ISSN- 2394-5125 VOL 07, ISSUE 09, 2020

STUDY OF GROUNDWATER QUALITY BY THE ASSESSMENT OF PHYSICO-CHEMICAL PARAMETERS AND WATER QUALITY INDEX IN HATHRAS CITY AND ITS ADJOINING VILLAGES, UTTAR PRADESH

Waseem Ahmad Khan[1], Harit Priyadarshi[1], Harish Saraswat[2], and Manish Kumar[3]

[1]Department of Civil Engineering, Mangalayatan University, Aligarh, UP

[2]Institute of Applied Sciences, Mangalayatan University, Aligarh, UP

[3]Faculty of Engineering & Applied Sciences, Usha Martin University, Ranchi, Jharkhand

Email. waseem.khan@mangalayatan.edu.in

ABSTRACT

The present research paper is focused to calculate the water quality index (WQI) for irrigation suitability and livestock drinking purposes of the groundwater of Hathras city .WQI is calculated on the basis of Weighted Arithmetic Index by analysing 13 physico-chemical parameters. The parameters namely pH, total alkalinity, total hardness, Ca &Mg hardness, turbidity, conductivity, total dissolved solids (TDS), total solid (TS), total suspended solid (TSS), dissolved oxygen (DO), chemical oxygen demand (COD) and chloride. The WQI for these samples range from 36.09 -91.96. The analysis reveals that the groundwater of the area needs some treatment before consumption, and it is need to be protected from the perils of contamination.

Key words: Groundwater, WQI, physico-chemical analysis, Hathras (Uttar Pradesh).

INTRODUCTION

Water is the main, plentiful and valuable normal assets on the earth in light of the fact that no life is conceivable without water. It is fundamental for the endurance of every living being and assumes a significant part in our life [1]. Be that as it may, tragically the water quality is affected by the normal and anthropogenic exercises including ecological pressure especially contamination like homegrown, agribusiness, modern, hydropower and so forth Along these lines logical concentrate needs to survey procedures for preservation and better usage of groundwater. Water quality record is one of the best devices to screen the groundwater just as surface water contamination and can be utilized proficient in the execution of water quality redesigning programs [2-4]. WQI gives the single number that communicates by and large quality dependent on the distinctive physico-synthetic boundaries like pH, complete alkalinity, absolute hardness, Ca and Mg hardness, turbidity, conductivity, all out disintegrated solids (TDS), all out strong (TS), all out suspended strong (TSS), broke up oxygen (DO), substance oxygen interest (COD) and chloride, and so forth The groundwater nature of Sialkot, a modern city of Pakistan was examined comparable to substantial metal contamination and its suggestion on human wellbeing during October-November 2005 and found that the groundwater of the review region can't be considered of good quality [5]. The investigation of physico-synthetic attributes of Bore well water quality in Vidharbh Region, Nagpur city-south zone was completed and reasoned that a few pieces of bore well water required treatment for drinking reason because of hardness, pH, DO, alkalinity and chlorides are available in advantageous cutoff points and some sort little variety [6]. Surveyed the WQI for the ground water of Koilwar square of Bhojpur, Bihar and dissected that the ground water of the Koilwar block needs some treatment before utilization and it additionally should be shielded from tainting [7]. The fifteen physico-synthetic and microbiological water quality boundaries recorded at the eight inspecting stations during 2013 by utilizing factual methods like Correlation, Hierarchical bunching investigation (CA), guideline part examination (PCA) and component investigation (FA), and WQI device was likewise applied to transform complex water quality information into data that is reasonable and utilizedby people in general and the examination uncovered that the water nature of Keenjhar isn't reasonable for drinking reason before legitimate treatment [8]. The effect of the groundwater nature of Vuyyuru, some portion of East Coast of India was explored by physical and compound boundaries [9]. The WQI examined for the ground water tests of Sugar town, Mandya city and uncovered that the groundwater is completely clear, unscented and tasteful and WQI falls in the Excellent Range yet needs specific level of treatment before utilization (basically sanitization) [10]. Different physico-compound boundaries assessed to concentrate on the appropriateness of groundwater primarily for savoring reason Taj-city Agra and tracked down that all the water nature of all examples isn't appropriate for drinking without earlier treatment [11]. Assessment of physico-synthetic boundaries was done to evaluate the nature of groundwater in Kurnool environs, A.P., India and inferred that the groundwater of Kurnool, however fit for homegrown and drinking reason, need medicines to limit the defilement particularly the alkalinity [12]. The current work is an endeavor to quantify the water nature of different water wellsprings of 16 areas of Aligarh, U.P, India.

Study Area

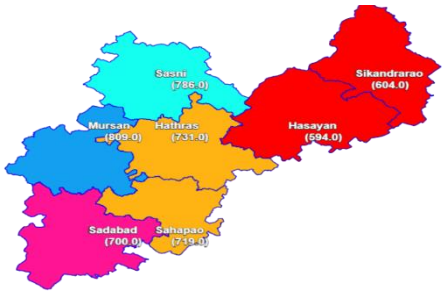

Fig 1: Location of Hathras and its adjoining Block

EXPERIMENTAL SECTION

The water sample from the hand pumps were collected in polythene bottles. After the collection of samples, these bottles were labelled and possible efforts made to transport them to the laboratory as earlier as possible. The samples were chemically analysed for various water quality parameters such pH, total alkalinity, total hardness, Ca & Mg hardness, turbidity, electrical conductivity, total dissolved solids (TDS), total solid (TS), total suspended solid (TSS), dissolved oxygen (DO), chemical oxygen demand (COD) and chloride using standard procedures described in NEERI Manual [13]. The methods used for estimation of various physico-chemical parameters are tabulated in Table1.

Table1: Methods used for estimation of physico-chemical parameters

No.	**rameter**	**thods**
		meter
	ctrical Conductivity	nductivity meter
	bidity	hlometer
	alinity	icator method
	S	ration method
	S	poration method
	solved Oxygen	inkler's method
	D	en reflux method
	oride	er nitrate method

Calculation of WQI

In this review, 13 boundaries were picked for the estimation of WQI. It has been determined by utilizing the norms of drinking water quality suggested by WHO [14], BIS [15] and ICMR [16]. The weighted number juggling record strategy has been utilized for the computation of WQI of the groundwater [17]. Further quality rating or sub file (Qn) was determined utilizing the accompanying recipe.

$$Q_n=100*[(V_n-V_{iO})/(S_n-V_{iO})] \quad (1)$$

where,

Q_n= quality rating for the n^{th}water quality parameter.

V_n= estimated value of the n^{th}parameter at a given sampling station.

S_n= standard permissible value of n^{th}parameter

V_{io}= ideal value of n^{th}parameter in pure water.

V_{io}= ideal value of n^{th}parameter in pure water. (i.e. 0 for all other parameters except the parameter pH and DO (7.0 mg/l and 14.6 mg/lrespectively)

The unit weight (Wn) was determined by a worth contrarily relative to the suggested standard worth (Sn) of the comparing boundaries.

$$W_n = K/S_n$$

where,

W_n= unit weight for n^{th}parameter

S_n= standard value for n^{th}parameters

K = proportionality constant.

The general water quality file was determined by conglomerating the quality rating with the unit weight directly by utilizing condition (1) and (2) we have

$$WQI=\Sigma^{n}_{i=1}Q_nW_n/W_n$$

Table 2: **WQI and status of water quality** (Chatterjee and Raziuddin, 2002 [18]).

ter quality index	ter quality status
5	cellent water quality
50	od water quality
75	r water quality
100	y poor water quality
00	fit for drinking

Table 3: **Parameter wise ICMR/BIS standards and their assigned unit weight**

No.	ameter	MR/BIS Standards	signed Unit Weight (W_n)
	value	- 8.5	17647058
	al alkalinity (mg/l)	)- 600	05000000
	al hardness (mg/l)	)- 600	03333300
	cium hardness (mg/l)	200	13333300
	gnesium hardness (mg/l)	150	33333300
	(mg/l)	5	00000000
	D (mg/l)	10	00000000
	bidity (NTU)	5	00000000
	nductivity (µS/cm)	)- 2250	03333300
	(mg/l)	00- 2000	01000000
	S (mg/l)	)- 2700	02000000
	5 (mg/l)	)-1000	02000000
	oride	)- 1000	05000000

RESULTS AND DISCUSSION

pH

pH is a significant boundary which decides the appropriateness of water for different purposes. The pH level estimated the sharpness or alkalinity of the water. The outcomes acquired from examination of 16 ground water tests are given in Table 4. High worth of pH may result because of waste release, microbial deterioration of natural matter in the water body. The scopes of pH in concentrate on region is 7.2-8.01.

Dissolved Oxygen (DO): Disintegrated oxygen Dissolved is a significant boundary in water quality evaluation and organic cycles winning in the water. The DO esteems show the level of contamination in the water bodies. The presence of DO improves the nature of water and furthermore worthiness. An ideal DO worth of 5.0 mg/l is the norm for drinking water [20]. DO of bore well water under still up in the air in the current examination ran between from 10.08-18.09 mg/l which shows the serious level of contamination because of quality of microorganisms and minerals in water.

Chemical oxygen demand (COD): Synthetic Oxygen Demand is a proportion of contamination in amphibian framework. High COD might cause oxygen consumption by virtue of disintegration by organisms to a level impeding to amphibian life [21]. In the current concentrate COD upsides of different ground water tests were found from 0-5 mg/l. Most elevated upsides of COD found in sample5 . It very well might be because of leakage from sewage waste or modern release in adjacent areas.

Total hardness: The presence of carbonates and bicarbonates of calcium and magnesium, sulfates, chlorides nitrates, impact the groundwater to turn out to be hard. In the current review complete hardness shifted from 144-689 mg/l. The qualities for sample16.

Calciumis from regular sources like granitic territory which contain enormous convergence of this component. The outcome shows that calcium esteems for most examples in the scope of 111-338 mg/l. High upsides of calcium

hardness might be because of the presence of carbonates and bicarbonates. In the review space of the multitude of tests Ca hardness are found inside as far as possible with the exception of sample9 , sample15 and sample16.

Magnisim: Magnesium in the groundwater of the review region are viewed as 54-359mg/l and every one of the examples of Mg hardness are found inside as far as possible with the exception of sample2, sample11, sample14, sample15 and sample16 which is higher than recommended cutoff points might be because of rock enduring and spring materials.

Conductivity:

The conductivity esteems ran between 334.3 - 3910.44 µS/cm wherein few examples showed the qualities past as far as possible with the exception of sample14 and sample16. Higher qualities recommend the presence of high measure of disintegrated inorganic substance in ionized structure chart.

Chlorides

Chloride centralization of the multitude of tests is viewed as well inside as far as possible. The high chlorides content might hurt metallic lines and design. Abundance of chloride in groundwater gives saltiness in water and influence the human utilization.

Alkalinity

Regard in water gives a considered typical salt presents in water. In the current survey the alkalinity is gone from 380-760 mg/l. The alkalinity regards are under beyond what many would consider possible 600 mg/l and are a result of the presence of carbonates, bicarbonates and hydroxides. In the survey locale all of the models showed the characteristics well inside the cutoff focuses beside sample1 sample8 and sample14

Total Dissolved Solid (TDS):

Absolute disintegrated strong are available because of the centralizations of all minerals in water show the overall idea of saltiness of water. In the current review TDS esteem went from 1189 - 1410 mg/l and all example shows inside the positive furthest reaches of 2700 mg/l. TDS in groundwater begin from normal sources, sewage, metropolitan run-off and modern squanders.

Total Suspended Solid (TSS):

The whole example for TSS is inside reasonable cutoff points (500 mg/l) aside from sample1 and sample12.

Total solid (TS)

For the most part every one of the examples of TS are inside as far as possible aside from sample14, sample15 and sample16

WATER QUALITY INDEX

WQI is set up through the estimation of different significant physico-compound boundaries of the groundwater. The computation of WQI for different physico-synthetic boundaries are introduced in Table 4. The upsides of WQI showed the higher level of helpless class of groundwater was found in the example area. It very well might be because of the successful ionic filtering, over double-dealing and anthropogenic exercises like release of effluents from modern, rural and homegrown employments. It is found that the 18.75% of groundwater on the example area are exceptionally low quality. This plainly shows that water tests for this district are exceptionally contaminated. They are not appropriate for drinking reason and other valuable human exercises. The WQI demonstrates that example area 14, 15, 16 are exceptionally contaminated. The sets of WQI for various examples area are: 12 < 4 < 8< 7< 2 < 1< 5< 13 < 6 < 10< 11 < 3< 9< 15< 14< 16. The groundwater gathered from test area 3, 5, 6, 9, 10, 11, and 13 has helpless water quality and 1, 2, 4, 8, and 12 have great water quality. The area is might be dirtied because of waste unloading and modern effluents squanders and sewage water. We saw that, the water quality from different stations isn't utilized for human utilization by nearby individuals.

CONCLUSION

The WQI for 16 groundwater tests goes from 37.10509-93.93368 The high worth of WQI at these areas has been viewed as chiefly from the higher upsides of complete disintegrated solids, hardness, chloride, carbonates and bicarbonates in the groundwater. Around 43.75% of water tests are poor in quality and 18.75% of water tests are of exceptionally low quality and ought not utilize straightforwardly for drinking reason and the groundwater source are not appropriate for drinking reason with other legitimate treatment and investigation likewise uncovers that the groundwater of the space needs some level of treatment before utilization, and it additionally should be shielded from the modern waste and sewage tainting.

From the point-by-point investigation of different water assets of water assets of Tehsil Hathras and its bordering Blocks following end are being made.

Water assets in Hathras Tehsil and connecting Blocks are adequate to satisfy the requirements of individuals of

the district yet because of fast development in populace and changes in the way of life of individuals, certain procedures like Rain water reaping, Ground water re-energizing, Water use instruction, Efficient water system strategies, ought to be taken on for reasonable water the executives and improvement of Hathras Tehsil. Utilization of sub siphons and fly siphons ought to be checked and controlled for legitimate water withdrawal to safeguard the ground water table level. Lakes are proposed to be built in which water can be put away during blustery prepare and can serve cows for drinking. Withdrawal to save the ground water table level. Lakes are proposed to be developed in which water can be put away during blustery prepare and can serve cows for drinking. advancement of Hathras Tehsil.

Ground water re-energizing, Water use training, effective water system techniques, are being proposed for reasonable water the executives and improvement of Tehsil Hathras.

Water assets in various Block towns with the exception of Bisawar are adequate to fulfill the necessities of individuals. In Bisawar Village of Sadabad Block, where water assets are at their edge, safeguards through training of the town individuals for ideal utilization of water ought to be taken to keep up with the current water assets in economic condition.

REFERENCES :

1) Indian standards for drinking water speciation. Bureau of Indian standard , New Delhi (BIS 10500),2012

2) Jain, C.K., Bandyopadhyay, A. & Bhadra, A. Assessment of ground water quality for drinking purpose, District Nainital, Uttarakhand, India Environmental Monitoring and Assessment. 2010; 166(1–4): 663–676

3) Priyadarshi, Harit, Sarv Priya, Alvi, S.H. and Jain Ashish **,** physico-chemical analysisof selected groundwater samples from sikandrarao town and its adjoining villages (hathras district) uttarpradesh, india, International Journal of Civil Engineering and Technology (IJCIET), 2018;. Volume 10, Issue 02, February 2019, pp. 355-368.

4) Priyadarshi, Harit and et.al. Rain Water Harvesting Plan and Design for Mangalayatan University Campus, Aligarh" Uttar Pradesh, India" Int. Journal of Engineering Research and Application, Vol. 8, Issue4 (Part -III) April 2018, pp18-28

5) Priyadarshi, Harit, Girija, SarvPriya, Shabber Habib A;lvi and Ashish Jain A Study on Physico- Chemical Charecterstics of Groundwater in Aligarh and Agra District Uttar Pradesh, India, Indian Journal of Public Health Research & Development,, May 2019, Vol.10, No. 5pp. 339-343

6) Rajappa and T. Puttaiah. Physico-chemical analysis of underground water of Harihara Taluk of Davanagere District, Karnataka, India. Pelagia Research Library Advances in Applied Science Research. 2011 ; 2 (5): 143-150

7) Rajappa and T. Puttaiah. Physico-chemical analysis of underground water of Harihara Taluk of Davanagere District, Karnataka, India. Pelagia Research Library Advances in Applied Science Research, 2 (5), 2011, pp. 143-150.

8) Rao, Liaqat A.K. and Priyadarshi Harit. Hydrogeomorphological studies for ground water prospects using IRS-ID, LISS III Image, in parts of Agra district along the Yamuna river U.P. India Journal of Environmental Research And Development. 2009; 3 (4): 1204-1210

9) Sinha, D. K. and Saxena, R. Statistical Assessment of Underground drinking water contamination and effect of monsoon at Hasanpur, J. P. Nagar (Uttar Pradesh, India). Journal of Environment science and Engineering. 2006; 48(3): 157-164

10) WHO Report 2012

ISSN- 2394-5125 VOL 07, ISSUE 09, 2020