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THE HARVESTING OF RAINWATER FOR MULTISTORIZED RESIDENTIAL BUILDINGS AS AN EFFICIENT WATER SUPPLY IN SRINAGAR, J&K

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***ABSTRACT**: The Rainwater collection is prevalent in nations and regions with substantial yearly precipitation and a scarcity of clean drinking and useable water. Low-income populations all around the globe are harvesting rainwater for domestic and vital needs as a result of the current economic situation. In this study we have created a rainwater harvesting plant for multistoried buildings. This study tells us how to construct a harvesting plant and how to store the rainwater in perfect manner and also tells us what are the various physical, chemical and biological parameters that makes the water fit for domestic purposes. In this study we have mentioned both rooftop rainwater harvesting and surface rain water harvesting. The total surface area of rooftop is 7140 ft^2 , the rainwater from the rooftop is collected in the collection tank 1 through pipes and for the ist 30 minutes ,the rainwater is diverted to the percolation pit, for the first 30 minutes the rainwater may be contaminated hence can be used to recharge the ground water.*

***INDEX-TERMS:** Catchment area, Rainwater Harvesting, Physical parameters, Chemical parameters, Biological parameters, Storage Tank, Sediment mechanism, Rainwater Retention.*

1. INTRODUCTION AND BACKGROUND

Fresh water, a renewable but finite resource, is in short supply in many developing countries due to uncontrolled water withdrawals from rivers and underground aquifers. Resulting in serious environmental issues such as arsenic pollution. The quantity of water utilised in many nations has surpassed the yearly amount of regeneration, resulting in an unsustainable condition. Furthermore, rainwater run-off from roofs and other sealed surfaces during heavy rain causes cumulative floods in many nations, including India, where the drainage system was not intended to accommodate the amount of rainwater runoff. Rainwater harvesting, or the practice of collecting and utilizing precipitation from a catchment area, has been used as an alternative source of water since the dawn of civilization. Rainwater harvesting, unlike traditional water supply systems that rely on groundwater or stream flow, is entirely reliant on the availability of water from precipitation. To make it accessible for ingestion, it must first be intercepted. The amount of water that may be gathered is determined by the amount of rainfall and the catchment area's size. The usage of the roof, courtyard, and ground catchments are some of the interception techniques. The most often used method for rainwater collection is the use of a roof. Roof run-ff may complement or even replace the traditional supply source in certain circumstances. Any form of roof may be used to collect rainwater. The only sort of roof that should not be used for drinking is one with lead flashings or paint that contains lead.

Sediment Separation is the process of separating sediments.

The initial consignment of rainwater collected from the roof comprises dust, trash, bird droppings, and other particles. Before it is kept, it should be isolated from the source. For redirecting this water, there are simple, automated devices (called first flush diverters) that may be readily integrated with a rainwater collecting system. It comprises of a pipe chamber and a ball float. When the rain begins to fall, it passes through a screen and collects in the pipe chamber with any debris. The ball floats on the surface of the gathered water as the chamber fills. The ball eventually becomes trapped at the junction of the first flush device and the pipe leading to the storage tank. As a result, water is channeled to the storage tank.

Rainwater Retention

The quantity of precipitation in a catchment region determines the amount of runoff. Because rainwater harvesting is inherently intermittent, storage is an essential component of the system. Depending on the location and other variables, storage facilities may be either below or above ground. To avoid health risks and water loss due to evaporation, the cistern or tank used should be entirely cover

Rainwater collecting in urban areas

When it comes to rainwater harvesting, on the other hand, it refers to the process of collecting, storing, and using rainwater for a variety of uses, both drinkable and non-portable. Rainwater is collected from a variety of hard surfaces, including roofs and other man-made above-ground hard surfaces, to provide irrigation for crops (Rainwater Harvesting,). Typically, the three primary components of a rainwater collection system are collecting, conveyance, filters, and storage. Rainfall collecting is mostly done in two ways in metropolitan or city areas: surface runoff harvesting and rooftop rainwater collection.

(a) Collecting surface runoff

(b) Rainwater is collected from landscapes, open fields, parks, gardens, roads and pavements, driveways, and other open spaces in the environment.

c) Rainwater harvesting from rooftops.

2. PLACE OF WORK

- Rathsuna tral ,pulwama jammu and Kashmir.
- Kashmir University
- NIT Srinagar
- Govt Degree college Tral

3. OBJECTIVES OF THE STUDY

1. To study the rainwater quality as drinking purpose. 2. Rainwater harvesting and its characteristics will be defined.
3. To investigate the benefits and drawbacks of rainwater gathering.
4. To evaluate the storage of rain water condition such as microbial reaction.
5. To study the increase in water table.
6. To study the ground water features after ground water recharge by means of rain water harvesting.
7. Evaluate the impact of rain water in storage tank.
8. Health and sanitation.
9. Comparison of results with WHO standards.

4. METHODOLOGY

Recently, a number of projects and programmes have been launched to promote and construct rainwater collecting systems, both in the coastal parts of Bangladesh and in arsenic-affected areas of JAMMU AND KASHMIR. Furthermore, the nation is blessed with a plentiful supply of rain every year. Approximately 2200 mm of rain falls in Srinagar on a yearly basis, with seventy-five percent of it falling between the months of May and September but in district pulwama it is only 642 mm according to IMD Department. Using rainwater collected from the Srinagar Water Supply and Sewerage Authority (WASA), researchers have shown that it is devoid of arsenic pollution, and that the physical, chemical, and bacteriological features of harvested rainwater make it an acceptable source of drinkable water. Rainwater may be utilized for a variety of non-potable purposes in urban settings, including flushing toilets, watering gardens, and cleaning floors, all of which are common in households. While in rural regions, it becomes the primary supply of

potable water for needs such as drinking, bathing, and cooking, as well as for irrigation. Identifying

1. The amount of treatment necessary to make the water drinkable; and

2. In order to give a reason for the implementation of rainwater harvesting systems in Jammu and Kashmir, users must be able to demonstrate total savings, if any, while switching either partly or fully to water provided by rainwater harvesting systems in Srinagar.

Potentiality of RWH

Rainfall is an unexpected element that must be taken into consideration when calculating the possibilities for rainwater collection in a given location. The Indian Meteorological Department (IMD) provided average monthly rainfall data for the period 2010-2018, which was utilised in this research. The catchment area for the structures was believed to be the roofs of the buildings. In order to calculate the rainfall potential, the amount of rain that falls on certain roofs was taken into account. The amount for rainwater collection can be find out by using the formula. Where,

A =Area in sq. m

Total Rooftop area =7140 ft^2

Total surface area = 30625 ft^2

Therefore total catchment area = 37765 ft^2

R = Annual Rainfall in mm

C =Runoff Coefficient

Total potential for rainwater harvesting = 3508.48x0.9x0.642= **2252.45 m^3 /s.**

Explanation of the system

I have considered two types of rainwater harvesting systems, one is Rooftop rainwater collecting system and another is surface rainwater collecting system I,e from courtyards .

The rooftop consists of the roofs of the buildings named and having catchment area as follows:-

1. Building 1 having catchment area =1600 ft^2
2. Building 1 having catchment area =1440 ft^2
3. Building 1 having catchment area =1200 ft^2
4. Building 1 having catchment area =1850 ft^2
5. Building 1 having catchment area =1050 ft^2

The total surface area of rooftop is 7140 ft^2 , the rainwater from the rooftop is collected in the collection tank 1 through pipes and for the ist 30 minutes ,the rainwater is diverted to the percolation pit, for the first 30 minutes the rainwater may be contaminated hence can be used to recharge the ground water. On the other hand , the surface rainwater that is collected from the courtyard of the buildings is collected in the sedimentation tank in order to remove the sediments .After the sediments are removed from the rainwater then the rainwater is allowed to flow into the collection tank 2, from where the rainwater is collected in the main collection tank. As the courtyard area is of concrete finish ,hence the infiltration coefficient will be taken as 0.9. This is the full procedure that I have fallowed to collect the rainwater. After the rainwater gets stored ,the further tests were carried out to make it fit for domestic and agricultural uses.

CHEMICAL PARAMETERS

1. **pH of Rainwater Samples**

The pH value of rainwater sample during rainfall **7.5 .**

2. The pH value of rainwater sample after 30 days of storage **6.9 .**

2. **Analysis of Acidity**

1.Acidity in mg/L as CaCO3 = .**7.1 mg/l**

2.Acidity in mg/L as CaCO3 after one month of storing = .**7.67 mg/l .**

Alkalinity of Rainwater Observations:-

S.NO	VOL.OF SAMPLE (ML)	INITIAL BURRETE READING	FINAL BURRETE READING	DAYS AFTER RAINFALL	DIFFERENCE
1	20	38.6	38	1	0.6
2	20	39.5	38.7	1	0.8
3	20	40.3	39.50	1	0.8
4	20	39.3	40.20	30	0.9
5	20	38.3	39.30	30	1.0
6	20	37.45	38.30	30	0.85

Result:-
During rainfall:-
a. Phenolphthalein alkalinity of rainwater sample **0 .**

b. Total alkalinity of rainwater sample **36.67 .**

After one month of storing:-

a. Phenolphthalein alkalinity of rainwater sample **000.**
b. Total alkalinity of rainwater sample **45.83**

4. Analysis of rainwater sample for hardness

Protocol:-

1. Take a known sample of rainwater say 20 ml in a clean flask.
2. Add 2 drops of buffer solution to maintain ph .
3. Add 2 to 3 drops of EBT indicator
4. Titrate against EDTA-0.01N till color changes from wine red to blue
5. Note down the volume of titrant (ml).
6. Repeat the protocol

Observation table:-

Details of parameter	Vol. of sample (ml)	Initial reading	Final reading	Vol .of EDTA (Ml)	Testing frequency
Total hardness	20	10.2	11.10	0.90	After 1 day
		11.20	12.20	1.0	
		5.2	7.10	1.90	After 30 days
		7.10	9.10	2.0	
Calcium hardness	20	7	7.5	0.5	After 1 day
		8.2	8.85	0.65	
		0	1.4	1.4	After 30 days
		1.4	2.75	1.35	

Results:-

Total hardness as $CaCo_3$ (mg/l) after one day of rainfall = **47.5**

Calcium hardness as $CaCo_3$ after one day of rainfall = 28.75

Total hardness as $CaCo_3$ **(**mg/l) after one month of storage = **97.00**

Calcium hardness as $CaCo_3$ after one month of storage = **68.75**

Magnesium hardness after one day of rainfall (mg/l) = **18.75**

Magnesium hardness after one month of storage (mg /l) = 28.25

5. Analysis of Rainwater Sample for Chlorides

Adding silver nitrate solution to chloride-rich water precipitates out the chlorides as white silver chloride, which is poisonous. Chromium is supplied to the system through potassium chromate, which is used as an indication. Until a reddish brown silver chromate precipitate is formed, it is necessary to reduce the chloride ion concentration to the point where the maximum concentration of chloride ions is achieved.

Observation

Description	Trail No	Burette Reading		Volume of silver Nitrate(ML)	Chloride in mg/L
		Initial	Final		
During rainfall	A	5.0	12.20	7.20	179.94
	B	17.20	24.20	7.00	174.94
	C	24.20	31.40	7.20	180.00
After one month	A	0	8.2	8.20	204.94
	B	14.10	22.20	8.10	202.44
	C	22.20	30.20	8.00	200.00

Result:-

1. The chloride content in rainwater sample = **178.29 mg/l**

2. The chloride concentration in rainwater specimen after just month of storage= **202.46 mg/l**

PHYSICAL PRAMETERS

1. Suspended solids

(a) Dissolved solids = **440 mg/l**

(b) Suspended solids = **400 mg/l**

2.Turbidity

1. The Turbidity of the rain water Sample after one day of rainfall = **0.02NTU**

2. The Turbidity of the rain water Sample after one month of storage = **0.08NTU**

3. Color

The word "color" refers to the real color of water that has had the turbidity removed. The true color of water comes from dissolved matter, whereas the apparent color comes from suspended matter and compounds in solution

Results:-

1. The color of the rainwater sample after one day of rainfall = **3 TCU**
2. The color of the rainwater sample after one month of storage = **4.5 TCU**

4. Temperature

Results:-

1. The temperature of the rainwater sample after one day of rainfall = **15° C**
2. The temperature of rainwater sample after one month of storage = **15° C**

BIOLOGICAL PARAMETER

1. Dissolved Oxygen Observation:-

Days of testing	Vol of sample (ml)	Initial burette reading	Final burette reading	Vol of $Na_2S_2O_3$
1 day after rainfall	203	2.2	7.0	5.5
	203	0.0	4.5	4.5
30 days after storage	203	0.0	5.5	5.5
	203	5.5	12.10	6.6

Results:-

1. The DO content of given rainwater sample after 1 day of rainfall =**4.92 mg/l**
2. The DO content of given rainwater sample after 1 month of storage =**5.96 mg/l**

5. CONCLUSIONS

Rainwater harvesting is basically collecting rainwater off surfaces and storing it for later use. Rooftop rainwater gathering is one approach. Rainwater harvesting is safe for the environment and its consumers. If purified, it may become an important supply of drinking water. Rainwater harvesting would be a gift for cities like INDIA where millions of people struggle daily to acquire clean drinking water. Rainwater collection might also help. Existing generation may help future generation live by utilising rainwater.This study focused on water purification using laboratory tests for chemical, mineral, and microbiological factors. There will be three types of water quality tests in the lab. It's

(1) Rainwater chemistry

(2) Mineral composition of rainwater

(3) Rainwater microbiology.

(4)All outcomes are safe according to INDIA and WHO standards.

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