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THE EVALUATION OF SOIL QUALITY IN THE INDIAN LOCAL GOVERNMENT AREA IRRIGATED WITH SURFACE WATER

Harpal Singh[1], Amanpreet Kaur[2]
[1,2]Guru Kashi University, Talwandi Sabo

ABSTRACT

It was determined that Bathinda district's alluvial aquifers in the southwest Punjab are suitable to be used for drinking and irrigation purposes by measuring the physicochemical characteristics and the main ion chemistry of groundwater samples. While pre-monsoon samples are generally fine to appropriate, post-monsoon samples are often uncertain to unsuitable. During the post-monsoon season, increased groundwater salinity is a result of infiltrating precipitation leaching salts from the unsaturated zone. Pre-monsoon dissolution and ion exchange of carbonate and silicate minerals and post-monsoon leaching of salts deposited in the vadose zone determine the geochemistry of this district's groundwater. Animal faeces and soluble fertilisers are the two most common contaminants. Anthropogenic inputs are degrading groundwater's quality and quantity over time, making this research particularly important given the scarcity of available surface water supplies.

Keywords: hydrochemical, availability, groundwater, magnesium

I. Introduction

The availability of freshwater resources is critical to the socioeconomic growth of every town. While there are many other forms of freshwater resources accessible, many countries rely heavily on groundwater as a large portion of their total supply. A rising number of people in India's semi-arid and arid regions are suffering from a lack of water because of a lack of rainfall. Due to a lack of surface water and a lack of monsoon rain, groundwater resources have become increasingly important (Kumari, & Rai, 2020). Surface waters can quickly decrease in quality, while groundwater is more resistant due to the fact that toxins are either diluted or degraded as they pass through the vadose zone. Groundwater quality in alluvial aquifers is frequently subject to rapid shifts in time and space. Alluvial aquifers, particularly in metropolitan areas, are vulnerable to anthropogenic pollution, thus monitoring them is critical.

II. Background

Groundwater supplies a large portion of Punjab's irrigation demands, making it an important agricultural state. The previous two decades have seen a 40% to 50% decrease in rainfall, according to long-term precipitation statistics. As precipitation decreases and surface water resources are used up, overuse of groundwater resources for agriculture has resulted. Effluents from thermal industries, brick-kilns, and other small and large-scale industrial operations have a negative influence on groundwater quality in this state. Approximately 47% of the region's groundwater is deemed unsafe for human consumption or agricultural use due to excessive salinity, according to research conducted by (Solangi, Siyal, &Siyal, 2019). Dissolution of evaporite deposits and foetid limestone/dolomite occurring in the formations of this region were discovered to be the sources of salinity, high sulphate, magnesium, sodium, and potassium. The thermal power stations' fly ash may have contributed to the groundwater's high alkaline content. In addition to cancer, fluorosis, and gastrointestinal discomfort, people of this region have also been found to suffer from these conditions in several investigations. Monitoring water quality on a regular basis is critical to determining the extent of the problem and devising a plan to prevent future damage (Zhang, et al. 2019). There haven't been any recent research done in Punjab's Bathinda district. Because of this, a hydrochemical analysis was carried out in this district to understand the changing groundwater chemistry, to evaluate the influence of rainfall recharge, and to determine the processes and variables influencing the groundwater quality in this area.

III. Sampling and measurement

Thirty-six samples of water were taken during the pre-monsoon season (eighteen) and post-monsoon season (eighteen). Bore wells and tube wells, on the other hand, may access both shallow and deep levels of the groundwater column (15–150 mg bgl) (Setia, et al. 2020). Groundwater samples were taken from four district blocks that have been deemed safe for development. There are four blocks: Bathinda, Sangat, Talwandi Sabo, and Maur in the area. Filtered samples were kept in plastic bottles cleaned with nitric acid and rinsed completely with distilled water before being stored in the polyethylene bottles. An additional sample was taken and acidified with ultrapure nitrate to pH = 2 for cation measurements. Field kits were used to assess physical properties including pH, conductivity, and temperature on-site, while a laboratory carried out the chemical analysis. The Gran titration technique was used to assess alkalinity by titrating 10 mL of water sample with 0.02 N H2SO4. Na+ and K+ were examined using a flame photometer 128 (Systronics), chloride was examined using a titration technique, and NO3, F, and SO4 2 were examined using a spectrophotometer (Spectronic 21 D). Analytical procedures were carried out in accordance with established guidelines and procedures.

IV. Result and discussion

Physicochemical parameters

The hydrochemical data from the pre- and post-monsoon seasons. Box–whisker plots are used to demonstrate the temporal fluctuation of the data. Temperatures ranged from 21.1 to 35.4 °C over a single season (pre-monsoon) (RamyaPriya, &Elango, 2018). Pre-monsoon pH values varied from 6.2 to 8.7, with an average of 7.5, while post-monsoon pH values ranged from 7.0 to 7.9, with an average of 7.3. pH values in natural groundwater range from 6.0 to 9.0, which is regulated by the presence of CO2, microbial activity, and photosynthesis by plants in the surrounding environment. pH changes show that groundwater in the studied region is not heavily affected by any microbial or other activities. Groundwater pH is consistent throughout the year, according to the average values of pH. Most of the samples have pH values that fall within the acceptable range for drinking water.

The salinity and dissolved ions are measured using electrical conductivity (EC). Leaching or dissolving of the aquifer's material, mixing of salt sources, or a combination of these activities might explain the high EC seen in water samples (Adedokun, et al. 2019). Pre-monsoon EC values ranged from 174–4014 S/cm, with an average of 1336 S/cm, while post-monsoon EC values ranged from 269–3806 S/cm, with an average of 1956 S/cm. It ranged from 122 to 2811 mg/L in pre-monsoon samples, with an average of 935 mg/L, to 188 to 2657 mg/L in post-monsoon samples, with an average of 1366 mg/L. During the monsoon, salts from the unsaturated zone are dissolved in entering water and reach the water table, increasing TDS. In both seasons, the TDS variation is the same.

Suitability for drinking purposes

Based on WHO (2011) and BIS (2012), the findings of the analysis have been deemed suitable for home use (2012). Values and percentages of water quality metrics and samples that do not meet WHO and BIS standards. The table shows that in the pre-monsoon period, groundwater is mostly polluted by F in 72% of samples, followed by 25% of TH and 22% of Mg2+, but in the post-monsoon period, the order is 50% of F, 39% of Mg2+, and 28% of TH (see Figure 1). Post-monsoon concentrations of major ions, as well as TH, TDS, and EC values, are found to be greater than pre-monsoon levels. Total dissolved solids (TDS) and TH (total dissolved solids in water) are commonly used to assess water's suitability for use in drinking, irrigation, and industrial applications, respectively (Mukherjee, & Singh, 2020). TDS can induce gastrointestinal discomfort in humans and could have laxative effects if it is present in high concentrations. During pre- and post-monsoon periods, TDS in groundwater in this location varied from 122 to 2811 mg/L with a mean value of 935 mg/L, respectively. Salts dissolve and water evaporates, resulting in an increase in TDS. TDS readings are used to classify groundwater. A total of 22.2 percent of samples from both seasons were deemed fit for consumption. Pre-monsoon samples had a higher drinking-quality percentage than post-monsoon ones (Dangar, et al. 2021). This shows that precipitation penetrating into shallow aquifers during the post-monsoon season raises the TDS of groundwater by bringing salts from the unsaturated zone. There are certain samples that can be considered "irrigation-ready" after the monsoon.

V. Conclusion

For drinking and agricultural purposes, the groundwater in Bathinda district was investigated in this study. In addition to Piper's trilinear and Chadha's plots, geochemical mechanisms influencing groundwater chemistry were also studied (Mohanakavitha, et al. 2019). Groundwater samples were taken before and after the monsoon and compared for their chemistry. Some hydrochemical parameters, including F, Mg2+ and TH, were found to be over drinking water permitted limits in most samples, whereas other parameters were determined to be minimally contaminated. During the pre-monsoon season, water quality indicators including SAR, RSC, Na percent, and PI were found to be good to appropriate, however during the post-monsoon season, water quality indicators were found to be dubious to unsuitable. Water samples that have a high concentration of bicarbonate are considered dubious or unsafe for human consumption. The geochemical interpretation of hydrochemical data suggested that Na+, Mg2+, and Ca2+ are the most common cations, followed by Cl, HCO3, and SO4 2, respectively, as anions. As raindrops from the unsaturated zone carried salts, it contributed to the local groundwater during pre-monsoon. However, during the rainy season, dissolution of minerals and ion exchange activities had a greater impact on the local groundwater. Piper tri-linear and Chadha's groundwater classifications are used to draw together a geochemical schematic diagram (Barik, &Pattanayak, 2019). This district's shallow aquifers have been contaminated by the leaching of salts in the unsaturated zone, the addition of soluble fertilisers, and the faeces of cattle. This research is important because of the scarcity of surface water resources and the degradation of groundwater quality and quantity as a result of human activity.

VI. References

Adedokun, M. B., Aweda, M. A., Maleka, P. P., Obed, R. I., Ogungbemi, K. I., &Ibitoye, Z. A. (2019). Natural radioactivity contents in commonly consumed leafy vegetables cultivated through surface water irrigation in Lagos state, Nigeria. *Journal of Radiation Research and Applied Sciences*, *12*(1), 147-156.

Barik, R., &Pattanayak, S. K. (2019). Assessment of groundwater quality for irrigation of green spaces in the Rourkela city of Odisha, India. *Groundwater for Sustainable Development*, *8*, 428-438.

Dangar, S., Asoka, A., & Mishra, V. (2021). Causes and implications of groundwater depletion in India: A review. *Journal of Hydrology*, *596*, 126103.

Kumari, M., & Rai, S. C. (2020). Hydrogeochemical evaluation of groundwater quality for drinking and irrigation purposes using water quality index in semi arid region of India. *Journal of the Geological Society of India*, *95*(2), 159-168.

Mohanakavitha, T., Shankar, K., Divahar, R., Meenambal, T., &Saravanan, R. (2019). Impact of industrial wastewater disposal on surface water bodies in Kalingarayan canal, Erode district, Tamil Nadu, India. *Archives of Agriculture and Environmental Science*, *4*(4), 379-387.

Mukherjee, I., & Singh, U. K. (2020). Delineation of groundwater potential zones in a drought-prone semi-arid region of east India using GIS and analytical hierarchical process techniques. *Catena*, *194*, 104681.

RamyaPriya, R., &Elango, L. (2018). Evaluation of geogenic and anthropogenic impacts on spatio-temporal variation in quality of surface water and groundwater along Cauvery River, India. *Environmental Earth Sciences*, *77*(1), 1-17.

Setia, R., Dhaliwal, S. S., Kumar, V., Singh, R., Kukal, S. S., &Pateriya, B. (2020). Impact assessment of metal contamination in surface water of Sutlej River (India) on human health risks. *Environmental Pollution*, *265*, 114907.

Solangi, G. S., Siyal, A. A., &Siyal, P. (2019). Analysis of Indus Delta groundwater and surface water suitability for domestic and irrigation purposes. *Civil Engineering Journal*, *5*(7), 1599-1608.

Zhang, W., Ma, L., Abuduwaili, J., Ge, Y., Issanova, G., &Saparov, G. (2019). Hydrochemical characteristics and irrigation suitability of surface water in the Syr Darya River, Kazakhstan. *Environmental monitoring and assessment*, *191*(9), 1-17.