AJES ASIAN JOURNAL OF ENVIRONMENTAL SCIENCE
VOLUME 11 | ISSUE 1 | JUNE, 2016 | 45-50
DOI: 10.15740/HAS/AJES/11.1/45-50
e ISSN-0976-8947 Visit us : *www.researchjournal.co.in*

RESEARCH ARTICLE

Study on comparative analysis of tap and stored water quality

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Article Chronicle :
Received **:**
22.01.2016;
Revised **:**
24.04.2016;
Accepted **:**
05.05.2016

ABSTRACT : In the present study the quality of drinking water supplied to the area Mahewa, in Allahabad had been analyzed, through municipal pipe supply and stored water. Following parameters were analyzed to check the water quality. pH value, hardness, chloride. All the parameters analyzed were according to the Indian standard of drinking water (IS:10500) and were within the permissible limits. The study duration was April to June. Average pH, total hardness, chloride of the tap and stored water ranged from 7.40-8.13 to 7.32-8.00, 40.1-44.9mg/lit. to 41.1-42.9mg/lit.,21-24.1mg/lit. to 22.1-23.1mg/lit. These tests concluded that the water supplied to the area is fit for the drinking purposes but stored water showed a slight variation in values, which may have resulted due to unhygienic practices in the household. The study also revealed the fact that the water supplied from the pipelines is properly filtered and distributed.

HOW TO CITE THIS ARTICLE : Singh, Swati and Dwivedi, Akanksha (2016). Study on comparative analysis of tap and stored water quality. *Asian J. Environ. Sci.*,**11**(1): 45-50, **DOI: 10.15740/HAS/AJES/11.1/45-50.**

Key Words :
Water quality, IS: 10500, pH, Total hardness, Chloride

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Most human activities involve the use of water in one way or other. It may be noted that man's early habitation and civilization sprang up along the banks of rivers. Although the surface of our planet is nearly 71 per cent water, only 3 per cent of it is fresh. Of these 3 per cent about 75 per cent is tied up in glaciers and polar icebergs, 24 per cent in groundwater and 1 per cent is available in the form of fresh water in rivers, lakes and ponds suitable for human consumption (Steven *et al.*, 2012). Due to increasing industrialization on one hand and exploding population on the other, the demands of water supply have been increasing tremendously. Moreover, considerable part of this limited quality of water is polluted by sewage, industrial waste and a wide range of synthetic chemicals. Fresh water which is a precious and limited vital resource needs to be protected, conserved and used wisely by man. But unfortunately such has not been the case, as the polluted lakes, rivers and streams throughout the world testify. According to the scientists of National Environmental Engineering Research Institute, Nagpur, India, about 70 per cent of the available water in India is polluted. Safe drinking water is essential for human survival, yet it is unavailable to over 1 billion of the world's people living in poverty .

Tap water (*running water*, *city water*, *municipal water*, etc.) is potable water supplied to a tap (valve) inside the household or workplace. It is a principal component of "outdoor plumbing", which became available in suburban areas of the developed world during the last half of the 19th century, and common during the mid-20th century. It is well known that water collected from local taps are not suitable for drinking without treatment (Sheat and Doria, 2010).

Although significant advances have been made globally in the provision of community water supplies, there is increasing concerns that the health gains from investment in water supply are being compromised by the fact that water often becomes contaminated during distribution or transport to the home, and during storage and handling within the home. One of the key options for dealing with this problem is promotion of point-of-use water treatment and safe storage in the home which reduces diarrheal and other water-borne diseases in communities' households.

Experimental Methodology

pH :

The instrument was standardized with a buffer solution of pH to that of the sample.The electrodes were gently wiped and rinsed with the solution. Electrodes were immersed into the sample beaker and stirred at a constant rate to provide homogeneity and suspension of solids. Rate of the stirring should minimize the air transfer rate at the air water interface of the sample. Now the readings were taken.

Total hardness :

Standardization – 25.0 ml of solution was pippeted out of standard calcium solution in a porcelain basin and adjusted volume was 50 ml with distilled water. 1 ml buffer solution was added. After that 1 to 2 drops of indicator was added then titration was done slowly with continuous stirring until the redish tinge disappears, adding last few drops at 3 to 5 second interval. At the end point the colour that appeared was blue :

$$\text{Total hardness as}(CaCO_3), \text{mg/lit.} = \frac{100(V_1 - V_2) \times CF}{V_3}$$

where,

V_1 = volume in ml of the EDTA standard solution used in the titration for the sample,

V_2 = volume in ml of the EDTA solution used in the titration for blank,

V_3 = volume in ml of the sample taken for the test,

CF = X_1/X_2 = correction factor for standardization of EDTA

X_1 = volume in ml of standard calcium solution taken for standardization and

X_2 = volume of ml of EDTA solution used in the titration.

Chloride :

100 ml sample was used that the chloride content is less than 10 mg. 1.0 ml indicator acidifier reagent was added. For highly alkaline or acid waters, pH was adjusted to about 8 before adding indicator-acidifier reagent. 0.41 1 N mercuric nitrate was titrated to a definite purple end point. The solution turns from green blue to blue a few drops before the end point. Determine the blank by titrating 100 ml distilled water containing 10 mg of sodium bicarbonate :

$$\text{Chloride, mg/lit.} = \frac{(V_1 - V_2 \times N \times 35450)}{V_3}$$

where,

V_1 = volume in ml of silver nitrate used by the sample,

V_2 = volume in ml of silver nitrate used in the blank titration,

V_3 = volume in ml of sample taken for titration and

N = normality of silver nitrate solution.

Statistical analysis :

The experiment were conducted in Completely Randomised Design and the data recorded on average, pH, hardness, chloride, were subjected to statistical analysis of variance one way classification.

The ANOVA table for the above design appended below :

Source of variation	d.f	SS	MSS	F(cal)	F (tab, at 5%)
Treatment	t-1	Trt.SS	Trt.SS/t-1	MSST/ MSSE	-
Error	T-t	ESS	ESS/T-1		-
Total	T-1	TSS			-

d.f = Degree of freedom

F(tab) = Tabulated 'F' value

F(cal) = Calculated 'F' value

T= Total number of treatments

t = Number of treatment

SS= Sum of square

Trt.SS = Treatment sum of square

ESS= Error sum of square

TSS =Total sum of squares

MSS=Mean sum of squares

MSST= Mean sum of square due to treatments

MSSE =Mean sum of square due to error.

$$\text{C.D.}(P = 0.05) = \sqrt{\frac{2 \times MSSE}{T}} \times F(cal)$$

Experimental Findings and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

pH :

According to the study the minimum average pH in poor families was 7.40 and the maximum was found to be 7.77 in tap water and in stored water it was 7.54 and 8.13, respectively (Fig. 1). In middle class families minimum average pH was 7.32 and the maximum was 7.82 in tap water (Fig. 2) and in stored water it was 7.41 and 8.10, respectively. The pH is a measure of the intensity of acidity or alkalinity and measures the concentration of hydrogen ions in water. It has no direct adverse affect on health, however, a low value, below 4.0 will produce sour taste and higher value above 8.5 shows alkaline taste. A pH range of 6.5 – 8.5 is normally acceptable as per guidelines suggested by ISI. Stored water showed variation in pH due to unhygienic activities practiced in the houses. Similar finding were given by Raina *et al.* (2009).

Total hardness :

According to the study the minimum average hardness in poor families was 40.1 and the maximum was 45.4 in tap water and in stored water it was 44.0 and 46.6, respectively (Fig. 3). In middle class families minimum average hardness was 41.1 and the maximum was 42.8 in tap water and in stored water it was 41.6 and 42.9, respectively (Fig. 4). Based on present investigation, hardness varied from 40.2 to 45.2mg/lit. Stored water showed variation because of high alkinity as bicarbonates are the common source of alkinity.

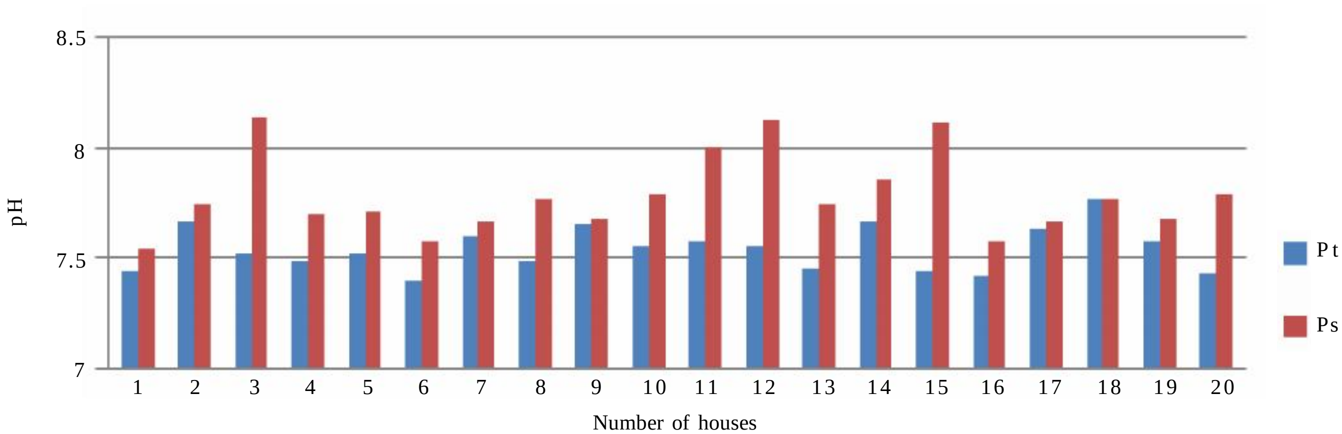

Fig. 1 : pH of the water sample collected from the poor families

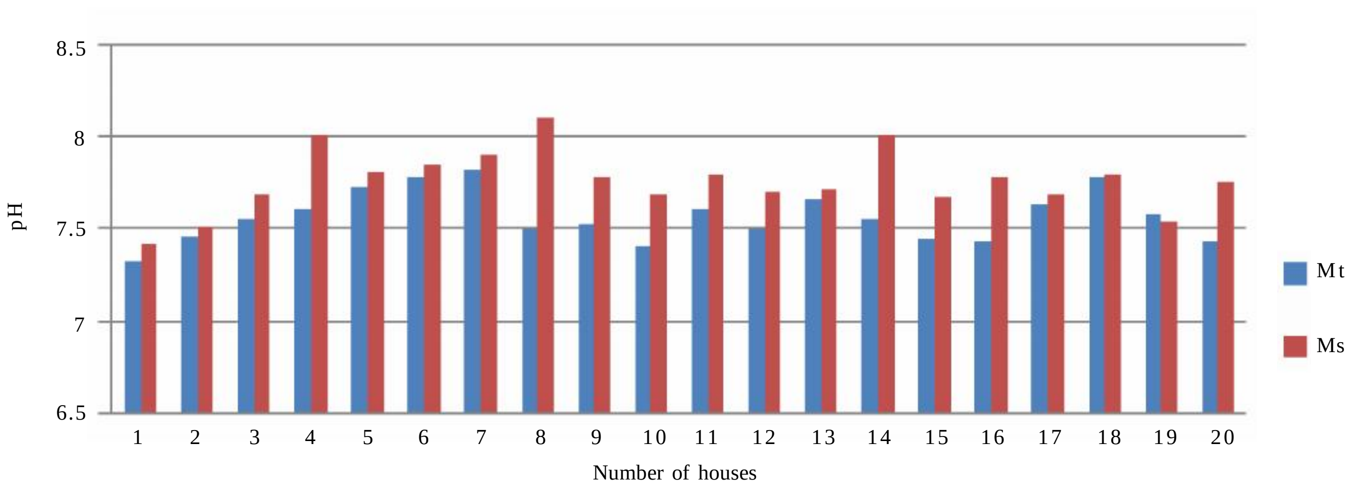

Fig. 2 : pH of the water sample collected from middle class families

Similar findings was given by Mitra (2010). However the permissible limit of Hardness for drinking water is 300 mg/lit.

Chloride :

According to the study the minimum average chloride in poor families was 21 and the maximum

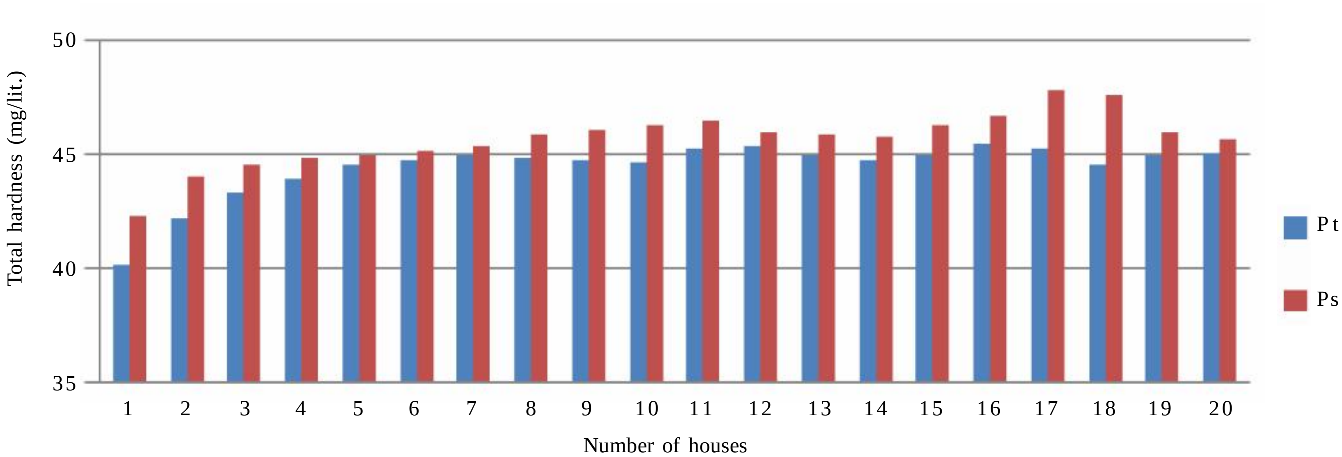

Fig. 3 : Total hardness(mg/lit.) of the water sample collected from the poor families

Fig. 4 : Total hardness(mg/lit.) of the water sample collected from the middle class families

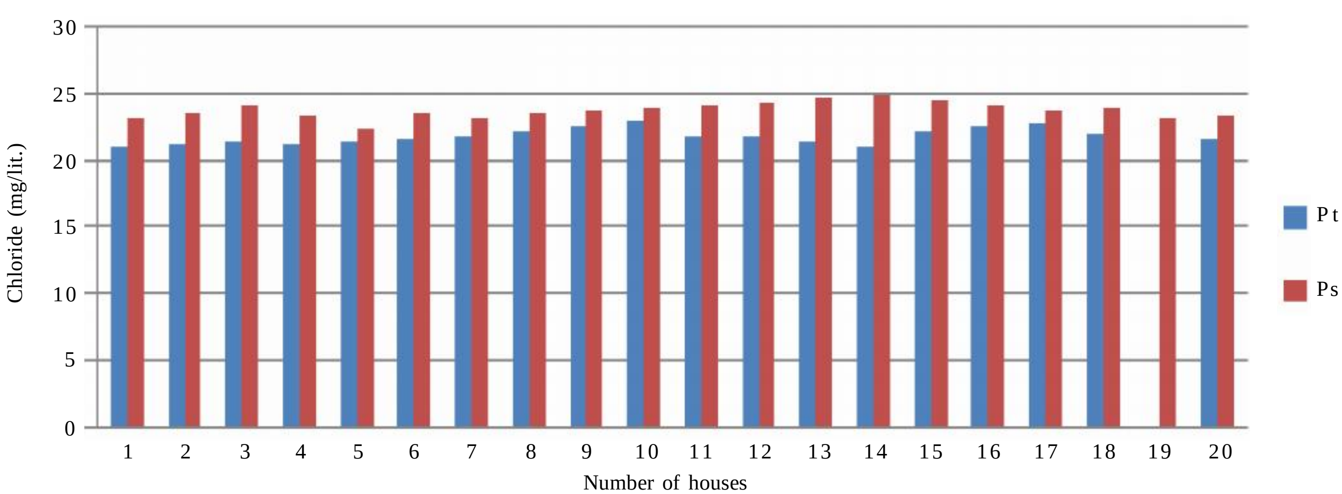

Fig. 5 : Chloride (mg/lit.) of the water sample collected from the poor families

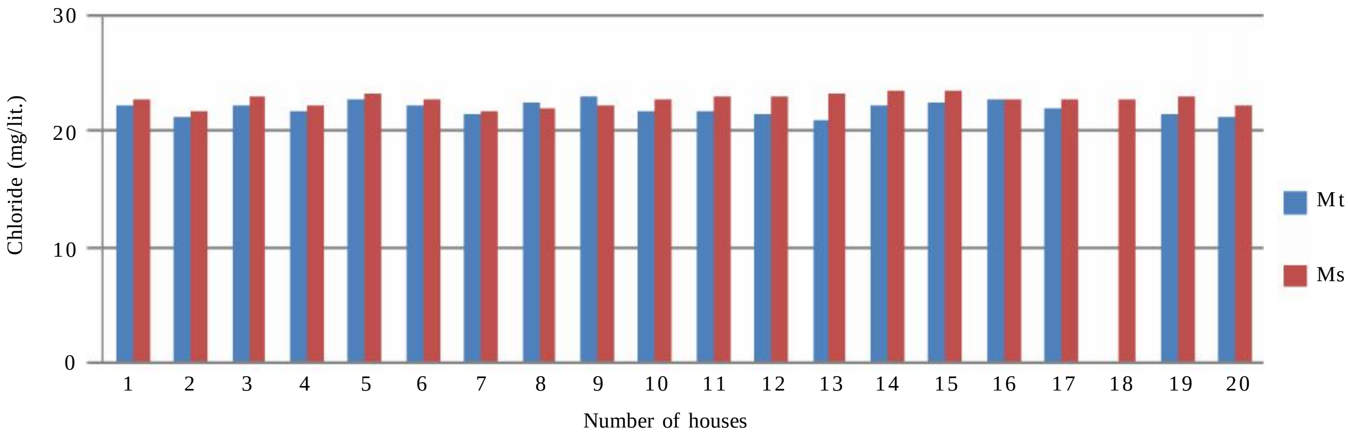

Fig. 6 : Chloride (mg/lit.) of the water sample collected from the middle class families

average was 22.9 in tap water and in stored water it was 22.3 and 23.5, respectively (Fig. 6). In middle class families minimum average alkinity was 21.2 and the maximum was 22.7 in tap water and in stored water it was 21.8 and 23.1, respectively. In the study area there is no significant change in chloride concentration Chloride which have been associated with pollution as an index are found below the permissible value set at 250 mg/lit. in most of the study area. Chloride in excess (> 250 mg/lit.) imparts a salty taste to water and people who are not accustomed to high Chlorides can be subjected to laxative effects. Similar findings were given by Sheat and Doria (2010).

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