

Partial Replacement of Fine Aggregate by Bagasse Ash in Rigid Pavement - A Review

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Abstract—Disposal of bagasse ash in environment is considered to be a very big problem due to its very low biodegradability and presence in large quantities. Therefore, finding alternative methods of disposing waste, by using it has become a major research issue. The review paper mainly discusses some work related to analysis & study as to how the waste bagasse ash will be effectively utilized in construction of rigid pavement. The attempt is to investigate structural properties of pavement by using bagasse ash in construction of cement concrete pavement over conventional cement concrete pavement.

Keywords— *bagasse ash, rigid pavement.*

I. INTRODUCTION

India has one of the largest road networks in the world, consisting national highways, state highways, major district roads, other district roads and village roads. Roads are the key to the development of an economy. A good road network constitutes the basic infrastructure that accelerates the development process through connectivity. Roads also play a key role in inter-modal transport development establishing links with airports, railway stations and ports. As compared to the railways, the road transport system has definite advantages. In addition, they have an important role in promoting national integration, which is particularly important in a large country like India.

But on the other side, there is a large quantity of agricultural wastes produced daily basis such as wheat straw, ash rice husk ash, hazel nutshell, fly ash, cork and sugarcane bagasse ash. Agriculture industry is the largest industry in India as more than 70% of Indian population is dependent on it. Sugarcane is largely produced in the states of Uttar Pradesh, Maharashtra, Karnataka and Tamil Nadu.

1.1 Sugar Industry: Current Scenario In World

Sugarcane is a profit crop grown in many countries all over the world. To undergo detail estimation of sugar cane Bagasse Ash the quantity of sugarcane production in different countries is obtained. Sugarcane is used mainly for making sugar, ethanol, alcohol and many more in different countries.

At present, 115 countries of the world cultivate sugarcane mainly for sugar and ethanol production. As per the statistics about 1850 million tonnes of sugarcane is grown all over and used for different purposes. The three largest sugarcane growers in terms of production are Brazil, India and China. About 50% of the total production of sugarcane is found to be concentrated in Brazil, India and china.

1.2 Sugar Industry: Current scenario in India

India is the second largest producer of sugar over the global after brazil. It is one of the largest sugarcane growing nations with an estimated production of around 300 million tons in the marketing year 2009-10. There are nearly 500 sugar factories in India along with around 300 molasses based alcohol distilleries. Amongst all the states in India The Maharashtra sugar industry has been contributing nearly 40% of India's total sugar production. In 2001-02, sugar industry in Maharashtra produced an approximate 50-67 lakh tons of sugar.

India's sugar production in the current season is set to touch a record 30 million tonnes, surprising both the industry and the government, with the two biggest producing states of the sweetener reporting bumper output. Maharashtra has already produced about 10 million tonnes, with the northern sugar bowl of Uttar Pradesh following closely at 9.3 million tonnes. India's earlier record output was in 2014-15 when mills here had produced 28.46 million tonnes of sugar. [1]

1.3 By products of sugar industry

1.3.1 Bagasse fly ash:

This is the waste generated by the combustion of bagasse which is waste produced from sugar industry. silica is the major component and apart from, it contains other metal oxides and unburned carbon. This waste is typically disposed off in large pits; in some areas it is also applied on open land for soil amendment. Approximately 0.97 million tonnes of unburned carbon is available from bagasse fly ash alone in India.

1.3.2 Bagasse :

It is the fibrous matter that remains after sugarcane stalks are crushed to extract their juice. It is currently used as a biofuel and in the manufacture of pulp and paper products and building materials. For each 10 tonnes of sugarcane crushed, a sugar factory produces nearly 3 tonnes of wet bagasse.[4] Since bagasse is a by-product of the cane sugar industry, the quantity of production of waste bagasse in each country is mainly depends upon the quantity of sugarcane produced in that country.

1.3.3 Sugarcane trash:

During the harvesting and milling process of sugarcane, Cane trashes are produced which normally lasts between 6 to 7 months.

Table 1.
Quantity Of Byproduct Per Ton From Sugarcane Industry

Sr. No.	Byproduct from sugarcane industry	Quantity per tonne of sugarcane crush
1	Bagasse	0.25-0.3 tonne
2	Bagasse fly ash	0.005-0.066 tonne
3	Sugarcane trash	0.09-0.11 tonne
4	Cane juice	0.565-0.615 tonne

II. LITERATURE REVIEW

“Study on the use of Bagasse Ash Paver Blocks in Low Volume Traffic Road Pavement” P. R. Kannan Rajkumar, K. D. Krishnan, P. T. Ravichandran, T. A. Harini – ISSN : 0974-6846 [16 Nov 2018].

For this pavement study the materials used are bagasse ash, cement, fine aggregate, finer coarse aggregate. Laboratory tests were conducted as per IS provisions on these materials to determine their properties. Various tests on soil were conducted to study the properties of soil, to design the flexible pavement and low volume traffic road pavement using bagasse ash interlocking paver blocks. From the tests on soil, the soil was classified and CBR value was obtained which is helped in the pavements designed. The paver blocks using Plain cement concrete as well as for specimens with 50% bagasse ash were casted based upon the mix design calculated and the compressive strength was obtained at the curing age of 7 and 28 days. The usage of Bagasse ash leads to far lesser environmental hazards than conventional concrete, which leads to reduce the pollution and global warming.

“Experimental Investigation on the Use of Bagasse Ash in the Construction of Low Volume. Traffic Roads” ISSN:2321-9653; Volume5, October 2017

From This paper some conclusions have been made based on the present study Sugarcane bagasse ash modified concrete performed better when it compared to ordinary concrete up to 20% (finer Sugar Cane Bagasse Ash) for cement replacement and 10% (less finer Sugar Cane Bagasse Ash) of sand replacement in ordinary concrete. Due to presence of high amount of silica in

sugarcane bagasse ash strength in paver blocks get increased. The spillage of oil from vehicles does not affect pavements and these pavements are ideal for bus stops, bus depots and parking areas. The damage occurrence is less in bagasse ash paver blocks road and it is easy to rectify the road with less amount of work. In the case of block pavement, digging and reinstatement of trenches for repairs to utilities is easier. Concrete block pavements restrict the speed of vehicles to about 60 kmph is the most important conclusion, where speeds have to be restricted and cornering stresses are high. Block pavement does not exhibit very deterioratory effect due to thermal expansion and contraction, and are free from the cracking phenomenon unlike concrete pavements.

“Characterization of Mixed Mortars with Partial Replacement of Sand with Sugarcane Bagasse Ash (SCBA)” C. H. Martins, T. Rigotti de Castro, C. C. Gallo O.J.C.E. accepted 30 May 2016; published 2 June 2016

It was possible to observe that Through the analysis of the water retentivity results, even though the sand replacement with Sugar Cane Bagasse Ash reduced the consistency of the mortar. Retaining water increases the mortar’s ability. This is considered a positive improvement as a higher water retentivity would reduce water loss from the mortar to absorbent surfaces, allowing the complete hydration of the cement and the lime. The sand replacement with SCBA also caused a raise in the bulk density of the mortars. This increase could be explained by the higher bulk density of the ash in comparison to the fine aggregate and by the filling of the voids between sand grains with ash grains. To reinforce the pattern that the higher the sand replacement with ash the higher the bulk density.

The employment of sugarcane bagasse ash for the production of mortars can be an interesting waste utilization, which reduces the utilization of sand and the environmental impact. The partial sand replacement with sugarcane bagasse ash caused a decrease in the mortar workability, however it was corrected by the utilization of superplasticizer. The sugarcane bagasse ash use showed advantages such as the increase of water retentivity and the bulk density; the latter improvement caused an increase of the strengths. The slightly raise of the mortars permeability due to a higher porosity caused by the waste presence is main disadvantage. The strength reduces by use of superplasticizer; however its presence improves the workability and reduced the permeability.

“Experimental Investigation of sugarcane bagasse ash Concrete under sodium hydroxide solution” Sachin Mulay, Gaurang vesmawala, Yogesh patil, Vikas gholap ISSN: 2330-8729 November 23, 2016

The test results for the experimentation work carried out to understand the behavior of SCBA in concrete exposed to alkali is presented. Weight Loss For water cured concrete, with increase in SCBA from 0% to 30%, specimen weight was observed to be reducing at the end of 56 days. The behavior of concrete with different SCBA content exposed to alkali for 7 days, 28 days and 56 days. Exposure of concrete mixes to alkali attack showed overall reduction in weight at exposure period concrete specimens cured under water. The specimen weight exposed to alkali was observed to reduce at slower rate. The maximum loss in weight was observed with 30% SCBA content mixes for all alkali exposure period conditions. This study concludes were derived from the experimental outcome of concrete with bagasse ash under sodium hydroxide solution. Compressive strength and ultrasonic pulse velocity values were determined to be higher for mix with 15% bagasse ash content at all alkali exposure periods. Inclusion of bagasse ash in cement aggregate mix showed improvement in resistance to alkali silica reaction Optimal utilization of SCBA in concrete for maximum output was derived to be 15%.

“Design of low Volume Traffic Pavements Using Bagasse Ash” Er Aman Joon, Heemant Gulati ISSN: 2395 -0056, Volume: 04 Issue: 04, Apr -2017.

The pavements were designed after testing on soil, which soil was classified and CBR value was obtained. The pavers blocks using Plain cement concrete as well as for specimens with 50% bagasse ash were casted. After that the compressive strength was obtained at the two curing age. In addition to the reduction in cost, another advantage of using bagasse ash paver block road is the design life. For flexible pavement the design life is only 10 to 12 years, whereas the design life is 18 to 20 years in case of bagasse ash paver block road. The maintenance of bagasse ash paver blocks road shall be far easier when compared to conventional flexible pavement, as only the particular damaged block has to be removed and re-laid with a new one. This enormously contributes to the economy factor by reducing the overall investment in pavements in the long run.

III. LITERATURE REVIEW SUMMARY

- The usage of bagasse ash leads to far lesser environmental hazards than conventional concrete
- The partial sand replacement with sugar cane bagasse ash caused a decrease in the mortar workability; however it was corrected by the utilization of super plasticizer.
- bagasse ash is a readily available waste material and is also an eco-friendly material
- Sugarcane Bagasse Ash Modified Concrete Performed Better When Compared To Ordinary Concrete Up To 20% Of Sand Replacement In Ordinary Concrete.
- Increase Of Strength In Paver Blocks Is Mainly Due To Presence of High Amount Of Silica In Sugarcane Bagasse Ash
- In Addition To The Reduction In Cost, Another Advantage Of Using Bagasse Ash Paver Block Road Is The Design Life
- The Maintenance Of Bagasse Ash Paver Blocks Road Shall Be Far Easier When Compared To Conventional Flexible Pavement

IV. CONCLUSION

After studying availability and reuse of waste bagasse ash in pavement some conclusion has to be made for further studies are as follows;

- Utilization of waste bagasse ash is vital nowadays.
- Bagasse ash is in large quantity so that use of waste bagasse is liable in coming years.
- Reduction in construction cost is major objective.
- We can get equal strength by using waste product without disturbing natural resources.
- New road construction material is useful where sugar industries are placed.
- Bagasse ash is eco-friendly material.

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