount) of water quality information into one number. For decision makers' possible uses and quality of any water body, a single number (WQI) is straightforward to understandable.

II. LITERATURE REVIEW

In the year 2008 K. Yogendra, et al. have studied on, 'Determination of Water Quality Index and Suitability of an Urban Water body in Shimoga town, Karnataka.' In this study they determined WQI of an urban water body on the basis of different physico-chemical parameters. The analysis revealed that water bodies have low DO, high COD and high nitrate concentration. And it shows that, for domestic purpose that water was unsuitable.

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In the year 2009 C.R. Ramakrishnaiah, et al., studied on, 'Assessment of Water Quality Index for the Groundwater in Tumkur Taluk, Karnataka State (India).' In this study they were calculate WQI for 12 parameters and WQI for those 269 sample ranges from 89.21 to 660.56. Many water samples were poor in quality; the analysis shows that the groundwater of that area required some treatment before utility.

In the year 2012 Patil, et al., studied completely different physical, chemical and trace metal parameters for testing of water quality. The supply of excellent water quality, water is crucial. The standard of potable water ought to be checked at regular interval, as a result of use of contaminated potable water, human population suffers from varied of water borne diseases.

In the year 2013 P. Shroff, et al., studied on, 'Assessment of Water Quality Index for Groundwater of Valsad District of South Gujarat (India).' In this study they were used WQI created by CCME (Canadian Council of Minister of the Environment). 17 physico-chemical parameters were considered for calculating the WQI. And 59.6 was the overall WQI of Valsad. And WQI of few location lie under fair category and some of them lie under excellent while rest of them falls under good category. The analysis shows that the groundwater of Valsad required some treatment before utility.

In the year 2013 Udit Mohan, et al., studied on, 'Water quality assessment and physico-chemical parameters of groundwater in district Hapur, Uttar Pradesh, India.' In this present study, 28 groundwater samples collected from hand pumps marks II which was situated at different locations in Hapur district. For analysis, various physico chemical and biological parameters were used and the water quality index of Hapur reveals that the quality of water is not suitable for drinking purpose, and therefore it must to be guarded from pollution.

In the year 2014 Devendra Dohare, et al., studied on, 'Analysis of Ground Water Quality parameters.' For calculating status of water quality of Indore, they were used statistical evaluation and WQI. Twenty seven parameters were considered like pH, Colour, TDS, EC, TH, Calcium, Total Alkalinity. And obtained results are compared with IS: 10500-2012. They suggest that the monitoring of water quality should be done periodically.

In the year 2014 S. Selvakumar, et al., studied on, 'Groundwater quality and its suitability for drinking and irrigational use in the Southern Tiruchirapalli district, Tamil Nadu, India.' In this study there was 20 groundwater samples were taken from dug and bore wells. The following parameters were analyzed: pH, EC, TDS, Calcium, Magnesium, Sodium, Potassium, Bicarbonate, Carbonate, Sulphate, Chloride, Nitrate, and Fluoride. Chemical analysis indicates that the groundwater was slightly alkaline and some samples were suitable and some of them unsuitable for drinking. According to their study they found that by evaporation dominance and rock water interaction dominance, the water quality of study area has been changed.

In the year 2015 Dr. C. Nagamani, studied on, 'Physico-Chemical Analysis of Water Samples.' In this study he was carried out the quality of water in five blocks of Banglore (urban and rural location) with the help of various physico chemical parameters. And after analysis obtained results were compared with WHO standards. Results indicated that all parameters were lie under the permissible limit.

In the year 2016 Sajitha V., et al., studied on , ' Study of Physico chemical parameters and pond water quality assessment by using water quality index at Athiyannoor panchayath, Kerala, India.' In this study pond water quality was checked by pysico chemical parameters and WQI. And then results were compared with different water quality standards of WHO and BIS. It was found that, WQI results of collected samples are comes under excellent category. Therefore water is applicable for domestic activities.

In the year 2016 Dhanji Kanase G, et al., studied on, 'Physico chemical analysis of drinking water samples of different places in Kadegaon Tahsil, Maharashtra (India).' Two different scenarios were compared in this study like bore well water and well water. Different parameters are used for this. Obtained result shows that drinking water was not suitable for drinking purpose.

In the year 2017 S.S. Kolekar studied on, 'Physico chemical analysis of groundwater quality parameters- A review.' In this study he focused on reviews of different research papers which are related to physic chemical analysis of groundwater (for drinking purpose). After study, he conclude that, when results are not obtained within the permissible limit then that type of drinking water need simple pretreatment before use.

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In the year 2017 V.Jena, et al., studied on, 'Physico chemical analysis of ground water of selected area of Raipur city.' In this study, during 2015-2016 assessment of physico chemical parameters is done for 20 groundwater samples of Raipur city. Standard methods and procedures were used for assessment. They conclude regular chemical analysis must be done.

In the year 2017 Namita, et al., studied on, 'Evaluation of Water quality index for drinking purpose in and around Tekanpur area M.P.(India).' They carried out experimental work on physic chemical parameters of groundwater samples taken from in and around Tekanpur, Gwalior (M.P.). Water samples were collected from five selected locations. After analysis results were compared with WHO and ISI standards. Most of the parameters satisfy the guidelines. WQI ranges from 58.66 to 93.75 are obtained for those samples. And they suggest that the pretreatment required before consumption.

In the year 2017 Jebastina, et al., studied on, 'GIS based assessment of groundwater quality in Coimbatore district (India).' In this study they were checked the quality of groundwater. By hydro chemical parameters, quality of groundwater assessed for its suitability for different purposes. 78 samples were collected during post monsoon season. For sample analysis different physical and chemical parameters were considered. To find out the quality, for drinking and irrigation purposes, the quality of groundwater has been carried out by an analysis which is based on Geographic Information System (GIS). Results show that, seventy three percent of samples are lie within the permissible limit for drinking. And for irrigation all the groundwater samples of study area are suitable.

III. ASSESSMENT OF WATER QUALITY

Under mentioned parameters are analyzed: pH, TDS, EC, TH, COD, Sulphate, Chloride, Alkalinity, Turbidity.

pH: The pH value is the –ve log of hydrogen ion concentration. The hydrogen ion concentration usually ranges from zero to fourteen. When values of pH lower than seven then the water is termed acidic. When pH value exceeds seven then water is consider basic. When pH value is exactly equal to seven then water is said to be neutral. pH value is measured by pH meter. 6.5 to 8.5 is the limit of pH value for drinking water [Namita et al. 2017].

Electrical Conductivity (EC): Electrical Conductivity (EC) is a numerical value. This is the ability of an aqueous solution to take away the electric current. The purity of water is evaluate by EC (electrical conductivity) and therefore it is a useful tool to check the purity of water [Sajitha V. et al. 2016]. EC is measured by an instrument called electrical conductivity meter. The instrument is standardized with the help of std. KCl solution.

Total Dissolved Solid: Solids might impact on water quality adversely in many ways. A different kind of minerals which is present in water is denoted by total dissolved solids (TDS). TDS is directly associated with the purity of water and also the quality of water. And we can say the sum of the cations and anions concentration is equal to TDS. TDS can be calculated by TDS Meter. As per IS: 10500-2012 acceptable limit is 500 mg/l and permissible limit is 2000 mg/l [Devendra Dohare et al.; 2014, Sajitha V. et al. 2016].

Total Hardness: The sum of calcium and magnesium hardness in mg/l is equal to the total hardness [SS Sagar et al.2015]. And it is determined by EDTA method. The impact of hardness is scale in utensils and plight system in boilers etc. The degree of hardness of potable water has been classified in terms of equivalent $CaCO_3$ concentration as follows: Soft- 0-60 mg/l, Medium- 60-120 mg/l, Hard- 120-180 mg/l, terribly hard- > a hundred and eighty mg/l [Devendra Dohare et al. 2014].

Turbidity: Particles which are suspended in water interfering with route of light is known as turbidity. Turbidity is due to the presence of different types of suspended particles. It is measured by Turbiditymetry. As per IS: 10500-2012 acceptable limit is 1 NTU and permissible limit is 5 NTU [Devendra Dohare et al. 2014].

Sulphate: In natural water ions of sulphte are present and most of those ions are soluble in water. It is measured by Ultraviolet Spectrophotometer. As per IS: 10500-2012, acceptable limit of sulphate is 200 and permissible limit is 400 mg/l.

Total Alkalinity: Alkalinity could be a chemical activity of water's ability to neutralize acid. Hydroxide, carbonate and bicarbonate are caused the large part of the alkalinity in natural water. In potable water 120 mg/l is the acceptable limit of alkalinity [Namita et al. 2017].

Chemical Oxygen Demand: For measuring the organic strength of domestic and industrial waste COD test is widely used. COD is evaluating in short time means it takes about 3-4 hours while BOD takes five days. It is used to assess the carbonaceous fraction of organic matter.

Chloride: In all types of natural waters the amount of chloride present in widely varying concentration. When the mineral content will increase in water then chloride content will automatically increases. Due to human activities the concentration of chloride is high. As per IS: 10500-2012 acceptable limit of chloride is 250 mg/l and permissible limit is 1000 mg/l.

Water Quality Index (WQI): The Water Quality index is employed to combination of numerous parameters and their dimensions into one score.
Water Quality Index, WQI = $\sum_{i=1}^{n} Wiqi$
Where,
q_i(quality rating for the parameter) = $(C_i/S_i)\times 100$
C_i = Concentration of the i^{th} parameters
S_i = Standard guidelines value for each parameters, mg/l
$W_i = w_i / \sum_{i=1}^{n} wi$
w_i= weight to the i^{th} parameter,
n = Number of parameters
Canadian council has discovered Canadian Water Quality Index (CWQI) that is founded on W.Q.I. of British Columbia. Canadian Water Quality Index is predicted on 3 attributes of water quality that relate to water quality objectives: i.Scope-F_1, ii.Frequency-F_2, iii. Amplitude-F_3 ++++++++
$$CWQI = 100 - \frac{(F_1{}^2+F_2{}^2+F_3{}^2)}{1.732}$$
Quality Index defines ranges for each CWQI: Unhealthy (0-44), Marginal (45-64), Good (65-79), Superb (80-94), and Glorious (95-100) [Devendra Dohare et al. 2014].

IV. CONCLUSION

Ground water quality is dependent on the type of the pollutant. And it is also depend on the nature of mineral found at specific space of bore well. Ground water quality monitoring is done by collecting water samples and analysis of physico-chemical characteristics of water samples at completely different location of Indore city wherever door to door garbage pickup vehicle brought their garbage (substation of waste collection). The present review paper undertaken to fetch an awareness among those who lives close to the substation of waste collection. The individual, the community and Municipal Corporation will facilitate to reduce bore well water pollution by straightforward housework and management practices. Estimation of water quality index by exploitation appropriate technique and verify the standard of bore well water by applied math analysis for post and pre monsoon seasons, results of water quality assessment showed that some water quality parameters slightly higher in wet season as compare to summer season [Devendra Dohare et al. 2014].

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