

Tap water quality assessment of some selected regions of Mhow, District Indore India

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ABSTRACT

An attempt has been made to analyse the physicochemical and bacteriological examination of ground water (Tap water) seasonally (rainy, winter and summer seasons) at selected regions of Mhow Tehsil area (Sangi Street, Raj Mohalla, Kali Mata Mandir area, Cantonment Board area and Main Street) for two years, during 2011-2013. During physicochemical examination, Water Colour, Temperature (°C), pH values, Total hardness (mg/lit), Specific conductivity (μ mhos/cm), Total alkalinity (mg/lit), TDS (mg/lit), Chloride (mg/lit), Fluoride (mg/lit), Nitrate (mg/lit), Phosphate (mg/lit), Sulphate (mg/lit) and BOD (mg/lit), DO (mg/lit) and COD (mg/lit) values have been analyzed however, the total coliforms (MPN/100ml) and faecal coliforms (MPN/100ml) were also estimated during bacteriological examination. Continuous monitoring and environment management programs should be run properly to manage the elements in limit range which is necessary to control drinking water pollution.

KEY WORDS: TAP WATER, MHOW TEHSIL AREA, PHYSICOCHEMICAL AND BACTERIOLOGICAL EXAMINATION

INTRODUCTION

Ground water plays an important role in our environment and our economics. In the environment it supports rivers, lakes, wetlands, springs, ponds, marshland, swamps, streams and used as an important sources of freshwater around the world. Groundwater is available at purest form in nature which is colourless and taste-

less. Safe potable water is not likely to be harm humans which keeps healthy lives throughout the world. The quality of ground water depends on various physicochemical constitutes and their geographical data of the particular region. Ground water is the major sources of drinking water. The clean drinking water is one of the essential compounds that profoundly influence life. The deficiency of the clean water increases day by day due to

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pollution of water. In recent years, an increasing threat to ground water quality is the results of human activity at ground water. Now water is getting contaminated, which can cause water borne diseases and gets health hazards, (Shahida and Ummatul, 2015, Singh 2016, Jena and Sinha, 2017, Nagaraju *et al.*, 2018 and Patil 2018).

It has been reported that the more than 90% of population of various states in our country are dependent upon groundwater source for drinking and other purposes (Ramachandraiah, 2004; Tank, 2010). Now days, groundwater is used in agricultural and industrial sector (Ramesh and Soorya, 2012). However, due to increase in industrialization and urbanization, deterioration in the quality of groundwater has been noticed (Lalraj *et al.*, 2005 Leelavathi *et al.*, 2016; Prajapati and Rokde, 2016; Behailu *et al.*, 2017; Soni and Singh, 2018).

The availability of pure water through surface and groundwater resources has become more critical day today. Only 1% of surface and groundwater resources are available on earth for drinking purpose, domestic purpose, power generation, industrial consumption, agricultural purpose, transportation and waste disposal (Mishra *et al.*, 2002; Tahir, *et al.*, 2008). The majority of the recent problems related to drinking water contamination, associated with pollution of surface and ground water resources and with the formation of reaction by-products resulting from the use of disinfectants and oxidants in drinking water treatment, are closely connected with the rapid advances in analytical techniques. It has been noticed that the most common and wide spread danger associated with drinking water is the direct or indirect contamination by sewage, human and agriculture, chemical and industrial influents etc. (Clark *et al.*, 1982 and WHO, 1985). It is therefore considering the importance of health problem in context of ground water (Tap water) contamination.

Mhow is that the cantonment of the Indore district in M.P. The water from the main source is the municipal corporation supply to fulfil the need of population. Thus quality of potable and non potable Tap water resource of Mhow is an urgent need to protect human health. Hence, it was thought to study physico-chemical and bacteriological parameters of different Tap water resources of Mhow. Therefore a continuous periodical monitoring of water quality is necessary. In order to protect human health from different water borne and water related diseases appropriate steps should be taken. The study will be helpful in the management of water resources and save human health of Mhow Tehsil from environmental pollution.

Although various workers have contributed in the field of water monitoring related to health problems in various parts of India, yet most of the parts of Madhya Pradesh are neglected even today. Mhow is a canton-

ment of Indore, but there is no work done in this area. Therefore, looking to the importance from health point of view, the present work has been aimed to analysis of potable or non-potable Tap water resources of Mhow Tehsil. The undertaken work has been aimed to study the physicochemical and bacteriological examination of ground water (Tap water) seasonally (rainy, winter and summer seasons) at selected regions of Mhow Tehsil area (Sangi Street, Raj Mohalla, Kali Mata Mandir area, Cantonment Board area and Main Street) during 2011-2013.

MATERIALS AND METHODS

The physicochemical and bacteriological examinations of ground water (Tap water) were analyzed seasonally (rainy, winter and summer seasons) as per standard methods of APHA (2005). The samples were collected seasonally (Winter–December/January, Rainy–July/August, Summer–April/May) from the various sampling station in the morning (between 8 a.m. to 11 a.m.) for the consecutive two year (2011- 2012 and 2012 -2013). For the analysis of physicochemical parameter of ground water (Tap water) APHA, 2005 was applied.

- Hydrogen ion concentration (pH): The hydrogen ion activity of the water sample was measured with the help of calibrated analyzer (pH meter).
- Colour: Colour of water was observed by visual comparison method.
- Temperature: The water samples were collected in suitable container, measured with the help of mercury thermometer.
- Specific conductivity: It was measured with the help of a Conductivity meter. The unit of conductivity measurement is $\mu\text{mhos/cm}$.
- Dissolved oxygen: Dissolved Oxygen was measured titrimetrically by Winkler's method
- Biochemical oxygen demand: Biochemical oxygen demand was estimated by 5 days BOD method (APHA, 2005).
- Chemical oxygen demand: Chemical oxygen demand was estimated through titrimetric method
- Alkalinity: Total Alkalinity was estimated by titrimetric method
- Sulphate: Sulphate was estimated by gravimetric method.
- Phosphate: Phosphate was measured by spectrometric method
- Nitrate: Nitrate was measured by spectrometric method
- Total Hardness: Hardness was the combination of Ca or Mg ions. The total hardness was estimated by titrimetric method

- Chloride: Chloride was estimated by argentometric method
- Fluoride: Fluoride was estimated by SPADNS calorimetric method
- Methods for analysis of bacteriological parameter

Bacteriological parameters of ground water (Tap water) were also analysed as per standard methods of APHA (2005). Total coliform microbes (Bacteria) - Total coliform in ground water were estimated by multiple tube method. Results were obtained in MPN (Most Probable Number) per 100 ml by consulting the MPN table. Faecal coliform microbes (Bacteria) - Faecal coliform were also estimated by multiple tube method by using BGB broth. Results were also documented in MPN (Most Probable Number) per 100 ml by consulting the Most Probable Number table.

RESULTS AND DISCUSSION

The results obtained in present investigation have been summarized by Figures (1-5). The true colour has been noticed for tap water around all the studied area during rainy, winter and summer seasons during 2011-2013. The highest and the lowest temperature (°C) were recorded as 40°C (Summer, 2012 -2013) for Main street and 13 °C (Winter, 2011-12) for Sangi Street, respectively. The pH values were noticed the lowest as 7.1 (Rainy, 2011 -2012) for Main street and the highest as 8.1 (Summer, 2012-13) for Main street also. Whereas, the total hardness (mg/lit) were estimated the lowest as 100 mg/lit (Rainy, 2011-12, for Sangi Street and Raj Mohalla both) and this value were analysed the highest as 139 mg/ lit (Summer, 2012-13, for Cantonment Board area). Specific conductivity (µmhos/cm) value were noticed the lowest and the highest as 176 µmhos/cm (Rainy, 2011 -2012) for Sangi Street and 412 µmhos/cm ((Rainy, 2012-13) for Kali Mata Mandir area, respectively. Total alkalinity (mg/ lit) value were found to be the lowest as 74 mg/ lit (Rainy, 2012-13, for Raj Mohalla both) and the highest as 110 mg/ lit (Summer, 2011 -2012 for Kali Mata Mandir area and Main street both).

The values of TDS(mg/ lit) were noticed highest as 289 mg/ lit (Rainy, 2012-13, for Kali Mata Mandir area) and lowest as 158 mg/ lit (Winter, 2011-12, for Cantonment Board area). Whereas, Chloride (mg/ lit) value has been calculated the lowest as 120 mg/ lit (Rainy, 2011 -2012 for Kali Mata Mandir area) and the highest as 230mg/ lit (Summer, 2011 -2012, for Cantonment Board area). Fluoride (mg/lit), Nitrate (mg/lit), Phosphate (mg/ lit) and BOD (mg/lit) value were fluctuated in the range of 0.1 -0.6, 1.1-1.7, 0.01-0.02 and 1.0-2.0 respectively during studied season of experimental period. The value of Sulphate (mg/lit) were found the highest as 82mg/lit

(Rainy, 2011-2012) for Sangi Street and the lowest as 19mg/lit (Summer, 2011-12) for Main street.

The DO(mg/lit) contents were found to be in the ranged between 6.1 mg/lit (Winter, 2011-12, for Cantonment Board area) to 7.9 mg/lit (Summer, 2012-13, for Main street). Whereas, COD (mg/lit) value were also noticed the highest as 10.4 mg/lit(Rainy, 2012-13, for Cantonment Board area) and the lowest as 7.2 mg/lit (Winter, 2011-12, for Raj Mohalla). However, the total coliform (MPN/100ml) were found 2 to 4 (Sangi Street and Raj Mohalla area) during rainy seasons only but faecal coliform (MPN/100ml) were found to be nil throughout the studied season of experimental period.

Analysis of groundwater quality is unavoidable because its poor quality may badly affect its users (Prasanna *et al.*, 2010). Various agencies like industrial effluents, agricultural runoff, sewage contributes several kinds of pollutants and nutrients in to the water bodies that brings about a series of changes in the physicochemical characteristics of water, which becomes the need of several investigations (Mahananda *et al.*, 2010). Whereas, water quality parameters has been assessed in Veeranna Cheruvu, Hasnapur, Mahabubnagar District, Telanagana State. It was found that the water quality parameters were within the permissible limits of standards and during the study period it has been noticed that many water quality parameters were minimum in monsoon and maximum in pre monsoon periods (Nagaraju *et al.*, 2018).

It has been reported that the lowest and highest values of the borehole and spring water samples such as pH ranged between 6.34-6.37 and 6.34-7.92, EC between 627.33-621 µmho/cm and 566.33-569 µmho/cm, Total dissolve solids between 407.67-414.33 and 355.33-351.67 mg/lit and Total suspended solids between 14.37-14.83 and 13.00-13.08 mg/lit, respectively. Total hardness (TH), both calcium and magnesium hardness in terms of calcium carbonate concentration, ranged between 63.63-66.61 and 32.44-38.76 mg/lit respectively. Whereas, the highest and lowest concentration of NO₂ were ranged between 0.11-0.12 and 0.05-0.06 mg/ lit, NO₃ between 1.10-1.89 and 2.83-8.40 mg/lit, SO₄ 2- between 26.33-33.00 and 17.00-18.33 mg/lit and PO₄ 3- between 0.21-0.30 and 0.16-0.22 mg/lit in the borehole and spring water respectively (Shigut *et al.*, 2017).

However, assessment of Water Quality Index (WQI) of groundwater in Rajkot District, Gujarat were done and noticed that the pH values ranged between 7.38-8.27 indicates that samples was changes from neutral to slightly alkaline. The TDS varied from 309-4858 mg/ lit, chloride concentration ranged from 57-2237 mg/ lit, total hardness ranged from 127 to 1582.40 mg/lit, Sulphate concentration ranged from 3-120 mg/lit and nitrate concentration in groundwater samples ranged

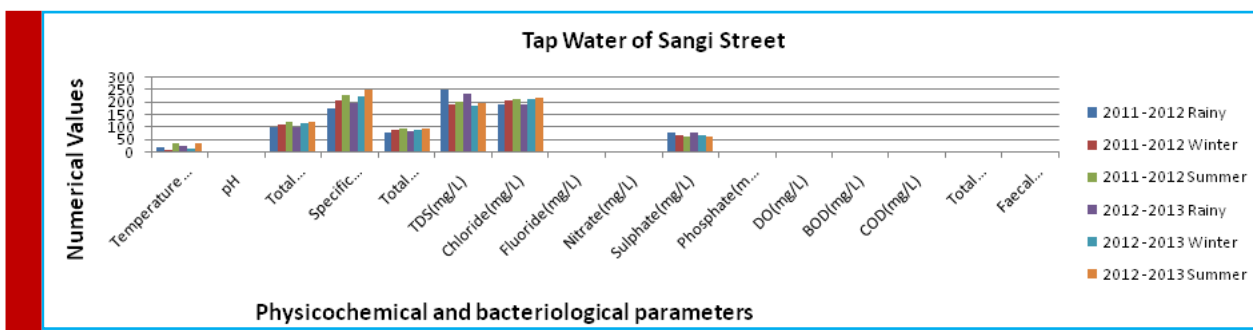


FIGURE 1. Physicochemical and bacteriological examination of Tap Water of Sangi Street during Rainy, Winter and Summer seasons (2011-2013).

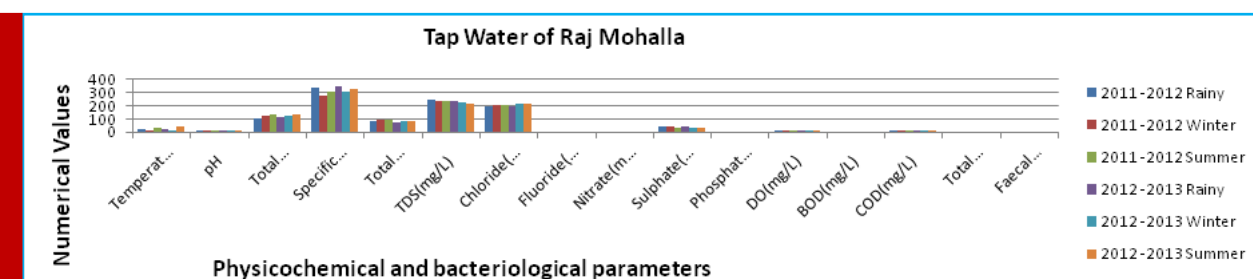


FIGURE 2. Physicochemical and bacteriological examination of Tap Water of Raj Mohalla during Rainy, Winter and Summer seasons (2011-2013).

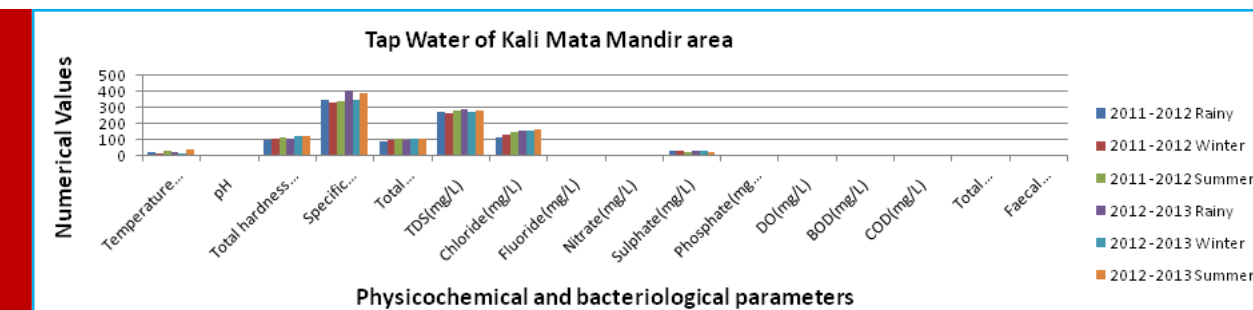


FIGURE 3. Physicochemical and bacteriological examination of Tap Water of Kali Mata Mandir area during Rainy, Winter and Summer seasons (2011-2013).

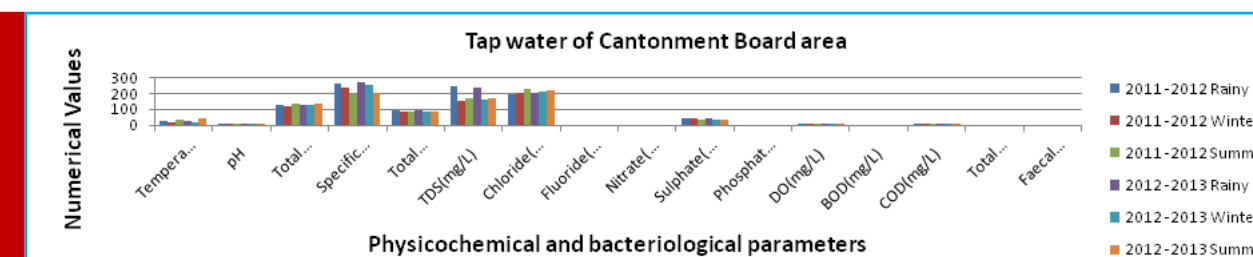


FIGURE 4. Physicochemical and bacteriological examination of Tap Water of Cantonment Board area during Rainy, Winter and Summer seasons (2011-2013).

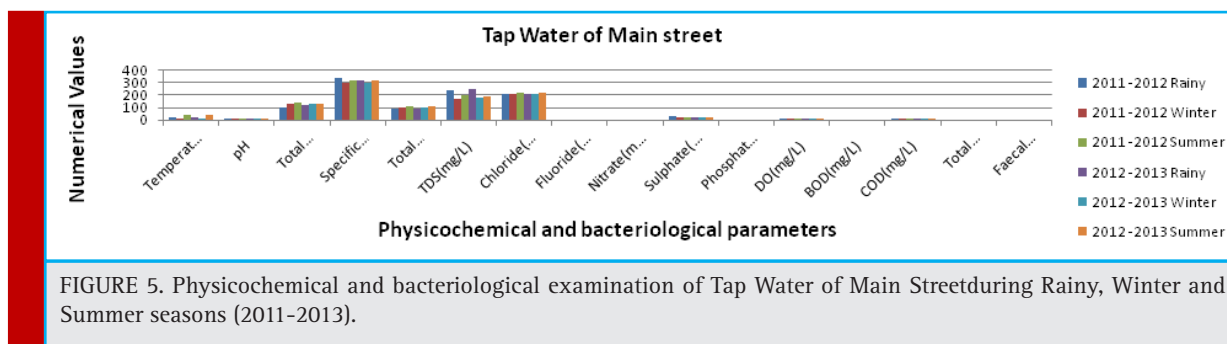


FIGURE 5. Physicochemical and bacteriological examination of Tap Water of Main Street during Rainy, Winter and Summer seasons (2011-2013).

from 1-876 mg/lit (Krishan *et al.*, 2016). Results of present investigation also in conformities with the finding of previous authors in context of studied parameters. Besides this, results of present work are also supported by several workers, (Chapolikar, and Ubale 2010; Manjappa *et al.*, 2011; Arya *et al.*, 2012; Nagarnaik and Patil, 2012; Kumar *et al.*, 2013; Chandne, 2014; Leelavathi *et al.*, 2016; Prajapati and Rokde, 2016; Behailu *et al.*, 2017; Soni and Singh, 2018).

According to WHO standard, potable water should be free of coliform bacteria (WHO, 2008) but the data from other study proves that the tube wells are commonly contaminated with faecal organisms (Luby *et al.*, 2008; Omezuruike *et al.*, 2008). It was found that out of the 454 samples, 49% (221/454) samples were contaminated with total coliform, ranges from 1.45 ± 4.15 to 10780 ± 33814 MPN/100ml and 14% (65/454) samples were contaminated with *E.coli* with concentrations ranges from 0.09 ± 0.43 to 24.95 ± 104.37 MPN/100ml and; 3% (13/454) of the samples were contaminated with *Salmonella species*, noticed as 0.06 ± 0.41 MPN/100ml during analysing the status of groundwater contamination in Rural Area, Kelantan (Idrus *et al.*, 2014). The total coliform contents of the samples ranged from zero to 16 MPN of coliform/ 100ml analysed during bacteriological assessment of selected borehole water samples in Ilorin metropolis (Agbabiaka and Sule, 2010). Whereas, the total coliform and faecal coliform were noticed in the range of 03-97 MPN/100 ml and 00-78 MPN/100 ml during microbiological analysis of groundwater of Khulais Province, Kingdom of Saudi Arabia (Saleem and Algamal, 2016).

Significant high coliform bacteria were noticed in borehole water, qualitatively correlate with levels of possible pollution in the immediate surroundings environment in some communities (Anima *et al.*, 2010). However, more or less similar patterns of total coliform (MPN/100ml) and faecal coliform (MPN/100ml) reported in present study are also in conformities with the findings of previous authors.

The present investigation can be concluded that there is a need of continuous monitoring of water quality and

also proper environment management programs should be run to control drinking water pollution.

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