Utilization of Sugar Mill Waste in Manufacturing of Bricks

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Abstract—In India, bricks are usually made up of clay, and a re generally produced in traditional, unorganized small scale i ndustries. Brick making consumes larger amount of clay whic h leads to top soil removal and land degradation. To avoid all this environmental threats an attempt was made to study the behavior of bricks manufactured using, waste materials from sugarcane industrial waste. Recycling of such waste as raw m aterial alternatives may contribute in the exhaustion of the na tural resources and reduction in waste disposal costs. In this p roject we choose sugarcane bagasse ash (SBA) and press mud in ordinary Portland cement (OPC) stabilized bricks. The bric k was manufactured of size 25cm x 12cm x 6.5cm. The blocks were named as 4, 6 and 8 then it is added with SBA and press mud by weight of dry soil, then the bricks followed by curing f or period of 28 days. The test like compressive strength, water absorption test, shape and size test in accordance with Burea u of Indian standards (BIS) specifications by also considering the cost.

Key words: Sugarcane bagasse ash (SBA), press mud, ordinary Portland cement, cost effective.

I. INTRODUCTION:

There is a strong demand for environmentally safe reuse an d effective disposal method for bagasse ash and press mud due to the increasing amount of sludge generated by the var ious industries or plant in India. Landfills are commonly us ed for disposal of sludge in India; rapid urbanization has m ade it increasingly difficult to find suitable landfill sites. Th erefore, incineration has become one of the few alternatives available for disposal of sludge. The ultimate disposal of i ncinerated bagasse ash and press mud can be accomplished by using it an engineering construction material. One possi ble solution for the management of this sludge is to re-use i t as a building material, namely, to incorporate this bagasse ash and press mud into bricks. The fired clay brick is one o f the most common and abundant masonry building materia ls and remain popular for its many characteristic properties. As such, the recycling of waste materials by incorporating them into bricks has been a popular topic of investigation o ver the last century, with varying degrees of success across a wide range of waste material. This popularity is likely du e to flexibility on the type of wastes which can be mixed in to the brick making material, but more importantly, the hig h temperature involved in firing the bricks allows for the v olatilization of dangerous Component, as well as the fixatio n of wastes into the vitreous phase of the brick. The current study investigates t he potential for reusing sugarcane slud ge or bagasse ash and press mud by using it as a partial repl acement material.

II.SCOPE:

- To promote the solid waste from the sugar mills as a useful product
- To manage the disposal of waste product into construction raw material
- To dispose the waste safely
- To encourage the waste products as eco friendly material
- To make the bricks which are energy efficient which is the only viable solution to the environmental concerns and natural resources conservation for future generations

III. LITERATURE REVIEW

As we all know that the waste from the industries is very h armful for the environment as well as to our health, if not d isposed in proper manner. The fibrous residue of sugarcane after crushing and extraction of its juice, known as “bagass e” is one of the largest agriculture residues in the world. Th e bagasse is however used as a biomass fuel for boilers, but after burning the by-product left is of no use and generally disposed into the rivers which affect the health of human b eing, environment, fertile land, sources of water bodies etc. Depending on the incinerating conditions, the resulting sug arcane bagasse ash (SCBA) may contain high levels of SiO 2 and Al2O3.Uses of Sugarcane bagasse ash waste in brick can save the sugarcane industry disposal costs and produce a ‘greener’ bricks for construction.

Indian sugarcane crop cultivation forms an important part o f the Indian agricultural economy. Production of sugar has shown a phenomenal increase in the last 65 years. One of t he byproducts of sugar industry is pressmud, a solid residu e, obtained from sugarcane juice before crystallization of s ugar. Generally pressmud is used as manure in India. The a im of the present investigation is to recover protein, sugar a nd wax *from* pressmud. The amount of protein is estimated to be 3.3%. The percentage of sugar is about 0.8%. Extracti on of Wax by solvent has resulted in a recovery of about 12 %.

IV.MATERIALS:

A. Sugarcane Bagasse Ash:

Fig 1.Sugarcane bagasse ash

The burning of bagasse which a waste of sugarcane produc es bagasse ash. Presently in sugar factories bagasse is burnt as a fuel so as to run their boilers.India alone generates 90 milion t of bagasse as a waste material, from sugarcane ind ustry. Bagasse is a residue obtained from the burning of ba gasse in sugar producing factory. Bagasse is the cellular fib rous waste product after the extraction of the sugar juice fr om cane mills. Its currently used as a bio-fuel and in the ma nufacture of pulp and paper products and building material s. For each 10 tons of sugarcane crushed, a sugar factory pr oduces nearly 3.1 tons of wet bagasse which is a by-produc t of the sugar cane industry. When this bagasse is burnt the resultant ash is bagasse ash. Western Maharashtra is having maximum number of sugar factories, these factories faces a disposal problem of large quantity bagasse. The effective use of these waste products is a challenging task for a resea rcher through economical and environmental impact. This material contains amorphous silica which is indication of c ementing properties.

Properties:

- Physical properties of cement and bagasse ash:

Material	Density (K g/cu.m)	Specific grav ity	Fineness passing 4 5µm	Specific s urface are a (cum/K g	Mean grain size (µm)
Cement	1.15	3	82	300	2.1
Bagasse ash	0.4	1.8	95	900	5.1

Tab1.Physical properties of cement and bagasse ash

- Chemical properties of bagasse ash:

SI.NO	Component	Mass %
1	Silica (SiO2)	66.89
2	Alumina (AL2 O3) Ferric oxide (Fe2 O3)	29.18
3	Calcium oxide (CaO)	1.92
4	Magnesium oxide (MgO)	0.83
5	Sulphur tri oxide (SO3)	0.56
6	Loss of Ignition	0.72
7	Chloride	-

Tab2.chemical properties

B. Press Mud:

Pressmud from the sugar mills is a very useful source of fer tilizer as well as some chemicals. The major use that has re cently been developed in India is in biocomposting (usually trade named as Bioearth) where it is treated with the spent wash from the distillery. The concept of biological degrada tion of organic wastes by anaerobic digestion for the genera tion of methane has been used by waste management indust ries for many years. Pressmud is an industrial waste availab le from the sugar mills.

Fig2.Press mud

The above waste materials are used as a replacement for ce ment and fine aggregate. Other than waste materials the ma terials which used in the manufacturing of bricks are as foll ows:

C. Ordinary Portland Cement:

Portland cement is the most common type of cement in gen eral use around the world, used as a basic ingredient of con crete, mortar, stucco, and most non-speciality grout.

The magnesium oxide content (MgO) shall not exceed 5.0 % by mass. Cement sets when mixed with water by way of a complex series of chemical reactions still only partly und erstood. The different constituents slowly crystallise and th e interlocking of their crystals gives cement its strength. Ca rbon dioxide is slowly absorbed to convert the portlandite ($Ca(OH)_2$) into insoluble calcium carbonate. After the initial setting, immersion in warm water will speed up setting. G ypsum is added as an inhibitor to prevent flash setting and quick setting.

Properties:

Physical Properties:

Compressive strength (MPA)	44
Fineness (%)	8
Specific gravity	3.157
Initial setting time (Minute)	65
Final setting time	320

Tab3.physsical properties of cement

Fig.3 ordinary Portland cement

D. Fine Aggregate:

Fine aggregate was purchased which satisfied the requirement of fine aggregate required for experimental work and conforming to zone-2, as per IS 383:1970. The sand was oven-dried and sieved to eliminate any foreign particles before mixing. Locally available natural sand with 4.75 mm maximum size was used as fine aggregate, having specific gravity, fineness modulus and unit weight as given

1) Fineness modulus=2.81
2) Specific gravity=2.61
3) Silt content=2.63

Fig4.fine aggregate

E. Water:

Water is an important ingredient of brick as it actually used for manufacturing of brick. Since it helps to bind all the raw materials for giving proper mix. Water used for making brick should be free from impurities.The common specifications regarding quality of mixing water is water should be fit for drinking. Such water should have inorganic solid less than 1000 ppm. This content lead to a solid quantity 0.05% of mass of cement when w/c ratio is provided 0.5 resulting small effect on strength.

IV.MIX DESIGN

SI.no	Name of thebrick(for identification)	Amount of cement Added(kg)	Amout Of fine Aggregate (kg)	Amount of Bagasse Ash(kg)	Amount of pressMud(kg)
1	4	1 1/2	1 1/2	1/2	1/2
2	6	1	1	1	1
3	8	1/2	1/2	11/2	11/2

Tab4.Mix design

V.METHODOLOGY:

A. Drying Of Waste Materials:

Fig5.Sugar cane bagasse ash

Fig6.Drying of press mud

The waste materials are sun dried for a period of 12 hours to eliminate the water content.

B. Sieve Process:

It is essential to sieve the fine aggregate and bagasee ash in Is sieve size of 4.5mm for the proper binding of bricks.

C. Mixing of materials:

Fig8.Mixing

The above materials are mixed based on the mixed design f or proper binding.

D. Casting of bricks:

Fig9.casting

The mixture is casted in the mould of size 250mmx120mm x65mm.

E. Casted bricks:

Fig10.Casted bricks

The casted bricks are named as 4,6,8 based on the mix desi gn, then the bricks are sun dried for a period of 5hrs and it i s subjected to curing for 28 days . The cured bricks are und ergone various test for identifying the strength.

VI.TEST ON BRICKS:

A. Compressive Strength Test / Crushing Strength:

The brick specimens are immersed in water for 24 hours. T he specimen is placed in compression testing machine with 6 mm plywood on top and bottom of it to get uniform load on the specimen. Then load is applied axially at a uniform r ate of 10 N/mm2. The crushing load is noted for the bricks named 4, 6, and 8.

B. Water Absorption Test:
A brick is taken and it is weighted dry. It is then immersed in water for a period of 16 hours. It is weighed again and th e difference in weight indicates the amount absorbed by the brick. It should not in exceed 20 percent of weight of dry b rick.

C. Shape And Size Test:
In this test, a brick is closely inspected. It should be of stan dard size and its shape should be truly rectangular with sha rp edges. For this purpose 3 bricks are selected at random a nd they are stacked length wise ,along the width and along the height.

VII.CONCLUSION:

Based on the above experimental procedure and test, we co nclude as;

1. Use of bagasse ash and pressmud in brick can solve the d isposal problem; reduce cost and produce a ‘greener’ Eco- f riendly bricks for construction.
2. The crushing strength or compressive strength of bricks named as 4 is 9N/mm2 and the brick named as 6 is 6N/mm 2 and the brick named as 8 is 5N/mm2.
3. Hence we strongly recommend brick 4 has a good compr essive strength and suitable for construction.
4. Environmental effects of wastes and disposal problems o f waste can be reduced through this brick manufacturing pr ocess.
5. This study helps in converting the non-valuable bagasse ash and press mud into bricks and makes it valuable.
6. In this research maximum compressive strength can be a ttained.
7. The expected cost of the bricks can be reduced.

REFERENCES

[1] A. P. Singh and P. Kumar, “Light weight cement-sand an d bagasse ash bricks,” *International Journal of Innovativ e Research*

[2] *in Science and Technology*, vol. 1, no. 12, pp. 284–287, 2 015. M. V. Madurwar, S. A. Mandavgane, and R. V. Ral egaonkar

[3] "Use of sugarcane bagasse ash as brick material," *Curren t Science*, vol. 107, no. 6, pp. 1044–1051, 2014.
[4] A. Kulkarni, S. Raje, and M. Rajgor, "Bagasse ash as an effective replacement in flyash bricks," *International Jou rnal of Engineering Trends and Technology*, vol. 4, no. 1 0, pp. 4484–4489, 2013.
[5] P. Khobklang, K. Nokkaew, and V. Greepala,
[6] "Effect of bagasse ash on water absorption and compress ive strength of lateritic soil interlocking block," in *Proce edings of the International*
[7] *Conference on Excellence in Concrete Construction Thro ugh Innovation*, M. C. Limbachiya andH. Y. Kew, Eds., pp. 181–185, Kingston UponThames, London, UK, Septe mber 2008.] V. Greepala and R. Parichartpreecha,
[8] 4."Effects of using flyash, rice husk ash and bagasse ash as replacement materials on the compressive strength and water absorption of lateritic soil-cement interlocking blo cks," in *Proceedings of the 9th Australasian Masonry Co nference*, pp. 583–603, Queenstown, New Zealand, Febr uary 2011.] M. Balakrishnan and V. S. Batra,
[9] "Valorization of solid waste in sugar factories with possi ble applications in India: a review,"*Journal of Environme ntalManagement*, vol. 92, no. 11, pp. 2886–
[10] 2891, 2011. N. Partha andV. Sivasubramanian,
[11] "Recovery of chemicals from pressmud—a sugar industr y waste," *Indian Chemical Engineer*,
[12] vol. 48, no. 3, pp. 160–163, 2006. R. L. Yadav and S. Sol omon, "Potential of developing sugarcane
[13] by-product based industries in India," *Sugar Tech*, vol. 8, no. 2-3, pp. 104–111, 2006. S. R. Teixeira, A. E. De Sou za, G. T. De Almeida Santos, A. F. V.Pe˜na, and ´ A. G. Miguel,
[14] "Sugarcane bagasse ash as a potential quartz replacement in red ceramic," *Journal of the American Ceramic Societ y*, vol. 91, no. 6, pp. 1883–1887, 2008. K. Umamaheswar an, V. S. Batra, and D. V. S. Bhagavanulu,
[15] "Development of biomass ash filters for high temperature
[16] applications," in *Proceedings of the International Sympo sium of Research Students onMaterials Science and Engi neering*, pp. 1–8, IIT-Madras, Chennai, India, December 2004. Sales and S. A. Lima.
[17] "Use of Brazilian sugarcane bagasse ash in concrete as sa nd replacement," *Waste Management*, vol. 30, no. 6, pp. 1114–1122, 2010. G. Sua-iam and N. Makul,
[18] "Use of increasing amounts of bagasse ash waste to prod uce self-compacting concrete by adding limestone powde r waste," *Journal of Cleaner Production*,vol. 57, pp. 308 –319, 2013. J. A. Sadeeq, J. Ochepo, A. B. Salahuddin, a nd S. T. Tijjani,
[19] "Effect of bagasse ash on lime stabilized lateritic soil," *J ordan Journal of Civil Engineering*, vol. 9, no. 2, pp. 203 –213, 2015. K. C. Onyelowe, "Cement stabilized akwuet e lateritic soil and the use of bagasse ash as admixture,"*I nternational Journal of Science and Engineering Investig ations*, vol. 1, no. 2, pp. 16–20, 2012.