
Treatment of collected Rainwater for Household Usage to facilitate Energy Conservation

Sharwar Ahmed Chowdhury¹, Sougata Banerjee², Dr. Vishwajeet Khan³

¹*M.Tech scholar, Department of Civil Engineering, University of Engineering and Management, Jaipur*

²*Research Associate, Department of Civil Engineering, University of Engineering and Management, Jaipur*

³*Associate Professor, Department of Civil Engineering, University of Engineering and Management, Jaipur*

Abstract.

Being witnessed by the alarming reduction in groundwater level it is important to store water from various sources like rain, snow, etc. and treat the collected water and purify for household usage and even drinking purpose. So, it will become a necessity in the upcoming future for the conserve and treatment of water from outsources. It can be done by adding simple machineries outside any apartment or any building or home. These machineries include outsourcing water collector attached with solar water heater and condenser unit. This can be governed under smart city management with solar energy. It will serve increasing population and may help to develop the urbanisation. So conserving water from out sources may serve a whole nation significantly and will provide to the construction of smart cities.

Keywords. Groundwater, Solar water heater, Rain water, Condenser, Conserve, Smart city

1. INTRODUCTION

Among all the classic elements in nature, water plays the vital role in human life. Nature is collateral to the chain of hydrology, and by any means any imbalance may lead to lose in fractional management of water [1]. 70% of earth crust is covered with water-body but still it is difficult to find portable water for household usages. The purest form of water is mainly rain and onto some extent snow can also be used as the form of water. So, to conserve the rain water and to use it, continuous cycle of evaporation, condensation and precipitation is required. Global warming and many more effects have caused significant decrease in water resources, in order to overcome these circumstances, it has been taken in counter to ask take forth many techniques in Rain Water Harvesting (RWH). For increased demand in water RWH is highly accepted and is mostly used as common means of economical conservation of water [2, 3]. This paper represents the conservation and

treatment of water for house hold usage in duration of natural calamities and to avoid usage of underground water frequently.

2. OBJECTIVES

- To collect rain water from out sourcing.
- Heating the collected water to make it evaporate to stick on the upper wall of the figure 2.
- The evaporated droplets will run down to the condenser chamber.
- Condensation procedure will take part and make the droplets precipitate.
- The precipitate water will be delivered to the house.
- This study aims in portraying the need for adopting RWH as a common practice in day-to-day life [4, 5].

2.1. Collection of Rainwater

A channel will be constructed from the roof of the house to the collector where the rainwater will be collected whenever rain persists. The collected rain on the roof will then be drained through the channel to the collector.

2.2 Work Approach

After the collection of rain water it is heated by the solar water heater in order to make it pure and treated to be used in household works and drinking purpose as shown in the figure 2. This heating procedure will make the collected water to evaporate onto the upper wall of the collector and the lid will open due to vapour pressure and the water droplets will slide down to the other side to the condenser chamber. Where the condensation procedure will take place and the water droplets will be condensed to precipitate. This precipitate will be supplied to the house.

2.3 Set Up Procedure

A collector unit will be set up outside the building or house which will be connected to the roof of the building by a pipe system. The collector will receive rainwater whenever it rains. Solar water heater will be set up at the bottom of the collector as per demand of the building. This solar water heater will heat the collected water to purify, the purified water will be evaporated and collected to the inside wall of the lid as shown in the figure 2, the lid is connected to the collector by hinge instrument and is extended to the condenser unit. After the evaporation process is done, due to the vapour pressure the lid will open and the water droplets will slide to the condenser unit and the condenser will make it cold and it will precipitate. The precipitate will then be supplied to the building with the help of pump. The treated water can be used for various purposes, and further can be purified by RO purifier for drinking purpose [6].

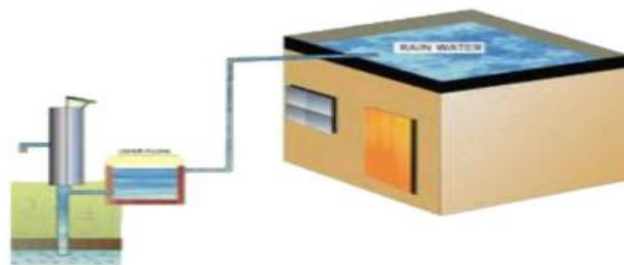


Figure 1 – Roof Top harvesting on open terrace

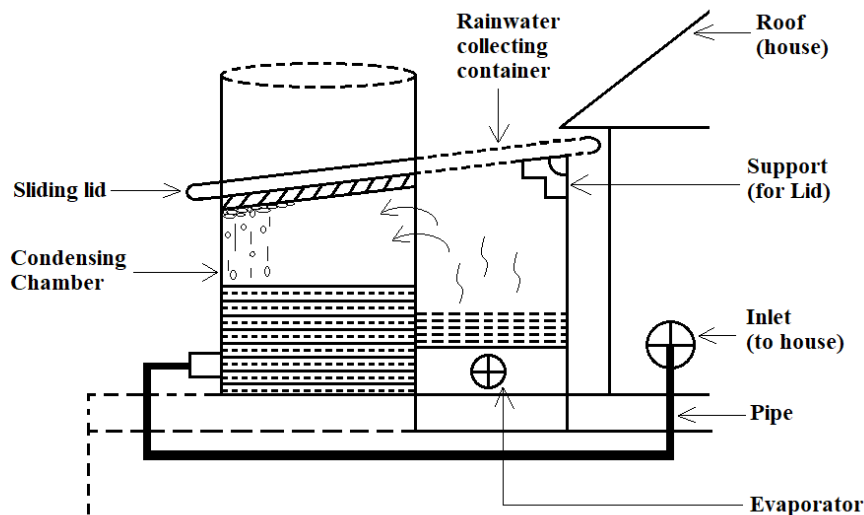


Figure 2- Schematic diagram representing collection of water in unit 'A' and being heated by solar water heater and is collected in unit 'B' and condensed to precipitate and supply to the building by pump for house hold usages.

3. RESULTS AND DISCUSSION

After reviewing and researching many papers and from day-to-day usage of the setup there are consequences with both benefits and drawbacks of the setup. So, user have to take under consideration the drawbacks and make it work or to minimise the drawbacks in order to fulfil the criterions. Table 1 shows the mentioning benefits and drawbacks.

Table 1

Benefits	Drawbacks
<ul style="list-style-type: none"> • Easy maintenance when needed. • Technology of water collection is simple. • Can serve at the time of drought. • Can also reduce the water bill. • Rise in water table. • Assists reduction in soil erosion leading to the balancing in moisture of soil 	<ul style="list-style-type: none"> • This setup may not work in the areas where there is limited or scarce rainfall. • Installation cost is very high. • In spite of easy maintenance regular supervision is mandatory. • The reservoirs should be chemical free and the growth of algae and other microbes should be inspected regularly.

4. FUTURE SCOPE

- This feature of collecting and harvesting rain water may lead to increased volume of water and on future it may be an aid to water crisis and establish a crisis free society.
- As INDIA is the second most populated country, it may soon be a water scarce country. So, harvesting and collecting water may endure an increase in demand by 30%, this can be the solution to provide the growing demand.
- Rain water harvesting will act as a sprint mode for generation of revenue with sustained implementation with the increased rainwater reserves, it may also lead to prefatory reforms and taxes can also be imposed [7].

5. CONCLUSION

This paper divulges an eloquent idea about the methods of harvesting and conservation of water by means of collector and reservoir units. After intense study on the conservation of water the best conclusion is to make major changes in the working modules leading to more emphasised and precise results. The last phase of the incarnation of RWH would be “Natural Resources are meant to be used, conserved and reused just as the hydrological cycle of precipitation and evaporation goes on.” For a developed urbanisation, enlightened future and cosmopolitan society, conservation of water is mandatory and it should be a duty and not a hobby and should be accepted in each and every country to fight in times of scarcity of water.

6. REFERENCES

- [1]. D. Pham, New Rooftop Solar Hydro Panels Harvest Drinking Water and Energy at the Same Time, Inhabitat, 2017.
- [2]. Rainwater Collection – Calculating Water Supply and Demand to Estimate Storage Needs (2011): University of Arizona Cochise County Cooperative Extension Water Wise Program.
- [3]. Rainwater Harvesting (2012): Tamil Nadu State Government India.
- [4]. KashiwarSumedh, DongarwarUsha, MondalBijoya, KunduManik (2016): An overview on the ground water recharge by rainwater harvesting. J. Energy Res. Environ. Technol., 3.
- [5]. DhanBahadurKathayat, Mahananda Joshi, SadanandaUpadhaya. Snow Harvesting – An Innovative Irrigation Method, LEISA INDIA.
- [6]. J.S. Mun, M.Y. Han, Design and operational parameters of a rooftop rainwater harvesting system: Definition, sensitivity and verification, J. Environ. Manage. 93 (1) (2012) 147–153, <https://doi.org/10.1016/j.jenvman.2011.08.024>.
- [7]. Rainwater harvesting - A review on conservation, creation & cost-effectiveness Gireesh Kumar Pala, AbhiramiPriyankaPathivada† , SasiJyothishmaHimajaVelugoti, ChandrikaYerramsetti, ShaliniVeeranki.
- [8]. M.M. Islam, S. Afrin, A.M. Redwan, M.M. Rahman (2015): Impact of Climate Change on Reliability of Rainwater Harvesting System: A Case Study in Mongla, Bangladesh. Proceedings of 10th Global Engineering, Science and Technology Conference, ISBN: 978-1-922069-69-6.

- [9]. Kathy DeBusk and William Hunt (2014): Rainwater Harvesting: A Comprehensive Review of Literature. Water Resources Research Institute of The University of North Carolina, WRI Project No. 11-12-W.
- [10]. Kathy DeBusk and William Hunt (2014): Rainwater Harvesting: A Comprehensive Review of Literature. Water Resources Research Institute of The University of North Carolina, WRI Project No. 11-12-W.
- [11]. Miguel Ángel López Zavala, Mónica José Cruz Prieto, Cristina Alejandra Rojas (2018): Rainwater harvesting as an alternative for water supply in regions with high water stress. Water Sci. Technol. Water Supply, 18 (6).
- [12]. Mohammed Thamer, MegatMohd Noor, MegatJohari, Abdul Ghazali (2006): Study on Potential Uses of Rainwater Harvesting in Urban Areas.

7. BIBLIOGRAPHY



Mr. Sharwar Ahmed Chowdhury is a M.Tech scholar in University of Engineering and Management, Jaipur. His area of research is Structural Dynamics, Material Science and Sustainability. He has also contributed some publications in his research field.



Mr. Sougata Banerjee currently working as Research Associate in University of Engineering and Management, Jaipur. He is also a M.Tech scholar. His area of research is Sustainability, Green Technologies, Building Materials and Automation in Civil Engineering. He has contributed 4 publications and 2 patents in his research field.



Dr. Vishwajeet Khan is working as an Associate Professor in the department of Civil Engineering at University of Engineering and Management Jaipur, Rajasthan, India. His research interest includes Geotechnical Engineering, Geo-environmental Engineering, and Unsaturated Soil Mechanics.