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Physico-Chemical Analysis Of Drinking Water Samples Of Different Regions Of Chennai.

Sunitha PG*, Abirami K, Kiruthika L, Praveen G, and Selvarathinam K.

College of Pharmacy, Madras Medical College, Chennai, Tamil Nadu, India.

ABSTRACT

Drinking water has great effect on human health. In the present study, the analysis of various drinking water samples from different regions of Chennai was carried out to determine the quality of water being consumed. The drinking water samples were analysed for different parameters like pH, Temperature, Electrical Conductivity, Total Dissolved Solids, Alkalinity, Hardness, Chloride content and Turbidity. All the measured parameters were within the standard values as laid down by the WHO.

Keywords: Water samples, Physico-chemical parameters, Total dissolved solids, Hardness, Conductivity, Standards.

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**Corresponding author*

INTRODUCTION

Water is one of the most important and most precious natural resources [1]. Water plays an important role in human life. A healthy water ecosystem is depended on the physico-chemical and biological characteristics. The increase in industrialization, urbanisation and agricultural activities has increased the pollution of water [2]. Water intended for human consumption must not contain harmful chemicals or pathogens [3]. The WHO revealed that 75% of all diseases in developing countries arise from polluted drinking water [4]. Therefore water quality concerns are often the most important component for measuring access to improve water sources. Acceptable quality shows the safety of drinking water in terms of its physical, chemical and bacteriological parameters [5]. International and local agencies have established parameters to determine biological and physiochemical quality of drinking water [6].

The problems associated with chemical constituents of drinking water arise primarily from their ability to cause adverse health affects after prolonged periods. Therefore it is necessary to check the quality of water at regular time intervals. The aim of this study is to check the collected water samples for various physico-chemical parameters to prove if they are suitable for the intended purpose.

EXPERIMENTAL

All the reagents and chemicals used were of analytical grade.

Collection of samples

Water samples were collected from various regions of Chennai. The samples were collected in polystyrene bottle of 1.5 L capacity. Before sampling, the bottles were washed thoroughly with the detergent, acid(1:1 HNO₃ and H₂O), tap water and then distilled water. Chemical parameters were determined by using standard methods immediately after taking them into the laboratory. The samples were analyzed as soon as it was possible. A total of 6 water samples were collected. The sources of sample collection are given in **Table 1**.

Table 1. Collection of water sample.

SAMPLE	REGION
1	Central Chennai
2	East Chennai
3	North Chennai
4	South Chennai
5a	West Chennai
5b	West Chennai

METHOD

Measurement of pH and temperature

The pH of all water samples was measured at the time of collection. The sample temperature was determined at the same time. The reading was taken after the indicated value remains constant for about 1 min. After each measurement, the electrode of the pH meter was washed with distilled water.

Total dissolved solids (TDS)

Solids refer to matter dissolved or suspended in water. Solids may have an effect on water quality adversely in a number of ways. The TDS of all water samples were checked at room temperature by using TDS meter. The samples were transferred into a beaker in specific volume and the TDS of each sample was noted.

Electrical conductivity

The conductivity of the samples was measured using pre-calibrated conductivity meter. Before measurement, the beaker and electrode must be washed several times with the solution under test. The samples were transferred into a beaker in enough volume and the conductivity of each sample was noted.

Total Hardness

To determine the total hardness of water samples, 50ml of each of the water samples was pipetted out into a clean conical flask. 10 ml of ammonia - ammonium chloride buffer solution and 2-3 drops of Eriochrome Black-T indicator were added, the colour of the solution turns wine red. This solution was titrated against previously standardized EDTA solution until the colour changes from wine red to blue colour which indicated the end point. The total hardness of water samples was determined in terms of mg/L of CaCO_3 .

Alkalinity

Alkalinity is a measure of hydroxide and carbonate ion content in water. Pipette out 20ml of the sample of water into a 100 ml conical flask. 2 drops of phenolphthalein indicator was added and titrated against 0.1M HCl till the colour of the solution changes from pink to colourless. Corresponding burette reading indicates the phenolphthalein end point (V1).

Again pipette out 20ml of the water sample in a conical flask, add 2 drops of methyl orange indicator. Colour of the solution becomes yellow. Continue the titration against 0.1M HCl solution till the colour changes to red. This burette reading corresponds to the methyl orange end point (V2). The total alkalinity was calculated using the following formula.

$$\text{Total Alkalinity} = \frac{V1 - V2 \times S}{V3} \times 50 \times 100$$

where,

V1=Volume of HCl consumed in ml for phenolphthalein.

V2= Volume of HCl consumed in ml for methyl orange.

S=Strength of HCl

V3=Volume of sample taken in ml.

Determination of chlorides

This test was carried out to evaluate the quantitative determination of chloride ions. 15ml of each of the water sample was taken in a conical flask. 1 ml of 5% potassium chromate indicator was added and titrated with previously standardized silver nitrate solution to brick red colour precipitate end point. The volume of titrant was noted (V1). Similarly a blank titration was done and the volume titrant was noted (V2). Finally the concentration of chloride present in the sample was calculated by using the following equation.

$$\text{Chloride ion concentration (mg/L)} = \frac{(V1 - V2) \times 35.6 \times 1000}{V_{\text{sample}}}$$

where,

V1=Volume of titrant consumed for water sample,

V2=Volume of sample for blank,

V_{sample}=Volume of sample used (ml)

Turbidity Determination

To determine the turbidity, Nepheloturbidimeter was used in this experiment.

RESULTS AND DISCUSSION

Physical parameters

Temperature and pH of water

Temperature of water samples taken at the time of collection were in the range of 24°C -25°C. The maximum permitted standard of temperature for drinking water is 25°C. The pH value of water samples collected from different regions of Chennai were in the range of 6.6 to 8.4. The standard of water quality on pH basis lies in the range of 6.5 to 8.5.

Total Dissolved Solids

The palatability of drinking water has been rated by panel of tasters in relation to its TDS level as follows : excellent - less than 300 mg/litre ; good- between 300 to 600 mg/litre; fair- between 600 to 900 mg/litre ; poor - between 900 to 1200 mg/litre and unacceptable- greater than 1200 mg/litre . Maximum TDS of drinking water samples in various regions of Chennai possessed the values of 690 while the minimum TDS value found to be 30. The results showed that the drinking water of various regions of Chennai is fit for drinking in terms of TDS.

Conductivity

The maximum value of the conductivity obtained for the drinking water sample was 1360 μ s. The minimum conductivity value obtained was 60 μ s.

Turbidity

The turbidity range set by WHO is 5 NTU .Minimum turbidity found in various regions of Chennai drinking water samples was 0.01NTU. The maximum range of turbidity reported in the study is 0.15NTU.

The results of physical parameters studied are furnished in **Table 2**.

Chemical parameters

Hardness

Hardness is most commonly expressed as milligrams of calcium carbonate equivalent per litre. Water containing calcium carbonate at concentrations below 60 mg/l is generally considered as soft ; 60-120 mg/l - moderately hard ; 120-180 mg/l- hard and more than 180 mg/l -very hard. The minimum hardness found in the present study was 5.4 mg/L and the maximum hardness was 64.8 mg/L

Chlorides

The maximum range of chloride is 26 mg/L set by WHO. No samples exceeded the barrier of WHO specifications, so the water samples considered for study are found to be suitable for domestic use.

Alkalinity

The alkalinity range set by WHO is 500 mg/ L. The minimum alkalinity was found in sample-3 (247.5 mg/L) . The maximum alkalinity was reported in sample-2 (462.5 mg/L) .

The results of chemical parameters studied are furnished in **Table 3**.

Table 2 : Results of analysis of physical parameters of water samples

S.No	Sample	pH	Temperature (°C)	Conductivity μs	TDS (mg/L)	Turbidity (NTU)
1	Sample 1	6.6	24°C	80	30	0.01
2	Sample 2	7.0	24°C	130	50	0.01
3	Sample 3	7.0	25°C	1080	520	0.15
4	Sample 4	8.4	25°C	1360	690	0.01
5	Sample 5a	7.2	25°C	940	400	0.01
6	Sample 5b	6.7	25°C	60	30	0.01

Table 2 : Results of analysis of chemical parameters of water samples

S.No	Sample	Hardness (mg/L)	Chloride content (mg/L)	Alkalinity (mg/L)
1	Sample 1	7.2	10.22	405
2	Sample 2	5.4	5.90	462.5
3	Sample 3	34.2	25.86	247.5
4	Sample 4	37.8	25.8	292.5
5	Sample 5a	27	14.54	292.5
6	Sample 5b	37.8	5.90	270

CONCLUSION

The results of water samples analysis in the present study indicate that all the samples tested are suitable for domestic use.

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