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An Overview on Analysis of Ground Water Quality Parameter

Hemantkumar Tidke, Richa Chavan, Nikhil Bagade, Sharwari Bhusari, Anshul Bharadbhunje, Paras Rathod and Utkarsha Dahagane

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Hemantkumar Tidke[1], Richa Chavan[2], Nikhil Bagade[3], Sharwari Bhusari[4], Anshul Bharadbhunje[5], Paras Rathod[6], Utkarsha Dhagane[7]

[1-7]UG, Student Dept of Civil Engineering, K.D.K College of Engineering, Nagpur

ABSTRACT

Water is a basal natural resource for sustain environment & life but in last few decades the water quality is deterioration due to its overexploitation. Groundwater is the major source of drinking water in urban and rural areas over 94% of drinking water demand is from groundwater. The physical, chemical characteristics of water for its suitability describe quality. The study aim is to analyse the underground water quality parameter of the Nagpur region by water quality index. In this study, Water samples were by a different physiochemical parameter such as suspended solids, turbidity, colour, taste and odour, temperature, TDS, Alkalinity, pH, Hardness Chloride content, Nitrogen content, phosphorous, fluorides, Metals and this obtained study is compared with Indian standard water specification (IS: 10500-2012). The data has been collected from 5 location which is located in the Nagpur region. The study of a physio-chemical characteristic of the groundwater sample suggested that the evaluation of water quality management, as well as water quality parameter, should be protecting the water resources.

Key Words:- physiochemical parameter, water quality index, Weighted Arithmetic Index method.

1. INTRODUCTION

Ground water is good source of fresh water & ground water contamination has become one of the most serious problem in the world in last few decades. In many region especially in arid and semi-arid areas is substantial supply of water. Ground water quality is depend on the quality of ground water recharged, island surface water, atmospheric precipitation and on subsurface geo chemical process .some temporal changes in constituent and origin of the recharged water, human factor and hydrologic may cause periodic changes in ground water quality .water pollution is not only affect the water quality but also threaten human health , social prosperity and economic development . According to WHO about 80% of all the diseases in human beings are caused by water.

The ground water quality has particularly received immense attention since water high quality required in irrigation and domestic needs. ground water assessment is based on laboratory investigation and it can be done in satellite technology and (GIS) made it very easy to integrate in various database .In India ground water is not only most important for drinking purpose it also used extensively to satisfy agricultural , domestic and industrial water demand .the effect of ground water pollution not only harm water supply well and aquifer but with moment toward river and lakes .The water Quality Index method is widely used for ground water assessment around the world due to capability of full expressing of water quality information and it is one of most effective tool and important parameter for evaluation of ground water quality .

2. Literature Review

1) Mona Hagras et.al (2013)was done the study of analysis of groundwater quality and to characterize the hydro-chemical characteristics of the water sample in Punjab , The water

samples were collected from different cities of Punjab realm and analysed for 28 water quality parameters, weather the groundwater suitable for irrigation and domestic consumption. That was assessed by using WHO and USDA standards. The sodium percentage (Na%) in location indicates that majority of the groundwater samples are suitable for irrigation. This investigational study indicates that water sample in many cities of Punjab is unsafe for human consumption due to presence bacterial and chemical contamination.

2) K Khare et.al(2008) was done water quality assessment on water of Katraj lake , Pune .He did water analysis for the parameters like TDS, pH, BOD, COD, DO, ca, Mg and Hardness for lake water sample. The analysis of water quality indicates the temperature in the range of 240C. The pH was between 7.3 to 8.45. It show slightly alkaline water .The DO varies from 4.7 to 5.6mg/l. The total hardness ranged from 160 to 298 mg/l which is higher than permissible limit. The range of turbidity of water was between 28 to 42 NTU i.z. higher as per the APHA standards.

3) M Sayyed et.al (2015) He collected and assessed the water sample from the south-Eastern part of Pune city for the seasonal variation in their water quality parameters. Using piper diagram the hydro-geochemical appearance were classified with regards to the changes in their major chemical compositions. Based on the hydro-geochemical appearance . It has been found that the groundwater regime is rigorously deteriorated by the anthropogenic activities .The predominant SO4 and Cl in the wells of fursungi and mantarwadi areas have strong influence of leachate throughout the year due to solid waste disposal site.

4) S M Ghoraba et.al (2011) she collected 120 ground water sample from 29 different Districts of Balochistan, Pakistan.The various parameters are taken for the testing of samples. All samples were analysed for pH, Ca, Mg, Na, K, Cl, and TDS and bi-carbonate. The result revealed highly variable hydro-chemicals. The chloride is found to be most prime factor. The groundwater sample in Balochistan has high concentrations of fluoride and nitrate in many districts. The pH ternary graphs reveals that groundwater in study area is alkaline and electric conductivity in most of samples lies in range of drinking water standards adapted by country . Comparison of data with WHO(2011) standards for drinking water indicate that the groundwater in the most of study area are suitable for drinking purpose except some few districts . The groundwater recorded a high range in TDS.

5) Sara C. et.al (2012) she studied that the groundwater quality parameters in the surrounding wells of jawahar nagar, upper Musi catchment regions of Ranga Reddy district , AP. The bore-well data was collected from the study area for two season i.e. post monsoon in December 2007 and pre monsoon in June 2008. The groundwater is very acidic in nature and hard. It was done by using GIS software. The study reveals that the concentrations of major constituents are well within the permissible limits in IS10500-1994, except in few cases where total hardness and fluoride concentration are high. The fluoride conc Beyond the limit. From the analysis it was analysed that the groundwater sample is polluted in the entire study area. During last years, the utilization of surface and groundwater for drinking, industrial and agricultural purposes has increased manifolds but consequently, it is observed that the water is polluted and affecting the human health ,soil nutrients, livestock, bio-mass and Environment.

6) Chidanand P et.al carried out physical, chemical, bacteriological analysis of water sample. Which is collected from around 7 bore wells located around landfill site at Turmuri, Belgaum to ascertain the magnitude of dumpsite pollution on groundwater. During the study period, 7

bore wells were selected around the landfill area at a distance of 500,750 and 1000m.The parameters analyzed during the study period were pH, Total dissolved solid (TDS), Total hardness,Nitrate, Most probable number (MPN) and heavy metal eg. Lead using standard laboratory procedures. The pH ranged from 6.01 to 7.33 indicate acidic in nature in the month of feb and march, but in the month of April and May all the wells within the levels.

7) Vikas Tomar et.al (2011) Vikas has done analysis of water parameters of sample is collected from 67 location during pre and post monsoon seasons in the year 2011 from Aarnal district, haryana and were subjected to analysis for chemical characterstics. The type of water that mainly found in the study area was rich sodium calcium bicarbonate and magnesium bicarbonate type during pre and post monsoon season on that year respectively and based on hydro-chemical appearance . Based on chemical analysis, the pre and post monsoon water samples were classified as per different standard of irrigation criteria it study the chemical changes resulting due to rain and natural recharge. It indicates that Na-Ca-HCO3 rich type water dominates during pre-monsoon and Mg-HCO3 during post monsoon seasons of the year 2011.

8) Neelima Bagde et.al (2016) she has done studied on ground water quality assessment and its impact with special reference to Chhindwara district of Madhya Pradesh,India.The study was carried out on ground water quality assessment of some Blocks of Chhindwara district.Water is the most consuming thing on all around the world , it is most sustaining for human activities, so its provision in desired quantity and quality is most important. Samples of ground water were collected from 5 block of the affected area and analysed for physic-chemical parameters like PH, Electrical Conductivity, alkalinity, total hardness and fluoride ion concentration, turbidity level. Over all some part of well water and hand pump water needed treatment for drinking purpose due to hardness and fluoride which are present in desirable limit.

9) K. Elangovan et.al.(2010) has carried out characteristics of tube well water for Erode in Tamil Nadu, India. He collected ground water of 60 locations in district during pre-monsoon and post monsoon seasons. Ground water samples were tested for 11 physico-chemical parameters in laboratory by physical methods and procedure, and concluded that at few places water can be use for drinking and irrigational purpose.

10) Manjesh Kumar & Ramesh Kumar et.al (2012) carried out experimental work on Physisco-Chemical Properties of Ground Water of UP, India. The study deals with evaluation of granite miners situated in Jhansi for their status about Physico-chemical contamination of ground water. Six different sites are selected for sample testing collected from mines and urban area.

11) Rajankar P. N et.al (2009) carried out assessment project on tube well water quality using WQI in Wardha, India. Using WQI some towns of district Wardha. It is calculated by parameters, such as PH, Turbidity, Temperature, DO , BOD, in the residential, commercial and agricultural areas. Some other physio-chemical parameters are EC, Total hardness, Calcium, chlorides, sulphate, potassium, etc.

12) Darshan Mehta, Pradeepsingh Chauhan, Keyur Prajapati et.al.(2018) carried out the present study deals with the determination of Ground water quality Index(GWQI) of Surat city. The GWQI indicates in terms of index number, which shows useful presentation of quality of water in water quality management. The aim of the study is to protect and maintain the chemical, physical and biological actuality of water and maintain the quality of water and

important purities. The parameters to be selected for the study will be Physio-chemical such as PH, temperature, turbidity, hardness, etc. Based on above study, it shows the groundwater quality lies in the range of poor to tolerable good but the temporary analysis indicates that such quality fluctuates in some of the area, it has been found within the bad range of water.

13) K. Saravankumar & R.Ranjith Kumar et al (2011) had done project on ground water quality of Ambattur industrial area in Chennai City. Ten different locations were selected for the study. The parameters were studied i.e. pH, total hardness, turbidity, chloride, sulphate, fluoride, total dissolved solids and conductivity. From overall analysis, it was observed that there was a slight rise and fall in the Physico-chemical parameters among the water samples study. Comparison of the Physico-chemical parameters of the water sample with WHO and ICMR standards showed that the ground water is highly contaminated and not good for health, hazards for human consumption.

14) P.V.Chinnu Mary, Anusmita A, Anjuna Mohana et.al (2016) under guidance of Er. Lakshmipriya A.R et.al (2016) carried out Availability of clean drinking water is most importance. Owing to the shortage of clean drinking water in recent years, identifying areas of deteriorating groundwater quality is of great importance. This realization has been the reason for the study of ground water quality near the industrial estate of Arur Gram Panchayat in Alappuzha district of Kerala. The chosen area shows a decline in ground water quality effluents, unhygienic sewerage with improper methods of toilet waste disposals contributed to a raising alarm on the quality of ground water.

15) R. P. Dhok, A. S. Patil & V. S. Ghole et.al(2011) carried out an assessment on the groundwater quality of Baramati city, Maharashtra, India was studied in two different seasons namely pre monsoon 2010 and post monsoon 2010. The various physiochemical parameters such as pH, EC, Ca2+, Mg2+, Na+, K+, Total dissolved solids, HCO3-, Cl-, (SO4)2, NO3-, F-, (PO4)2, DO, BOD were determined using standard procedures of APHA. Six parameters namely pH, TDS, phosphates, nitrates, DO & Biochemical Oxygen Demand were considered compute Water Quality Index based on National Sanitation Foundation (NSF-WQI). WQI is an excellent management and general administrative tool is communicating water quality information. NSF-WQI calculator is used to calculate the Water Quality Index. Our findings highlighted the deterioration of water quality in the study area due to anthropological activities. According to NSF-WQI ranking water quality in bad to medium and not suitable for drinking purposes.

16) Suman K. Dhaka & Narendra Bhaskar et.al(2017) has to access ground water quality in terms of water quality index by Weighted Arithmetic Index Method. Total 22 groundwater samples and 10 water quality parameters of each sample are considered in this study. Water quality is good at seven stations and very poor and unsuitable for drinking at 10 stations. High water quality index is due to high turbidity, high concentration of Fluoride and iron. Correlation of selected parameters is analysed and found that electrical conductivity has significant correlation with alkalinity, nitrate, sodium and sulphate. Regression equations relating correlated parameters were formulated. They both did comparative study with Indian standard and WHO standard for drinking water.

17) Devendra Dohare, Shriram Deshpande & Atul Kotiya et.al(2014) identify that due to human and industrial activities the groundwater is contaminated now a day. Thus the analysis of the water quality is very important to preserve the natural ecosystem. The assessment of the

groundwater quality was carried out in the different wards of Indore city. The present is aimed at assessing the water quality index (WQI) for the groundwater of Indore city and its industrial area. The groundwater samples of all the selected stations from the wards were collected for a physiochemical analysis. For calculating present water quality status by statistical evaluation and water quality index, following 27 parameters has been considered viz. pH, colour, total dissolved solids, electrical conductivity, alkalinity, hardness, calcium, chromium, zinc, manganese, nickel etc. The obtained results are compared with Indian Standard drinking water specification IS: 10500 - 2012. The study of physicochemical and biological characteristics of this ground water sample suggests that the evaluation of water quality parameters as well as water quality management practice should be carried out periodically to protect the water resources.

18) Dinesh Kumar et.al(2009) carried out study focused on the hydrochemistry of groundwater in the Jaipur city to assess the quality of groundwater for determining its suitability for drinking and agriculture purposes. Groundwater samples were collected from 11 stations of Jaipur city during monsoon season and were analysed for physicochemical parameters such as pH, EC, TDS, sodium, potassium, calcium, magnesium, chloride, sulphate, carbonate, bicarbonate, nitrate and fluoride. Comparison of the concentration of the chemical constituents with WHO (Word Health Organization) drinking water standards of 1983, status of groundwater is better for drinking purposes. Some of the parameters like pH, carbonate, bicarbonate, etc are within permissible limit as per WHO but, some chemical contains like sodium, cl, mg, N, etc values exceeding the limit. The calculated values of SAR, and percentage of sodium indicate that the water for irrigation uses is excellent to good quality. US Salinity diagram was used for evaluating the water quality for irrigation which suggests that the groundwater samples were good for irrigation.

19) Priyanka Pandey et.al (2012) does analysis the physiochemical properties of groundwater near municipal solid waste dumping sites in Jabalpur. All the samples were collected from bore well and hand pump near the MSW dumping sites and stored at 40C. The temp. of groundwater sample ranged from 25.11 to 27.310C. The study is carried out on parameters which are selected for testing are pH, TSS, TDS, COD, nitrate, CI, PO4-, F-, etc. The parameters for both types water are within permissible limit for the use except TDS, TSS, TS.

20) Dattatrya Bharti, Isub Ali Sayyed, G. G. Gaikwad, D. R. Taikar & J. Dhore et.al(2011) carried out water pollution and contaminant present in water, so it may affect the ground water which drilled out as bore well water. A study has been carried out to get its physicochemical characteristics of bore well water which are collected from Vidharbha Region, Nagpur city- south zone. Water samples were collected from different locations of the city area of same zone at particular distance and analysed for pH, conductivity, total hardness, total alkalinity, sulphates, chlorides, fluoride, sodium and potassium etc.

3. METHODOLOGY

3.1. Physical water quality parameter

3.1.1. Suspended solid

These are called as physical parameter where is dissolved solids are considered as chemical parameter suspended solids comes from inorganic particle like field Le extra immiscible liquid like oil likewise and greases and organic particle like plant fibre algae etc. Inorganic solids are non degradable solid
Note : problem of suspended solid come only in surface water not in groundwater

Measurement

- Most of the method or Grab a metric that is suspended solid are calculated by weighing them
- Total solid that is all solid are calculated by evaporating the sample and measuring their Residue heating temperature is 104 C
- Suspended solid is obtained by filtration and heading the Residue on filter at 104 degree centigrade
  dissolve solid = total solid - suspended solid.

3.1.2 Turbidity

Turbidity is measure of extent to which light is either absorbed or scattered by the suspended material in water it is not a direct control to measure of suspended solid

Measurement of turbidity is done using the following

- Turbidity Road
- Jackson turbidity metre
- baylis turbidity metre
- Nephelometer

3.1.3 Colour

- Calories caused by suspended and dissolved method in water after suspended matter causing colour is removed by centrifugation the colour obtained is called true colour
- humic acid give yellow Brown colour iron oxide give reddish colour Magnus oxide give Brown or blackish water
- water containing oxidized iron and magnesium important characteristic radiation or black colour heavy growth of algae also important colour to the water

Measurement

- Measurement of colour is done by colour matching (tintometer)
- Result is expressed in your has any unit where 1 is equal to colour produced produced by 1 mg per litre of platinum in the in form of chloroplatinate (it is only for yellowish brown
- For colour other than yellowish brown ie. from industrial effluent spectrophotometric technique is used
- The colour testing is done within 72 hours of collection as otherwise biological or physical properties may change.

3.1.4 Taste and Odour

Taste and odour are caused by gases like Hydrogen sulphide mercaptans, Methane, organic matter derived from certain dead or Living microorganism , decomposing organic matter ,industrial liquid , water containing phenols , cresol , Ammonia agriculture chemical , high residual chlorine and chloro-phenols.

Measurement

- Measurement test and order causing Organics can be done using gas or liquid chromatography however this method is costly and not done in routine .
- Order is generally measured by and instrument known as Somoscope .
- Intensity of taste and odour is measured by threshold odour number (TON)
- It is represented the dilution ratio odour is hardly detectable .
- Threshold odour number 15 is done in cold water because increasing in temperature Mein change the taste and odour .
- TON allowed in is between 1-3.
- Order can be removed by mechanical variation oxidation by chemical like chlorine or its compound for Ozone or per magnet and absorption of order by agents such as activated carbon Floc or clays.

3.1.5 . Temperature

Temperature affects the chemical and biological biological reaction and increase in 10 degree centigrade double the biological activity hence for water supply the temperature should be between 10 to 25°C and greater than 25°c is objectional.

3.2. Chemical properties of water

3.2.1. Total dissolved solids :-

The material remaining in the water after filtration is considered to be dissolved

A direct measurement of TDS can be made by evaporating to dryness a sample of water which has been filter to remove the suspended solid the Residue is weight and represented TDS in water

Major list characterize the dissolved solids content of water and these are called common ions

According to jio manual acceptable limit of TDS mg per litre in 500 cause rejection in 2000

3.2.2. Alkalinity

Alkalinity is defined as quantity of ions in water that will react to neutralize hydrogen ions alkalinity is there is a measure of the ability of water to neutralize acid

Alkalinity in water come due to minerals or it may produce to atmospheric CO_2 mixed in water or due to microbial decomposition of organic matter

Alkalinity simbus beta tester water the principal objection is that reaction can occur between alkalinity and certain question in water the resultant precipitate can fall 5 and other water system appurtenances .

3.2.3. pH

pH is one of the most important parameters of water quality. It is defined as the negative logarithm of the hydrogen ion concentration [9, 12]. It is a dimensionless number indicating the strength of an acidic or a basic solution [23]. Actually, pH of water is a measure of how acidic/basic water is [19, 20]. Acidic water contains extra hydrogen ions (H+) and basic water contains extra hydroxyl (OH−) ions [2

It can also be measured by colour indicator colour form is compared with standard colour

Indicator used for methyl orange its original colour is red and colour produces a low pH ranges 2.8 to 4.4 methyl orange is an acidic indicator

Phenol helpline red has pH range of 8.6 to 10.3 original colour is yellow and final colour is red phenolphthalein is a basic indicator

Acidic water cause corrosion and alkaline water cause incrustation of pipe

Alkaline water cause difficulty in chlorination chlorine is a disinfectant

3.2.4. Hardness

It is defined as concentration of multi well planned metallic colour time in solution multivalent metallic iron most abundant metallic iron most abundant in natural water are calcium and magnesium other ions which lead to hardness are Fe2 To Hamen to Strontium and Aluminium but Fe2 2mm to as R2 and R3 are found in much smaller quantities and hymns for all practical purposes hardness may be represented by the sum of ca2 andmg2 ions.

Hardness can be divided into two part that is carbonate hardness and non carbonate hardness.

It is measured by using spectrophotometric technique.

3.2.5. Chloride content

Chloride in water are derived mostly from natural minerals deposit agriculture or irrigation discharge

presence of chloride in high quantity indicate pollution of water due to sewage industrial water chloride are estimated by most method in which rock water is titrated with standard agno3 solution using potassium chromate as

Argentormetric method is also used to detect chloride content acceptable limit is 200 mg per litre and cause for rejection is thousand mg per litre.

3.2.6. Nitrogen content

Presence of nitrogen in water indicates presence of organic matter

It occur in the form of-

•Free ammonia – indicate recent pollution

•Organic ammonia indicates quantity of nitrogen before decomposition has started

•Nitrate -indicate partly decomposed condition

•Nitrate indiacate old pollution.

3.2.7. Phosphorus

It is not toxic and do not represent direct health trade but indirect it to water quality because

1 .It facilitate rapid growth of aquatic plants

2 .It interface with water treatment like chemical coagulation

3. Even a low concentration of .0.2mg/l interfere with the water treatment process.

3.2.8. Fluorides

Up to 1 mg per litre it help to prevent dental cavities during formation of permanent teeth it combined chemically with tooth enamel breast resulting in harder stronger teeth than that are more resistant to decay

Access value greater than 1.522 PPM result is this coloration of teeth call mottling teeth

Greater than 5 mg per litre cause the formation of bone called bone fluorosis

Acceptable Demat it is up to 1 mg per litre and greater than 1.5 mg per litre is cause for rejection.

3.2.9. Metals

Metas are of two types i.e toxic and non-toxic

- Ca, k , Na , Fe , Mn , Zn , are non-toxic metals.
- Arsenic, Barium, cadmium , chromium, caynide, lead and mercury are toxic metals.

4. Water Quality Index :-

Water Quality Index (WQI) is considered as the most effective method of measuring water quality. A number of water quality parameters are included in a mathematical equation to rate water quality, determining the suitability of water for drinking .The main objective of computing of water quality index (WQI) is to turn the complex water quality data into information which is easily understandable and usable.

Classification of water :-

The water may be classified into five types based on computed WQI as given below:

WQI range and water type+:

<50	Excellent water
50-100	Good water
100-200	Poor water
200-300	Very poor water
>300	Water unsuitable for drinking

4.1.Calculation of WQI :

The WQI Computed following the three steps :

1st Step :

Assigned the Weight (wi) to the selected water parameter (eg. pH , TDS , HCO_3 , Cl , SO_4 , NO_3, Fe, …..)According to their relative importance in the overall quality of water for drinking purpose (Weight may be from 1 to 5) .

2nd Step :

computation of relative weight of the chemical parameter using the following equation :

$WI=wi/\sum wi$ (i=1to5)
Where, Wi is the relative weight, wi is the weight of each parameter and 'n' is the number of parameter.

3rd Step : Assigning of a quality rating scale (qi) for each parameter ,as below :

$qi=(ci/si) \times 100$
where , qi is the quality rating , Ci is the concentration of each chemical parameter in each water sample in mg/l and si is the guide line value / desirelable limit is given in indian drinking water standard (BIS 2004).

$Sli = Wi \times qi$ $WQI = \sum sli1\text{-}n$

Where, sli is the subindex of its parameter , Wi is relative weight of i^{th} parameter , qi is the rating based on concentration of i^{th} parameter and 'n' is the number of chemical parameter.

5. Conclusion

The groundwater quality monitoring by various physiochemical parameters and by integrating them is very much necessary in order to determine and maintain the groundwater quality. Water quality index is evaluated by using the Weighted Arithmetic Index method.

In the present analysis we found that most % of water were good quality and only remaining few % of water samples under poor category or is in the condition of treatment. The water quality index calculated for location and concluded that water need to treat before daily usage and also required to protect that area from contamination. The water harvesting structures should be installed to restore the ground water for improvement of ground water level and resources in order to maintain the quality and quantity of ground water reservoir and thus diluting the higher concentration of chemical constituents and dissolved salts. Public awareness about water quality of that area must be needed so take program begun to enhance the knowledge and awareness to save water and save it from pollution.

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