

Quality of Collected Rainwater in Relation to Household Water Security

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Introduction

Rainwater harvesting has gained popularity in rural areas of Sri Lanka during the last few years through number of water supply projects funded by government as well as NGO's. The greater attraction of the rainwater harvesting system is the low cost, simple design and construction technology, independence of central system, accessible and easily maintained at household.

However, whether the systems provides the households with adequate safe water is still a unanswered question. As water security is been defined as 'accessibility, reliability and timely availability of adequate safe water to satisfy basic human need' (Ariyabandu). The question is how safe is rain water?. Safety of water is measured at household level by people's perception and laboratory by absolute measurements. At household the level of acceptability is based on cultural and socio-economic standards and the quality of alternative water supply. In rural Sri Lankan families, taste plays a major role in drinking water. Drinking people still prefer to use known groundwater to unknown rainwater. Reluctance to drink rainwater collected from the rooftop thought to be a perception of water quality. Quality of rainwater collected depends on when it is collected (after the first rain), how it is stored as well as method of use.

Rainwater users

Since 1995 Community Water Supply and Sanitation project implement by Ministry of National Housing and Urban Development with World Bank assistance build more than 6000 rain water harvesting systems in Badulla and Matara district (Ariyananda). Since then the technology developed under this project has been introduced to other districts (dry zone) by various other government organisations as well as NGO's. Today estimated 6500 systems are in operation through out the country. The two technology options available are: an underground brick tank modeled after the Chinese biogas digester and a free standing ferrocement tanks of 5 m³ capacity.

While the concept and technology has become popular there s still reluctance for the people to use rain water as a drinking source. Studies has reveled (Ariyabandu) that only 10% of these householder use the collected rainwater for drinking purposes. However other householders use it for every other purposes including cooking.

Peoples perception of Rainwater

Taste plays a major role in drinking water. As rainwater do not contain any minerals and does not carry any taste it is not well accepted widely in rural Sri Lanka as means of drinking water. However, in some part of the country where the ground water is

mineralized or saline rainwater is used for drinking. These households collect water directly from the sky or use collected rainwater for drinking just after the rain. This is because debris and organic matter from badly managed roof get collected in the tank and creates a bad smell in the collected rain water due to anaerobic action or open tank breed mosquitoes after few days making the water unacceptable for drinking.

Consumption of rainwater is related to perception of quality. Most of the rain water tanks are generally not tested for water quality, therefore householders has no knowledge of true water quality only perception of water quality. General quality of rain water is measured at household level by

1. presence of leaves and other material
2. presence of mosquito larvae and other insects, rodents and frogs.
3. color
4. taste

Absolute quality of Rain water

Studies revealed rainwater collected and stored with adequate care meets the microbiological standard set by the WHO for drinking water (Heijnen, & Mansur, 1998) A survey conducted in five rain water collection locations reveal that, in general quality of rain water collected depends on the storage and management of the system.

Table 1 shows results of the survey conducted. Results shows that rain water collected meet the WHO standard for physical chemical quality except in few new tanks (Siyabaladuwa and Puttlam) the pH is little high due to cement dissolving. Conductivity, Turbidity and Hardness in all locations meet the required WHO standards.

Table 1: Survey of quality of collected water from 5 locations ins Sri Lanka

LOCATION	pH	Conductivity μ C/cm	Turbidity NTU	Hardness CaCO ₃ mg/l	F.Coliform/ 100ml
MATARA	8.2(6-9.8)	60 (10-160)	5	0-20	28 (0-2000)
BANDARAWEL LA	7.8 (7.1-11.5)	70(30-170)	5	0-20	11(0-400)
WELIMADA	8.4(10.7-7)	100 (60-160)	5	0-20	75 (1-600)
SIYABALADU WA	10.7(6.5- 11.5)	220 (110- 770)	5	0-20	0 (0-10)
PUTTLAM	9.3-9.8	10-360	5	20	5
WHO Standard	6.5-8.5	500	5	250	0

However bacteriological quality (Fecal Coliform) of rain water does not meet the WHO standard except at Siyabaladuwa where all the tanks are fitted with filters. In other places better bacterial quality water was recorded from systems fitted with filters than without filters (Figure 2).

Survey also revealed that at the start of the rainy season (November) Figure 2, F.Coliform count in the tank is high due to roof washout. This contradicts the popular concept that rain water collected during the rainy season is better quality than the stored water. However, later during the rainy season as the roof are been washed clean the bacterial quality become better.

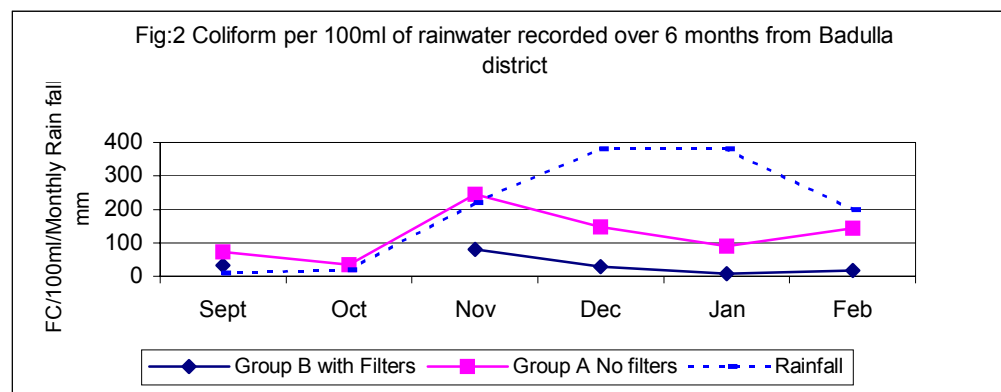


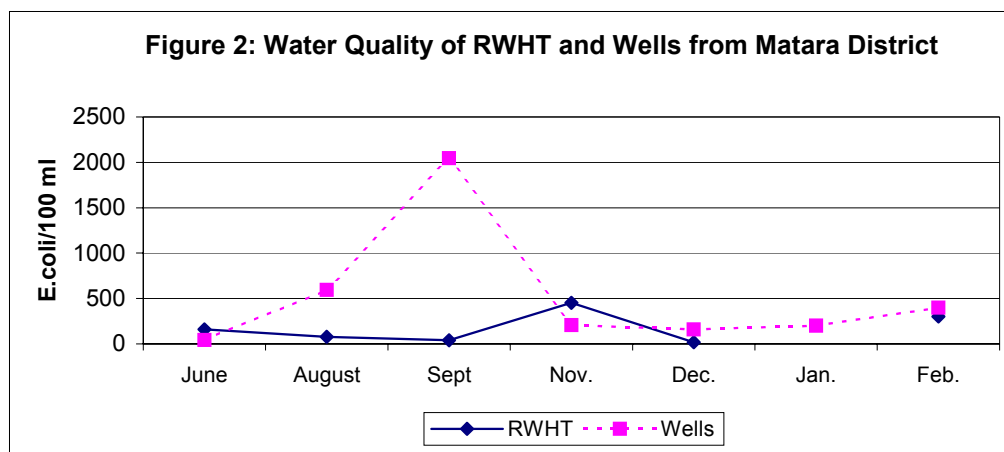
Table 2: Chemical quality of collected rainwater from Badulla district

Location	Zn (mg/l)	Cd (mg/l)	Mg (mg/l)	Al (mg/l)	Cr (mg/l)	Mn
Bandarwela	0.5556 (1.04-0)	0.027 (0.034-0.016)	0.12 (0.25-0.04)	0.37 (0.77-0.079)	0	0.0043 (0.014-0)
Welimada	0.045 (0.16-0)	0.013 (0.21-0.003)	0.19 (0.41-0.08)	0.54 (0.99-0.3)	0.0078 (0.015-0)	0
WHO standard	3	0.003	0.6	0.2	0.05	0.5

Zinc, Magnesium Chromium and Manganese levels in the rain water tanks are well below the WHO acceptable levels. However, Cadmium and Aluminum are higher than the WHO standards. Households where Aluminum was high contained GI roofs.

A comparison of Rain water with other conventional water sources

Bacterial quality of rain water collected in tanks has always been better than the conventional shallow wells in all districts sampled. In some dry zone district (Puttlam and Tangalle) hardness and conductivity in the shallow wells is higher than the recommended WHO standard. In these district people prefer to drink rainwater than the well water. In the wet zone (Bandarawella and Welimada) often in the conventional water sources water is acidic. This could be due to high agricultural activities and use of fertilizers and other chemicals in these areas.



Conclusion

Good quality rain water can be collected and stored if the rain water harvesting system is managed and operated efficiently. That is if the roof is kept clean, first flush device and filters are used and the tank is kept closed to prevent sunlight entering to from algae and mosquitoes breeding. Chemical quality of rain water is not a major concern in the rural areas except in Tin roof. People perception of quality of water rainwater need to changed through education and awareness raising. A simple, low cost water quality testing systems should be designed for the householders to monitor their own water quality.

Reference

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