

Health Risk Assessment of Ground Water Contamination by Sipcot Pollutant in Cuddalore

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Abstract:

Groundwater is a important source for all living organisms in the earth surface. The main objective of the present study is to water samples collection, methods of analysis and water quality index. It is aimed to get ground water first-class in phrases of water quality index by way of Weighted Arithmetic Index Method. High water high-quality index is because of excessive turbidity, high attention of Fluoride and iron. Correlation of selected parameters is analysed and discovered that Electrical conductivity has substantial correlation with Alkalinity, nitrite, sodium, and sulphate. Regression equations touching on correlated parameters had been formulated. A comparative have a look at is likewise finished with Indian and WHO preferred for consuming water and irrigation purpose.

Keywords: Water Quality Index, Groundwater, Correlation and Regression

INTRODUCTION

Ground water is one the major resource for the survival for all living beings or any other organisms due to the human activities the ground water get contaminated this result in decreases the quality of ground water .This causes the unstable for aquatic life also. Some of the reasons such as industrialization, urbanization and mainly population growth .Groundwater is used for home, business and irrigation. Within the previous limited a long time, there is an terrific growth in the call for clean water owing to speedy increase in populace also multiplied pace of industrial development. Rendering to WHO the diseases in people are due to water as soon as the underwater is polluted, its first-rate can't be bring back again effortlessly and manner the shield. Water high-class index this is the best equipment for statistics at high-class of waterto the worried public.

In the Guadalquivir river at three different area . The site are selected at mining area ,industrial and agricultural waste water . The contamination were found in the upper part of the steam. These result

show the useful and strength of the biomark. The author is conducted the study in the port to analysis water quality in deep water channel . The water pollution is rapidly increased by Guangzhou port. For environmental impact assessment report single factor index method is used. The H₂O standard in 3 zone in 2014 is good than in 2016 (Yi Chen. et al.)Study area is selected at mining area which forms an serious impact in environment. In our study on surface water and ground. In mining area 33 water samples are collected . The major irons are tested water quality assessment are calculated. The water samples collected in pond are heavy polluted. (Xianfeng Cheng, et al.)

The water front area of cuddalore to distinguish the hydrogeochemical procedure controlling ground water 64 examples are estimated for earth and stable isotopes . The investigation shows that particle trade, enduring, salt water interruption along the coast, and anthropogenic effects are the major controlling elements for the groundwater science of the area. The example bottles are then marked, fixed, and brought to the research

centerThe proportions and measurable examination uncover the way that ocean water ingress, silicate enduring, and particle trade process oversee the geochemistry of waterfront groundwater in the investigation territory (Chidambaram, S., et al.)

Consequently, will become a critical parameters of the evaluation the administration of underwater. More a share of the solvable material at floor water comes from solvable natural resources at the earths and alluvial rocks. Ground water is considered as a safe supply of sparkling potable water. Whose first-rate can be prompted directly and not directly via microbiological tactics, it could transform each inorganic and organic ingredients of floor water. These organic changes commonly have ten geochemical techniques. Ground water is final and most appropriate clean water aid with nearly balanced concentration of the salts for human consumption. Solitary and many-celled creatures has grow to be changed to the usage of the solvable cloth and suspended solids within the water and strong remember in the aquifer of their metabolism and then releasing the metabolic merchandise again into the water . The maximum organically favourable surroundings mostly arise in hot, humid situations. Heavy metal are obviously present inside the surroundings and in well-known are harm to people. However, a few coliforms can also reason infection in human beings the occurrence of coliforms is an symptom that different bacteria can be gift. Coliforms are discovered in human being and animal trashes and whilst gift, point out infection. Consumption of water that includes heavy metal rises the chance in turning into sick. Healthy proprietors ought to not drink water with heavy metal in it. Assessment ground water quality and elevation of scaling and corrosiveness potential of drinking water.to study about drinking water .The calculation of WQI for ground water 25%-Excellent water,50%- good Water category ,25%-poor water category. Sample were are collected in plastic bolltes and immediately transported at 4°C to the central

laboratory. Software used Excel 2010 and Arc GIS 10.3 software.(Abbas Abbasniaet al.) The water quality index is calculated during last few years the research are made to evaluate H₂O standards. In many places are selected . the water quality is affected by surrounding environment by abstraction, misconnection and water run off .at last result during summer period WQI period is ‘bad’

In that work 22 ground water samples are taken from different area and 10 parameter are checked.7 samples are in good condition ,10 samples are very poor. water is very important for both animal, plants, human beings. The ground water is polluted by industrial and municipal solid waste .In the study area is located in solan district of Himachal Pradesh .

Water Quality Index

Some of the methods are followed the **first step** is a relative weightage of each parameter is calculated by taking reciprocal of standard permissible value for that parameter. **Second step:** water quality ratings are calculated for each parameter at each station **Third step:** In last step water quality sub indices are calculated for each parameter by multiplying relative weightage and water quality rating and divided by sum of relative weights Water samples are divided in 5 categories according to value of water quality index. Water quality parameters are compared with drinking water guidelines of WHO and Bureau of Indian standards. Concentrations of sulphites and chlorides have 100 percent compliances with BIS and turbidity has minimum 32 percent compliance with BIS. Turbidity is exceeded permissible limit(Dhaka, Suman K., and Narendra Bhaskar.)

The water samples are collected from surface. During 2017 seventeen parameter are measured in spring, winter, autumn and winter. In this assessment water quality assessment is checked . the water samples are taken from the river around 60 km. water quality index software is used for calculating water quality index. The river water which is belonged to **fair category**.(Milaimmusuliet al.)

Sampling Techniques:

Sampling procedure : 30 days as three trials ,the samples were collected in clean plastic bottles and few testes likes pH and dissolved oxygen are done within half an hour .samples are preserved and other test were also conducted. The collection was executed in one of these ways that samples did now not get contaminated with other materials. During sample collection, surface water changed into gathered and saved in polythene plastic bottles formerly washed in 10% nitric acid for 24 hours and rinsed with distilled water. 500 ml water changed into accrued in each bottle and six parameters were cited at the website online.

WATER QUALITY PARAMETERS

Samples are collected in two different sites of the river in Nigeria . the people depend on the river for drinking ,fishing and irrigation. Microsoft office excel 2007 is used for data analysis. As the result the water is highly contaminated by the heavy metals . It is not suitable for drinking .(Ayaandrian TA. et al.)

Remote sensing is suggested for water quality monitoring . the water quality is measured from satellite imagine for rapid identification and faster response . Remote sensing imagery consist of four steps , first step is image sub setting and value Extraction. Second step is Atmospheric correction and radio metric, step three is Data Extraction, step four is Statistical Analysis. 14 images are taken from the 34 sample point and calculations are made . this method is an automated measurement.

pH:. Value range of pH from 7 to 14 is alkaline, from 0 to 7 is acidic and 7 is neutral. Mainly drinking water pH lies from 6.5 to 8.5. The pH scale commonly ranges from 0 to 14.Exposure to extreme pH values results in irritation to the eyes, skin, and mucous membranes. pH values greater than 11- Eye irritation, pH 10–12.5- cause hair fibres, Below pH 4- redness and irritation of the eyes Below pH 2.5- damage to the epithelium is

irreversible and extensive

T.D.S:The suitable and permissible limits As in step with IS: 10500-2012 is 500 and 2000 mg/l respectively. TDS degree in water is much less than 50 is Unacceptable because it lacks vital minerals, TDS fee 50-150 is Acceptable for drinking. The TDS stage is good for regions wherein the water polluted via sewage or industrial waste, TDS price a hundred and fifty-250 is Good. The water is right for people with cardiovascular disease, TDS value 250-350 Good. The water is good for humans with cardiovascular disorder, TDS value 350-500 Fairly desirable, TDS cost 500-900 is Less acceptable. TDS value 900-1200 is Least suitable. Avoid consuming water which has a TDS level of 900, TDS Value 1200-2000 is Water isn't desirable for drinking. Above 2000 is Unacceptable. Safe water is free from chemical and organism. Industrial water contains microbes, chemical waste. The which is situated in upstream of river. Water samples are collected these are analyzed by Physical(Turbidity, Total Dissolved solids,Chemical, Nitrates,Total alkalinity, sulphate, phosphate). All this parameters are analyzed. In this study the result are compared with (WHO) and standard .The TDS value of 19.67mg/l within permissible limit of 1000mg/l.Nitrate impact human health the concentration falls in permissible limit . Excess Iron concentration in water Taste and odour problem .it result in red coloration of water .Excessive concentration will affect human system and result in hemochromatosis tissue were damaged. Dam is important structure which store water for various purpose.it may get easily contaminated. The dam contains high lead and iron .(Ojelabi S.A et al.)

Foot print of ground water quality in bangarpet taluk in this study 30 water samples are taken at different places to analysis that water is safe of drinking. Total water resources available in India is 1850 km. roughly 4% of water is fresh water. kolardistrict has no perennial river. In this experiment 30 water samples are collected of 2 liters capacity container. ph color and temperature are study at the area itself some parameters are

pH, temperature, colour, conductivity, turbidity, hardness, calcium, magnesium are compared with BIS (Bureau of Indian Standard). As the result of pH values ranged from 7.32 to 8.20 with an average of 7.75. The standard limit is 6.5 -8.5. this water is safe for drinking purpose. It contains some of hardness before supply the water to consumer to reduce the hardness. (K.L. Prakash et al.)

Sulphate: The maximum permissible level is 200 mg/L as per IS 10500:2012. It can aggravate eyes, pores and skin and lungs. Especially with long term use. In this study it was doubted that the water is polluted due to industrial activity we have tested ground water and surface water. The plastic water bottle are cleaned and then water samples are collected. Our study area is surrounded by industries steel distillery etc. six locations are selected water is collected within 30 days three trials are made after the collection of samples some of the test are checked within half hour they are pH, dissolved oxygen. It is noticed that water samples are **not affected**. (G. Venkatesan et al.)

Total hardness: Permissible lies between 200 to 600 mg/l. In pipe long term movement in hard water which result in scale build up like wise in human body it reduces inside the diameter due to cholesterol buildup. It also affect cardiovascular disease, cancer, Malfunction of central nervous system, kidney stone Reproductive health. Water quality assessment and appointment (Northern Pakistan) Indus is one of the largest river 29 samples are kept in polythene plastic water bottle. Some of the parameter, electrical conductivity, pH, total dissolved oxygen are tested. In this samples Two-Three drops of nitric were to avoid chemical characteristics would not deteriorated. As the result total alkalinity is high and total dissolved solids, D.O, Salinity, Chloride, Sulphate, and nitrate met the acceptable limit. (Muhammad Usamazafar et al.)

Nitrate: Nitrate in water is less than 45 is

acceptable limit. It causes Birth defect, bladder cancer, thyroid cancer

Chloride: Desirable restrict for chloride is 250 and 1000 mg/l in Permissible restrict. Chloride is taken into consideration to be an crucial nutrient for human fitness and the primary source of chloride is from meals, with ingesting water making up only a small portion of normal dietary intake

Chromium: It is a colourless, odorless and tasteless metallic element. It is formed naturally in rocks, plant and soil. The maximum not unusual kinds of chromium arise in water is Trivalent chromium, hexavalent chromium. Trivalent chromium -found in vegetable, fruits. Hexavalent chromium -found naturally in the environment by erosion. It can also be produced by industrial process. **WHO guideline = 0.05 mg/L.**

IMPORTANT INDICES FOR DRINKING AND IRRIGATION PURPOSE

Water Quality index

First step is a relative weightage of each parameter is calculated by taking reciprocal of standard permissible value for that parameter. Second step: water quality ratings are calculated for each parameter at each station. Third step: In last step water quality sub indices are calculated for each parameter by multiplying relative weightage and water quality rating and divided by sum of relative weights. Water exceptional index refers back to the chemical, physical and biological characteristic of water used to assess the quality of water in the terms health of ecosystem, human uses, quality of drinking water.

$$WQL_i = \frac{\sum (WQR)_i \times (w)_i}{\sum W}$$

$$wQR_i = \frac{(C_i - v_i)}{(s_i - v_i)} \times 100$$

Sodium Absorption Ratio (SAR): SAR is an irrigation water fine parameter. It is a hallmark of the suitability of water to be used in agricultural irrigation, as decided

from the SAR concentrations of the primary alkaline and earth alkaline cation present inside the water.

$$SAR = \frac{Na^+}{\sqrt{1/2 (Ca^{2+} + Mg^{2+})}}$$

Kelly Ratio : The present of Na, Mg and Ca in water leads to hazard. when the KI value is greater than 1 indicates bad water and the value is less than 1 is acceptable for irrigation purpose.

$$KR = \frac{Na}{Ca + Mg}$$

Percentage Sodium: Soluble sodium percent is used to find the hazard present in water. It represent the amount of sodium ,when the SSP value is greater than 60% is not suitable for irrigation. And less than 60% is suitable for irrigation.

$$SSP = \frac{[Na + k] \times 100}{ca + Mg + Na + k}$$

Magnesium Absorption Ratio: The MAR when excit 50 it causes harmful effect in soil. Mg:Ca ratio having an possible when it is used for irrigation water.

$$MAR = \frac{Mg \times 100}{Ca + Mg}$$

(parisa,piroozfaret al.)

In this study 38 water samples are collected in the main stream the major anion and cation are checked .for sampling sites GPS is used. Some of the parameter are checked in the situ itself they are (pH, temperature, EC, TDS) .the bottles are metal free,filtered with 0.45 micron filter paper and then samples are kept at 4°C . most of the water samples are in acceptable limit. Calcium , magnesium are above the permissible limit. For irrigation it is evaluated by using Wilcox diagram, SAR,EC,RSC indices which shows it is within the limit and also suitable for drinking and irrigation.

CONCLUSION

Water is dependent on the form of the pollutant brought and the character of mineral determined at particular area of bore well. Tracking of the water quality of floor water is carried out through collecting representative water samples and evaluation of physicochemical traits of water samples at one-of-a-kind locations of Indore town. Estimation of water great index via formulation of suitable the usage of approach and evaluate the amazing of tube properly water through statistical analysis for post and pre monsoon seasons. End result of water great assessment confirmed that most of the water parameters slightly higher within the wet season than the dry season. Emphasis is positioned on integrated strategies that account for physicochemical and natural parameters, and combine every water and sediment signs of pollution, consistent with the holistic nature of the marine framework strategies directive. We highlight preferred capabilities that any marine pollution signs and symptoms, indices, and statistical techniques ought to possess. These review ambitions to keep in mind that vast guidance needs to be realistic sufficient to address the significantly differing characteristics of marine ecosystems global.

REFERENCE

- [1] Abbasnia, A., Alimohammadi, M., Mahvi, A. H., Nabizadeh, R., Yousefi, M., Mohammadi, A. A., ... & Mirzabeigi, M. (2018). Assessment of groundwater quality and evaluation of scaling and corrosiveness potential of drinking water samples in villages of Chabahr city, Sistan and Baluchistan province in Iran. *Data in brief*, 16, 182-192.
- [2] Ajmal, T., Anyachebelu, T. K., Conrad, M., & Rawson, D. M. (2019). Evaluating urban surface water quality in Luton. *Environmental monitoring and assessment*, 191(3), 147.
- [3] Ayandiran, T. A., Fawole, O. O., & Dahunsi, S. O. (2018). Water quality assessment of bitumen polluted Oluwa river, South-Western Nigeria. *Water Resources and Industry*, 19, 13-24.
- [4] Balamurugan, P., & Balakumaran, S. (2015). Soil quality assessment around magnesite mines

- and salem township using GIS techniques. *International Journal of Advances in Engineering & Technology*, 8(1), 1997.
- [5] Balamurugan, P., & Kumar, P. S. (2016). Quality of ground water assessment in Salem District using GIS Techniques. *Advances in Natural and Applied Sciences*, 10(3), 22-32.
 - [6] Balamurugan, P., Kumar, P. S., Shankar, K., Nagavinothini, R., & Vijayasurya, K. (2020). NON-CARCINOGENIC RISK ASSESSMENT OF GROUNDWATER IN SOUTHERN PART OF SALEM DISTRICT IN TAMILNADU, INDIA. *Journal of the Chilean Chemical Society*, 65(1), 4697-4707.
 - [7] Balamurugan, P., Kumar, P. S., & Shankar, K. (2020). Dataset on the suitability of groundwater for drinking and irrigation purposes in the Sarabanga River region, Tamil Nadu, India. *Data in brief*, 29, 105255.
 - [8] Kumar, P. S., Elango, L., & James, E. J. (2014). Assessment of hydrochemistry and groundwater quality in the coastal area of South Chennai, India. *Arabian Journal of Geosciences*, 7(7), 2641-2653.
 - [9] Kumar, P. S., & Balamurugan, P. (2018). Evaluation of groundwater quality for irrigation purpose in attur taluk, Salem, Tamilnadu, India. *Water and Energy International*, 61(4), 59-64.
 - [10] Sigamani, S., Samikannu, M., & Alagiri, T. G. (2019). Assessment of Effluent Stressed Ecosystem of Cuddalore Coastal Waters—a Bio-Indicator Approach. *Thalassas: An International Journal of Marine Sciences*, 35(2), 437-449.
 - [11] P.S. Kumar and P. Balamurugan 2019, Suitability of Ground Water for Irrigation Purpose in. Omalur Taluk, Salem, Tamil Nadu, India. *Indian Journal of Ecology*, 46(1): 1-6.
 - [12] Tahmasebi P, Mahmudy-Gharaie MH, Ghassemzadeh F, Karouyeh AK (2018) Assessment of groundwater suitability for irrigation in a gold mine surrounding area, NE Iran. *Environ Earth Sci* 77:766.
 - [13] Thivya C, Chidambaram S, Thilagavathi R, Prasanna MV, Singaraja C, Adithya VS, Nepolian M (2015) A multivariate statistical approach to identify the spatio-temporal variation of geochemical process in a hard rock aquifer. *Environ Monit Assess.* <https://doi.org/10.1007/s10661-015-4738-5>.
 - [14] Venkateswaran S, Karuppannan S, Shankar K (2012) Groundwater Quality in Pambar Sub-Basin, Tamil Nadu, India Using GIS, *International Journal of Recent Scientific Research*, 3(10):782- 787.
 - [15] Venkatramanan, S., Chung, S. Y., Ramkumar, T., Rajesh, R., & Gnanachandrasamy, G. (2016). Assessment of groundwater quality using GIS and CCME WQI techniques: A case study of Thiruthuraipoondi city in Cauvery deltaic region, Tamil Nadu, India. *Desalination and Water Treatment*, 57(26), 12058–12073. <http://dx.doi.org/10.1080/19443994.2015.1048740>.
 - [16] Wagh, V. M., Mukate, S. V., Panaskar, D. B., Muley, A. A., Sahu, U. L., 2019b. Study of groundwater hydrochemistry and drinking suitability through Water Quality Index (WQI) modelling in Kadava river basin, India. *SN Applied Sciences*, 1(10). DOI: <https://doi.org/10.1007/s42452-019-1268-8>.
 - [17] Wagh, V. M., Panaskar, D. B., Jacobs, J. A., Mukate, S. V., Muley, A. A., & Kadam, A. K., 2019a. Influence of hydro-geochemical processes on groundwater quality through geostatistical techniques in Kadava River basin, Western India. *Arabian Journal of Geosciences*, 12(1). DOI: <https://doi.org/10.1007/s12517-018-4136-8>.
 - [18] Wagh, V. M., Panaskar, D. B., Varade, A. M., Mukate, S. V., Gaikwad, S. K., Pawar, R. S., Muley A. A., & Aamalawar, M. L., 2016. Major ion chemistry and quality assessment of the groundwater resources of Nanded tehsil, a part of southeast Deccan Volcanic Province, Maharashtra, India. *Environmental Earth Sciences*, 75(21), 1418. <https://doi.org/10.1007/s12665-016-6212-2>
 - [19] WHO, 2017. Guidelines for Drinking Water Quality: Fourth Edition incorporating the First Addendum. World Health Organization, Geneva.
 - [20] Wilcox, L.V., 1955. Classification and use of irrigation waters. U.S. Department of Agriculture. Circ, Washington, DC, p 969.
 - [21] Xu, P., Feng, W., Qian, H., & Zhang, Q. (2019). Hydrogeochemical Characterization and Irrigation Quality Assessment of Shallow Groundwater in the Central-Western Guanzhong Basin, China. *International journal of environmental research and public health*, 16(9), 1492.
 - [22] Zilberbrand M, Rosenthal E, Shachnai E (2001) Impact of urbanization on hydrochemical evolution of groundwater and unsaturated-area gas composition in the coastal city of Tel Aviv, Israel. *J ContamHydrol* 50:175–208.