# A Study of Drinking Water Quality in Southern Indore City, M.P.

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**Abstract:** *In the present study, the water quality of drinking water of various water samples namely tap water, boring water, well and hand pump in southern Indore city has been tested. Water samples were analyzed for various water quality parameters like pH, electrical conductance, total dissolved solids, total alkalinity, total hardness, chloride, sulphate, nitrate, fluoride, sodium, potassium, mercury, iron, copper, zinc, lead and cadmium. In the present study 23.33%, 25%, 28.33% samples of total hardness were cross the standard permissible limits as (300mg/l) during rainy, winter and summer seasons. Only 81.25%, 84.37% and 84.37% of drinking water samples for TDS crossed the permissible limit as 500 mg/l (BIS, 1998) in Rainy, winter and summer seasons respectively. In the present study the values of fluoride, nitrate and sulphate found were under the permissible limit in all the drinking water samples. None of the water samples crossed the permissible limit for heavy metals namely Copper, Cadmium, Mercury and Lead except Zinc. Only three sample crossed the permissible limit (0.5) for Zinc.*

**Keywords:** Drinking water analysis, parameters, Heavy metals and urban areas

## 1. Introduction

Water plays an indispensable role in every species that survive in this world and is required by all living organisms for their existence. Though water is a renewable resource, reckless usage and improper management water system may cause serious problems in availability and quality of water. Groundwater is the most important source of water supply for drinking, irrigation and industrial purposes. Increasing population and its necessities have lead to the deterioration of surface and sub surface water (Dhiviyaa, *et al.,* 2011). Ground water comes mainly from seepage of surface water. Urbanization and Industrialization have adversely affected quality of drinking water, therefore continuous monitoring of water quality is necessary.

Indore is regarded as the commercial capital of the Indian state of Madhya Pradesh. It is the largest city of the state, Located on the Malwa Plateau, it lies just north of the Vindhya Mountain Range. The presence of heavy metals in drinking water is of great concern because of their toxicity and threat to human life. The known fatal effects of heavy metal toxicity in drinking water include damaged or reduced mental and central nervous function.

## 2. Material and Methods

Drinking water samples were analyzed physically and chemically by Standard method of water and waste water (APHA, 1989). To assess the quality of drinking water of south Indore city, a total of 60 samples were collected from the city during 2010-2011. pH, electrical conductivity and total dissolved solids were measured by pH meter, conductivity meter and TDS meter respectively. The concentrations of Na and K were estimated by flame photometer. Spectrophotometer was used to determine by concentration of sulphate, nitrate, fluoride, iron and mercury. The concentrations of zinc, lead, copper, mercury and cadmium were estimated by Atomic Absorption Spectrophotometer.

## 3. Result and Discussions

In the present study the values of pH ranged from 7.2 to 8.6, 7.1 to 9, 7.2 to 8.4 in rainy, winter and summer seasons respectively **Table-1**. Only 1.66% (each seasons) sample crossed the permissible limit as 8.5 (WHO, 2004) in rainy, winter and summer seasons respectively. The value of Conductivity of drinking water of south Indore city, ranged from 142 µmhos/cm to 1769 µmhos/cm and 230 µmhos/cm to 1807 µmhos/cm and 250 µmhos/cm to 1811 µmhos/cm in rainy, winter and summer seasons respectively. Tatawat and Chandel (2007) reported EC (340 µmhos/cm to 1905 µmhos/cm) in Ground water of Jaipur city.TDS ranged from 128 mg/l to 1011 mg/l, 131 mg/l to 1288 mg/l and 137 mg/l to 1100 mg/l in rainy, winter and summer seasons respectively **Fig-1**. Prajapati *et al.* (2008) recorded TDS 1240 mg/l -2920 mg/l, in studies on ground water quality of Patan city, north Gujarat. Only 81.25%, 84.37% and 84.37% of drinking water samples for TDS crossed the permissible limit as 500 mg/l (BIS, 1998) in Rainy, winter and summer seasons respectively.

A high chloride contents cause cardiovascular problem. The value of Chlorides of drinking water of south Indore city, ranged from 15 mg/l to 07 mg/l and 36 mg/l to 500 mg/l and 40 mg/l to 500 mg/l, in rainy winter and summer seasons respectively. Tatawat and Chandel (2007) noted that chlorides range from 17.49 mg/l to 347.88 mg/l, in Ground water of Jaipur city. In the present study 5.55%, 6.66%, 8.33% samples of drinking water of Chloride were cross the standard permissible limits as (250mg/l) during rainy, winter and summer seasons.

The value of Total alkalinity ranged from 30 mg/l to 390 mg/l and 75 mg/l to 260 mg/l and 100 mg/l to 280 mg/l, in rainy, winter and summer seasons respectively **Fig-3** . Hasnain and Narayan (2008) recorded Total alkalinity 225mg/l to 271mg/l in ground water quality of Patna, Bihar. In the present study only 36.66%, 10%, 13.33% samples were cross the standard permissible limits as (250mg/l)

during rainy, winter and summer seasons for Total alkalinity.

The value of Total hardness ranged from 20 mg/l to 630 mg/l and 50 mg/l to 660 mg/l and 100 mg/l to 690 mg/l, in rainy winter and summer seasons respectively **Fig-2**. George and Koshu (2007) reported value of total hardness varying from 6 mg/l to 472 mg/l in water quality of well water around Chengannur of Kerala state. In the present study 23.33%, 25%, 28.33% samples were cross the standard permissible limits as (300mg/l) during rainy, winter and summer seasons respectively. The value of Calcium ranged from 10 mg/l to 160 mg/l and 25 mg/l to 200 mg/l and 30 mg/l to 150 mg/l in rainy, winter and summer seasons respectively. In the present study 71.66%, 90%, 98.33% samples were cross the standard permissible limits as (30mg/l) during rainy, winter and summer seasons.

The value of magnesium hardness of drinking water ranged from 7.3 mg/l to 114 mg/l and 13 mg/l to 111 mg/l and 15 mg/l to 135 mg/l in rainy winter and summer seasons respectively. While Fokmare and Mosuddiq (2001) recorded the higher values of Magnesium hardness (53 mg/l to 104 mg/l) in the ground water of Akola, Maharashtra. In the present study 50%, 38.33%, 46.66% samples were cross the standard permissible limits as (30mg/l) during rainy, winter and summer seasons.

In the present study the value of Sodium of drinking water of south Indore city, ranged from 6 mg/l to102 mg/l and 8 mg/l to 110 mg/l and 5 mg/l to 105 mg/l, in rainy, winter and summer seasons respectively **Fig-4** . Sodium enters in the drinking water from detergent, domestic, industries discharge mining waste and natural geological sources. In the study area the value of potassium reported from 0.0001 mg/l to 12 mg/l and 1 mg/l to 8 mg/l and 0.5 mg/l to 4 mg/l, in rainy, winter and summer seasons respectively.

The value of Nitrates ranged from 0.021 mg/l to 1.99 mg/l and 0.01 to 2 mg/l and 0.01 mg/l to 1.39 mg/l in rainy, winter and summer seasons respectively. Discharge of industrial wastes and domestic sewage tends to increase its concentration. The value of Sulphate ranged from 1.22 mg/l to 29.18 mg/l and 1 mg/l to 40 mg/l and 1 mg/l to 50 mg/l, in rainy, winter and summer seasons respectively. In the present study all samples of sulphate, Nitrate and Fluoride were under the standard permissible limits as (200 mg/l)

(BIS, 1998), (45mg/l) (BIS, 1998) and (1.5 mg/l) (WHO, 2004) respectively during rainy, winter and summer seasons. In the present study the value of Fluoride ranged from 0.001 mg/l to 0.06 mg/l and 0.001 mg/l to 0.06 mg/l, 0.001 mg/l to 0.06 mg/l in rainy, winter and summer seasons respectively. Excess of fluoride cause dental and skeletal fluorosis when potable water has crossed the excessive limit of fluoride (1.5 mg/l).

In the present study none of water samples crossed the standard permissible limit for heavy metals namely Iron (0.3 mg/l) (WHO, 2004), Zinc (0.5 mg/l) (WHO, 2004) , Lead (0.05 mg/l) (WHO, 2004) ,Cadmium (0.01 mg/l) (BIS, 1998) and Mercury (0.001 mg/l) (WHO, 2004) respectively during rainy, winter and summer seasons.

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**Table 1:** Maximum, minimum and average values of drinking water samples in Southern Indore city seasons wise

| .S.N. | Parameters | Raining season | | | Winter season | | | Summer season | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Max. | Mini. | Aver. | Max. | Mini. | Aver. | Max. | Mini. | Aver. |
| 1 | pH | 8.6 | 7.2 | 7.96 | 9 | 7.1 | 7.85 | 8.4 | 7.2 | 7.71 |
| 2 | TDS | 1011 | 128 | 558.8 | 1288 | 131 | 354.6 | 1100 | 137 | 404.1 |
| 3 | Conductivity | 1769 | 142 | 558.8 | 1807 | 230 | 618.8 | 1811 | 250 | 660.1 |
| 4 | Total hardness | 630 | 20 | 218.16 | 660 | 50 | 230.9 | 690 | 100 | 250.4 |
| 5 | Calcium hardness | 160 | 10 | 55.74 | 200 | 25 | 60.03 | 150 | 30 | 66.81 |
| 6 | Magnesium hardness | 114 | 7.3 | 39.61 | 111 | 13 | 41.70 | 135 | 15 | 44.81 |
| 7 | Total alkalinity | 390 | 30 | 180 | 260 | 75 | 161 | 280 | 100 | 172 |
| 8 | Bicarbonate | 260 | 30 | 180 | 390 | 75 | 161 | 280 | 100 | 172 |
| 9 | Chloride | 407.67 | 15 | 110.9 | 500 | 36 | 123.38 | 500 | 40 | 134.81 |
| 10 | Fluoride | 0.06 | 0.001 | 0.011 | 0.06 | 0.001 | 0.006 | 0.06 | 0.001 | 0.009 |
| 11 | Nitrate | 1.99 | 0.021 | 0.29 | 2.0 | 0.01 | 0.29 | 1.39 | 0.01 | 0.35 |
| 12 | Sulphate | 29.18 | 1.22 | 11.46 | 40 | 1.0 | 13.34 | 50 | 1.0 | 15.92 |
| 13 | Sodium | 102 | 6 | 36.15 | 110 | 8 | 41.1 | 105 | 5 | 38.15 |
| 14 | Potassium | 12 | 0.0001 | 2.1 | 8 | 1 | 1.83 | 4 | 0.5 | 1.65 |
| 15 | Iron | 0.099 | NIL | 0.72 | 0.091 | NIL | 0.044 | 0.082 | NIL | 0.051 |
| 16 | Copper | 0.0008 | NIL | 0.0004 | 0.0008 | NIL | 0.0003 | 0.0008 | NIL | 0.0002 |
| 17 | Zinc | 1.694 | 0.0001 | 0.067 | 0.0008 | 0.001 | 0.0003 | 0.0009 | 0.001 | 0.0003 |
| 18 | Lead | 0.0004 | 0.0001 | 0.0001 | 0.0003 | ND | 0.0001 | 0.0003 | ND | 0.0001 |
| 19 | Cadmium | 0.0004 | 0.0001 | 0.0002 | 0.0006 | ND | 0.0001 | 0.0005 | ND | 0.0002 |
| 20 | Mercury | 0.0004 | 0.0001 | 0.0002 | 0.0002 | ND | 0.0001 | 0.0002 | ND | 0.0001 |

* All values in mg/l except pH and Conductivity (unit-μmhos/cm)



Figure-1 TDS



Figure-2 Total Hardness

Figure-3
Total Alkalinity



Figure-4
Sodium