



HYDROCHEMISTRY ANALYSIS: A CASE STUDY OF BANIKHET VILLAGE, CHAMBA, HIMACHAL PRADESH

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ABSTRACT

Banikhet – A beautiful village in the lap of Himalayan Dhauladhar range is serene, very peaceful and aesthetic. This place is situated at an altitude of 5500 feet above mean sea level. Mesmerizing hills and charismatic beauty of alpine vegetation are acts as eye tonic especially for one, who enters from the Punjab corridors. With all the cultural hues water sweetness adds something very magical to this place. Surprisingly, with this there is one more thing to be notice that is every morning and evening young or old, male or female carry small or big utensils with them for taking water. Yes, for water. They carry drinking water from hand pumps. Although, people consume both surface and sub surface water for fulfilling their water requirements. But for drinking purposes hand pumps dependency is more. Hand pumps have been dug at every half meter distance with 35 to 70.12 m bgl depth. Hydrochemistry of sub surface water of Banikhet Village has been assessed on the basis of twelve parameters i.e. Hydrogen ion (pH), Specific Electrical Conductance (EC), Bicarbonate (HCO₃), Chloride (Cl), Sulfate (SO₄), Nitrate (NO₃), Potassium (K), Calcium (Ca), Magnesium (Mg), Sodium (Na), Phosphate (PO₄) and Fluoride (F) for the year 2017. All selected parameters found positive with their set permissible presence. But, surface stream is visibly polluted due to disposal of household and animal waste. Mostly people prefer sub surface water for drinking purposes. Pinned work depicts the present condition of sub surface hydrochemistry of Banikhet village.

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INTRODUCTION

Water is very essential element for the survival and growth of all possible creatures. Chemical salt variability in water can affect the growth rate of dependent species. Plants and human's sustenance and health can adversely affect due the presence of inconsumable or imbalanced elements chemistry. So it is necessary to test, purify and enact required chemical adjustments in water before its consumption for any purpose.

Water requirements fulfilled through surface and sub surface water sources. Water gets affected by the surrounded rock material and human activities of the source region. With time these sources of water depleted and also quality of water is deteriorated. Sub surface water condition of Punjab can be the best illustration of water resource degradation. The reason of this excessive deterioration and depletion of water resource in Punjab is expansion of intensive and extensive agricultural activities with the advent of Green Revolution. Implication of Green Revolution and unsustainable resource utilization worsen the condition of water in Punjab. Whereas when cross the northern and north eastern corridors of Punjab and reached

at Himachal Pradesh water quality and quantity get changed. Sweetness and purity in water can be easily observed after its consumption. Rivulets and spring will be your companion with big rivers and streams. Greenery is all around with colourful folks. Additionally these colours add due to the promotion and progress of tourism and cultural amalgamation in that area with time.

METHODOLOGY

Hydrochemistry of Banikhet village has been analyzed on the basis of laboratory testing of groundwater samples for Hydrogen ion (pH), Specific Electrical Conductance (EC), Bicarbonate (HCO₃), Chloride (Cl), Sulfate (SO₄), Nitrate (NO₃), Potassium (K), Calcium (Ca), Magnesium (Mg), Sodium (Na), Phosphate (PO₄) and Fluoride (F) extraction for the period 2017. After laboratory testing following formulas have been applied for acquiring actual values of stated substances:

Specific Electrical Conductance (EC): $x \times 1000 = 1000x \mu\text{S}/\text{cm}$

Bicarbonate (HCO₃): $\frac{x \times 0.1 \times 1000 \times 50}{20} = x \text{ mg/l}$

Chloride (Cl): $\frac{x \times 0.1 \times 1000 \times 35.5}{20} = x \text{ mg/l}$

Sulfate (SO₄): $\frac{x + 0.0579}{0.0616} = x \text{ mg/l}$

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$$\text{Nitrate (NO}_3\text{): } \frac{x+0.1839}{0.1838} = x \text{ mg/l}$$

$$\text{Calcium (Ca): } \frac{x \times 400.8}{20} = x \text{ mg/l}$$

$$\text{Magnesium (Mg): } \frac{x - Ca \times 400.8}{20 \times 1.645} = x \text{ mg/l}$$

$$\text{Fluoride (F): } \frac{1.449 - x}{0.184} - 0.744 = x \text{ mg/l}$$

$$\text{Phosphate (PO}_4\text{): } \frac{x - 0.002}{1.14} = x \text{ mg/l}$$

These formulas have been applied for extracting the actual values from the sample readings.

DISCUSSION AND ANALYSIS

Hydrochemistry analysis of sub surface water of Banikhet village explains the acceptability status of consumption water. Spring, streams and hand pumps are the major source of water. Snowfall and rainfall helps in replenishing these sources. Presence of sub surface water occurs under unconfined to semi-confined conditions. Hard rocks formed during Paleozoic to Triassic period underlain most of this part. Mostly these rocks are devoid of any primary porosity. Joints and fractures in this type of rock structure helps in sub surface water movement. Average water depth in this area ranges between 10 m bgl to 30 mbgl. Sub surface water quality has been assessed on the basis of permissible values of Hydrogen ion (pH), Specific Electrical Conductance (EC), Bicarbonate (HCO₃), Chloride (Cl), Sulfate (SO₄), Nitrate (NO₃), Potassium (K), Calcium (Ca), Magnesium (Mg), Sodium (Na), Phosphate (PO₄) and Fluoride (F) during 2017.

- Sub surface water of Banikhet village is basic in character as Hydrogen ion concentration is 7.29.
- Specific Electrical Conductance reflects the salinity level (Grattan, 2002). In this area EC is 386 µS/cm at 25°C.
- Bicarbonate is the primary anion in groundwater (De Ridder, 1994). Its value is 375 mg/L i.e. also under permissible limit.
- Chloride concentration in water is 88.75 mg/L.
- Sulfate ion concentration is 17.206 mg/L.
- Nitrate concentration in sub surface water is 1.2018 mg/L.
- Potassium concentration is 0.3ppm.
- Calcium concentration is affected by the pH, carbon dioxide and carbonate minerals (Richter and Kreitler, 1993 and Debrewer *et al.*, 2007). In this area Calcium concentration is under acceptable limit with 28.056 mg/L.

- Magnesium concentration is 9.745 mg/L.
- Concentration of Sodium is 12.9ppm in this area.
- Concentration of Fluoride and Phosphate is 0.12 mg/L and 0.1 mg/L respectively.

Values of all the selected parameters are under the permissible consumption limit. Absence of industrial, intensive agricultural and other pollution proliferation activities are the major reason for the presence of good quality sub surface water.

CONCLUSION

Banikhet - a lush green place canvassed by the creator away from the rush of city. This place is not only at par excellence with beauty but also with purity. Yes, pure air and water. Water quality is indispensable. Concentration of all the selected parameters for quality test of sub surface water i.e. Hydrogen ion (pH), Specific Electrical Conductance (EC), Bicarbonate (HCO₃), Chloride (Cl), Sulfate (SO₄), Nitrate (NO₃), Potassium (K), Calcium (Ca), Magnesium (Mg), Sodium (Na), Phosphate (PO₄) and Fluoride (F) are found under World Health Organization set permissible limit. Sub surface water of Banikhet village is suitable for every type of consumption purposes.

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