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Utilization of sugarcane fiber waste (Baggase): A review

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ABSTRACT

The plants, which produce natural fibers, are classified as primary and secondary depending on their utilization. Primary plants are those grown for their fiber content while secondary plants are plants in which the fibers are produced as a by-product. Jute, hemp, kenaf, and sisal are examples of primary plants. Pineapple, Bagasse, oil palm and coir are examples of secondary plants. India is second largest sugarcane producer in the world. Cane stalk is crushed in sugar mills and alcohol mills, generating 30% of residue left after crushing called bagasse. The present review paper provides an overview of appropriate utilization of sugarcane fiber, which could enhance the value of the sugarcane produced and its solid waste such as bagasses.

Key Words : Sugarcane, Bagasse, Fibers, Utilization

INTRODUCTION

Sugarcane (*Saccharum* spp.) is a Poaceae commonly cultivated in tropical areas. In 2011, 1.7 billion tons of sugarcane was produced worldwide. Cane stalk is crushed in sugar mills and alcohol mills, generating 30% of residue left after crushing: bagasse. Now-a-days, the valorization of such byproducts is crucial for environmental and sustainable reasons. A transformation of byproducts at low environmental impact is of interest for the creation of new products, for instance, in the textile, composite, or geotextile industries.

Bagasse comes from different parts of the cane stalk comprising the outside rind crushed with the inner pith. It contains 45% of fiber and composed of 45% cellulose, 33% hemicelluloses, and 20% lignin. Long and fine fibers are located in the rind part of the stalk and short fibers in the

inside part known as the pith as discussed by Van Dillewijn. As bagasse is a mixture of both parts, the fibers have uneven and uncontrolled lengths. However, because of its high fiber content and particularly because of its cellulose rate, bagasse can be used to produce sustainable fibers.

Raw material preparation :

According to Michel *et al.* (2014), samples of bagasse of sugarcane from 12 varieties of Saccharum ssp. were collected. There was no significant difference between these varieties in the chemical composition and morphological structure of the basic components. Wet bagasse was collected at the exit of the sugar mill with 50% moisture content. The bagasse was oven-dried at 150^0C for 24 hours. The granulometric method was used for size wise classification of the dry

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bagasse particles. 25% of particles was collected in the 4mm mesh of the sieve and used for experimental purposes.

Extraction of sugarcane fiber:

Asagekar and Joshi collected the residue left after extraction of juice called bagasse. The samples were then subjected to hot water treatments (material: liquour ratio 1:50) and kept in hot water at 90^0 C for 1 hour for removal of colouring matters and sugar traces. The samples were dried under the sunlight and then subjected to chemical extraction. In this process, samples were treated with 0.1N NaOH solution, at boiling water temperature for 4h under atmospheric pressure. The material: liquour ratio taken for the process was 1:100. During the tenure samples were subjected to vigorous stirring for effective separation of fibers. The well separated fibers were then dried.

Sugarcane fiber waste for textile use:

Fiber bundles were chemically extracted from raw bagasse of sugarcane. The alkaline extraction was the best and most efficient way to remove lignin since the solution was more concentrated. A pre hydrolysis in salty water inflated fibers that facilitated the impregnation of chemical reagent. Alkaline extraction affected the dimensions as well as the mechanical properties of the fibers in bundles. However, the use of alkaline alone or combined with pre hydrolysis did not produce ultimate individual fibers. The use of concentrated solution was limited because of the severity of the extraction which prematurely can affect the cellulosic content. Thin fibers were obtained at high alkaline concentration with a lack of tenacity, of bending rigidity, and of bending hysteresis. These parameters could be improved by changing extraction conditions, using additional tools like ultrasounds and mechanical action after the chemical extraction. All in all, fiber bundles dimensions and properties can be controlled by the extraction condition according to the use wanted.

Sugarcane fiber waste as a building material :

Hyeng *et al.* (2016) stated that raw soil as a constructional material generated renewed interest primarily because of its availability, low cost and compliance with global sustainability goals. In order to improve the mechanical properties of adobe bricks, an investigation was conducted to assess the mechanical properties of sugarcane fiber waste stabilized adobe bricks. As a vegetable, the sugarcane fiber (bagasse) is an entirely biodegradable natural resource which is available in large quantities all over the world.

The tests confirmed that the addition of sugarcane fiber waste to adobe bricks improved its compression strength, resistance to moisture penetration, shrinkage and durability. The bricks with 3% sugarcane fiber by weight had the best properties with the highest compression strength (4.79 MPa). The water submersion test revealed that the addition of sugarcane waste fibers reduced adobe brick sensitivity to water because while the non-stabilized adobe bricks lasted only two hours before total deterioration, the 3% fiber stabilized bricks lasted for more than one week. The optimum values were obtained for the bricks with 3% sugarcane fibers. However, further tests should be carried out in order to determine the maximum content of sugarcane fiber beyond which the mechanical properties of sugarcane stabilized adobe bricks will start to decline. Recycling abandoned sugarcane fiber waste for the manufacture of adobe bricks will reduce the environmental and economic challenges associated with the disposal of sugarcane waste. Also, the improved sugarcane fiber stabilized adobe bricks will contribute to the production of more durable and sustainable adobe brick structures. In the long term, the diffusion of sugarcane fiber waste stabilized bricks should

contribute to the advancement of global housing sustainability goals leading to reductions in environmental deterioration.

Sugarcane fiber waste in cement composites:

Ghazali *et al.* (2008) found in their work that natural sugarcane bagasse fibres and cement were used as precursors for composites, with styrene butadiene (SBR) latex as a binding agent. The matrix was cement whilst the filler and reinforcement was bagasse fillers. Various compositions of SBR ratio; ranging between 3 -18 %wt were prepared for evaluation. These samples were then evaluated for mechanical property measurement as well as morphology. It was found that the composites with 6 % of SBR content showed the highest stiffness. Composites with the highest stiffness and elastic modulus value were then subjected to radiations between 10 - 70 kGy. The electron beam radiation technique at different doses was carried out in order to modify the microstructure of the bagasse/cement composites. It was noted that the elastic modulus was greatly improved by 26.5% with 30 kGy radiation dose. Analyses by the scanning electron microscopy on the microstructures of the irradiated composites indicated that the voids within the matrices were greatly reduced, which therefore increases the mechanical properties of the composites, as a whole, than those of unirradiated ones.

Sugarcane fiber waste for production of non woven materials:

Visco elastic nonwoven composites exhibiting good mechanical characteristics were successfully prepared by hot pressing bagasse/cotton webs sandwiched between Eastar biocopolymer (EBC) melt blown nonwoven fabrics. The nonwoven composite degraded at a rather high temperature (220°C), but the exploitation temperature is limited to 70-100°C by softening and melting of the synthetic polymer. Nonwoven composite samples exhibited low thermal and heat transmittance coefficients. For the same composition these coefficients can be tuned by changing the construction parameters (density and number of layers). The soil burial method clearly evidenced the starting of the biodegradation process by the diminution of the mechanical characteristics (strength, modulus) of the test samples after weeks in soil.

Sugarcane fiber waste as an adsorbant in textile industry waste water :

Vijayakumar *et al.* (2014) found in their research that natural adsorbant sugarcane bagasse was used for removal of color from waste effluent of textile industry. The adsorbant prepared was employed for the removal of color at the different doses. The adsorbant was found to be capable of removing color from wastewater; the color removal capacity for sugarcane bagasse was approximately 88% at normal pH and temperature from the experimental investigations, the maximum color removal from the textile industry wastewater was obtained at an optimum adsorbant dosage of 10g/l of wastewater, with an optimum contact time of 24 hours, at room temperature. This result was higher than the results obtained by different process parameters for various adsorbants. Finally, from the results of adsorption study, it was concluded that adsorbants has the capacity of removing the color from textile industry wastewater especially sugarcane bagasse because of its higher adsorptive capacity. Thus it was found that sugarcane bagasse can be used as an effective adsorbent for removing color and other pollutant parameters such chloride, sulfate, iron, BOD, COD from textile industry wastewater. As the result of this study transmittance was found to be at the increased level of 88%, absorbance was reduced up to the level of 0.05, the sulfate was reduced from 318.45mg/l to 92 mg/l.

Conclusion:

The sustainable tomorrow for future generation lies with the present industrial development towards eco efficiency of industrial products and their process of manufacturing. High performance, biodegradable materials and renewable plant materials can form new platform for sustainable and eco-efficient advance technology products As we all know that the waste from the industries is very harmful for the environment as well as to our health, if not disposed in proper manner. The fibrous residue of sugarcane after crushing and extraction of its juice, known as "bagasse" is one of the largest agriculture residues in the world. The 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 affects the health of human being, environment, fertile land, sources of water bodies etc. Kulkarni *et al.* (2013) studied that Utilization of industrial and agricultural waste products in the industry has been the focus of research for economic, environmental, and technical reasons.

REFERENCES

Asgekar, S.D. and Joshi, V.K. (2014). Characteristics of sugarcane fibers. *Indian J. Fiber & Textile Res.*, **39** : 180-184.

Christian Bock Hyeng, Andrea N Ofori Boadu, Emmanuel Yamb Bell and Musibau Shofoluwe (2016). Mechanical Properties of Sustainable Adobe Bricks Stabilized With Recycled Sugarcane Fiber WasteInt. *J. Engg. Res. & Application*,**6** (9) (Part -3) : 50-59.

Davina, Michel, Bruno, Bachelier, Jean-Yves Drean and Omar Harzallah (2013). Conference Papers in Materials Science, Volume2013, Article ID651787.

Ghazali, M.J., Azhari, C.H., Abdullah, S. and Omar, M.Z. (2008). Characterization of Natural Fibers (Sugarcane Bagasse) in Cement Composites, Proceedings of the World Congress on Engineering, 2008 vol II London UK

Karthikeyan, B., Ramanathan, S. and Ramakrishnan, V. (2010). Thermo physical property measurement of metal matrix composites. *Materials & Design*, **31** : S82 - S86.

Kulkarni, Apurva, Raje, Samruddha and Rajgor, Mamta (2013). Bagasse ash as an effective replacement in fly ash bricks. *Internat. J. Engg. Trends & Technology (IJETT)*, **4** (10) : 4484-4488.

Suddell, B. (2009). Industrial Fibres: Recent and Current Developements. In Proceedings of the Symposium on Natural Fibres. p. 71 - 82.

Vijayakumar, S., Arunprakash, C., Gobinath, R., Poornimasree, S.R. and Shidhardhan, C.K. (2014). Preliminary Adsorption Studies on Textile Industry Waste Water Using Sugarcane Bagasse as an Adsorbant. *Internat. J. Sci. & Technol.*, **2** (3) : 55-58.

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