



## Original Research Article

# The assessment of water quality in Bhilai with reference to microbial parameter

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## ABSTRACT

### Keywords

Water pollution,  
Bacterial flora,  
Organic pollution,  
Bhilai

Water pollution is a major problem and it is the leading worldwide cause of death and disease that account for the deaths of more than 14,000 people daily. The global contest 1000 Indian children die of diarrheal sickness every day, same 90% of China cities suffer from some degree of water pollution and nearly 500 million people lack access to safe drinking water, According to the world health organization diarrheal disease account's for an estimated U.S.I. of the total global burden of 1.8 million people every year. Most of studied parameters are beyond ISI limits of drinking water which indicate a bad sign in water quality. Also the presence of bacterial flora alerts the areas of drinking water. During the study of water sample of hand pump and well if amount of chloride higher than ISI limit's hypochloride of chlorine will indicate organic pollution. If the amount of total dissolved solid higher than ISI limit alum salt will used for water treatment. If the amount of calcium and Magnesium higher then ISI limit settlement of water for overnight is the treatment method. Red not brick placed in water used for treatment of microbial flora. Sewage disposal affects people for water related illness such as diarrhea.

## Introduction

Water is a chemical compound with the chemical formula  $H_2O$ . A water molecule contains one oxygen and two hydrogen atoms with covalent bonds. Water is a liquid at standard ambient temperature and pressure, but it often co-exists on Earth with its solid state, liquid and gaseous state.

Water is one of the most important substances on earth. All plants and animals must have water to survive. If there was no

water there would be no life on earth. Water is also essential for the healthy growth of farm crops and farm stock and is used in the manufacture of many products.

Physical impurities impart colour, taste, odor and turbidity to the water, chemical impurities cause hardness and water pollution. Excess quantities of metal and dissolved gases cause corrosion of pipes and fittings. Bacteriological impurities are due to

pathogenic bacteria which spread disease such as cholera, diarrhea and dysentery.

The most important industries which are responsible for water pollution in India are chemical and pharmaceutical, pulp and paper, sugar, distilleries, textiles, steel mills, oil refineries, etc. The arrangement for property organizing the hydrosphere in order to avoid is called water crises in future water management.

Chakraborty, 2004 had been studied water utilities in the Netherlands aim at controlling the multiplication of (micro-) organisms by distributing biologically stable water through biologically stable materials, Disinfectant residuals are absent or very low.

We all know that water is the life matter and matrix and without it life cannot exist. It gives us the evolution and functions of universe on the earth hence water is "Mother of all living world". Majority of water available on the earth is saline in nature; only small quality exists as fresh water. Fresh water has become a scare commode due to over exploitation and pollution (Ghosh *et al.*, 1968; Gupta and Shukla, 2006; Patil and Tijare, 2001; Singh and Mathur, 2005). Industrial, sewage and municipal wastes are being continuously added to water reservoirs affect physiochemical quality of water making them unfit for use of livestock and other organisms (Dwivedi and Pandey, 2002; Chaurasia and Pandey, 2007).

A major problem in urbanized areas is the collection and disposal of domestic wastes (Kolade, 1982). Because a large volume of sewage is generated in a small area, the waste cannot be adequately disposed of by

conventional septic tanks and cesspools. The intensive use of natural resources and the large production of wastes in modern society often pose a threat to ground water quality and have already resulted in many incidents of ground water contamination (Chakraborty *et al.*, 1959; Rao *et al.*, 1999, Edema *et al.*, 2001).

### **Ground water pollution**

The source of bacteria in ground water is the contaminated surface water or indigenous bacteria spread to ground water. No matter what the sources of bacteria but the bacteria and their biological processes affect the quality of our ground water. The purpose of this study is to identify pathogenic bacteria and its roles in ground water. Access to safe drinking water is indicated by the number of people using proper sanitary source (Okonko *et al.*, 2008). These improved drinking water sources include household connection, public stand pipe, borehole condition, protected dug well and protected spring and rain water collection.

Sources that don't encourage improved drinking water to the same extent as previously maintained include unprotected wells, springs, rivers and ponds (Rao *et al.*, 1999).

#### **1. Collection of Sample**

250 ml capacity Bottles were used for water collection.

- 2. Determination of colour:** 50ml water sample taken in a 150ml Erlenmeyer flask and observed against light for any colour and appearance. It was found colorless.

3. **Determination of odor:** 50ml cooled sample taken in a 150ml of Erlenmeyer flask and observed for any smell. It was found odorless.
4. **Determination of taste:** 50ml water sample taken in a 150ml of Erlenmeyer flask and observed for any taste. It was found water like taste.
5. **Determination of pH:** 50ml water sample taken in a 150ml of beaker and with the help of pH meter electrode dipped into water sample and observed for pH values.
6. **Determination of total hardness:** 50ml of sample in Erlenmeyer flask and 1ml of ammonia buffer solution and 4–5 drops of eriochrom black-T indicator was taken. Titrated with EDTA solution and observed for red wine colour changed to blue.
7. **Determination of total dissolved solid:** An evaporating dish of suitable size was taken and weighed. 50ml Sample was filtered through a filter paper and the filtrate is evaporated in evaporating dish. Evaporated sample was placed on hot water bath, when whole water is evaporated, the weight of evaporating dish was noted after cooling it in desiccators.
8. **Determination of calcium hardness:** 50ml of sample in Erlenmeyer flask was taken and sodium hydroxide solution and a pinch of murexide indicator were added to the sample. Titrated against EDTA solution and observed the pink colour changed to purple colour.
9. **Determination of total alkalinity:** 50ml of sample in Erlenmeyer flask was taken and 2–3 drops of phenolphthalein

indicator was added. Pink colour developed. This solution was titrated against sulfuric acid (2.02N) until solution becomes colourless. 2–3 drops of methyl orange indicator was added in the same flask and titrated continuously against sulfuric acid and observed the yellow colour solution changed to orange.

#### 10. **Determination of chloride**

10ml sample in an Erlenmeyer flask was taken and 5–6 drops of potassium chromate indicator was added, the colour of sample became yellow and titrated against silver nitrate solution and observed the appearance of brick red colour.

#### 11. **Determination of electrical conductivity**

50ml of sample in a beaker was taken and an electrode was dipped in to it. The calibration and changes made on the electrical conductivity was noted down with the reading on display of device.

#### 12. **Determination of total salt**

50ml of sample was taken in beaker and dipped the electrode and the change made on total salt was then noted down with the reading on display of device.

#### 13. **Streak plate method**

Streak plate method was developed by two bacteriologists, **Löffler** and **Gaffkey** in the laboratory of **Robert Koch**. It is most practical method of obtaining discrete colonies and pure culture.

#### **Determination of total coli form bacteria by multiple tube or serial dilution method**

One ml water sample was poured into sterile screw cap tube having 10ml of lactose broth and Durham's tube was placed in it in the

inverted position. Tube was incubated at 37°C for 48 hrs. After incubation, it was observed for gas production.

### Microbiological techniques

#### Determination of TBC (Total Bacterial Counts)

##### A. By pour plate technique

1ml water sample poured into sterile plate, 15ml SCDA agar was poured. After solidification plates were kept in inverted position at 37°C (35 ± 2°C) for 48 hrs. Positive plates were counted with the help of digital colony counter. Multiple tube or serial dilution method was used for total coliforms with using lactose broth at 35 + 2°C for 48 hrs.

##### B. Test for specified microorganisms

*Salmonella* – 1g or 1ml of the sample was added to 10ml of nutrient broth in a sterile screw capped jar, shaken, allowed to stand for 4 hours and shaken again to loosen the cap and incubated at 35°C–37°C for 24 hours.

##### Primary test:

10.0ml of the enrichment culture was added to each of the two tubes containing (a) 10ml of selenite F broth and (b) tetrathionate- bile- brilliant green broth and incubated at 36°C–38°C for 48 hours, from each of these two cultures subculture on at least two of the following four agar medium, four agar media: bismuth sulphite agar, brilliant green agar, desoxycholate-citrate agar and xylose-lysine desoxycholate agar was made.

##### Membrane Filtration technique:

1000ml of water sample was filtered through a Sartorius filter membrane (0.45 µm pore sized). The membrane was placed into the enrichment broth and incubated at 37°C for

18 hrs. After incubation a small inoculum was streaked on selective enriched agar plates for specific pathogens i.e. for *Staphylococcus aureus*:

A. *Staphylococcus* enrichment broth.

B. *Staphylococcus* enrichment agar plates.

Positive growth in specific medium showed the presence of pathogenic bacteria.

Dysentery may be caused by *Shigella*, *Salmonella*, *Entamoeba histolytica* and some viruses. *Shigella flexneri* and *Shigella dysenteriae* have been isolated from monkeys in captivity and from day.

### Results and Discussion

Given water samples were colourless, odourless, and tasteless. The pH was found to be higher (6.85) in hand pump water of Ruabandha village and was lower in hand pump water of Katulbod village i.e. 6.38.

The total hardness were found to be higher in sample of Risali village hand pump (372 mg/l) and lowest total hardness were found in hand pump water of Ruabandha village i.e. 220 mg/l, indicating the water is little bit hard in compound. The calcium hardness were found towards higher in hand pump water of Risali village i.e. 207.9mg/l and lower calcium hardness were found in hand pump water of Ruabandha village i.e. 37.9g/l. The total dissolved solids were found to be higher in hand pump water (342 mg/l) of Risali village and were lower in sample of Ruabandha village i.e. 191mg/l. The magnesium hardness was found to be maximum in hand pump water of Kohka village i.e. 273.3mg/l and minimum magnesium hardness was found in hand pump water of Risali village i.e. 68.1mg/l. The chloride was found towards higher side in hand pump water of Katulbod village i.e.

225mg/l and lower chloride was found in hand pump water of Kohka village 7.09mg/l indicates no organic pollution. The electrical conductivity was found to be maximum in hand pump water of Katulbod village hand pump 415 mg/l and minimum electrical conductivity was found in hand pump water of Kohka village i.e. 171mg/l. The total alkalinity were found to be high i.e. 320 mg/l in Govt. Hand pump water Katulbod village hand pump and low total alkalinity was found in well water of Risali village 80mg/l and are within limits.

High Yeast mould- 27 = Kohka village, Low Yeast Mould -19 = Risali village, High Total Coliform - 210 = Risali village, Low

Total Coliform -36 = Ruabandha village.

The *Staphylococcus aureus* in out of five samples was showed positive result in three samples and negative result in two samples. The *Salmonella* was studied in five samples and it was positive result in two samples and negative result in three samples. The total coliform was found to be maximum in hand pump sample i.e. 210 mg/l and minimum total coliform was found in hand pump sample i.e. 36 mg/l. Most of these above studied parameters are beyond ISI limits of drinking water which indicate a bad sign in water quality. Also the presence of bacterial flora alerts the areas of drinking water.

**Table.1** Physico-chemical characters of different drinking water sample in around Bhilai

S N	Parameter	Drinking water sample				I <sup>st</sup> limits	Ref. method
		A	B	C	D		
1	Colour	Colourless	Colourless	Colourless	Colourless	2	Work book of limnology A.D. Adony 1985
2	Odour	Odourless	Odourless	Odourless	Odourless	Agreeable	
3	Taste	Tasteless	Tasteless	tasteless	tasteless	tasteless	
4	pH	6.85	6.38	6.75	6.65	6.5 to 8.5	
5	Temp	20 <sup>0</sup> C	24 <sup>0</sup> C	23 <sup>0</sup> C	23 <sup>0</sup> C		

**Table.2** Physico-chemical parameter of different drinking water sample in around Bhilai

S N	Test parameter	Drinking water sample				I <sup>st</sup> limits	Ref. method
		A	B	C	D		
1	Total dissolved	191 mg/l	337 mg/l	251mg/l	342mg/l	500mg/l	1. Work book of limnology A.D. Adony 1985 2. Drinking water specification third reprint October 1996
2	Total hardness mg/l	220 mg/l	292 mg/l	322 mg/l	372 mg/l	300 mg/l	
3	Calcium hard. mg/l	37.90 mg/l	163 mg/l	38.7 mg/l	207 mg/l	75 mg/l	
4	Magnesium hard.	182.1 mg/l	128 mg/l	273 mg/l	68.1 mg/l	30 mg/l	
5	Total alkalinity mg/l	200 mg/l	320 mg/l	120 mg/l	80 mg/l	80 mg/l	
6	Chloride mg/l)	113 mg/l	255 mg/l	7.09 mg/l	42 mg/l	78.0 mg/l	
7	Elect. conductivity	271 mg/l	415 mg/l	171 mg/l	373 g/l	478 mg/l	
8	Total salt	148 mg/l	226 mg/l	260 mg/l	197mg/l	264 mg/l	

**A=** Ruabandha village, **B=** Katulbod village, **C=** Kohka village, **D=** Risali village

**Table.3** Occurrence of microbial flora in different drinking water sample

S N	Parameter	Drinking water sample				I <sup>st</sup> limits	Ref. Method
		A	B	C	D		
1	Total bacterial count	42	36	107	98	50	1. Work book of limnology A.D. Adony 1985. 2. Drinking water specification Oct. 1996
2	Yeast mould	11	12	27	19	Absent	
3	Total coli form by MPN technique	36	78	209	210	Absent	

**Table.4** Detection of pathogenic bacteria in different drinking water samples

SN	Pathogenic Bacteria	A	B	C	D	Result	
1	<i>Staphylococcus aureus</i>	-	-	+	+	Absent	Medical bacteriologs (eight ceition) by N.C. Dey & T.K. Dey 1975
		+	-	+	+		
2	<i>Salmonella</i> sp.	+	-	+	+	Absent	
		+	-	+	+		

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