Fuel from Green Tender Coconut

B.Koteswararao[1],L.Ranganath[2],K.Radha Krishna[3]

[1,2,3]Assistant professor, K L University
Vaddeswaram,Guntur,India-522502
basam.koteswararao@gmail.com
mechranga@hotmail.com
radhakrishna.k@kluniversity.in

Abstract: ***India is known for its production in tender coconuts. Crops laid throughout the year not like any other fruits or vegetables. The usage of coconut is immense, in temples, homes, drinking purpose etc., we can see lots of tender coconut shells as waste after using in above places and found them near to street bins and road sides. Our paper is focusing on utilizing that waste in to coconut Briquettes. The tender coconut will be mashed in to pieces and then pressed by special pressing machine by supplying heat to remove unwanted coir .Briquettes produced by this procedure will be having hallow elliptical shape Thus the briquettes we are looking to replace fuel is formed. The main difference from normal coal to our paper is efficiency and also environment friendly . The solid briquettes can be burnt up to 3-4 hrs. where as normal one only light up to 20 minutes at the max . The normal coal produces carbon dioxide, sometimes carbon monoxide and sulphur oxides. But this coconut shell brick lead to clean environment. our aim is to use the waste product into fuel as well as control the dieses which will cause by wastage of tender coconut in open places.***

Keywords*:* Briquettes[1] ,Crops[2], Elliptical[3], street[4] ,temples[5], vegetables[6].

1. Introduction

Coconut or Tender Coconut once we heard this word, the first country to hit our minds is INDIA. Coconuts are used on regular basis for several purposes like marriages, ceremonies, temples, drinking purpose etc., everyone uses the water or white flesh inside it .After the usage it will be thrown out, as waste and this waste is enormous on roads of cities and in villages. Our focus is to utilize this waste in to a form as a household product.

The coconut shell is hard and tough in nature (outside) this coconut shell in villages will be used as fuel for campfires, cooking purposes. Looking deep in that application point of view, it can be utilized as replacement for coal in villages and also in power plants . To form a raw coconut as briquette it needs to undergo different process.

PROCESS WE ARE FOLLWING

Figure 1: process followed

Shells of tender coconut are gather and spread on a colander and then fed in to a masher as shown in figure below (where all these coconut shells will be cut in to pieces of 50mm size. These sizes will be further cut down in to 10 mm size. After finishing of sizing the next is separation chamber. The pieces will be collected and dried in sunlight for days and then grind it powder form. The formed powder will be mixed with water and then compress will form a briquette.

In general coconut shells has a concentration of about 1.2 g/cm3 and is five times harder than the hardest hardwood grown in the India mainly in villages. The extremely high concentration and hardness make coconut shell an excellent provide for stock for charcoal and activated carbon filters. While the shell is widely used for these applications, the price of charcoal is low and stipulate for activated carbon filters utilize only a small fraction of the coconut shell that is available. The pith's other property, the chemical reactivity, is the subject of this study. Naturally[1] taking place chemicals in the pith allow it to be hot pressed into a binder less particle embark that may be used as a wood substitute in places where wood resources are scant and costly or where there are sell demands for green materials. It has been said that man has made everything from pith except money, but that notion is going to change. Coconut[2] pith will quickly be formed into a viable construction product that will help elevate the value of coconuts and improve the profits of millions of coconut farmers around the world. Coconut shells are also used to made charcoal which is use as fuel and this coconut charcoals are outlying better than other charcoals. Coconut shell charcoal[23,24,25] is generally used to fabricate active carbon. Normally on the go carbon is known as the charcoal which has treat with oxygen's. Active[3] carbon is use widely for removing impurities. This coconut shell charcoals are widely used in purification industry[4] and other industries which active carbon are used.

Availability of source

Table:2.Production of Tender coconut

S.No	Area	Production	Percentage
1	Andhrapradesh	6.85	6
2	Karnataka	21.51	21
3	Tamilnadu	19.10	19
4	Kerala	50.56	50

5	Maharashtra	1.09	2
6	Pondicherry	0.89	1

These calculations taken depend on the seller in respective state coconut seller and distributors. These may vary from 2 to 3% in production.

In this paper we are elaborating the machine parts and process to our desired output.

Figure 2: Tender coconut

2.Literature Review

As the availability of wood is increasing , most of the countries are turning towards re-usage of residual waste from agriculture or other parts[4] (grover and Misra ,1996; Tripathi et al . 1998) The residue from the agricultural waste has many disadvantages like low calorific value , difficulty in burning , inventory control , transportation problems. These disadvantages with low density will be converted in to high density fuel in the form of briquettes. When we heard the word [10]Briquettes, which mean it as replacement or form of coal. And these coal briquettes is commonly used for various purposes like campfire, household and for other purposes. Goldstein, 1981). The production of these residual briquettes has drastically increased with various technologies. On the other hand it is very easy for transportation. (sugumaran and Seshadir 2009)

They are two types of residues 1. Crop residues 2. Agro industrial residues. Our paper is focusing on agro industrial residual waste especially coconut shell & coir. During our child hood, we saw dried coconuts were thrown in to campfire to prepare food along with this dung[5,6,7] cakes. Taking this in to account researchers given a thought how we can make this in a better and that is where our briquettes are in to picture. After world war II , as there was scarcity in fuel resources people started using drenched waste paper along with other domestic waste which can be flammable . (Lardinois and Klundert ,1993) . Based on the equipment used to form a briquette , they are categorized in to 5 types : manual press , roller press, screw press, piston press according to FAO(1990). A survey was conducted by FAO(1990) on briquette plants established in different parts of world and the result was huge failure, due to lack of knowledge on procedure, misusing of spares, implementation failure , lack of government support

Coconut is a dry drupe the outer thin layer is named as exocarp and middle layer is a mesocarp and hard inner layer called an endocarp.

http://www.geochembio.com/biology/organisms/coconut/

Figure 3: Nomenclature of Coconut shell

http://waynesword.palomar.edu/ecoph10.htm

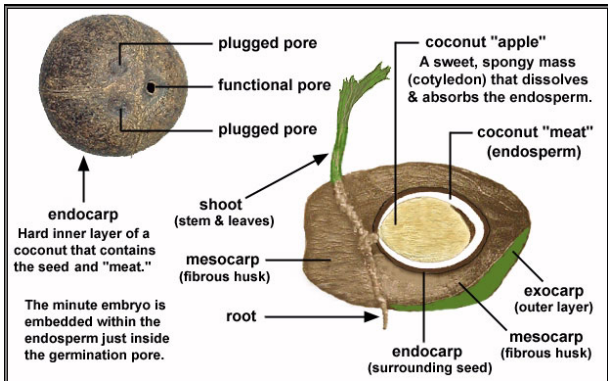

Figure 4 : Description of cocunt nomenclature

The nut sizes varies from 147 to 196 mm in diameter and 245 to 294 mm long. The thickness of fleshy layer is about 12.25mm and is known as coconut meat. Coming to cultivation aspect more than 90 countries cultivate the crops of coconut throughout world. 15.28% of the global area and 19.44% of global production is form India, next to India it is Indonesia.

The coconut meat was chopped in to fragments by back and forth rotation of a knife shaped shallow spoon Rey(1995). Mix (1957) designed a machine which remove the shell from coconut meat. With high pressure water the coconut meat will be separated from its shell by Blandis and Glaser (1973).So far de-shelling machines[11,12,13] are not in to market, and our objective is make an attempt to achieve this.

Briquetting technology is classified in to three forms one at high pressure, medium pressure and low pressure. For high pressure compaction is more than enough, in case of medium, compaction along with heating. Finally for low pressure briquette will be formed by a binding agent.

In this paper we are following medium pressure compaction to form briquette.

3.Cutting machine

The main components of the machine are as follows :

- Belt conveyer,
- Damper motor,
- Chopper blades,
- Frame.

Frame is a structural component which can withstand all the load acting on it .The cutting machine comprises of two shafts intermediate shaft and cutter shaft made up of mild steel . These two shafts are ended by ball bearings. A 3 HP power motor is attached to base for transmitting power from motor shaft to cutting shaft through intermediate shaft. Low speed cutting is preferable as the strength of coconut shell is low.

The tender coconuts dumped in the funnel. A conveyer system connecting the damper and funnel. Machine consist of Belt Conveyer, Damper Motors, Damper Pistons, and Chopper Blades. This cutting machine specially design for the coconuts it is more rigid. It has good material properties like stiffness ductility and corrosion resistant, this machine has more flexibility to operate, this is operation[18,19] made with the help of motor the following details are given below

Table 1: Machine specifications

S.No	Name of the component	Specifications
1	Belt Conveyer	8 meters length
2	Damper Motors	a) 5 H.P Motor b) 3 H.P motor
3	Damper Pistons	a) 50 mm Diameter b)15 mm Diameter
4	Chopper Blades	10+5

The chopper blades were shown in the figure below , The cutters are framed like mesh , when the coconut from the source moves on to the mesh are , the damper will damp the coconut in to pieces , and further ramming will lead to desired output (here 50mm size). The material is mild steel for better accurate and reliability .

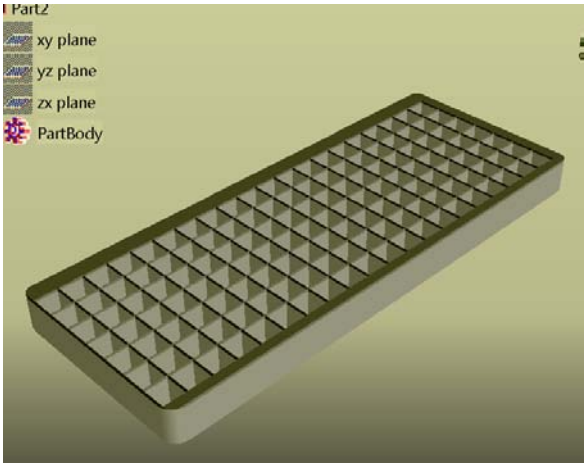

Figure 5: 50mm dia cutter

After shredding to 50 mm size , the pieces of shell are fed to another slicer mesh for further reduction in size i.e., from 50mm to 10mm .

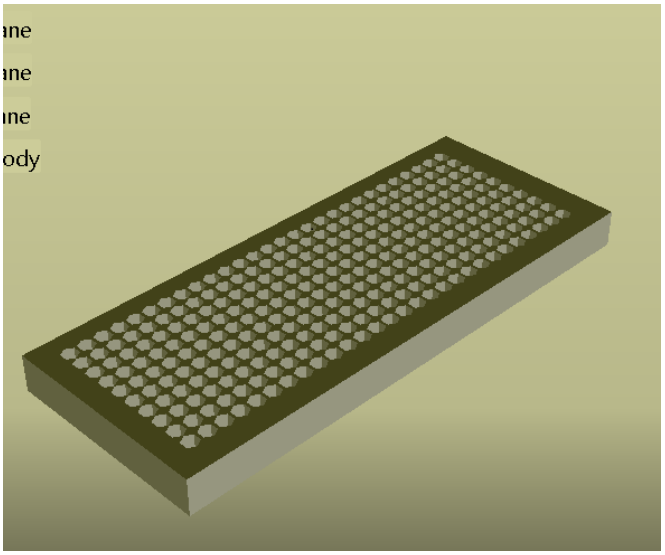

Figure 6 :10mm Dia cutter

2.1 Working Principle

The tender coconut passes over the belt conveyer to major chopper machine. There the pieces cut into 50 mm size slices or square pieces. The pieces collected in the bottom collector and again passes through the conveyor and rush in 5 mm size pieces in the minor chopper.

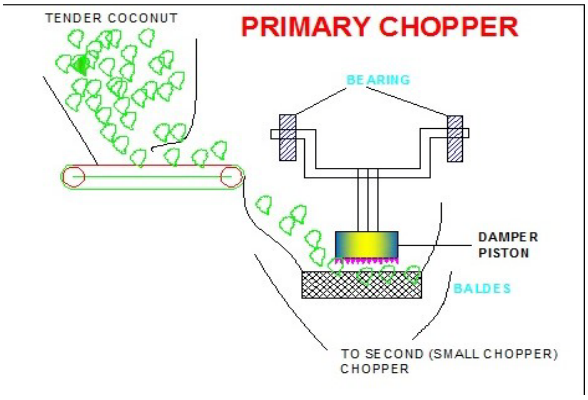

Figure 6: Primary chopper

Fig:3. Primary chopper output

The rate of cutting is 5Kg/minute. Whereas major chopper speed is 12Kg/minute. The cutting pieces are going to kept in presence of sunlight for 7 to 10 days depend on sun intensity.

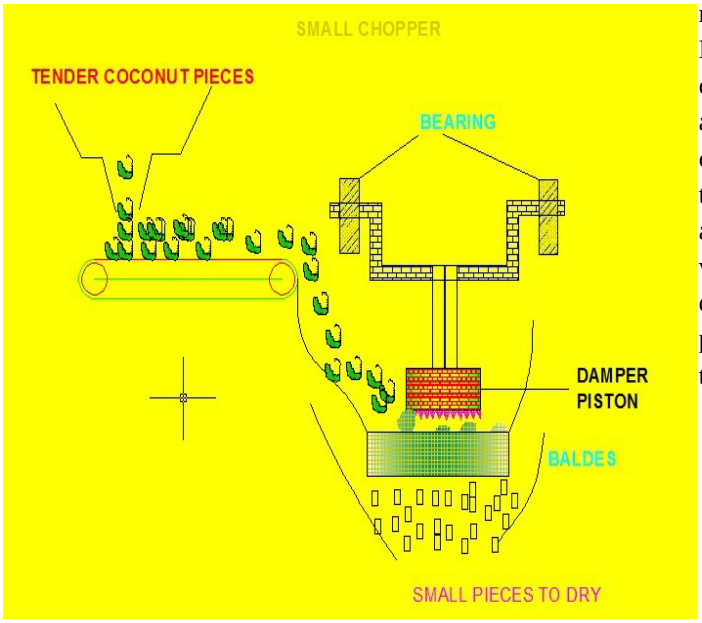

Fig 7: Prototype of Chopper machine

Fig: 8 secondary chopper output

2. Drying of pieces

The small size briquettes are keeping in closed case and applying heat in the absence of oxygen for some time to remove moisture content. In this process we are placing a vent hole to remove the gases which are going to generate in this process. Now those briquettes we can use like a fuel for small scale industries which are going to run by het applications. An industrial-scale bunch fluidized bed dryer was used to dry lightly chopped coconut pieces. The effects of different operating parameters, i.e., the values and pattern of air velocity and temperature, on the drying kinetics and some selected quality attributes of dried coconut viz. color and surface oil content were then examined. It was found that the color of the dried product was affected regularly by the air temperature, while the size of surface oil was affected regularly by the air velocity. The surface oil comfortable of the product dried by any tested conditions was still higher than that of the reference sample, which is accepted by the market.by sending the coconuts into a heating room then it is placed for some time keep with warming in big quantities with in shells. the traditional method of reducing the moisture content of the coconuts is by open sun drying. During traditional open sun drying, the farmers spread coconut on mats, cement floors, roof tops or even on soil along the roadsides so as to expose to solar intensity until the completion of drying. In this method the samples are exposed to direct sun light and as a result the coconut pieces heat up and the internal temperature[15,16] rises without regulation which destroy color, vitamins and tang giving rise to low quality production that cannot compete with the mainland product thereby ensuring quicker drying of the products than the open sun drying method by sending to the heating room.

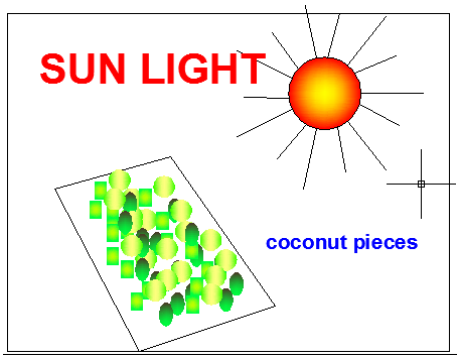

Fig: 9.sun light application

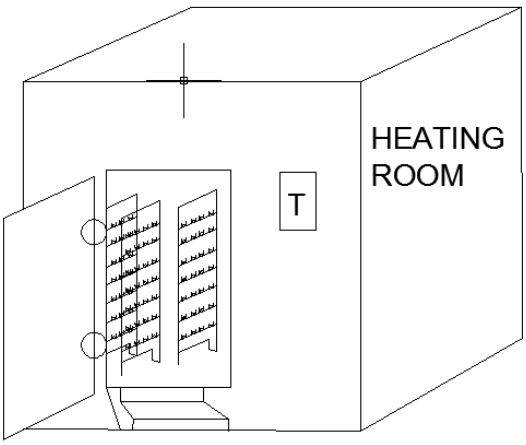

Figure 10 : Heating Room

5.Results

Calorific values and other relevant information mentioned in the following table. These briquettes[20,21,22] can replace the coal usage and LPG usage in sun rising industries which are running on Thermal applications. Uses include domestic applications because of its less smoke and odor.

Table: 2.Specifications of outputs

S.No	Name	Specification
1	Calorific value	2800-3600Kcal/Kg
2	Ash content	10.5%

3	Moisture content	8.5%
4	Volatile matter	17-20%
5	Fixed carbon	65%-73%
6	Foreign Matter	11-13%

Advantages

1. Freely available.
2. Control the growth of mosquitoes in urban areas.
3. Avoid normal wood with usage of this one.
4. Low emissions.
5. Good smell output.
6. Low ash content.
7. Easy to travel because of its cross section.

6.Conclusion

We framed hallow elliptical briquettes by using our machine. The calorific value of this briquettes is much higher than normal wood and easy to carry. The operational cost is less compare to bulk quantity. The fuel produced is a good replacement for coal applications.

Figure 11: Elliptical briquettes

References

[1] Sandhyarani, Ningthoujam.." http://www.buzzle.com /articles/how-to-make-activated-charcoal.html.
[2] "Fuel from the Fields: Charcoal from Agricultural Waste." edited by Massachusetts Institute of Technology: Practical Action, 2009.
[3] "Effect of rice husk ash on cement stabilized laterite", Leonardo Electronic J. Practice and Technol., vol. 6, no. 11, pp. 47-58, 2007.
[4] "Potentials of rice husk ash for soil stabilization," Assumption University Journal of Technology, vol. 11, no. 4, pp. 246-250, April 2008.
[5] "Tropical residual soils". A Geological Society Engineering Group Working Party Revised Report, Geological Society Publishers, London, 1997.
[6] "An assessment of cement - PFA and lime - PFA used to stabilize clay size materials", in Bull. of the International Ass. of Eng. Geology, no. 49, L. Primel, Ed. Paris: IAEG, April 1994, pp. 25-32,.
[7] Smith & Associates, "Tender Presses",530 Hollywood Drive, Monroe, Michigan 48162-2943, Dec 1999.
[8] Q.S.KHAN, "Introduction to tender presses & press body" volume-1, tanveer publications.
[9] "Design and Manufacture of a 30-ton Tender Press" , Mechanical Engineering Department, Federal University of Technology Yola, Adamawa State, Nigeria, Jan 2011.
[10] "Force and position control of a tender press" .
[11] Dr.Ing T. Hong, Dr. Richard K., "Computerized Design Analysis of Machine Tool Tender System Dynamics", FES/BarDyne Technology Transfer Publication.
[12] V. D. Lee, "Configuration Development Of A Tender Press For Preloading the Toroidal Field Coils of the Compact Ignition Tokamak", Fusion Engineering Design Canter and McDonnell Douglas Astronautics Company , 1998.
[13] ManarAbdElhakimEltantawie, "Design, manufacture and simulate a tender bending press", International journal of mechanical and robotic research, 2013.
[14] Foale, M.A. The Coconut Palm. In: Chopra, V.L. and Peter K.V. edited Handbook of Industrial Crops. Haworth Press, New York, 2005
[15] APCC. Coconut Food Process – Coconut Processing Technology. Information Document. Arancon, Jr, R.N., ed. Asian and Pacific Coconut Community. Jakarta, Indonesia,1996. [3] Brandis, C. and Glaser, F. (1973). Specification for separations of kernels from coconuts. Philippine patent No: 9865.
[16] Madhavan, K. (1985). Design and development of copra moisture meter. J. Planta. Crops. 16: 113-116.
[17] Tilledaratne, H.A. Processing of Coconut Products inSri Lanka. Asian and Pacific Coconut Informantion Document. Arancon, Jr., R.N., ed. Asian and Pacific Coconut Community. Jakarta, Indonesia.
[18] Thampan, P.K. Handbook on Coconut Palm. Oxford & IBH Publishing Co., New Delhi. 1996.
[19] Ohler, J.G.. Coconut, Tree of Life. FAO Plant Production and Protection Paper 57. FAO, Rome, Italy, 1984.
[20] Rethinam, P. (2003). Prospects for the coconut industry. J. Planta. Crops. 31(1): 1-7.
[21] Rey, H.O. (1955). Device for removing meat from coconut. Philippine Patent No. 793.
[22] Thampan, P.K. (1981). Hand Book of Coconut Palm, Oxford and IBH Co. Pvt. Ltd., New Delhi. Pp. 311.
[23] Shiwalkar B.D., Design Data for Machine Elements, Dattatraya Publications, Nagpur (India).
[24] Sharma, P.C. and Aggarwal, D.K. Machine Design. S.K. Kataria and Sons, Nai Sarak Dechi. Katra books @yahoo.com, 2006.
[25] Khurmi, R.S. and Gupta, J.K.. A Textbook of Machine Design (S.I. Units), Eurasia publishing House (PVT) Ltd., Ram Nagar, New Delhi-11005s, 2005
[26] IS 2494-1974. Indian Standards. Indian StandardsI institute, New Delhi, 1974. [15] Rajput, R.K. Strength of Materials, S. Chand &Company Ltd, Ram Nagar, New Delhi, 2006.

B.KOTESWARARAO.B was born in yedlurupadu, India, in 1990. He received the B.Tech. Degree in Mechanical Engineering from the JNTU Technological University Kakinada, India, in 2011, and the M.Tech. Degree in thermal Engineering from the university college of Kakinada, India, in 2014.Presently he is a Research Scholar in K.L University and also working as Assistant Professor. From May 2011 to December 2012, he has been with the Department of mechanical Engineering, RVR Institute of Engineering & Technology. Where he was an Assistant Professor. His current research interests include alternative fuels, automobile emission reduction , and power plant optimization.

L.Ranganath was born in vijaywada , India , in 1985.He received B.tech Degree in Mechanincal Engineering from SCSVMV university and Masters from Oxford Brookes university(London). Currently he is working as Asst.Professor in KLuniversity , Vijayawada.

K.RADHAKRISHNA was born in Vijayawada, India, in 1981. He received the B.Tech. Degree in Mechanical Engineering from the JNTU Technological University Hydrabad, India, in 2005, and the M.E. Degree in CAD/CAM from from Andhra university in 2011 .Presently he is a Research Scholar in K.L u niversity and also working as Assistant Professor.From May 2012. alternative fuels, automobile emission reduction , and power plant optimization.