Physiochemical, Biological Study of Harvested Rainwater Quality of Greater Noida, G. B. Nagar, U.P., A region of India

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Abstract: **Our earth is called a blue planet and 4/5 part of earth surface is covered by water, around 97 % World water quantity locked in sea/ocean, only 0.3% is available for human consumption. But today even this is getting polluted due to human activities like mining, industrialization and overpopulation growth has created acute shortage of drinking water. Rain water harvesting is one of the most ancient and easiest method that can be adopted at urban and rural level efficiently.**

The aim of this study is to investigate the possibility of using harvested rainwater as a source of drinking water without causing any health and environmental risks. This can be achieved by adopting suitable storage technique efficient and economical treatment methods.

Roof harvested rainwater samples were collected from five different places of Greater Noida, G.B. Nagar U.P., India, during September 2015. The water samples were collected from different sites and stored in containers (good grade plastic) and were analyzed periodically like chlorination, solar disinfections and use of silver nitrate and tests fro and use of silver nitrate and tests for Physiochemical and Biological parameters up to February 2016 as per IS 10500:2012.

All the above treatment methods suggested proved to be highly effective in reducing the colonies fro an initial value of around 280 to zero.

Keywords: **Physiochemical and Biological parameters, Quality parameters, harvested rainwater**

I. INTRODUCTION

Rain Water Harvesting is a technique [1- 4,11,13-17] of collection and storage of naturally available pure water through rainfall that runs off from catchments areas like roofs, pavements, roads, parks, open grounds etc. This rain water can be collected and stored as surface storage in tanks or can be recharged into the ground water. Rain water falling on roof tops and other areas and where sufficient space is not available for surface storages, is guided into sub-soil water through various techniques like Recharge pits, trenches, shafts , bore well, dug well, abandoned tube well & hand pumps, etc. Rainwater can provide clean, safe and reliable water for drinking so long as the collection system is properly constructed and maintained and analyzed appropriately for its intended use.

One third of world's population will experience severe water scarcity by the end of this century. In rural areas, the water may not be fit for drinking due to the polluted water bodies, due to contaminated ground water and also due to acute water scarcity. In urban areas, water demand increases due to increase in the population. Hence, the most effective way to obtain fresh drinking water is to harvest rainwater. Rainwater harvesting system [23] is inherently simple in form, and can often be assembled with readily available materials by owners, builders with a basic understanding of the plumbing and construction skills. Recharge of ground water through rain water is long continuous process. It is an investment for our next generation. Beside recharge of ground water, rain water harvesting benefits us in many ways like; improving the quality of ground water, reducing soil erosion as the surface runoff is reduced, choking of storm water drains and flooding of roads during monsoon is minimized.

The vision of present investigations was to overcome the scarcity of drinking water during the non – rainy seasons such that it gives easy and economical solution that can be suitable in urban as well as in rural areas.

II.EXPERIMENT

A. Sample Site and Collection:

Harvested rainwater samples were collected from the five different places of Greater Noida G.B. Nagar, U.P. India, about 42 Km from Delhi and 176 Km from Agra (U.P.), India, during September 2015. The samples were stored in good grade plastic bottles. Each sample from each site were collected for assessment of physic-chemical and biological analysis and compare with the limits for drinking water standards specified by WHO (1984) and IS 10500:2012

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B. Physiochemical Analysis:

The above rain water samples were analyzed for various physical, chemical [7-10] and microbiological parameters as per the described method in APHA[12], and each parameter was calculated by using various slandered methods[18-22]. Table 1 gives the experimental finding

Table 1
Experimental Results of Physical, Chemical & Biological Parameters

Catchment area → Properties ↓	Surajpur	Skyline Institute	BSF Society	Kasna	Dankaur
TDS (ppm)	110	116	121.4	132	127.6
Turbidity(ntu)	4.6	6.3	8.3	11.9	7.3
pH	8.2	7.2	7.4	8.4	7.2
DO(ppm)	7.3	7.6	8.1	7.7	8.4
BOD (ppm)	0.3	0.4	0.3	0.2	0.3
COD(ppm)	25	27	24	28	29
Hardness(ppm)	56	46	58	42	49
Chloride(ppm)	22.6	13.4	10.4	19.8	14.9
Alkalinity(ppm)	78	58	63	46	52
Acidity(ppm)	06	16	10	6	12

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C. Biological Analysis

All the five rain water samples were analyzed to the solar disinfection, Chlorination [27], Using Silver nitrate [5, 6], Combination of the methods.

Solar Disinfection:

In this process, temperature and ultra violet radiation provided by the Sun destroyed the microbes. Water is filled in both clean transparent and Black bottle oxygenated by shaking, followed by topping up. These bottles were placed for about seven hours in the horizontal portion and exposed to direct sunlight. Such an exposure and extended dose of solar radiation increases the temperature of water and kill the microbes of rain water samples.

Chlorination:

In this method the calculated amount of chlorine is added to one liter of water sample for a specified tune for disinfecting of water and thereafter tested for the coliform counts.

Silver Nitrate:

Silver nitrate is very small dose about 0.05 to 0.1 ppm helps in disinfecting the water. Silver nitrate in smaller dose does not impart any taste, odour and not produces any harmful effect on human body.

Combination of the above methods:

This analysis investigate the effectiveness of the treatment method's combinations were followed.

a) Chlorine + Solar disinfection
b) Silver nitrate + Solar disinfection.

Tables 2, 3 & 4 present the details of coliform counts of the above specified treatments.

Table 2
Coliform Count (At room temperature)

Sample Sites	Date of Collection	Date of experiment	Coliform Count/100ml (Average of 3 tests)	
			Chlorination	Silver Nitrate
Surajpur	10/09/15	17/01/16	0	0
Skyline Institute	12/09/15	17/01/16	0	0
BSF Society	12/09/15	17/01/16	0	0
Kasna	10/09/15	17/01/16	0	0
Dankaur	12/09/15	17/01/16	0	0

Table 3
Coliform Count (Solar disinfection using transparent bottle)

Sample Sites	Date of Collection	Date of experiment	Coliform Count/100ml		
			Transparent Bottle	Chlorination (Average of 3 tests)	Silver Nitrate
Surajpur	10/09/15	17/01/16	40	0	0
Skyline Institute	12/09/15	17/01/16	38	0	0
BSF Society	12/09/15	17/01/16	40	0	0
Kasna	10/09/15	17/01/16	35	0	0
Dankaur	12/09/15	17/01/16	28	0	0

Table 4
Coliform Count (Solar Disinfection using black painted bottle)

Sample Sites	Date of Expt. Collection	Date of experiment	Coliform Count / 100 ml (Average of 3 tests)	
			Black Bottle	Chlorination
Surajpur	10/09/15	17/01/16	2	0
Skyline Institute	12/09/15	17/01/16	2	0
BSF Society	12/09/15	09/02/16	3	0
Kasna	10/09/15	19/02/16	2	0
Dankaur	12/09/15	12/02/16	0	0

III. RESULT & DISCUSSION

Physico-chemical parameters such as TDS, Turbidity, pH, DO, BOD, COD, Hardness, alkalinity, acidity and chloride have been considered out of several parameters. ,A detailed study of Table 1 reveals that the physiochemical parameters [25,26,29]are very much within the limits for drinking water standards specified by WHO (1984) and IS 10500:2012. However, the colony counts were quite significant in all the five samples.

Therefore, it is decided to emphasize more on the microbial contaminations and suitable analysis methods [24, 28] to make the rainwater fit for drinking

Careful study of Table 2 depicts that chlorination and Silver nitrate in very small dosages are very effective even at room conditions, justifying their selection.

Detailed study of Table 3 indicates that solar disinfection using a transparent bottle is not very effective in reducing the coliform counts. However, additions of chlorine and silver nitrate have proved to be highly effective, further strengthening their selection as disinfectants.

Finally from Table 4, it can be seen that solar disinfection using a black painted bottle has yielded in a more effective disinfection, the coliform counts have very significant, reduced. The reason being that a black bottle or body absorbs more heat, which enables in destroying the bacteria. In the present study we observed that chlorination method is more effective for disinfection.

IV. CONCLUSION

In rural and urban areas, this method for collection of rainwater is very easy and economic. Harvested Rainwater samples were collected and analyzed between the month of Sep.2015 to Feb. 2016 without much changes in physical properties (colour, odour , turbidity) inspite of the fact that they were from various sources and stored in normal good grade plastic bottles. Physiochemical properties (DO, COD, BOD TDS etc.) of collected rainwater samples were very much similar to the limit of drinking water.

All the adopted methods were suggested that highly effective in reducing the microbiological contamination and also viable both at rural and urban areas. At last, we concluded that harvested rainwater and its analysis are affordable by individuals and it will be highly useful in drought prone rural as well as urban areas.

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