Harvested Rain Water for Drinking

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ABSTRACT *It is clear from the World water quantity that out of total available water, only 0.3% is available for human consumption. But today even this is getting polluted due to human activities like mining, industrialization has created acute shortage of potable drinking water. Rain water harvesting is one of the most ancient and easy methods 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 risk. 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 Bangalore during October 2005. The water samples were collected and stored in good grade plastic containers and were subjected to periodical treatments (like chlorination, solar disinfections and use of silver nitrate) and tests fro and use of silver nitrate and tests for physical chemical and Biological parameters up to May 2006 as per IS 10500:1991.

All the above treatment methods suggested proved to be highly effective in reducing the colonies from an initial value of around 300 to zero.

Introduction

For century's world has relied upon rainwater harvesting to supply water. Rainwater harvesting promotes self sufficiency and fosters an appreciation for water as a resource. It saves money, saves other resources of water, reduces erosion and storm water runoff and increases water quality.

Rainwater can provide clean, safe and reliable water for drinking so long as the collection system is properly constructed and maintained and treated appropriately for its intended use. Rainwater harvesting means capturing rain where it falls or capturing the runoff in a village or town and taking all precautions to keep it unpolluted.

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 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.

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

Sample Collection and Storage

Rainwater samples were collected from five different places of Bangalore during October 2005. The samples were stored in good grade plastic cans.

The above samples were tested for physical, chemical and microbiological parameters. Table 1 gives the experimental finding.

Table 1: Experimental Results of Physical, Chemical & Biological Parameters

Sample	Date of Expt	Turbidity NTU	pH	Do mg/l	Hardness mg/l of $CaCO_3$	Chloride mg/l	Alkalinity mg/l of $CaCO_3$	Acidity mg/l of $CaCO_3$
1. Banashankari	14/08/05	4.6	7	7.8	56	13.96	86	06
2. MSRIT	17/01/06	6.3	8.4	7.7	22	16	30	08
3. Shivajinagar	21/11/05	8.3	8.11	8	58	13.2	40	06
4. Vijayanagar	18/01/06	11.9	7	7.7	58	21.3	46	12
5. Vidyaranyapura	12/12/05	7.3	8	8.1	46	12	18	14

A detailed study of Table 1 reveals that both the physical& chemical parameters are very much within the limits for drinking water standards specified by WHO (1984) and IS 10500:1991. However, the colony counts were quite significant in all the five samples.

Therefore, it was decided to emphasize more on the microbiological contaminations and suitable treatment methods to make the rainwater fit for drinking.

Treatment methods and Results

All the five rain water samples were subjected to the following treatments.
· Solar disinfection
· Chlorination
· Using Silver nitrate
· Combination of the above method.

Solar Disinfection

Solar disinfection is a process where in microbes are destroyed through temperature and ultra violet radiation provided by the fun.

Water is filled either in a clean transparent or painted (Black) bottle oxygenated by shaking, followed by topping up. It is placed in the horizontal portion on tope exposed to direct sunlight for about sis hours. Such an exposure increases the temperature of water and also gives an extended dose of solar radiation killing the microbes.

Chlorination

Chlorination is one of the most reliable methods of disinfecting drinking water. In this method the calculated amount of chlorine is added to one litre of water sample for a specified tune and thereafter tested for the coliform counts.

Silver Nitrate

Silver nitrate is very small doses of 0.05 to 0.1 mg/l helps in disinfecting the drinking water. Silver nitrate in smaller doses does not impart any taste, odour or produces any harmful effect on human body.

Combination of the above methods

In order to investigate the effectiveness of the treatment methods following combinations were tried.
a) Chlorine + Solar disinfection
b) Silver nitrate + Solar disinfection.

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

Table 2: Coliform Count (At room temperature)

Sample	Date of Collection	Date of experiment	Coliform Count/100ml (Average of 3 tests)	
			Chlorination	Silver Nitrate
1. Banashankari	20/10/05	17/05/06	0	0
2. MSRIT	25/10/05	17/05/06	0	0
3. Shivajinagar	25/10/05	17/05/06	0	0
4. Vijayanagar	25/10/05	17/05/06	0	0
5. Vidyaranyapura	28/10/05	17/05/06	0	0

Table 3 : Coliform Count (Solar disinfection using transparent bottle)

Sample	Date of Collection	Date of Expt	Coliform count / 100ml		
			Transparent Bottle	Chlorination	Silver nitrate
			(Average of 3 tests)		
1. Banashankari	20/10/05	17/03/06	40	0	0
2. MSRIT	25/10/05	24/03/06	38	0	0
3. Shivajinagar	25/10/05	02/04/06	40	0	0
4. Vijayanagar	25/10/05	15/04/06	35	0	0
5. Vidyaranyapura	25/10/05	21/04/06	28	0	0

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

Sample	Date of Collection	Date of experiment	Coliform Count/100ml (Average of 3 tests)	
			Black Bottle	Chlorination
1. Banashankari	20/10/05	17/03/06	2	0
2. MSRIT	25/10/05	24/03/06	2	0
3. Shivajinagar	25/10/05	02/04/06	3	0
4. Vijayanagar	25/10/05	15/04/06	2	0
5. Vidyaranyapura	28/10/05	21/04/06	0	0

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, addition 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 investigations is was observed that the water temperature in the bottles recorded a temperature around 500 C. It is also very interesting of disinfection to note that the chlorination method has established its supremacy.

Conclusions

❖ Rainwater collection is easy and economical both in rural and urban areas.
❖ Rainwater harvested during Oct 2005, tested till May 2006 without much changes in physical properties like colour, odour & turbidity, inspite of the fact that they were from various sources and stored in normal food grade plastic containers.
❖ All the treatment methods suggested are highly effective in reducing the microbiological contamination and also viable both at rural and urban levels.
❖ Rainwater harvesting and its treatment is affordable by individuals and will be highly useful in drought prone areas.

Future

It is suggested that similar investigations are made on a number of samples collected from different places, stored under different conditions.

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