

Light Weight Brick from Sugar Cane Bagasse

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Abstract- Utilization of industrial and agricultural waste product has gained importance in research field, for economic and environmental and technical reason. Sugarcane bagasse is a fibrous waste product of the sugar refining industries huge quantity of bagasse which is waste product, available in a very negligible rate and also in abundance. In this paper a comparative study on various bricks prepared using clay, cement and sugarcane bagasse with lime and some chemicals. Also this paper is about reuse of industrial waste for manufacturing of bricks. As we have visited several industries and sugar factories in our locality. Throughout this survey, we have found that some percentage of waste bagasse is used to make paper and pulp etc, but remaining waste dumped in open areas and landfill. By observing this waste, we decided to utilize this in most effective manner.

Index Terms: Sugarcane bagasse, lime, chemicals (sodium hydroxide (NaOH), Sodium silicate (Na₂SiO₃)), Bricks, Building material etc.

I. INTRODUCTION

Bagasse is a fibrous matter that remains after sugarcane stalks are crushed to extract their juice. It is currently used as a biofuel and in the manufacturing of pulp and paper product and building materials.

For each 10 ton of sugarcane crushed, a sugar factory produces nearly 3 ton of wet bagasse, since bagasse is a by-product of the sugarcane industries, the quantity of production in each country, is in line with the quantity of sugarcane produced. A brick is a building material used to make walls, pavement, and other element in masonry construction, Brick is the one of the most common masonry units as a building material due to its properties.

II. CHEMICALS

1. Sodium silicate (Na₂SiO₃):-

Sodium silicate is a colorless, viscous solution of silica in sodium hydroxide. It is also known as water glass or soluble glasses is used in many applications, including soap and detergents, cement, binders and adhesive, water coating, fire proofing material.

2. Sodium Hydroxide (NaOH):-

It absorbs moisture from the air, it is stable towards heat and highly soluble in water

3. Lime:-

Calcium oxide (formula: CaO), commonly known as quicklime or burnt lime, is a widely used chemical compound. It is a white, caustic, alkaline, crystalline solid at room temperature. Its Soluble in water & Glycerol, Density of lime is 3.34 g/cm³. It is used for medicinal purpose & insecticides. Its application is manufacturing of cement, paper & High grade Steel lime is used as a reagent in laboratories for hydration precipitation Reaction etc.

4. Synthetic resin adhesive :-

Synthetic Resin Adhesive is a type of adhesive that can be used in construction material.

III. METHODOLOGY:-

1. TOPIC SEARCH:-

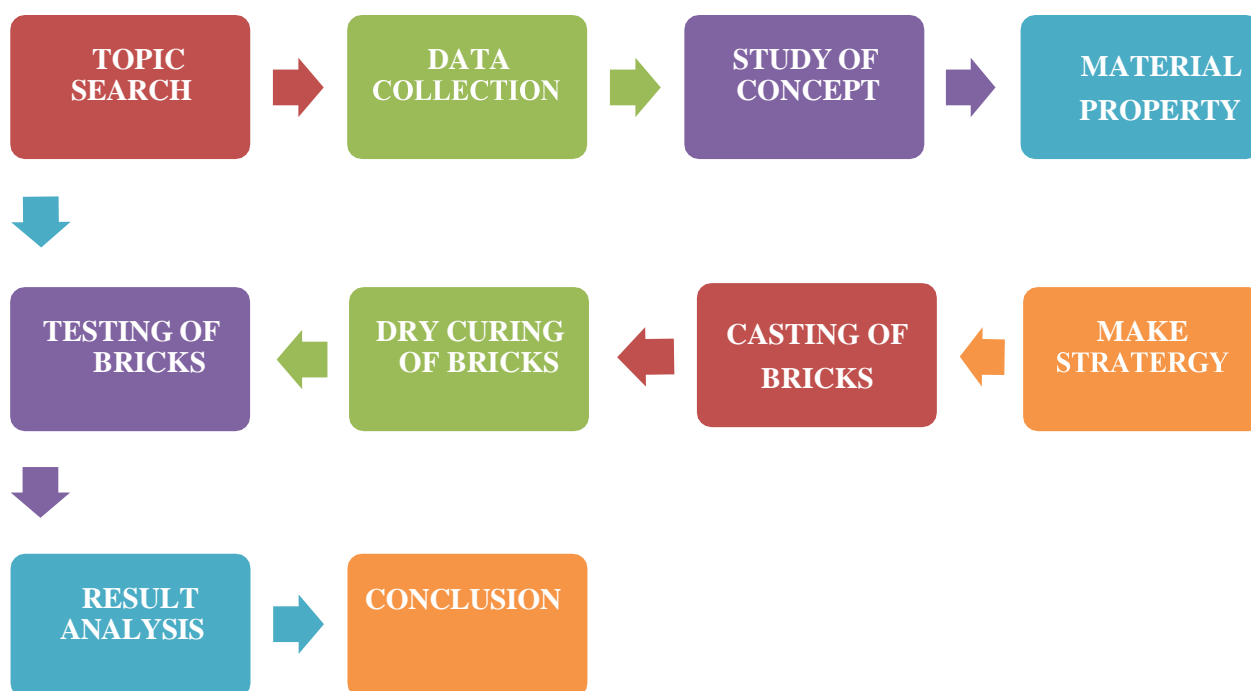
Being a civil engineering student, we were interested to find such a topic which will be beneficial to the construction industry. As well as common people. As bricks are very important construction material that's why we decided to make bricks from sugarcane bagasse which has cheaper rate and a purpose for economical to the common people. So we finalized this topic to research and implementation.



Fig: 1: Some glimpses of brick casting & testing

2. DATA COLLECTION:-

As sugarcane bagasse is a searchable topic we have gone through various research papers, initially we collected all the required data from various books and other sources.



3. STUDY OF CONCEPT:-

The conceptual phase is the initial phase of research and involves the intellectual process of developing a research idea into a realistic and research design.

4. CASTING OF BRICKS:-

As casting is the major part of this project in this stage. We had given our maximum input to get the desired output. We had cast various bricks by changing the proportion of chemicals, lime, and Synthetic Resin Adhesive.

5. TESTING OF BRICKS:-

After casting, testing is necessary to check the quality of product.

IV. RESULTS & CALCULATIONS:

Table1 : Market Prices of Used Materials

Material	Unit price (₹/kg)	Unit Price (₹/gm)
Baggase (gm)	5	0.005
Sodium Silicate (gm)	34	0.034
Sodium Hydroxide (gm)	36	0.036
Lime (gm)	2	0.002
Synthetic Resin Adhesive (gm)	100	0.1
Cement (gm)	7	0.007

Table : 2: Material proportion Details of Each trial made

Material	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15
Casting Date	02/03/2024	04/03/2024	05/03/2024	06/03/2024	09/03/2024	11/03/2024	12/03/2024	02/04/2024	04/04/2024	04/04/2024	05/04/2024	12/04/2024	12/04/2024	13/04/2024	15/04/2024
Demould Date	02/03/2024	05/03/2024	06/03/2024	07/03/2024	10/03/2024	12/03/2024	13/03/2024	04/04/2024	05/04/2024	05/04/2024	06/04/2024	13/04/2024	13/04/2024	15/04/2024	16/04/2024
Baggase (gm)	600	700	1000	500	500	400	300	600	250	500	200	300	200	500	1000
Sodium Silicate (gm)	420	500	500		500					350	100	150		500	400
Sodium Hydroxide (gm)	420	500	500		500					350	100	150		500	400
Lime (gm)	600	600	1500	1000	500					500	180	200	400	500	800
Synthetic Resin Adhesive (gm)							600	300	250						
Cement (gm)						800									
Water (ml)	1000	1200	2000	1000	1500	900	1000	2000	1500	1200	500	800	1000	1200	1500
No. Of Samples Made	2	2	4	3	2.5	3	2	4	1.5	2	1	2	1	2	4

Table: 3: Dimension & Weight Details of Each trial made

Weight of Wet Brick (gm)	sample 1	1418	1414	1280	960	1390	690	840	730	1200	1400	1000	820	1500	1480	980
	sample 2	1300	1000	1395	700	1275	695	710	690	775	1450		730		1430	960
	sample 3		-	1175	600	810	720		750							1010
	sample 4		-	930					840							1030
Weight of Dry	sample 1	1244	1292	750	550	1080	475	286	230	600	1290	840	600	1290	1160	700

Brick (gm)	sample 2	1180	882	855	480	990	483	154	140	250	1330		560		1090	660
	sample 3			700	420	710	590		243							820
	sample 4			650					311							880
Sample-1 Dimensions (cm)	Length	19	18.5	18.8	18.5	17.7	failed	20	19	20	18	17.6	19	18.8	19	18.5
	Width	8.3	8.5	8.8	9	8	failed	9	8.5	10	7.8	9	9	8.6	9	9.5
	Height	6.5	8.4	7.5	8	7.2	failed	7.8	9	9	9	9	8.5	9	8	9
Sample-2 Dimensions (cm)	Length	19	18	19	19	17.9	failed	19.8	19	18.9	18.6		19		18.5	19
	Width	8.5	8.5	8.3	9	8.2	failed	9	8	5	8		9		8	8.5
	Height	9	6.85	7.5	8	7.3	failed	9	8	5.8	7.5		7.9		9.3	7.9
Sample-3 Dimensions (cm)	Length	-	-	19	17.8	18.5	failed		18.3							19
	Width	-	-	9	8.6	4	failed		9.5							9
	Height	-	-	9.5	8.9	4.6	failed		7.9							8.7
Sample-4 Dimensions (cm)	Length	-	-	17.6					18.6							18.6
	Width	-	-	8.6					9							8
	Height	-	-	9.3					9							8

Table : 4: Material contains per brick of Each trial made

Material	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15
Baggase (gm)	300	350	500	250	250	200	150	300	125	250	100	150	100	250	500
Sodium Silicate (gm)	210	250	250	0	250	0	0	0	0	175	50	75	0	250	200
Sodium Hydroxide (gm)	210	250	250	0	250	0	0	0	0	175	50	75	0	250	200
Lime (gm)	300	300	750	500	250	0	0	0	0	250	90	100	200	250	400
Synthetic Resin Adhesive (gm)	0	0	0	0	0	0	300	150	125	0	0	0	0	0	0
Cement (gm)	0	0	0	0	0	400	0	0	0	0	0	0	0	0	0
Water (ml)	500	600	1000	500	750	450	500	1000	750	600	250	400	500	600	750
Load Taken (N/mm ²)	1.1 kN/mm ²	0.27 kN/mm ²	1.07 kN/mm ²	0.55 kN/mm ²	0.44 kN/mm ²	Failed	0.64 kN/mm ²	0.65 kN/mm ²	0.43 kN/mm ²	0.52 kN/mm ²	0.68 kN/mm ²	0.71 kN/mm ²	0.76 kN/mm ²	0.72 kN/mm ²	0.67 kN/mm ²
Total COST (₹) per brick	16.80 ₹	19.85 ₹	10.75 ₹	1.50 ₹	15.40 ₹	2.53 ₹	30.75 ₹	8.25 ₹	17.50 ₹	14.00 ₹	8.36 ₹	6.20 ₹	1.80 ₹	19.25 ₹	8.65 ₹

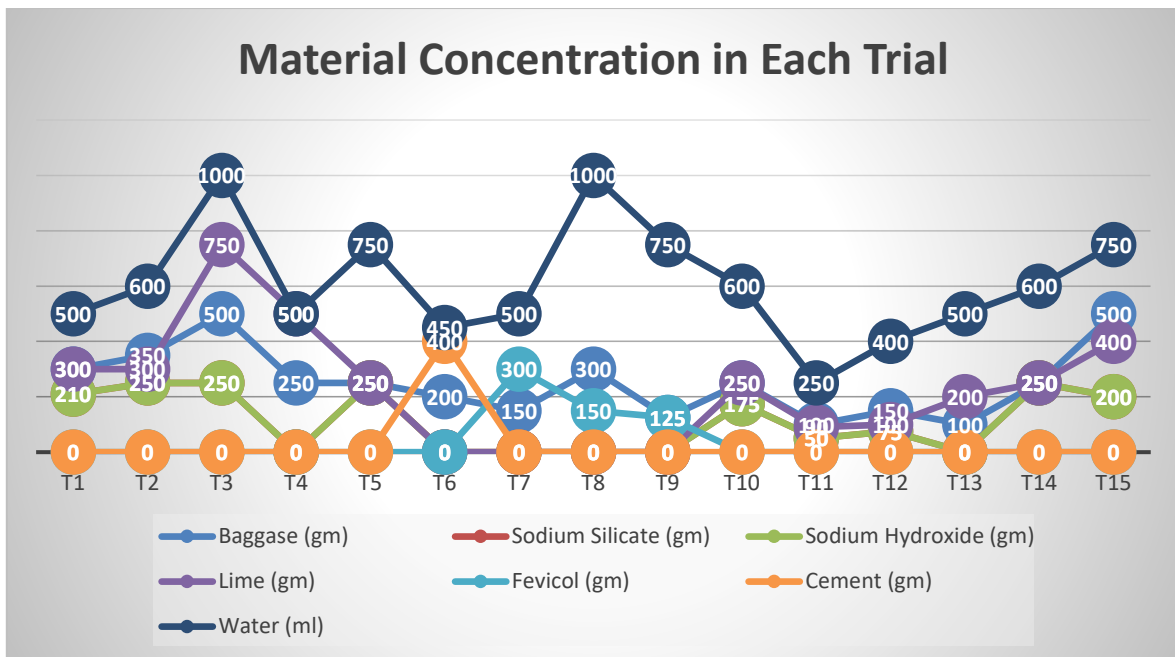


Fig: 2: Graphical Representation Of Each Trial With Its Material Proportions

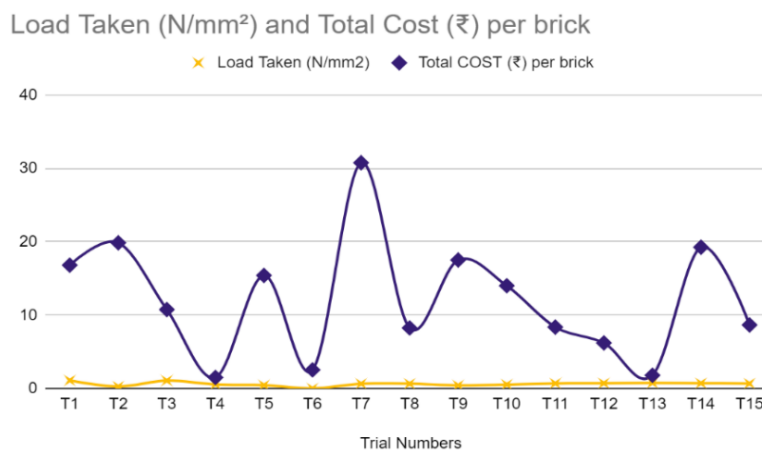


Fig: 3: Graphical Representation of Each Trial with Load vs Cost

Table 5: Load Taken vs Cost per Brick

Trial	Load Taken (N/mm ²)	Total Cost (₹) per brick
T6	0. N/mm ²	2.53 ₹
T2	0.27 N/mm ²	19.85 ₹
T9	0.43 N/mm ²	17.50 ₹
T5	0.44 N/mm ²	15.40 ₹
T10	0.52 N/mm ²	14.00 ₹
T4	0.55 N/mm ²	1.50 ₹
T7	0.64 N/mm ²	30.75 ₹
T8	0.65 N/mm ²	8.25 ₹
T15	0.67 N/mm ²	8.65 ₹
T11	0.68 N/mm ²	8.36 ₹
T12	0.71 N/mm ²	6.20 ₹

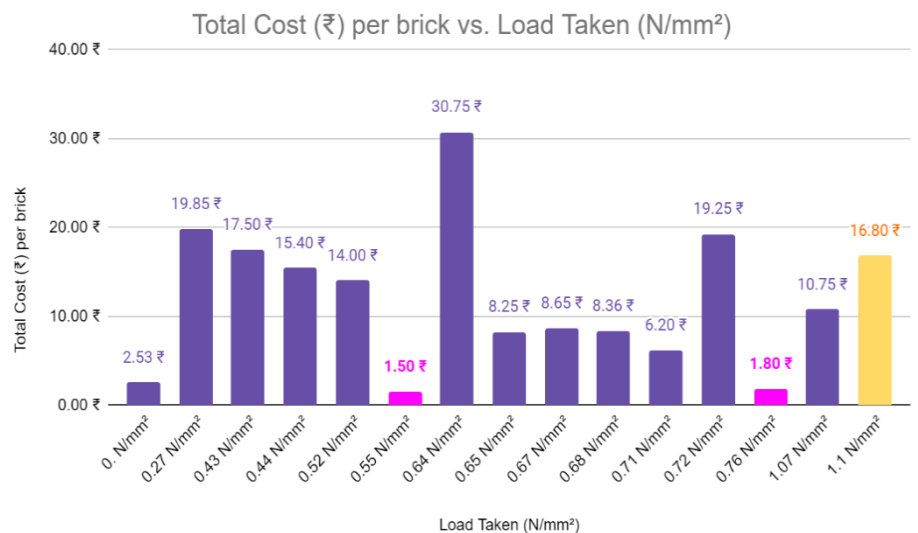


Fig:4: Graphical Representation of Each Trial with Load vs Cost

T14	0.72 N/mm ²	19.25 ₹
T13	0.76 N/mm ²	1.80 ₹
T3	1.07 N/mm ²	10.75 ₹
T1	1.1 N/mm ²	16.80 ₹

V. CONCLUSION

- 1.As per market value normal 4 inch brick price is 7.5 Rs same size of our brick price is start from 1.5 Rs to 30.75 Rs.as per strength basis.
- 2.The weight of standard bricks are 2.9 to 3.1 kg and weight of our bricks are 0.600 to 1 kg so these are light in weight.
- 3.On the basis of weight this bricks are used in partition wall,interior purpose and also used as sound isolation in theatre and hospitals.

VI. FUTURE SCOPE FOR THIS PROJECT -

- 1.Others study can be done by using marble powder for strength gain.
- 2.Future study can be done on bricks by using colors for aesthetic purpose.
- 3.Hardening accelerator admixture used for hardening purpose.
- 4.Brick making with the help of machine it gives best and accurate result.

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