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# RAINWATER HARVESTING SYSTEM BY USING BAMBOO TECHNOLOGY

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**ABSTRACT:-** The great challenge for the coming decades will be the task of scarcity of water. We know water scarcity is growing rapidly now a days due to increase in population. In our project we used eco friendly material i.e bamboo for the construction of roof to collect and conserve rain water . In this project we tried to make bamboo roof in most economical way. The amount of water saved is calculated. Also design of filtration system is workout. Flexural strength test, moisture content test as well as water absorption test has performed. Conclusion is drawn from experimental project that such bamboo roof can be used specially in rural areas in very economical way.

**KEYWORDS:-** Rainwater harvesting, bamboo, sustainable development, economy

## I. INTRODUCTION

Water is one of the most precious source on Earth. As we know about 71% of Earth surface is covered by water on which only 3% is covered with fresh water. Due to rapidly increase in population demand of fresh water increases. The main factor that contributes to water issues includes poor management of resource, Lack of government attention and manmade waste. Our paper deals with roof top rain water harvesting by using Natural resources i.e., Bamboo. As per world organization prospect, India is expected to add nearly 273 million people between 2019 to 2050. Our technique can become one of the solutions for solving or reducing problem of water scarcity. From our research it has found that more than163 million people in India do not have access to clean water, the highest in the world. The main objective of our project is to harvest rain water by using naturally available resource like bamboo. Bamboos are easily and naturally occurring material. On a conservative estimate the forest area with bamboo in India is about 9.57 million hector which is nearly 12.8% of total forest area. This project is done specially for rural areas, villages where bamboo can be available free of cost. Bamboo has higher tensile strength than most grade of steel. In our project amount of water saved is calculated for B-building of our campus. We had also designed filtration system. Flexural strength test, moisture content test as well as water absorption test has performed.

### 1.1 Site of construction:

Proposed site of construction is in B buiding of priyadarshini J.L college of engineering, Nagpur. Construction of rain water harvesting system in construction of rainwater harvesting system from the very beginning we started collecting material,cutting of bamboo,making bamboo surface plane for water passage,tying of bamboo,drilling of bamboo, rapid sand filter,

Step1: Collection of material
material required are bamboo,Binding wire.
1)first we started collecting bamboos each of length 24 feets.
2)binding wire almost half kg.
Step2: cutting of bamboo:
Step 3: Making bamboo surface plane for freely passage of water

**Fig 1- smooth passage for water**

**Fig 2- arrangment of bamboo for roof**

Step 4 : Drilling of bamboo for binding:
Step 5: Tying of bamboo for construction of roof.
Step 6 : Construction of water passage system
Step 7: Construction of rapid sand filter
Step 8: Tank for storage

## II. MATERIAL USED:

### Bamboo: The Green Gold and Rainwater Harvesting

Bamboo is a fast growing, versatile woody grass found across the country. It is an economic resource with an immense potential for improving the quality of life of rural and urban communities through environment regeneration qualities like carbon sequestering. Bamboo provides raw material for large industries like paper and pulp as well as for cottage and handicrafts industries Some bamboo species can grow one meter in a day.

**Fig 3- Eco friendly material i.e. bamboo**

**Binding wire:** Binding wires are mild steel wires used for the purpose of tying a bamboo alternately for making a roof in our model.

## III. METHODOLOGY

**3.1 Construction of material-**We are using eco-friendly construction material and that minimize the environmental impact.

**3.2 Suitability of material-** There are some Properties of bamboo:

1. Bamboo is a sustainable material since it grows quickly.
2. It can reforest much more promptly and grows throughout the World.
3. Bamboo with low moisture content has higher compressive strength than bamboo with high moisture content.

**3.3 Construction of roof, drainage system and filter media-**

We are constructing a bamboo roof for water harvesting and drainage is provided to allow the water to flow and drop into the sump.Generally, roofs in tropical climates need to be sloped or pitch for the certain angle. any roof needs to be first tilted at a certain angle without waterproofing layer.

**Fig 4- Sample of bamboo roof**

**Fig 5- Construction of bamboo roof**

The large overhang of the roof helps direct the rain water away from the earthen walls into the water drainage system. The whole property has been shaped so the rain water will flow downward into the drainage or water tank which is also made by bamboo material.

**3.4 Total quantity of rainwater harvest of B building-**

Quantity of water harvest =Roof surface area × average annual rainfall in Vidharbha region

$= 1060(m^2) \times 732mm$

$= 1060m^2 \times (732 \times 10^{-3})\ m$

$= 775.92m^3$

Considering 10% water as waste water.

Therefore, Quantity of water harvested = $698.32m^3$

**3.5 Cost estimate and result analysis-**

We are comparing the economical material that is bamboo roof with steel sheets roof and analyze the result.

**3.6 Testing of material-**

We are doing flexural strength test on bamboo to know the bending or flexural strength. We will be make the conclusion that bamboo roof is economical as compared to other roof and it is easily available since it is naturally occurring material therefore it is easily accessible for people of remote areas.

## IV. TESTING ON BAMBOO

1. flexural strength test
2. moisture content test

### 4.1 flexural strength test- According to IS code 2408-1963

**(Methods of static test of timber in structural sizes)**

The bed of the testing machine shall be provided with two steel rollers, 38 mm in diameter, on which the specimen is to be supported, and these rollers shall be so mounted that the distance from centre to centre is 60 cm for 15.0 cm specimens. The load shall be applied through two similar rollers mounted at the third points of the supporting span. The load shall be divided equally between the two loading rollers, and all rollers shall be mounted in such a manner that the load is applied axially and without subjecting the specimen to any torsion stresses or restraints.

**Fig 5- Flexural strength test on sample 1**

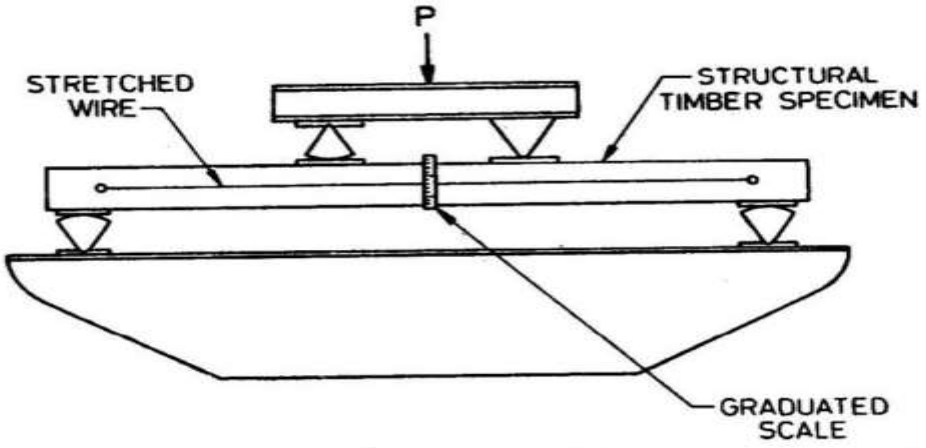
**Fig6. Flexural strength test on sample 2**

Formula for flexural strength ($F_b$) = $pl/bd^2$

$F_b$= Flexural strength
b = Width of bamboo in m.
d = Failure point depth in m.
p = Max load applied to the bamboo in KN.
a = distance between the line of fracture and nearest support.

Results

| Sr no. | Description | Results |
|---|---|---|
| 1 | Weight of one cutting bamboo | 1.04 Kg |
| 2 | Weight of roof | 54.08 Kg |
| 3 | Maximum Load taken by sample in two point loading test | 5KN |
| 4 | Modulus of rupture calculated ($F_b$) | 238.09KN/$m^2$ |
| 5 | Maximum capacity of flexural strength machine | 100KN |




2A Diagrammatic Sketch Showing the Method of Conducting Static Bending Test of Timber in Structural Sizes

**Fig 6. Simply supported two point load experimental setup**

**4.2 moisture content test**

For determining the moisture content test, the dimensions of the specimens shall be measured and all the three specimens of bamboo cut in 2.5 cm sizes. The weight of each specimen should be measured before immersing in water. After that the bamboo specimen will be immersed in water for 24 hrs and we obtain the results are

a) Moisture content of Peripheral zone ($M_p$) = (moisture content after 24 hrs - dry bamboo)

Mp = (19 - 13) = 6 gm

b) Moisture content of Intermediate zone ($M_i$) = (20 – 14) =6 gm

c) Moisture content of core zone ($M_c$) = (21 – 14) =7 gm

d) Average moisture content of zone ($M_s$) $= \frac{(mp+mi+mc)}{3}$

$= \frac{6+6+7}{3}$

Ms = 6.33 gm

Consider 10% wastage (Ms) = 5.697 gm

## V. FILTER MEDIA

**5.1 Rapid Sand Filter**

The rapid sand filter or rapid gravity filter is a type of filter used in water purification and its rate of filtration is 4000-6000 lit/hr/$m^2$**.** It requires small area for installation and it is economical. In this rapid sand filter we use four different layers that is fine sand, coarse sand, fine gravel and coarse gravel. We are installing rapid sand filter in our college campus.

Desirable characteristics for filter media are as Follows

- good hydraulic characteristics (permeable);
- It does not react with substances in the water.

- hard and durable;
- free of impurities
- Insoluble in water.

**Table 1: Filter media characteristics**

| material | Size range(mm) | Thickness(m) |
|---|---|---|
| Fine Sand | 0.63-0.85 | 0.7 |
| Coarse Sand | 1.18-2.8 | 0.1 |
| fine Gravel | 2.36-4.75 | 0.1 |
| Coarse gravel | 6.7-13.2 | 0.15 |

**Table2: Dimensions of filter media**

| Sr no | Filter Media | Dimension |
|---|---|---|
| 1 | Length of filter media | 1 m |
| 2 | Breadth of filter media | 0.63 m |
| 3 | Area of filter media | $0.63m^2$ |
| 4 | Depth of filter media | 0.50 m |

## VI. CONCLUSION

This study evaluates the quantity of rain water harvesting using bamboo roof. It was found that the amount of harvested and stored rain water could be utilized in rainy season as well as summer season. Roof rain water harvesting technology does not have any harmful effect on environment. This technology can be easily used to install. In rural areas it can be easily implemented in very economical and quick manner. Bamboo can be easily available in free of cost in villages. Rain water can be continuous source of water supply for rural and poor areas.

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