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Utilization of Sugarcane Bagasse Ash in Bitumen

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***Abstract* - This paper summarizes the ongoing researches about the experimental investigation on the use of bagasse ash in the construction of low volume traffic roads. The main focus of this research was to improve the transport industry so as to result in greater economy and mobility of goods and services by developing economic roads and also to utilize the various agro-wastes in the construction industry to result in suitable waste management for environmental susceptibility and eco-conservation. in this case sugarcane bagasse ash(an agro-waste) is being utilized for the Construction of low volume traffic roads(village roads, city street roads and other arterial roads).**

Key Words: Sugarcane bagasse ash, Coarse and Fine aggregate, Water bound Maccadam and Wet Mix Maccadam.

1. INTRODUCTION

Sugarcane is major crop grown in over 110 countries and its total production is over 1500 million tons.Sugarcane production in India is over 300 million tones per year.The processing of it in sugar mill generates about 10 million tones of SCBA as a waste material.one ton of sugarcane can generate approximate 26% of bagasse and 0.62% of residual ash.The residue after combustion present a chemical composition dominates by silicon dioxide.The SCBA contains high amounts of unburnt matter,silicon,aluminium and calcium oxide.The main parameter responsible for this improvement was higher silica content. Bagasse ash contains amorphous silica and display good pozzolanic property.Bagasse is often used as a primary fuel source for sugar mills;when burned in quantity,it produces sufficient heat energy to supply all the needs of a typical needs of a sugar mill.The dumping of these industrial wastes in open land poses a serious threat to the society by polluting the air and waste bodies.This also adds the no availability of land for public use.SCBA was tested in various part of the world and found the ash can improve the compressive strength of the material.

As we know that the roads are the life-line of every nation. A country's road network should be efficient in order to maximize economic and social benefits. Roads are an integral part of the transport system. They play a significant role in achieving national development and contributing to the overall performance and social functioning of the community. It is acknowledged that roads enhance mobility, taking people out of isolation and therefore poverty. Roads play a very important role in the socio-economic development of the country. The road transport industry is the backbone of strong economies and dynamic societies.

The road transport industry is indeed instrumental in interconnecting all businesses to all major world markets, driving trade, creating employment, ensuring a better distribution of wealth and uniting mankind. It plays a crucial role in the daily economic and social life of industrialized and developing countries alike. An important part of the road transport industry's story is sustainable progress.

The massive constructions release enormous amount of pollutants to the atmosphere and studies reveal that the pollutants from the construction industry are more harmful than the pollutants from any other segment. But on the other hand, there is a large production of agricultural wastes such as rice husk ash, wheat straw 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. It is observed that in India more than 600 MT wastes have been generated from agricultural wastes-(2010).

Sugarcane is largely produced in the states of Punjab, Haryana, Uttar Pradesh and Tamil Nadu. The state of Uttar Pradesh is called the "Sugar Bowl" of India. A large number of sugarcane processing industries are located in these areas. But a large quantity of wastes called as bagasse is produced from these sugarcane processing industries.

As production of sugar cane is more than 1500 million tons in the world and in India about 10 million tons of sugarcane bagasse ash is treated as a waste material.

These roads can be constructed in those areas where there is availability of sugarcane bagasse. In Uttar Pradesh and Haryana, there is a large scale cultivation of sugarcane and thus the sugarcane bagasse can be easily procured to be used in the construction of low volume traffic roads.

The fibrous residue (about 40–45%) of sugarcane after crushing and extraction of its juice is known as ‘‘bagasse”. The bagasse is reused as fuel in boilers for heat generation which leaves behind 8–10% of ash, known as Sugar Cane Bagasse Ash (SCBA) which is treated as waste and unutilized. Sugarcane bagasse consists of approximately 50% of cellulose, 25% of hemicelluloses and 25% of lignin. The use of sugarcane bagasse as bio fuel or burning in open fields has posed a great environmental threat of polluting air, water, etc. Even after strict restrictions by the government of these above said states, there is no end to field fires as people only want to get rid-off these bulky and huge wastes. During rains these wastes begin producing highly offensive gases, thereby again causing nuisance. The smoke produced also causes invisibility. It can therefore be advantageous to use it in the construction of pavements to mitigate the disposal problem as well as to minimize the use of natural aggregate (sand) and binding material (cement, bitumen), so as to construct the low volume economic road pavements.

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CHEMICAL PROPERTIES OF BAGASSE

Sr. No.	Chemical Compound	Percentge
1	Nitrogen	0.2- 0.3%
2	P2O5	1.5 -2%
3	K_2+Na_2	5-10 %
4	CaO	1-2%
5	Mgo	0.07%
6	Sio_2	85-90%
7	Heavy metals	NA
8	Fe	2-4%

1.1 Objectives and Scope of Study

The main objectives of the proposed experimental study is as discussed below-

- To study the physical properties of SCBA modified concrete.
- To arrive at a mix design review for modified concrete using IS code method.
- To study the workability of a fresh sample of this concrete.
- To study the different strengths of hardened concrete such as compressive strength of concrete samples at 7 and 14 days.
- To compare the workability and various strengths for different percentage substitutions of cement and sand with sugarcane bagasse ash.
- Economical design of low volume traffic road pavement tiles
  of different shapes and sizes by using SCBA.

2. MATERIALS USED

Waste Sugarcane Baggase Ash

Bagasse is a cellulose fiber remaining after the extraction of the sugar-bearing juice from sugarcane.Bagasse ash is one of the biomass source and valuable byproducts in sugar milling that often uses bagasse as a primary fuel source to supply all the needs of energy to move the plants. Burinf bagasse as a energy source yields its ash,considered as a waste causing disposal problems.It is well known that bagasse ash is an alternative source of energy with high silica content.The extracted silica from this study can be added value of silica source for many application of bagasse ash.

3. EXPERIMENTAL

Raw Material Preparation.

Sugarcane bagasse ,from local market and bagasse ash from sugarcane bagasse burnt in factory boilers,main raw materials,were used in this study.Before any treatment ,the sugarcane bagasse was dried,resized with refiner 2850 rpm &screened thriugh a sieve of 20 mesh size for 2 hours to eliminate the larger bagasse size.Then the pretreatment step with 1M&3M hydrochloric acid of those samples at 100 degree C for 2 hours was carried out.The samples were washed with distlled water until neutral condition was achieved.The samples were then dried in oven.The acid treatment helped to dealuminate the bagasse ash &to remove iron to certain extent for adjustig raw material quality.Afer acid treatment sugarcane bagasse&bagasse ash were treated in furnace under different temperatures at 600C,700C&800C ,different heating time 0f 1hour,2hour,3hour .The highly silica content from processing conditions was analyed.

4. MIXTURE PROPORTION AND SAMPLE PREPARATION.

Silica modified bitumen is prepared by adding Waste sugarcane bagasse ash in bitumen.The main purpose of this addition of bagasse ash in bitumen is to increase the strength of bitumen as baggase ash inherits ample amount of silica in it.Bagasse ash is added into the molten bitumen in the proportion of 10%,20%,30%,and 40% respectively and we further performed different kinds of bitumen tests over these samples.we found that the best result is attained at the addition of 40%of ash in Bitumen,which actually improves and enhances the property of Bitumen.

5. METHODOLODY

The evaluation of Bagasse ash for use as a replacement of Bitumen begins with the penetration test in which we add ample amount of bagasse ash in the bitumen in the proportion of 10%,20%,30% and 40% respectively.After the addition of bagasse ash in bitumen,the properties of bitumen is monitored and recorded for further analysis and the best attained data is appreciated.

6. CONCLUSION

Following conclusions have been drawn based on the present study:

- Sugarcane bagasse ash modified bitumen performed better when compared to ordinary bitumen up to 30% for baggase ash replacement and 10% of sand replacement in ordinary bitumen.
- Increase of strength in pavement is mainly due to presence of high amount of silica in sugarcane bagasse ash.
- These pavements are unaffected by the spillage of oil from vehicles and are ideal for bus stops, bus depots and parking areas.
- As far as the costs are concerned, it is estimated that the amount required per kilometre length of flexible pavement is Rs.90,10,000 and the cost of interlocking bagasse ash pavement is Rs.68,93,000 per kilometre. The construction of road using bagasse ash seems to be more cost effective than the conventional flexible pavement by 23.50%.
- Baggase ash pavement does not need in-situ curing and so can be opened to traffic soon after completion of construction.
- The design life of bagasse ash pavement is high when compared to conventional flexible pavement and also the maintenance of bagasse ash pavement is easy when compared to flexible pavement.
- The occurrence of damage is less in bagasse ashpavement and it is easy to remove and rectify the road with less amount. The digging and reinstatement of trenches for repairs to utilities is easier in the case of baggase ash pavement.
- Since there is ample amount of silica present in it, they are of a very high quality, thus avoiding the difficulties encountered in quality control in the field.
- Silica modified bitumen pavements restrict the speed of vehicles to about 60 km per hour, which is an advantage in city streets and intersections. The block pavements are ideal for intersections where speeds have to be restricted and cornering stresses are high.
- Unlike Rigid pavements, baggase ash modified bitumen pavement does not exhibit very deterioratory effect due to thermal expansion and contraction, and are free from the cracking phenomenon.
- Apart from these things, bagasse ash is a readily available waste material and is also an eco-friendly material. The design life of bagasse ash paver blocks road is 20 years, whereas design life of flexible pavement is only 10 years. So utilization of the waste material sugarcane bagasse ash is advantageous as a replacement of cement or fine aggregate in the preparation of concrete paver blocks.

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