

UTILIZATION OF SUGARCANE BAGASSE ASH IN MANUFACTURING OF BRICKS

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Abstract:

Due to the growing volume of sludge produced by various industries or plants in India, there is a significant demand for ecologically safe reuse and effective disposal methods for bagasse ash. Sludge is frequently disposed of in landfills in India, but the country's expanding urbanisation has made it harder and harder to locate suitable landfill sites. As a result, incineration has emerged as one of the few options for sludge disposal. Bagasse ash from combustion can be disposed of in the long run by utilising it as a building material. Repurposing this sludge as a building material, namely incorporating this bagasse ash into bricks, is one approach for managing this sludge.

I. INTRODUCTION:

Bagasse ash production in India has expanded as a result of the sugar industries' growing usage of cogeneration systems. In order to determine the precise availability of bagasse for the cogeneration process, it is critical to evaluate the size of the sugarcane production in India. This is due to the fact that sugarcane is crushed for a variety of uses, including the generation of sugar and ethanol. In order to accurately predict the availability of bagasse ash in India during the upcoming years, a thorough background of sugarcane farming and bagasse production is described in the sections that follow.

Bagasse is a byproduct produced when bagasse is burned in sugar manufacturing facilities. Bagasse is the cellular fibre waste material left over from cane mills after the sugar juice has been extracted. Currently, it is employed in the production of construction materials, pulp and paper products, and as a biofuel. Nearly 3 tonnes of wet bagasse, a byproduct of the sugar cane industry, are produced by a sugar mill for every 10 tonnes of sugarcane that is crushed.. When this bagasse is burned, bagasse ash is produced. Environmental issues result from this bagasse ash, which is typically scattered across farmland and dumped in ash ponds. Additionally, according to study, working around dusts from bagasse processing can lead to pulmonary fibrosis, often known as bagassosis, a chronic lung disease. There is a huge demand for its reuse, and bagasse ash may be utilised as a substitute for building materials since it has pozzolanic properties and is high in silica. Bagasse made from sugarcane has around 50% cellulose, 25% hemicellulose, and 25% lignin. Approximately 26% of bagasse (with a moisture level of 50%) and 0.62 % of residual ash are produced for every tonne of sugarcane.

In the present study, the possibility of employing bagasse ash or sugarcane sludge as a partial replacement for clay in bricks is examined. There is a shortage of traditional building construction materials as a result of scarce natural resources and growing urbanisation. On the other side, the energy needed to produce traditional building materials contaminates the air, water, and land. Uncontrolled agro-waste accumulation, particularly in emerging nations, is of growing environmental concern. Therefore, it is crucial to create innovative technologies that recycle garbage and turn it into useable resources in order to safeguard the environment and promote the sustainable growth of civilization.

II. AIM AND OBJECTIVES OF THE STUDY

This study aims at to manage the disposal of waste product into construction raw material. sugarcane sludge or bagasse ash by using it as a partial replacement material in clay bricks.

The specific objectives are as follows: -

1. to advertise sugar mill solid waste as a useful product.
2. To safely dispose of garbage.
3. To promote waste materials as environmentally acceptable materials
4. Making energy-efficient bricks is the only practical way to address environmental issues and preserve natural resources for future generations.
5. The disposal issue, cost reduction, and production of "greener" eco-friendly brick for building may all be achieved by using bagasse ash in brick.
6. Through this research, a better measurement by a cutting-edge construction material is developed.

III. MATERIALS AND METHODOLOGY

Material used

1. Sugarcane bagasse ash
2. Quarry dust
3. cement
4. Water

Methodology:

1. Selection and procurement of materials.
2. Evaluation of material properties.
3. basic material testing

Sieve size (mm)	Weight retained (g)	Weight retained (g)	Cumulative % weight Retained (%)X
0.6	170	170	34
0.3	135	135	61
0.15	135	135	88
Pan	60	60	100
Total	500		283

4. preparation and curing bricks
5. Casting and of cubes.
6. Conduction of test to determine strength of bricks.

Sugarcane bagasse ash: In Maddur Village, Mandya District, Karnataka, scba was gathered from NSL Sugar Limited. Physical property results and chemical property results are shown in Tables 2 and 3, respectively.

Quarry dust: Quarry dust is anything left over after removing and processing rocks to create tiny particles smaller than 4.75mm. It can also include tailings or other non-valuable waste materials. Quarry dust had a specific gravity of 2.7 according to the experiment. The characteristics are listed in Tables 4 and 5.

Water: For mixing and curing, potable water is used.

Cement : The cement used is ordinary Portland cement (OPC) of m53, and its parameters are listed in table.

TABLE 1: PHYSICAL PROPERTIES OF BAGASSE ASH

Sl. No	Properties	Observed Values
1	Specific gravity of bagasse ash	1.875
2	Finesse modulus of bagasse ash	2.83

TABLE 2: CHEMICAL PROPERTIES OF BAGASSE ASH

Sl. No	Properties	Observed Values
1	Silica (SiO ₂)	66.89
2	Alumina (AL ₂ O ₃) Ferric oxide (Fe ₂ O ₃)	29.18
3	Calcium oxide (CaO)	1.92
5	Magnesium oxide (MgO)	0.83
6	Sulphur tri oxide (SO ₃)	0.56
7	Loss of Ignition	0.72

TABLE 4: SPECIFIC GRAVITY OF QUARRY DUST

Sl No	Particulars	Trial
1	Empty weight of pycnometer W1 in g	648
2	Pycnometer + sample W2 in g	1148
3	Pycnometer + sample + water W3 in g	1973
4	Pycnometer + Water	1675
5	Mass of saturated surface dry sample W5 in g	500
6	Oven dried sample W6 in g	498

TABLE 5 : PROPERTIES OF CEMENT

Sl No	Test	Result
1	Specific gravity	3.15
2	Standard consistency %	32%
3	Initial setting time (minutes)	40min
4	Final setting time (minutes)	600min

TABLE 6: OXIDE COMPOSITION LIMITS OF OPC

Sl No	OXIDE	PERCENT CONTENT
1	CaO	60-67
2	SiO ₂	17-25
3	Al ₂ O ₃	3-8
4	Fe ₂ O ₃	0.5-6
5	MgO	0.1-4
6	Alkalies (K ₂ O,Na ₂ O)	0.4-1.3
7	SO ₃	1.3-3

TABLE 7: SPECIFIC GRAVITY OF CEMENT

Particulars	Tri al 1	Tri al 2

SI NO			
1	Empty weight of density bottle, W1 (g)	32	32
2	Empty weight of density bottle + water, W2 (g)	82	82
3	Empty weight of density bottle + kerosene, W3 (g)	71.5	70.5
4	Empty weight of density bottle + kerosene + cement, W4 (g)	86.5	85.5
5	Mass of Cement, W5 (g)	20	20
6	Specific gravity of cement	3.16	3.1

TABLE 8: STANDARD CONSISTENCY OF CEMENT

SI No	% of water added	Amount of water added	Penetration from top	Standard consistency
1	26	78	45-43=2	-
2	28	84	45-37=8	-
3	30	90	45-35=10	-
4	32	96	45-32=13	32

TABLE 9: SETTING TIME OF CEMENT

SI NO	TIME (MIN)	PENETRATION (MM)	REMARKS
1	5	45-0=45	-
2	10	45-0=45	-
3	15	45-0=45	-
4	20	45-0=45	-
5	25	45-0=45	-
6	30	45-6=39	-
7	35	45-8=37	-
8	40	45-10=35	INITIAL SETTING TIME

TABLE 10: PROPERTIES OF CEMENT

SI NO	CHARACTERISTICS	VALUES OBTAINED	STANDARD VALUE

1	Standard consistency (%)	32	26%-32%
2	Initial setting time (min)	40 min	>30min
3	Final setting time	60 min	Not > 600 min
4	Specific gravity	3.13	3.15

TABLE 11: DETAILS OF COMPOSITION OF BRICKS

Sl No	Amount of Bagasse ash in %	Amount of quarry dust in %	Amount of cement in %
1	10	45	45
2	20	40	40
3	30	35	35
4	40	30	30
5	50	25	25
6	60	20	20

TEST ON BRICKS

1. Size, shape, and colour test
2. Soundness test
3. Efflorescence test
4. Hardness test
5. Water

CUBES PREPARATION

- Drying of waste materials
- Sieve process
- Mixing of materials
- Casting of bricks
- Casted bricks naming
- Curing of bricks

CURING OF BRICKS

1. The bricks are exposed to cure for 28 days with the use of gunny bags after being sun dried for 5 hours. Various tests are performed on the cured bricks to determine their strength.

TABLE 12: WATER ABSORPTION TEST

Sample	Weight of dry brick (w1) in kg	Weight of wet brick (w2) in kg	% water absorbed	Average in %
1	2.731	3.124	14.39	15.89
	2.751	3.204	16.46	
	2.672	3.122	16.84	
2	2.668	3.126	17.16	15.55
	2.762	3.167	14.66	
	2.675	3.072	14.84	
3	2.706	3.122	15.37	15.34
	2.668	3.062	14.76	
	2.653	3.075	15.90	
4	2.704	3.149	16.27	16.26
	2.654	3.088	16.35	

	2.686	3.116	16.00	
5	2.580	3.020	17.05	17.68
	2.480	2.930	18.14	
	2.520	2.970	17.85	
6	2.480	2.960	19.35	20.82
	2.450	2.970	21.22	
	2.420	2.950	21.90	

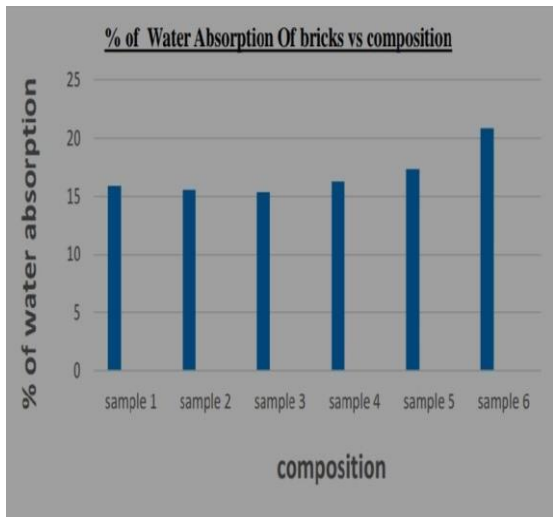
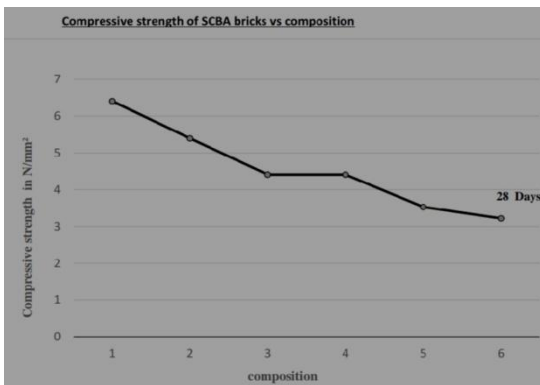


TABLE 13: COMPRESSIVE STRENGTH OF BRICKS

Sam ple	size	Sur face are a (m m ²)	Load At Failure in N	Compr essive strengt h (N/mm 2)	Aver age
1	200x100	20000	126380	6.30	6.41
			125670	6.20	
			134600	6.73	
2	200x100	20000	110850	5.59	5.40
			113800	5.69	
			99800	4.99	
3	200x100	20000	86328	4.31	4.41
			88290	4.41	
			90252	4.51	
4	200x100	20000	82640	4.13	4.14
			84760	4.2	
			86980	4.24	
5	200x100	20000	70822	3.54	3.53
			68860	3.44	
			72784	3.64	
6	200x100	20000	65974	3.30	3.22
			63164	3.16	
			64012	3.20	



RESULTS AND CONCLUSION

As we can see from the results, bricks' ability to absorb water rose as the proportion of bagasse ash increased. To replace, up to 50% of the bagasse ash is sufficient.

According to the findings of the compressive strength test, the strength of the bagasse ash is acceptable up to 50%. The strength starts to wane at 50%. Only using up to 50% bagasse ash is preferred.

The disposal issue, expense, and production of a more "green" and environmentally friendly brick for building may all be resolved by using bagasse ash in brick. Through this research, the negative consequences of garbage on the environment and waste disposal issues can be lessened. Through this research, a superior measurement by a cutting-edge construction material is developed. The non-useful bagasse ash is turned into valuable bricks thanks to this study. The price of materials for each brick is decreased. The results of the laboratory tests show that, up to 50% bagasse ash, all of the brick's properties are sufficient and suitable for use in building construction. As more than 50% of bagasse ash is added, the result is increased water absorption, a decrease in compressive strength, and reduced hardness. In comparison to clay bricks, the highest compressive strength may be achieved in this study. Therefore, we advise that up to 50% bagasse ash be utilised in the production of bricks.

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