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A Review: Design and Fabrication of Coir Pith Briquetting Machine

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Abstract: Today a vast shortage of fuel made us humans to search for the alternative sources of energy. These sources took various forms as natural as well as from the waste. Waste from best was the tagline for many years. Objective of this was to get best energy source with less harm to the environment. Thus a new term called Biomass (Coir pith) came to birth. It was nothing but using waste from food industries and household for obtaining the fuels. These fuels were in various forms liquid, semi solid viz. Thus further fuels were stored in form of their state so that they can be used at the time of necessity. Here we are manufacturing a device which in output gives a coir pith briquette which can be used as per need. The production value was found to be lower due to the lower binder requirement for the new machine, which is lower by about 65%. The starting moisture content of the feedstock required for this machine is lower by about 30 % compared to the best alternative, which results in shorter drying time for the fuel briquettes produced. The quality of the produced briquettes was found to be better and of lower smoke generation when burned due to the lower binder content.

Keywords: Motor, Hopper, Conveyor, Pneumatic Cylinder

I. INTRODUCTION

Coir pith briquettes are a bio fuel substitute to coal and charcoal. Briquettes are largly used in the developing world, where cooking fuels are not as easily available. Coir pith briquettes, mainly made of coconut shell waste, green waste and other organic materials, are commonly used for electricity generation, heat, and cooking fuel. These compressed compounds contain varied naturel materials, including rice husk, bagasse, ground nut shells, municipal solid waste, agricultural waste. The composition of the briquettes varies by space because of provision materials. The raw materials are gathered and compressed into block in order to burn longer and make transportation of the goods easier.

We are making machine which consist of motor, pulleys connected through belt drive and a type of screw conveyor which compresses the slurry and conveys to the output port from which a solid blocks of waste are made. Many of the developing countries produce turn out vast quantities of agro residues but they are used inefficiently causing extensive pollution to the environment. The conversion efficiencies are as lower as 40% with particulate emissions in the flue gases in excess of 3000 mg/Nm³ In addition, a large percentage of un burnt carbonaceous ash has to be disposed of. In the case of rice husk, this amounts to quite more than 40% of the feed burnt.

II. LITERATURE REVIEW

Briquetting is the densification of loose biomass material. Fuel briquettes emerged as a significant business enterprise in the 20th century. In the 1950s, several economic methods were developed to make briquettes without a binder where multitude of factories throughout the world produced literally tens of millions of tons of usable and economic material that met the household and industrial energy needs (Lardinois and Klundert, 1993).

J.T. Oladeji, the findings of his study have shown that, the briquettes produced from rice husk and corncob would make good biomass fuels. However, from the study, it can be concluded that, briquette from corncob has more positive attributes of biomass fuel than rice husk briquette. Finally, the study also concluded that, both briquettes will not crumble during transportation and storage because the values obtained for their relaxed densities are closed to the maximum densities of the briquettes from the two residues.

S. H. Sengar , A. G. Mohod , Y. P. Khandetod , S. S.Patil , A. D. Chendake have observed that the Cashew nut shell, grass and rice husk were used as major biomass in the form of raw biomass, hydrolyzed biomass and carbonized

biomass. Carbonized biomass was found suitable as compared to raw (as such) and hydrolyzed biomass for briquetted fuel. The briquettes were prepared on screw press extruder briquetting machine for different combinations of major biomass.

A. Olorunnisola said that the wood in form of fuel wood, twigs and charcoal has been the major source of renewable energy in Nigeria, accounting for about 51% of the total annual energy consumption. The other sources of energy include natural gas (5.2%), hydroelectricity (3.1%), and petroleum products (41.3%) (Akinbami, 2001). The demand for fuel wood is expected to have risen to about 213.4 x103 metric tones, while the supply would have decreased to about 28.4x103 metric tones by the year 2030 (Adegbulugbe, 1994).

Idah, P. A , Mopah, E. J. has studied The effect on environment by agricultural and other industrial wastes is on the increase and is causing a lot of problem. Adequate means of disposing these wastes are lacking, hence, converting them to other useful products such as briquettes for domestic fuel is desirable. In this work, the energy values of briquettes made from some of these agricultural by-products using two binders were assessed.

Harshita Jain , Y. Vijayalakshmi , T. Neeraja have derived an experimental research design was adopted to conduct the present investigation. For the present study six biomass materials namely Charcoal Dust, Saw dust Rice Husk, Dry Leaves, Wood Chips, Groundnut Shells and two binders namely Cow dung and Starch were identified. The commercially available briquetting machine of 5 horsepower motor was selected for making the briquettes. Subjective evaluation of physical properties of briquette i.e. texture, cohesiveness, moisture, shape, evenness of surface and appearance of surface was conducted by a panel of 6 judges comprising of staff and PhD graduate students of College of Home Science. The data obtained from the experimental tests was compiled, tabulated and statistically analyzed by mean and standard deviation.

Daham Shyamalee , A.D.U.S. Amarasinghe , N.S. Senanayaka found that the Biomass briquettes are often used as an energy source for cooking purpose and in some industries like bricks and bakery. The briquettes are produced by densification of waste biomass using various processes. In this study manual densification of saw dust was tested with three different binding agents; dry cow dung, wheat flour, and paper pulp.

Riya Roy has found that the Briquettes produced from ligno cellulosic waste, through a simple process and low cost are an excellent source of energy and environmentally benign, ideal for replacing fossil fuels in this day. In the present research, an experimental study was undertaken for production and quality analysis of different briquettes using dry leaves, wheat straw & saw dust as the feed stocks & paper pulp, cow dung as binder. These briquettes were analysed by using proximate analysis. The results were then compared with a commercially available cow dung briquettes. Results showed that briquettes produced by using these feed stocks and cow dung as a binder had a calorific value of 5920.40kCal/kg, which was higher than other briquettes used paper pulp (5874.12kCal/kg) as a binder and also higher than the commercially available cow dung briquettes (3452.34kCal/kg). Other properties like percentage of ash content, sulphur content & chloride content were less and also there was an increased percentage of volatile matter when compared to traditional cow dung briquettes. Thus produced biomass briquettes can be used as a replacement for the commercially available cow dung briquettes.

Olawale J. Okegbile, Abdulkadir B. Hassan, Abubakar Mohammed*, Barakat J. Irekeola have tested effect of starch and gum arabic as binders in the combustion characteristics of briquette prepared from sawdust of different ratios wa s investigated. Briquettes of sawdust were produced by mixing with different binders and agglomerate using starch paste and gum arabic. The mixture wa s compressed at 110kN using manually operated hydraulic briquette machine and sun dried. Water boiling test was employed to obtain percentage heat uti- lized, specific fuel consumption and time spent to boil 1kg water. The calorific value, the volatile matter and flame temperature were determined. Results showed that the briquette formed using starch as a binder performed better in all aspect than the gum arabic.

III. WORKING METHODOLOGY

Origin of Coconut: The origin of coconut palm is the subject of a good deal of controversy which once evoked the interest of a host of botanists. The primary recorded history of coconut in the country dates back to Ramayana period. Within the Valmiki Ramayana there are references of coconut in the Kishkindha Kanda and Aranya Kanda. The importance of coconut “The tree of Heaven or Kalpavriksha” will be appreciated when we consider its innumerable uses to mankind. The tree further its products have gone deep into our culture and have a record history of more than 4000 years.

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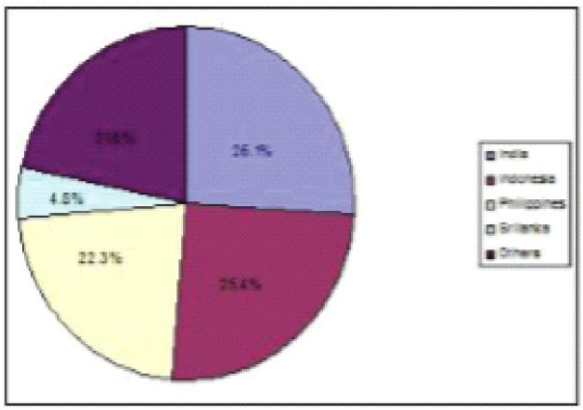
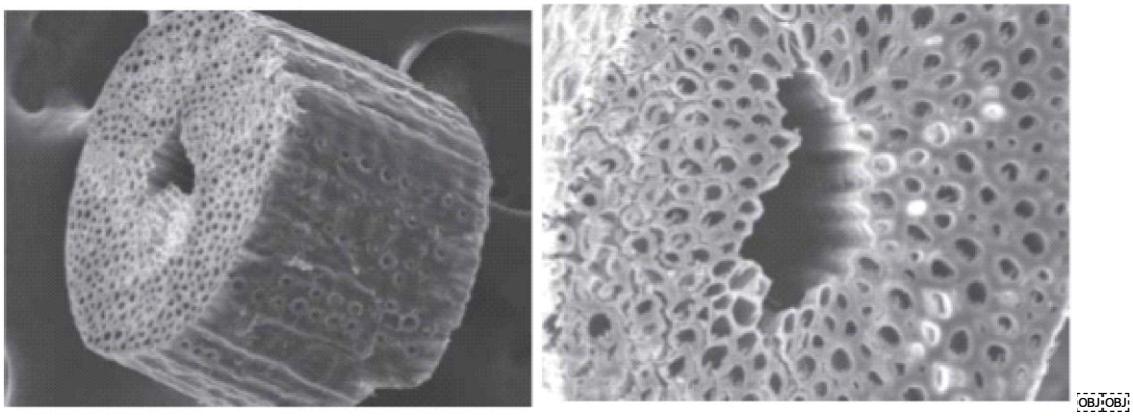
Areas of Coconut Cultivation in World: Though coconut palms grow throughout the tropical regions, the vast majority of the commercially produced coir comes from India and Sri Lanka. In recent years, India has attained the highest position amongst the coconut producing countries ie. about 26.1%. Indonesia, Sri Lanka and Philippines are the other major countries. In India, that coconut is primarily a food crop, that produces about one-fourth of the world's 53,598 million coconuts each year, and 15% of the husk fibers are actually recovered for use.



Coir is a 100% organic naturally occurring fiber derived from a renewable resource of coconut husk. Coir fibers resemble the wood fibers in terms of physical properties and chemical composition. Naturally resistant to rot, moulds and moisture, it is not treated with any chemicals during its spinning process for converting it into yarn. Hard and the strongest among all natural fibers, it can be spun and woven into different types of mattings and mats.

Coir fibers are categorized in two ways. One distinction relies is based on whether they are or not they are recovered from ripe or immature coconut husks. The husks of totally aged coconuts yield brown coir Truly brown in color, it is used primarily in brushes, floor mats and upholstery padding. On the opposition hand, white coir comes from the husks of coconuts harvested shortly before they ripen It is sometimes spun into yarn, which may be woven into mats or twisted into twine or rope. Both brown and white coir consist of fibers ranging in length from 4-12 inches (10-30 cm). The fibres of at least 8 inch (20 cm) long are called bristle fiber.



SEM Structure of coir fibre

Highly resistant to abrasion, coir fibers are used to make durable floor mats and brushes. Strong and nearly impervious to the weather, coir twine is the material that hops' growers in the United States prefer for tying their vines to supports.

Composition of Coir Pith: Coir waste has a high lignin (30-31%) and cellulose (26.8%) content. Its carbon nitrogen ratio is around 112:1. Lignin is a complex amorphous polymer of phenyl propane which surrounds the cellulose in cell walls and is relatively inert to hydrolysis. Because of the high lignin content left to it, coir waste takes decades to decompose. Coir pith has a calorific value of 3975 kcal per kg close to 4200 kcal per kg of coal and hence it can be used as fuel briquette and also in pig iron manufacture, tobacco fluecuring, gas absorbent cotton etc.

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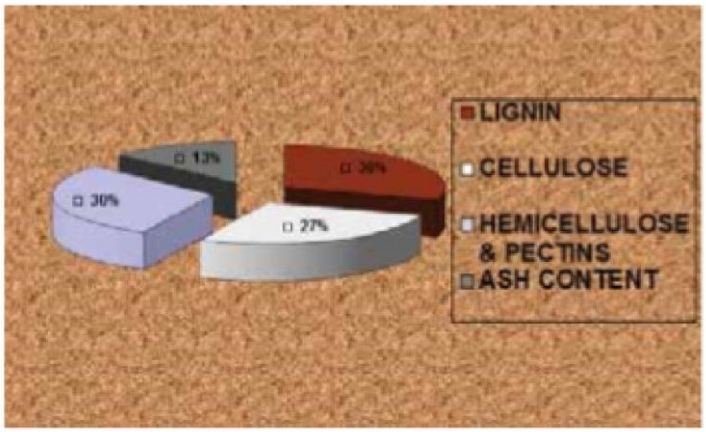
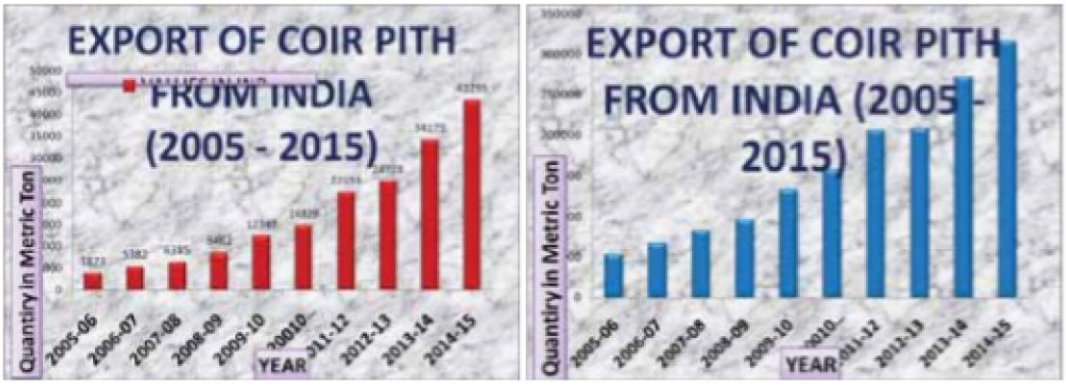


Export Potential of Coir Pith: Coir pith offers good scope for export if processed for use as soil conditioner. The most recent realization that there is shortage in development of peat moss and that the indiscriminate exploitation of bogs is very harmful to the environment has opened an opportunity for coconut husk in the growing market demand for gardening supplies. Coir pith is gaining popularity as a plant growth medium in U.K and elsewhere in Europe as an excellent natural alternative to other soil conditioners. The fibrous nature of coir pith makes it capable of breaking even the heaviest of clay soils, allowing free drainage. Because of its sponge like structure, coir pith helps to retain water, oxygen and prevent loosening of vital nutrients.



Export of coir pith

Coir pith could also be effectively marketed due to its consistent size, absence of glass, plastic, metals and objectionable odour. Some processes have been reported in the prior art for use of coir pith in horticulture, oil absorption, bio-pesticides, soil conditioners and as fertilizers. The industry though nascent in our country has managed to establish its position on the global arena. Industry insiders, however lament that the lack of awareness of the

Drying of fibre: Initially the fibre of the coco and jute are dried so it will be easy to remove the powder from the fibre. Drying is done by means of sunlight instead of electrical energy by effectively using it without wasting the electricity. Coco peat is a natural fibre made out of coconut mud. The combining of the coconut fibre from husks gives the by-product called coco peat. This coco peat dried in the natural sun, are processed to making different items. This makes an excellent growing normal for hydroponics or container plant growing. Clean coir has natural rooting hormones and anti-fungal properties. Most of all coco peat is 100% organic natural and root friendly product. An organic potting medium making from natural fibres, this all natural material is not only ideal for hydroponics and mixed media cultivation, but is an excellent soil conditioner as well. This material loosens clay soils and is highly porous to aid in strong root development. It has a soft fibrous texture that does not crust when it dry.

Separation of pith: After drying the fibres are separated according to the quality, so that low quality fibres are used for the purpose of making the preserver sponge. High quality fibres are used for toys making and commercial products. Coir dust is the soft, peat like residue from the processing of coconut husks (meso carp) for coir fibre. Also known as coco peat, it consists of less fibres.

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Powdering of the fibre: Separated fibre is taken and dropped into the revolving drum studded with metal spikes that comb the fibres out. Automatic process starts by grinding the fibre to required consistency, filtering and pressing. Grinding mechanism consist of nested bowl with spikes attached to single phase induction motor so that motor rotates the bowl and the powered pith fall into the filter.

Filtration: Filtering of the sand dust and waste material is done in the filtering process and the powder is transferred to the hopper.

Compaction: The pith in the hub is pressed using the double rod cylinder in which both the strokes of the cylinder is utilized for the pressing of the pith. Efficiently return stroke of the rod is utilized and the production is also increased by this design of the cylinder.

pH and EC (Electrical conductivity) were measured on a Squeeze extract. N is Nitrogen, P is phosphorus, K is potassium and Cl is Chlorine. Coir dust is less acidic than sedge or sphagnum peat and smaller amounts of lime are needed to achieve a pH suitable for growing plants. Tomato seedlings grew larger and faster than in coir or peat with an acceptable salt content. The nitrogen and phosphorus content of unamended coir as with peat and most other organic media is too low to contribute greatly to plant nutrient needs. These and other nutrients must be added as part of a balanced fertilizer program to obtain maximum plant growth.
Coir is a 100% organic naturally occurring fiber derived from a renewable resource of coconut husk. Coir fibers resemble the wood fibers in terms of physical properties and chemical composition. Naturally resistant to rot, moulds and moisture, it is not treated with any chemicals during its spinning process for converting it into yarn .Hard and the strongest among all natural fibers, it can be spun and woven into different types of mattings and mats. Coir fibers are categorized in two ways. One distinction is based on whether they are recovered from ripe or immature coconut husks. The mud of fully ripened coconuts yield brown coir. Strong and mainly resistant to abrasion, its method of processing also protects it from the damaging ultraviolet component of sunlight. Dark brown in color, it is used primarily in brushes, floor mats and upholstery padding. On the another hand, white coir comes from the husks of coconuts harvested shortly before they ripen.

IV. CONCLUSION

In this study, the potential of manufacturing block from coir dust and rice husk blend has been demonstrated. Coir mud and rice husk combining ratio of 80:20, 60:40, 50:50, 40:60, 20:80 and 0:100 were used to produce briquette. Effect of combining ratio on density, compressive strength, calorific value, burning rate and water vaporizing capacity was reported. The results indicate that briquettes from coir dust and combining ratio of 50:50, 40:60 and 20:80 are superior to the rice husk briquettes in terms of density, compressive strength, calorific value, burning rate and water vaporizing capacity. Briquette produced from the cobining ratio of 20:80 has greater calorific value, compressive strength and slower burning rate hence it is more suitable for briquetting. In addition, block created from the mixing ratio of 50:50 and 40:60 also have higher calorific value, compressive strength and slower burning rate over rice husk. Since the value of rice husk is higher in Bangladesh, production of briquette block using coir dust and rice husk mixing ratio of 50:50 is most suitable for commercial scale.

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