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A short review on "Utilizing Sugarcane bagasse (SCB) –Chhattisgarh (India) prospect"

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Abstract - *The sugar base industries are facing a challenging task of solid waste disposals, which is a serious issue in a fast developing state like Chhattisgarh. The present review paper provides an overview of appropriate application areas and relevant technologies, which could enhance the value of the sugarcane produced and its solid waste such as bagasses. Furthermore, gives some information to improve the economic condition of the sugar producers by using the waste in a prudent ways.*

Key Words: Sugarcane, Bagasse, Ash, Fibers, Brick, Composite Material, Glass-Ceramic

1. INTRODUCTION

The widely known fact is that the sugar industry produces the largest amount of waste known as bagasses. The sugar cane fibrous matter (lignocelluloses) has been crushed to extract the juice. India is second largest sugarcane producer in the world, therefore the waste management of these bagasses needs special attentions. In the present paper, the main focus is on the sugar cane waste and it effective utilization for environmental point of view. "More then 68,196 metric tonne of sugar was produced during the prious fiscal 2013-14 by three cooperative sugar factories in Chhattisgarh. The factories are based in village Ramhepur of Kabeerdham (Kawardha) district, village krerta of Surajpur district and village Karkabhaat of Balod district. Nearly 7.70 lakh metric tonne of sugarcane was produced from around 10,000 farmers. (The Times of India, 6 sep. 2014)
Historically, the bagasse waste has been burned in the fields, and thereby creating a large amount of pollution. However, in the present days the tends are changing and the environmental awareness driving the prudent use of the bagasse. Some of the area where these bagasse have being utilized are manufacturing biodegradable and compostable food service products, green building brickes made with clays and sugarcane bagasse ash [1], sustainable acoustic absorber[2], multiple utility of SCB with other additive /chemical composite materials [3], producing glass – ceramic materials [4] and cogeneration industry as active pozzolans for manufacture [5] etc. In Chhattisgarh prospect the main use of SCB is using residues as fuel in small-scale brick making.

2.0 PRODUCTION

India is second largest sugarcane producer in the world. Major growing area is Utter Pradesh, Maharashtra and Tamil Nadu. Chhattisgarh is conceder as minor growing area. Due to good rain fall in Chhattisgarh (791 mm in Kabirdham http://agricoop.nic.in) production is growing year to year.

Table -1 Production of sugarcane in worldwide (http://www.agritech.tnau.ac.in)

Nations	Area (Million ha)	Production (Million tons)	Productivity (Tons/ha)
Brazil	5.343	386.2	72.3
India	4.608	289.6	62.8
China	1.328	92.3	65.5
Thailand	0.970	64.4	66.4
Pakistan	1.086	52.0	47.9
Maxico	0.639	45.1	70.6
Colombia	0435	36.6	84.1
Austramlia	0423	36.0	85.1
USA	0.404	31.3	77.5
Philippines	0.385	25.8	67.1
Indonesia	0.350	25.6	73.1
Cuba	0.654	22.9	35.0
South Africa	0.325	20.6	63.4
Argentina	0.295	19.2	65.2
Myanmar	0.165	7.5	45.4
Bangladesh	0.166	6.8	41.2

General uses of bagasse small scale brick makers are using local material for burning fuel for clamps. The bricks can be fired in 'clamps': temporary structures built from 'green' (dry, unfired) bricks. Alternatively, bricks can be fired in kilns: permanent structures, typically with a chimney. These kilns can be designed for intermittent or continuous firing, and tend to be more fuel-efficient than clamps. The use of cow-dung, bagasse, coal and paddy grass is common for local brick maker

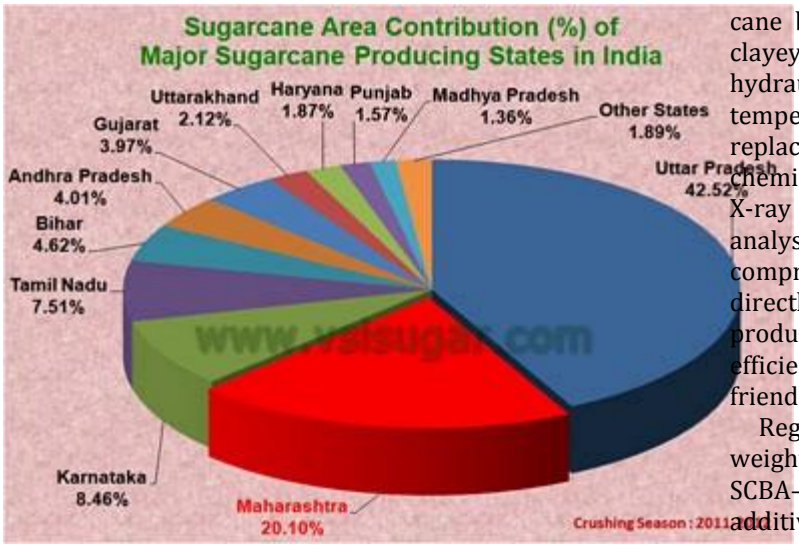

Figure-1: The sugarcane producing states [http://vsisugar.com/india/statistics/areaundersugarcane.htm]

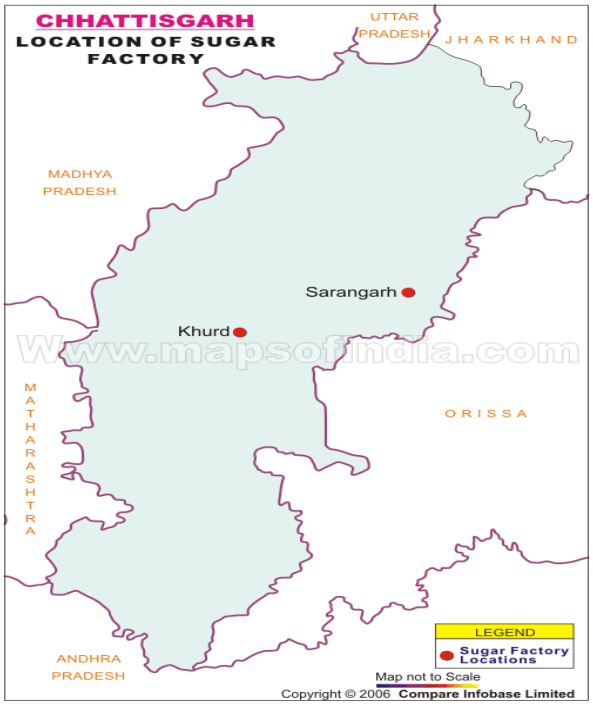

Figure-2: Location of Chhattisgarh Sugar Factory

3.0. USES OF SUGARCANE BAGASSE (SCB)

3.1 Green Building Bricks Made With Clays and Sugar Cane Bagasse [1]

Characterization in behaviour of the clay material used in construction clay brick industry due to additions of sugar cane bagasse ash (SCBA) was investigated. Mixtures of clayey soil and SCBA in proportions of 10-50wt.% were hydraulic uniaxial pressed and sintered at optimized temperature of 1,050°C. Experimental results of partial replacement of the SCBA specimens were carried out on chemical and mineralogical analysis (X-ray fluorescence and X-ray diffraction), thermal analysis (differential thermal analysis, TG), bulk density, water absorption and compressive strength. It is displayed that the SCBA can be directly affected on the properties of the sintered clay brick products. It influenced as a flux agent, becoming the energy efficiency of the lightweight clay brick and environmentally friendly brick.

Regarding to the advantages of less firing shrinkage, less weight loss on ignition and greater compressive strength of SCBA–CS brick should stimulate the use of SCBA as a brick additive in the green material. It indicates that SCBA has potential as a material for brick components .Based on the point of view, the energy-saving and maximum use of ash, it is apparent that mixture with 30% SCBA fired at 1,050°C was optimal for meeting the brick quality .Dried environment possess the highest values of mechanical strength. The resulting products have specific structure mainly composed of carbons and new formations of FeO, potassium and sodium silicates and aluminates as one crystal or amorphous phases.

3.2 Utilizing sugarcane Waste Fibers As A Sustainable Acoustic Absorber [2]

Utilization of sugarcane wasted fibers as an alternative sound absorbing material has been investigated. The effect of binder composition and fiber density are discussed with the former affects only for the 3 grams fibers and the latter to give better absorption coefficient. It is found that acoustical performance of the sugarcane absorber with thickness of ½ inch is comparable with that of commercial sound insulator with average absorption coefficient of 0.65 at frequency 1.2 - 4.5 kHz

3.3 Sugarcane bagasse the future composite material [3]

The SCB wastes have been applied in the following instance:

3.3.1 Cellulose, Lignin, Rind, combined enhance reinforcement in materials manufactured based on the different method applied;

3.3.2 Mixed with tapioca, starch and glycerol to produce composite material;

3.3.3 Mixed with gelatin, starch and agar to produce tableware packaging material;

3.3.4 SCB ash and sugar cane straw can partially replace cement and act as a pozzolanic additive in manufacturing of concrete and ash block;

3.3.5 SCB ash mixed with Arobic gum and water to produce ceramic and refectory precuts

3.3.6 Both sugar cane comrind and their mixture with hardwood are used with phenol formaldehyde resin and wax to manufacture composite board.

3.4 Reuse of sugarcane bagasse ash (SCBA) to produce ceramic materials [4]

Sugarcane bagasse ash (SCBA) is a residue resulting from the burning of bagasse in boilers in the sugarcane/alcohol industry. SCBA has a very high silica concentration and contains aluminum, iron, alkalis and alkaline earth oxides in smaller amounts. In this work, the properties of sintered ceramic bodies were evaluated based on the concentration of SCBA, which replaced non-plastic material. The ash was mixed (up to 60 wt%) with a clayed raw material that is used to produce roof tiles. Prismatic probes were pressed and sintered at different temperatures (up to 1200°C). Technological tests of ceramic probes showed that the addition of ash has little influence on the ceramic properties up to 1000°C. X-ray diffraction and thermal analysis data showed that, above this temperature the ash participates in the sintering process and in the formation of new important phases. The results reported show that the reuse of SCBA in the ceramic industry is feasible.

3.4 Sugarcane bagasse ashs from the cogeneration industry as active pozzolans for cement manufacture [5]

Sugarcane bagasse ash (SCBA) from the cogeneration industry as alternative cementing materials (active addition) for cement manufacturer .The ash from the industrial processes (filter and bottom) present different chemical and mineralogical compositions and pozzolanic properties as well. The SCBA can be used as a pozzlans. The main characterization requirements are

3.4.1 Physical characterization – Particle size distribution is required

3.4.2 Chemical characterization- chemical compositions of ashes by XRF in % mass required

3.4.3 Mineralogical characterization-X-ray diffraction (XDR) Thermogravimetric analysis required

3.5 Using residues as fuel in small-scale brickmaking [6]

The bricks can be fired in 'clamps': temporary structures built from 'green' (dry, unfired) bricks. Alternatively, bricks can be fired in kilns: permanent structures, typically with a chimney. These kilns can be designed for intermittent or continuous firing, and tend to be more fuel-efficient than clamps. The use of cow-dung, bagasse, coal and paddy grass is common for local brick maker.

3.6 The use of sugarcane bagasse ash and lime to improve the durability and mechanical properties of compacted soil blocks [7]

This study analyzes the use of lime and sugar cane bagasse ash (SCBA) as chemical stabilizers in compacted soil blocks. The blocks were tested for flexure and compression in a dry and a saturated state. The tests were performed at 7, 14 and 28 days of age in order to evaluate the effects of the addition of lime and SCBA on the mechanical properties of the compacted soil blocks. The results indicate that blocks manufactured with 10% of lime in combination with 10% of SCBA showed better performance than those containing only lime. Nevertheless, the addition of lime improved the strength of the blocks when compared with blocks fabricated with plain soil. According to SEM and DRX analyses, considerable improvement of the matrix was observed due to the formation of strong phases, such as CSH and CAH for the mixtures with additives. It was also concluded that the combination of SCBA and lime as a replacement for cement in the stabilization of compacted soil blocks seems to be a promising alternative when considering issues of energy consumption and pollution.

3.7 Developing uses for sugar-cane bagasse: Biotechnology applied to the paper industry [8]

The principal raw material used for manufacturing paper pulp is wood. However, growing demand in the paper industry, at a time of dwindling forest resources, have compelled the sector to turn to other sources of raw materials, such as cereal straw, reeds, bamboo or sugar-cane bagasse. This residue, obtained after crushing of the cane, is already used as a source of paper-making fibres in producer countries (in South America and India for example, where it represents 20% of the paper production). The industry absorbs 10% of the world bagasse production. This material offers several advantages: rapid growth of the sugar-cane plant, widespread cultivation, lower energy and bleaching

chemical requirements for bagasse refining. Such a process is also a convenient means of usefully clearing this voluminous sugar refinery waste product: indeed, one tonne of refined sugar results in two tonnes of bagasse. However, whatever the raw material used, paper pulp has to undergo processing stages of delignification and bleaching to turn it into high-strength and durable paper. In some countries the chemical processing involved still entail the use of chlorine, dangerous for both health and the environment.

3.8 Feed Categories [9]

Rabbits require high fiber content feeds and bagasse can be considered as good source of fiber (de Blas et al., 1999). Bagasse is fed ground to rabbits. In spite of various attempts to determine optimal size particle for rabbits, it is not clear that size particle has an effect on digestion coefficients or animal growth performances (Gomes et al., 2004 ; Vieira et al., 2003a; Vieira et al., 2003b).

3.9 Be used for animal bedding and animal feed (mary@vietnambiomass.com)

Sugar cane bagasse non-fermented, dry with moisture from 13-18%.
- Sugar cane bagasse fermented, wet with moisture from 55-65%
-Size : 5-8cm

Figure- 3: Compressed feed block

3.10 Improvement of indoor plantation.

We all bought a starter kit which included a plastic pot, vermi - compost, soil, wood ash, sugarcane bagasse, seeds. It gives good improvement in plant. This idea is good for reducing the west of small scale sugarcane juice producer in summer seasons.

Figure -4: Indoor Plant

3.11 Groundwater treatment through activated carbon of sugarcane bagasse

Smaller size of activated carbon is good for water parameter removal. Powder of activated carbon of sugarcane bagasse is good absorber for improving ground water treatment. Utilization of local agricultural waste producing of activated carbon (AC) for groundwater treatment.

Sugarcane bagasse's → Carbonized 500°C at 2 hours
Fertilized by Sulfuric acid → Activated carbon

Sugarcane Bagasse's Activated Carbon

Powdered AC (PAC), Granular AC (GAC)

Particle size 63 to 300 µm, Particle size 2mm to 3.35 mm Due to leaks of drain sewage and septic the ground water contamination may increase. Lot of waterborne diseases (hepatitis, dysentery, cholera, typhoid and skin) may have health effect. It can also harm flora and fauna. This problem can sort-out through proper cushion in these structures, of activated carbon of sugarcane bagasse.

4. CONCLUSIONS

In Chhattisgarh steady increase in the production of sugarcane requires urgent attention and awareness sugarcane waste management. Therefore, utilization of bagasse is must, which is one of major byproduct of these sugarcanes. This review article provides a brief overview of potential uses of sugarcane bagasse, which can be implemented in Chhattisgarh state to reduce the degradable environment impact. Beginning from the bricks to

ceramics, foods etc. shows that the sugarcane bagasse waste have a very promising prospective as a raw material for various applications.

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