

CHEMICAL AND MICROBIOLOGICAL ANALYSIS OF POTABLE WATER OF PATIALA CITY, PUNJAB

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ABSTRACT

The study pertaining to the thorough study of water, in reference to the quality in terms of sensory, physico-chemical and microbiological parameters, was undertaken in a model city "Patiala" of state Punjab, India. The results indicate that the water samples collected from the different localities and various water sources viz. municipal supply, submersible pumps and hand pumps were found satisfactory in terms of the sensory parameters except the water samples from hand pumps. Numerous water samples from various localities and sources failed in terms of their alkalinity, hardness and total dissolved solids as per the BIS specifications. Water samples collected from submersible pumps in all the areas, Model Town, Patiala city (old) and Urban Estate respectively, were having more values of TDS 850.75 ± 68.55 , 926.18 ± 62.32 and 871.85 ± 54.05 than the water samples from the other supplies and area. Although no case of potent pathogens was found. Municipal corporation supply had the poorest microbiological quality. The incidence of *coliforms* was very high.

KEY WORDS : Sensory, Physico-chemical, microbiological, potent pathogens, water.

INTRODUCTION

The use of water for drinking and other domestic purposes is generally conceded to be it's highest and most essential. The existing of ground water in India is estimated to be more than 45,000 million cubic meter (Rao, 1979). Water, in India and various Asian countries was never as unsafe as it is today due to the contamination from various sources. The inadequate water supply and poor sanitation services led to contamination of water supply through the input of sewage water into groundwater. Except municipal water from some areas and during certain periods, water from most other sources is reported to contain coliform, and in many cases faecal coliform, in amounts several magnitudes higher than any standards permit. Many samples contain heavy metals including chromium, lead, nickel and arsenic in higher amounts than permitted standards. The relationship between water quality, water availability, water accessibility, water use and incidence of diarrhoea due to these factors in an urban development in South Africa has been studied. Microbiological

indicators have been used to assess possible contamination of the water supply. Jarney-Swan (2001) studied the ubiquity of the water-borne pathogens, *Cryptosporidium* and *Giardia*. The study indicated that water-borne transmission is not the predominant route and other factors such as personal hygiene, potable water supply, sanitation and education probably have a more significant impact. Pipat *et al.* (1994) conducted testing of drinking water for microbial contamination using most probable number (MPN) technique for *coliform* estimation and observed that *coliform* contamination rate of a total of 95 samples of drinking water was 64.21%. *Coliform* were detected in 38 out of 59 samples of tap water.

Most of the water borne pathogens gain entry into water via human activities. *Salmonella* contamination of North sea water was detected during routine examinations of bathing areas. Gawthorne *et al.* (1996) observed *coliform* bacteria may not be adequate as sole indicators of recent faecal contamination. *Salmonella* spp. in particular has been found in tropical waters in the absence of traditional indicator bacteria. Pathak *et al* (1994)

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found 41-67% of water samples taken from open water sources from north and north eastern districts of India contained *coliform* and/or *faecal coliform*. Water samples in the proportion of 42-85% of different districts had unsatisfactory bacteriological quality. It has been concluded that monitoring of water sources is required. Most of the study so far lacks complete check on the quality of water therefore, the study pertaining to the detailed study of water, in reference to the quality in terms of physico-chemical and microbiological parameters, was undertaken in a model city "Patiala" of state Punjab, India.

MATERIALS AND METHODS

The water samples were collected from three different selected regions of Patiala city on the basis of population density. The samples were taken from three different sources in the regions viz. municipal supply, submersible sources and hand pump supply.

Patiala city was divided into three areas as -(i) Patiala city (old)-thickly populated, (ii) Model town and adjoining areas - moderate population density and (iii) Urban Estate-thinly populated. One hundred twenty samples were collected and analyzed from each area. This included 40 samples each from municipal supply, submersible pump and hand pump. Therefore a total of 360 samples were analyzed for the physico-chemical and microbiological parameters given in the respective tables.

The collected samples were brought to laboratory in an icebox and were analyzed for the physico-

chemical (APHA, 1989), sensory (Ranganna, 1986) and microbiological parameters (IS: 1622, 1981). Physico-chemical and sensory parameters included pH, total dissolved solids (TDS), hardness, alkalinity, suspended solids, taste and turbidity. Microbiological parameters included standard plate count (SPC), *coliforms*, *E. coli*, *Salmonella* and *Vibrio cholerae*.

RESULTS AND DISCUSSION

The results of various sensory characteristic are reported in Table 1. All the samples from municipal water supply and submersible sources, collected from Model town, Patiala city (old) and urban estate respectively were found satisfactory on the basis of sensory attributes. Most of the samples, collected from the above mentioned localities, obtained from hand pump were found unsatisfactory. They had a slightly yellowish tinge in all cases with slight turbidity and soily taste (Table 1).

Water samples from different localities were also examined for the physico-chemical attributes (Table 2). It was observed that water sample from hand pump from Patiala city (old) and some of the water samples collected from municipal supply from the Model Town, Patiala city (old) and Urban Estate respectively were showing hardness 302.75 ± 14.09 , 318.89 ± 88.03 and 271.95 ± 64.95 . Remaining samples were showing hardness more than the specified limit by the BIS standards (300 ppm). All the water samples collected from various supplies from the different localities, as given in Table 2 had more alkalinity and TDS than the specified limits. As regards, total dissolved solids (TDS), ISI (1983)

Table 1. Sensory*parameters of water collected from different sources and regions of Patiala city

Area		Appearance (Turbidity)	Taste	Suspended
Model Town	A	Clear (no turbidity)	Normal	Negligible
	B	Clear (no turbidity)	normal	Negligible
	C	Very slight yellow tinge (slightly turbid)	Slight soily	Negligible
Patiala City Old	A	Clear (no turbidity)	Normal	Negligible
	B	Clear (no turbidity)	Normal	Negligible
	C	Very slight yellow tinge (slightly turbid)	Slight soily	Negligible
Urban Estate	A	Clear (no turbidity)	Normal	Negligible
	B	Clear (no turbidity)	Normal	Negligible
	C	Very slight yellow tinge (slightly turbid)	Slight soily	Negligible

A=Municipal supply; B=Submersible; C=Hand pump

*Data reported are the average of forty samples each.

is 500 ppm for drinking water.

Water samples collected from submersible pumps in all the areas, Model Town, Patiala city (old) and Urban Estate respectively, were having more values of TDS 850.75 ± 68.55 , 926.18 ± 62.32 and 871.85 ± 54.65 than the water samples from the other supplies and area (Table 2). The observed higher total dissolved solids values in the water from submersible pumps may be attributed to higher mineral contents and the disposal of solid waste around.

Many types of epidemics and outbreaks are often associated with contaminated water supplies. Several water borne diseases due to different microorganisms are reported. Therefore, all the water samples were examined for their microbiological attributes as given in Table 3. Water samples collected from municipal supply, on an average were having high SPC count which was found 2902.50 ± 1546.77 , 2407.84 ± 1507.81 and 550.50 ± 299.01 for Model town, Patiala City (old)

and Urban Estate respectively. All the 120 samples showed presence of *coliforms* ranging from 10 to 620 MPN per 100 ml. Though, the *coliforms* count was found 210.80 ± 95.15 , 246.76 ± 163.32 and 161.58 ± 83.53 , as an average value, in the water samples from Model town, Patiala city (old) and Urban Estate respectively. Only two samples were conforming to BIS standard prescribed for drinking water (maximum bacteriological *coliforms* 10 MPN/100 ml). Interestingly no sample showed presence of pathogens such as *E. coli* type 1, *Salmonella* and *Vibrio cholerae*.

Water samples from submersible pumps offered very good results for *coliforms*. Only 18 samples out of 120 samples (15%) showed presence of *coliforms*, ranging zero to 30 MPN per 100 ml and no sample showed presence of pathogens such as *E. coli* type 1, *Sammonella* and *Vibrio cholerae* (Table 3). Water samples from the hand pumps were also found equally good in terms of bacteriological parameters. Water supply from Urban estate showed that all the

Table 2. Physico-chemical* parameters of water collected from different sources and regions of Patiala city

Area		pH	Hardness (ppm)	Alkalinity (ppm)	Total Dissolved Solids (ppm)
Model Town	A	7.82 ± 0.22	302.75 ± 14.09	298.40 ± 17.55	740.70 ± 38.01
	B	8.12 ± 0.27	667.75 ± 112.66	372.83 ± 33.25	850.75 ± 68.55
	C	7.87 ± 0.21	343.05 ± 21.38	314.3 ± 21.19	773.75 ± 41.03
Patiala City Old	A	8.04 ± 0.25	318.89 ± 88.30	321.97 ± 47.30	682.63 ± 59.92
	B	8.29 ± 0.21	597.70 ± 88.63	554.15 ± 78.40	926.18 ± 62.32
	C	8.30 ± 0.39	404.90 ± 117.19	394.80 ± 109.80	852.65 ± 36.70
Urban Estate	A	7.85 ± 0.26	271.95 ± 64.95	285.95 ± 51.30	809.25 ± 44.59
	B	7.95 ± 0.26	574.60 ± 125.46	402.50 ± 58.14	871.85 ± 54.65
	C	7.92 ± 0.23	365.20 ± 54.57	383.55 ± 42.65	808.58 ± 51.92

A= Municipal supply; B=Submersible; C=Hand pump

*Data reported are the average and \pm SD of forty samples each.

Table 3. Microbiological parameters* of water collected from different sources and regions of Patiala city.

Area		SPC/ml	Coliform MPN/100 ml	Salmonella MPN/50 ml	E. coli MPN/50 ml	Vibrio cholerae MPN/50 ml
Model Town	A	2902 ± 1546.77	210.80 ± 95.15	Absent	Absent	Absent
	B	349.00 ± 104.97	29.83 ± 20.64	Absent	Absent	Absent
	C	58.3 ± 39.08	10.57 ± 4.01	Absent	Absent	Absent
Patiala City old	A	2407.84 ± 1507.81	246.76 ± 163.32	Absent	Absent	Absent
	B	284.08 ± 165.34	27.55 ± 19.79	Absent	Absent	Absent
	C	126.15 ± 56.90	20.98 ± 7.88	Absent	Absent	Absent
Urban Estate	A	550.50 ± 299.01	161.58 ± 83.53	Absent	Absent	Absent
	B	397.53 ± 128.89	33.80 ± 24.47	Absent	Absent	Absent
	C	69.15 ± 37.79	1.41 ± 1.23	Absent	Absent	Absent

A= Municipal supply; B=Submersible sources; C=Hand pump supply

*Data reported are the average and \pm SD of forty samples each

forty samples were having *coliforms* count (1.41 ± 1.23) below than the specified level (Table 3). The samples from the other two regions viz. model town and Patiala city (old) were either according to the BIS limits or marginally higher showing better bacteriological parameters than the water samples from municipal supply and submersible pumps. The pathogens such as *E. coli* type 1, *Salmonella* and *Vibrio cholerae* were also found to be absent in all the samples from hand pumps.

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