



A study of Physico-chemical parameters of springs around Amarkantak Satpura Valley (M.P.)

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Abstract

Spring water is the main source of water providing life to people in the mountain region especially in the Himalaya. Spring is a natural source of groundwater. Unlike wells, which may be owned and controlled privately; springs are generally community-owned and community-managed. Thus, they give a sense of a “common” resource i.e. groundwater shared through a common mechanism, i.e. the spring. The spring water samples were taken from the main water sources where maximum peoples were using them for drinking purpose. The present study was carried out on the physico-chemical analysis of 5 springs in district Amarkantak Satpura valley viz: Kapil dhara, Doodh dhara, Hanuman dhara, Rudra dhara and Jaleswar dhara. The samples were collected on monthly basis from March, 2016 to June 2017. The analysed various water parameters viz: Temperature, pH, Conductivity, Total hardness, Chlorides, D.O. and Nitrite. The results indicated that certain sources of water are suitable for drinking and other household consumption for the people of the region.

Keywords: spring, valley, hydrogeology, physico-chemical

1. Introduction

The quality of water is a vital concern for mankind, since it is directly linked with human welfare. It is a matter of history that fiscal pollution of drinking water caused water born diseases which wiped out entire population of these cities. At present, the menace of water born diseases and epidemics still booms large on the horizons of developing countries. Polluted water is the culprit in such cases (Nollet, 2000) ^[1].

Water is the most widely distributed and abundant substances found in nature. The irony is that our planet is a wash with water. In total, there is 1400 million billion liters of water, but most of this water is not used for drinking purpose, because 97% is sea water and only 3% is fresh water, out of which 2% is lidedged in the polar ice caps and glaciers, only 1% water is available for portable use; whereas more water goes for irrigation than to drinking sanitation and all other uses (WHO, 2004) ^[2].

Springs provide the main source of freshwater for drinking and other household consumption in the Indian Himalayan Mountains. People in rural areas of Madhya Pradesh primarily depend for drinking water on natural water sources such as springs. It also forms a main source of irrigation water in many parts of the mountain region. The mountain springs known as “Dharas”. Springs occur where sloping ground and impermeable strata intersect with the ground water table. The water sources of such springs, in most of cases, are unconfined aquifers where the flow of water is under gravity. The objectives of the present study was to analyze the physicochemical parameters of drinking spring water samples collected around from the Amarkantak valley of Madhya Pradesh.

Amarkantak is located in the state of Madhya Pradesh in India at 22.67°N - 81.75°E. It has an average elevation of 1048 metres (3438 ft). Roads running through

Rewa, Shahdol, Anuppur, Jabalpur, Katni and Pendra connect it. The nearest railway stations are Anuppur and Pendra Road 43 km via Keonchi and only 28 km via Jwaleswar. The nearest airport is Dumna Jabalpur (Jabalpur Airport) in the city of Jabalpur, Madhya Pradesh (240 km) which has daily flight service to Delhi and Mumbai

2. Materials and Method

The present study was carried out on the spring water quality of five springs of the Amarkantak valley in district Anuppur Satpura valley, Madhya Pradesh namely; Kapil dhara, Doodh dhara, Hanuman dhara, Rudra dhara, Jaleswar dhara. Water samples from the various locations of Amarkantak valley were collected in clean 1 liter polythene bottles in the month of March 2016 to June 2017. Material requirement for sampling and analysis of water is sample containers, chemical and glassware, thermometer, tissue papers, other field measurement are, field note book, pen, pencil, markers, soap and towel, match box, spirit lamp, etc. All analysis was carried out as per APHA, (2005) ^[3] and BIS (1993) ^[4] desirable limit for drinking water. Some material and methods are depicted as follows:

1. Temperature is measured by the thermometer.
2. pH value: pH value in water is determined by pH meter.
3. Conductivity, D.O., in water is determined by the “EUTECH Instrument” of Cyberscan.
4. Total hardness: Hardness in water is determined by EDTA complexometric titration using EDTA solution, buffer solution, EBT indicator, distilled water and titration apparatus etc.
5. Nitrate: Nitrate in water is determined by UV spectrophotometric method using spectrophotometer, nitrate free water, stock nitrates solution, standard nitrate solution, hydrochloric acid solution

6. Chloride: Chloride in water is determined by argentometric titration method using potassium chromate indicator solution, standard silver nitrate titrant, standard NaCl solution etc.

3. Results and Discussion

Table 1 shows average value of physico-chemical analysis of spring water in the present study. The pH values show fluctuations within a range from a minimum of 6.9 (Kapil dhara, Doodh dhara, and Hanuman dhara) to a maximum of 7.2 (Jaleswar Dhara). However the value for (Rudra dhara) that is 7.8. The pH of all the springs is towards the basic level. The desirable limit for pH is 6.0 to 8.0.

The electrical conductivity exhibited as a variation within a range from a maximum of 684.01 $\mu\text{s}/\text{cm}$ (Hanuman dhara) to a minimum of 509.68 $\mu\text{s}/\text{cm}$ (Jaleswar dhara). However the value for (Kapil dhara, Doodh dhara and Rudra dhara) that is 595.51 $\mu\text{s}/\text{cm}$, 515.89 $\mu\text{s}/\text{cm}$ and 530.46 $\mu\text{s}/\text{cm}$. The electrical conductivity values shows fluctuations and may be due to the contamination from domestic sewage and inorganic fertilizer inputs (Kumar *et al.*, 1996) ^[5] and also may be due to bicarbonate and calcium ions present in the rocks there.

The values for temperature within a range from a minimum of 20.69°C (Kapil dhara and Jaleswar dhara) and maximum of 21.5°C (Hanuman dhara). While the value for Doodh dhara and Rudra dhara that is, 21.25°C. The temperature values shows significant seasonal variation however the lower temperature may also be due to the shading effect of trees and higher temperature may be due to the high pollution rates. The water temperature is one of the most important physical characteristics of aquatic ecosystem, as it affects the organisms (Bhadja and Vaghela, 2013) ^[6].

The DO values shows variation within a range from a minimum of 2.5 mg/l (Doodh dhara) to a maximum of 3.2 mg/l (Jaleswar dhara). While the value for (Kapil dhara, Hanuman dhara and Rudra dhara) that is, 2.89 mg/l, 2.8 mg/l, 3.05 mg/l. The fluctuation in the DO value may be difference in water temperature and also to the greater photosynthetic

activity. The higher value of dissolved oxygen may be due to the influence of run-off water from monsoon rain (Chennakrishanan *et al.* 2008) ^[7].

The chloride values show variation within the range from a minimum of 57.5 mg/l (Doodh dhara) to a maximum of 67.88 mg/l (Hanuman dhara). However the value for (Kapil dhara, Rudra dhara and Jaleswar dhara) that is, 58.38 mg/l, 59.13 mg/l, 59.5 mg/l. The chloride concentration exhibit small variation within the springs and the variation may be due to the same recharge zone and source of impurities that add chlorides.

The total hardness values show fluctuations ranging from a minimum of 211.19 mg/l (Rudra dhara) to a maximum of 267.13mg/l (Hanuman dhara). While the value for (Kapil dhara, Doodh dhara and Jaleswar dhara), that is, 245.88 mg/l, 220.25mg/l and 218.25mg/l. The variations in the total hardness values, that is, higher values may be due to carbonaceous or lime rich bed rock of the valley. The lower values may be due to seasonal variations. Water with hardness above 200 mg/l may cause scale deposition in the water distribution system and more soap consumption (Singh, 2014) ^[8].

The nitrite values shows variation within a range from a minimum of 4.25mg/l (Kapil dhara) to a maximum of 8.75mg/l (Jaleswar dhara). While the value for (Doodh dhara, Hanuman dhara and Rudra dhara), that is, 6.25mg/l, 7.5mg/l and 6.13mg/l. The fluctuations in the nitrite values or the higher concentration of nitrogen compounds in water may be due to domestic sewage which enters into the ground water through leeching from soil. However, similar findings of the parameters were reported by Adoni and Vaishya (1990) ^[9], Singh & Patil (1991) ^[10] and Khabade *et al.* (2002) ^[11].

In the present investigation, it was found that almost all water quality parameters lie within portability range of APHA (2005) ^[3] and WHO (2004) ^[2] So on the basis of these, water is suitable for drinking and other house hold consumption for the people of the region.

Table 1: Comparison of mean values of various physico-chemical properties of the water of five springs during the study period.

| S. No | Spring Name | Parameters | | | | | | |
|-------|----------------|------------|--|------------------------------------|-----------|-----------------|-----------------------|----------------|
| | | pH | Conductivity ($\mu\text{s}/\text{cm}$) | Temperature ($^{\circ}\text{C}$) | DO (mg/l) | Chloride (mg/l) | Total Hardness (mg/l) | Nitrate (mg/l) |
| 1. | Kapil dhara | 6.9 | 595.51 | 20.69 | 2.89 | 58.38 | 245.88 | 4.25 |
| 2. | Doodh dhara | 6.9 | 515.89 | 21.25 | 2.5 | 57.5 | 220.25 | 6.25 |
| 3. | Hanuman dhara | 6.9 | 684.01 | 21.5 | 2.8 | 67.88 | 267.13 | 7.5 |
| 4. | Rudra dhara | 7.1 | 530.46 | 21.25 | 3.05 | 59.13 | 211.19 | 6.13 |
| 5. | Jaleswar dhara | 7.2 | 509.68 | 20.69 | 3.2 | 59.5 | 218.25 | 8.75 |
| Mean | | 7.0 | 567.11 | 21.08 | 2.89 | 60.48 | 232.54 | 6.58 |
| SD | | 0.14 | 73.72 | 0.37 | 0.27 | 4.21 | 23.37 | 1.68 |

SD = Standard deviation

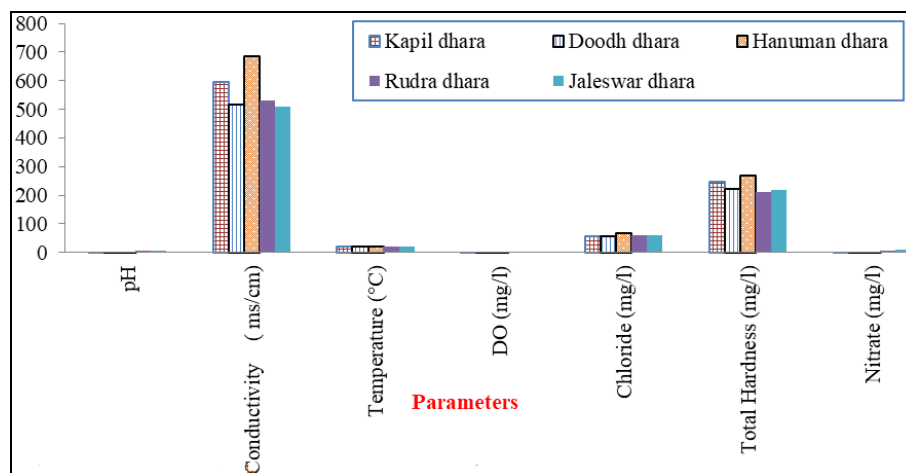


Fig 1: Graphics analysis of various physico-chemical properties of the water of five spring during the study period

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5. References

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