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Tanu Taneja
Department of Civil Engineering
Baba Farid College of
Engineering and Technology,
Bathinda

Nimisha Singh
Department of Applied Science
Baba Farid College of
Engineering and Technology,
Bathinda

Corresponding Author:
Tanu Taneja
Department of Civil Engineering
Baba Farid College of
Engineering and Technology,
Bathinda

Pysico-chemical analysis on assesment of groundwater in Malwa Region, Punjab

Tanu Taneja and Nimisha Singh

Abstract
Water covers 71% of the surface of the Earth; however, only 3% of that water is freshwater, and of that 3%, only 0.75 percent is groundwater. The remaining 31% of water is as ice. In the Punjab's district of Faridkot, the Malwa region's ground water testing analysis is presented in this report. The main goal of groundwater testing and analysis is to defend the environment from water contamination as well as the harmful impacts of agricultural and industrial pollutants on groundwater resources and the ecosystem. For the purpose of testing groundwater, various criteria are used. pH, alkalinity, turbidity, hardness, chloride, fluoride, and nitrate are some of these factors. After evaluating several samples and discovered that some of the samples had fluoride contamination, alkalinity, and hardness when compared to permissible standard limits. As a result, treating ground water prior to involving it for drinking and domestic tasks is necessary.

Keywords: Groundwater quality, fluoride content, alkalinity, testing, quantitative approach

Introduction
India is the world's largest consumer of groundwater. It oppupies a vast area below the surface of the It is the subsurface water that can be discovered in cracks in rocks, sand, and dirt (Sharma, 2012) [16]. It flows relatively slowly in aquifers, which are geological formations of soil, sand, and rocks. 71% of the outer layer of the Earth is covered by water, yet only 3% of that water is freshwater, and only 0.75 percent of that 3 percent is groundwater. The remaining water is as ice and subsurface water. The usage of surface water for drinking is extremely little and sea water is not suited for home use. Groundwater is used to supply about 80% of the world's drinking water and about 60% of irrigated agriculture. The majority of Indians in both urban and rural areas drink groundwater (Gupta *et al.* 2009) [11]. Due to the presence of several additional components in it over the allowable limit, some places' groundwater is also unfit for drinking. In this study, we analyzed the ground water in the Faridkot region and discovered that there are some places where it is contaminated because of high levels of fluoride, alkalinity, and hardness, rendering it inappropriate for use in home and industrial applications. These contaminants are to blame for diseases like typhoid and diarrhea (WHO, 2008) [1]. Fluoride is presented in water through normal as well as through anthropogenic sources. The vast majority of the fluoride in ground water is normal in beginning. Normally, a follow amount of fluoride can happen in soils, water, plants, creatures and a wide range of vegetables (Narsimha & Rajitha 2018; Adimalla 2020) [12, 3]. From one side of the planet to the other, fluoride levels past as far as possible in groundwater was because of the presence of fluoride bearing rocks and its versatility in ground water expanded the fluoride contents over as far as possible, which has up until this point impacted north of 200 million individuals having a place with 25 countries (Ayoob & Gupta 2006; Adimalla 2020) [5, 3]. In light of rock water collaboration, long home time and dissipate happening, the convergence of fluoride increments. Generally speaking, the regular centralization of fluoride in groundwater relies upon the land, substance and actual attributes of the spring, the porosity and corrosiveness of the dirt and rocks, the encompassing temperature, the activity of other compound components, profundity of the spring and power of enduring (Feenstra *et al.* 2007) [10]. Admission of fluoride higher than the ideal level is the primary justification behind dental and skeletal fluorosis. In India 62 million individuals including 6 million kids are assessed to have serious medical issues because of utilization of fluoride debased water. Admission of fluoride higher than the ideal level is the primary justification behind dental and skeletal fluorosis. In India 62 million individuals including 6 million kids are assessed to have serious medical conditions because of utilization of fluoride tainted water (Andezhath SK, Ghosh (2000) [4]. Openness to

exceptionally high fluoride over a drawn out timeframe brings about intense to ongoing skeletal fluorosis. Thirty two states in India, seventeen have been distinguished while prevalent regions with six million individuals impacted by skeletal fluorosis. The strength of individuals all around the world is impacted by ongoing openness to raised centralizations of fluoride in groundwater. Because of presence of fluoride wellbeing impacted, the World Wellbeing Association keeps a greatest rule of 1.5 mg/L in drinking water. It was illustrated that in the basaltic landscape of Maharashtra, India, study was undertaken (Podgorski & Berg 2022) [13]. The hydro-chemical data suggested that groundwater is permanently hard and alkaline in character. The excessive use of fertilizers in agriculture, which resulted in samples with high nitrate concentrations in 62.5 and 75% of cases, (Wagh 2020). To evaluate the uranium pollution in groundwater, researchers examined the Muktsar and Faridkot districts in the southwest of Punjab State. In Muktsar and Faridkot districts, respectively, 44.4 and 81.8 percent of samples are contaminated with high uranium levels, according to the data, which show that uranium levels can reach 190 lg/L, (Pant 2017) [8].

Studies done in the Malwa region of Punjab, particularly the Bathinda district, shows that certain places of the region has low groundwater quality. Mercury, arsenic, and lead were the heavy metals that were investigated in Bathinda's industrial sector. Groundwater in underdeveloped areas can be made drinkable by treating it with efficient methods (Sharma 2012) [16]. Sharma *et al.* (2014) [17] referenced in his review that pervasiveness of fluoride and nitrate in groundwater has become central issue because of their potential natural related wellbeing influences. High fluoride and nitrate fixations have been accounted for from many pieces of rustic southwestern Punjab making serious wellbeing dangers the occupants.

Groundwater contamination due to heavy metals in Punjab is alarming. It is higher than any other state in India. There is a distinct pattern of occurrence of heavy metals in Punjab, *viz*. arsenic predominance in Majha belt, selenium prevalence in Doaba belt, and uranium contamination in Malwa belt of Punjab. All arsenic debased homes in Punjab, 60% fall in Majha belt of Punjab, in particular, Amritsar, Gurdaspur and Pool Taran regions. Arsenic defilement can be dispose of by utilizing a nanotechnology based procedure called AMRIT (Arsenic and Metal Expulsion by Indian Innovation). Doaba belt of Punjab, to be specific, Jallandhar, Kapurthala and Hoshiarpur locale have high selenium contents in groundwater. Satisfactory cutoff (AL) for arsenic and selenium in groundwater is fixed at 0.01 mg/l (ppm) by the Agency of Indian Guidelines (BIS). The biggest number of towns with arsenic and selenium tainting of groundwater over the AL falls in the Amritsar and Jallandhar locale, separately. The wellbeing impacts of uranium focus in water on people are not legitimate. The general signs are that there is no obvious proof of impacts under an openness convergence of 30 µg/l (ppb). As a matter of fact, the proof for consequences for the kidney, which has all the earmarks of being the most touchy organ, is obscure until a lot higher openness fixations. At higher concentrations, above about 100 µg/l (ppb), radioactivity will begin to be a consideration (Virk 2020) [19]. Use of groundwater is worthwhile as it is similarly new and broadly appropriated not at all like the surface water. Dangers to groundwater have been expanding ordinarily because of raise in population and their requirements. Accordingly with expanding request of groundwater for domestic, industrial and horticultural necessities, the strain on this asset has become enormous. Overexploitation and ill-advised administration has likewise lead to pollution of this resource. (Brindha and Elango, 2011) use of ground water is favorable as it is similarly new and generally conveyed not at all like the surface water. Dangers to groundwater have been expanding ordinarily because of raise in population and their requirements. Subsequently with expanding request of groundwater for domestic, industrial and horticultural necessities, the tension on this asset has become enormous. Over exploitation and inappropriate administration has additionally lead to tainting of this asset. The corruption of groundwater might be because of normal or anthropogenic cycles. Normal causes are intrinsic topographical circumstances while anthropogenic causes incorporate wastewater from sewage treatment plants, release from ventures, inappropriate strong waste disposal, agro chemicals, overflow from rural fields, spillage from underground capacity tanks and so forth.

At the point when the compound piece of groundwater isn't inside the endorsed guidelines for drinking or water system or modern water, they become unsatisfactory. Arsenic, fluoride, nitrate, iron, manganese, boron, most weighty metals and radio-nuclides are not many toxins that are of extraordinary concern on the off chance that not present inside reasonable cutoff points (Brindha and Elango, 2011) use of groundwater is favourable as it is relatively new and generally dispersed dissimilar to the surface water. Dangers to groundwater have been expanding regularly because of raise in population and their necessities.

When the substance arrangement of groundwater isn't inside the recommended principles for drinking or water system or modern water, they become unacceptable. Arsenic, fluoride, nitrate, iron, manganese, boron, most weighty metals and radio-nuclides are not many impurities that are of incredible concern on the off chance that not present inside allowable cut off points (Brindha and Elango, 2011) use of groundwater is favorable as it is nearly new and generally circulated not at all like the surface water. Dangers to groundwater have been expanding regularly because of raise in populace and their requirements. Accordingly with expanding request of groundwater for domestic, industrial and horticultural requirements, the strain on this asset has become enormous. Overexploitation and ill-advised administration has additionally lead to tainting of this asset.

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Fluoride is one of the significant micronutrient in people which is expected areas of strength for furthermore, bones. Groundwater with fluoride fixations over as far as possible set by WHO, for example 1.5 mg/l (ppm), have been kept in a few regions of the planet. Fluoride contamination is far and wide, concentrated and disturbing in India as 14.5% of complete fluoride deposits on the world's hull are tracked down in India. Our examinations have uncovered that out of 2500 homes reviewed in Punjab State, 80% are impacted by fluoride pollution. The most noteworthy fluoride pollution is kept in Patiala and Fatehgarh Sahib areas of Punjab. There is a need to outline the wellspring of groundwater fluoride in these regions and to purify groundwater to make it potable. Fluoride is one of the significant micronutrient in people which is expected areas of strength for bones. Groundwater

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Methodology & Area: Study Area

Due to some industrial activities taking place nearby and the use of fertilizers and pesticides on the local soil, the quality of the ground water in the Faridkot region is gradually declining. As a result, it's crucial to examine the ground water and implement improvement methods when appropriate. Figure 1 below depicts the research area in the Malwa region of Faridkot.

Method

In the Faridkot district, samples of the ground water were taken at ten distinct sites (Nov. 2021). Glass vials were used to collect the samples. The bottle had a 1 Liter capacity, and polyethylene sheets were used to seal the lids. The location tags and sampling time were properly applied to the gathered samples.

Fig 1: Map of Faridkot District

Table 1: Sampling locations

Sampling Location	Sampling Coding
Guru Nanak Colony, Faridkot	S-1
Sadiq, Faridkot	S-2
Kotkapura road, Faridkot	S-3
Guru Gobind Singh Medical, Faridkot	S-4
Bus Stand, Faridkot	S-5
Clock Tower, Faridkot	S-6
Thana Sadar Police Station, Faridkot	S-7
Civil Hospital, Faridkot	S-8
Faridkot Canal-2 Kotkapura Road, Faridkot	S-9
Faridkot Canal-1 Kotkapura road, Faridkot	S-10

Table 2: Health effects of chemical parameters (Sharma, 2012) [16]

Parameter	Potential Effect on Human Health
Turbidity	Organisms found in it can cause side effects, for example, queasiness, cramps, the runs &headaches
pH	Affect mucous membrane; bitter taste; corrosion
Total Alkalinity	soda-like taste, can dry out skin and can cause scaling on fixtures
Total Hardness	Poor lathering with soap; deterioration of the quality of clothes; scale farming
Chloride	Taste affected' corrosion
Fluoride	Dental & skeletal fluorosis; non-skeketal manifesatations
TDS (Total Dissolved Solids)	Undesirable taste; gastro-intestinal irritation; corrosion or in cruststion

Result and Discussion

The pH of DW must be between 6.5 and 8.5. (IS 10500, 2012). The evaluated samples' pH values range from 6.8 to 8. All samples' pH readings fall below the level that is acceptable for drinking water. The water's alkalinity ranges from 175 to 1000 mg/l. This result indicates that the water is unfit for human consumption. In table No. 4, the amount of alkalinity is listed. Groundwater has a hardness range of 350–600 mg/l. Although the hardness of groundwater has no significant influence on human wellbeing, the WHO recognize a max. permitted limit of 500 mg/l for drinking purposes (WHO, 2008) [1]. A hardness value between 76 and 150 mg/l is regarded as moderate, b/w 151 and 300 mg/l as hard, and between more than 300 mg/l as very hard (Durfor, 1964). Punjab is confronting an emergency circumstance because of elevated degrees of uranium (U) and weighty metals in underground water table of Punjab. Division of Water Supply and Disinfection (DWSS), Punjab report on water quality checking and relief presents what is happening about the ebb and flow water quality situation in Punjab. Out of complete 874 homes covered under this study, 378 are viewed as quality impacted because of high defilement of arsenic, iron, aluminum, magnesium, nitrates and other fundamental boundaries. Arsenic pollution overwhelms the situation in Amritsar area with iron at number two in the rundown of weighty metal foreign substances of groundwater. Notwithstanding arsenic and iron, aluminum, magnesium, nitrate and fluoride are different toxins of groundwater found over the admissible limits (Andezhath & Ghosh 2000) [4].

Chloride levels in water samples are below the 500 mg/l permitted limit (WHO, 2008) [1]. The remaining samples are of fair quality, although samples nos. 1, 4, and 8 have fluoride contents that are more than the allowed limit of 1.5 mg/l. Laboratory tests were performed on the samples that were taken from the Faridkot district's neighborhoods. The table below shows the physical-chemical parameters that were observed-

Table 3A: Observation Table A

Sampling Location	⇨	1.Gurunanak Colony	2.sadiq, faridkot	3.fdk-kkp road	4.GGS Medical	5.Bus stand, FDK	
Sr.No.	Parameters ⇩						Max. Permissible Limit
1	Appearance	Colorless	Colorless	Colorless	Colorless	Colorless	Colorless
2	odour	None	None	None	None	None	None
3	Turbidity	No turbidity	No turbidity	No turbidity	No turbidity	No turbidity	No turbidity
4	Alkalinity (mg/l)	1000	625	650	725	500	600
5	Hardness (mg/l)	450	600	500	550	550	600
6	Chloride (mg/l)	210	250	150	280	250	1000
7	Fluoride (mg/l)	1.8	0.4	0.3	1.5	0.8	1.5
8	Nitrate (mg/l)	5	8	3	12	60	45
9	TDS (mg/l)	1992	1800	1560	1866	1560	2000
10	pH	7.3	7.2	7.3	7.6	7.5	6.5-8.5

Table 3B: Observation Table B

Sampling Location	⇨	6. clock house, bazzar	7. sadar police station	8. civil Hospital	9. fdk canal road -1	10. fdk canal road -2	
Sr.No.	Parameters ⇩						Max. Permissible Limit
1	Appearance	Colorless	Colorless	Slightly yellow	Colorless	Colorless	Colorless
2	odour	None	None	None	None	None	None
3	Turbidity	No turbidity	No turbidity	No turbidity	No turbidity	No turbidity	No turbidity
4	Alkalinity (mg/l)	475	350	500	175	250	600
5	Hardness (mg/l)	600	500	600	350	350	600
6	Chloride (mg/l)	210	200	250	70	150	1000
7	Fluoride (mg/l)	0.3	0.5	1.8	0.5	0.4	1.5
8	Nitrate (mg/l)	5	10	10	3	8	45
9	TDS (mg/l)	1592	1575	1620	714	900	2000
10	pH	7	6.8	8	6.8	7.7	6.5-8.5

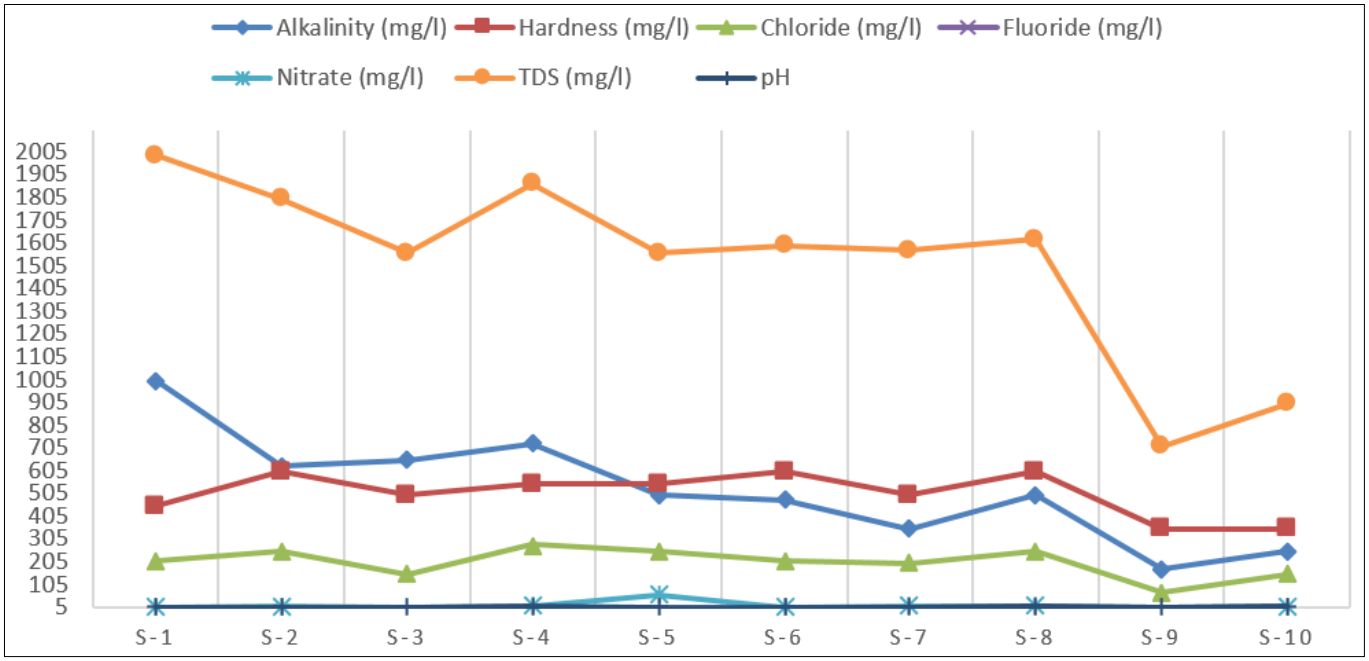

Fig 1: Physical-chemical parameter observation

Conclusion

We discovered from this investigation that the majority of samples are contaminated with alkalinity, an over limit of hardness in the ground water, and some samples are contaminated with high Fluoride Content. The water poses major health risks due to its high percentage of hardness, alkalinity, and fluoride. Because of this, treating groundwater before drinking is urgently necessary. Moderation of weighty metals tainting of groundwater is an issue of huge greatness in Punjab. The utilization of trench water for the purpose of drinking is the cost effective ideal arrangement of the issue. 6. There is an earnest need to change the editing design in Punjab to end the exhaustion of groundwater table further. The majority of the blocks have arrived at the high still up in the air by Focal Ground Water Board, Service of Water Assets, Administration of India.

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