International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 08 | Aug 2021 www.irjet.net p-ISSN: 2395-0072

Engineered Technology for Value Enhancement of Natural Producing Coconut Residues as Industrial Application

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Abstract - After having made study of subject matter presented in this paper the reader will have clear understanding on the aspects of value added products from coconut residues. As per the current scenario of Indian economy we are lagging behind the Global economical growth and it's every Indian duty to play a major role to enhancing the economical development for our Nation. India is one of the developed countries across the world and also well-known as Agricultural Country which would give us minimum investment and high output good productivity, quality base products along with healthy food products. So one of the most abundant available crops is coconut which can increase the market of naturally available and renewable resource in the form of useful Industrial products. Coconut residues yields us large amount of Industrial products which can create its own market at National and International level also boost up the entrepreneur which are already working on this area. Also as per Government new strategy for entrepreneurship for new comer those who want to work under the umbrella of "Entrepreneurship Development Programme' sponsored by AICTE with cooperation of state and central Gov. of India is one of the best opportunity to use technical skill for value added products of coconut residues. Surely It can increase farmers' incomes by 30-50 per cent with minimum capitals and give opportunity for younger generation approximately 50-100 million jobs The coconut palm exerts a profound influence on the rural economy of the many states where it is grown extensively and it provides sustenance to more than 10 million people. The contribution of the coconut oil to the national edible oil pool is 9%. In addition the crop contributes Rs.9000 crores annually to the Gross Domestic Product (GDP).

Key Words: **Coconut** residue, epoxy resin, Value added products

1. INTRODUCTION

The aim of the present work is to motive the people specially those who doesn't have enough capitals to establish their won set up by providing advanced engineering technology to become part of economically developed country as India. Second aim of this work is to enhance the beauty of naturally producing resources and manufactured value added products from its residues with the application of engineering advanced technology, modern methodology and machineries. Now a days there are number of companies and manufacturer who are producing variety of needful products as per human requirements which are playing role for economical growth of mankind and also for Nation. Any manufacturer needs basic things means raw materials to increase its productivity, selling which would increase the economical growth for manufacturer. But demand of people are day by day increasing so people are now more concentrated on the concept of renewable natural recourse instead of limited resource. Instead of manmade materials as raw materials, people are more interested for naturally producing which would give higher output at the cost of less input. So they want to focus on naturally producing residues. So this paper focus on more naturally producing resource as coconut and it's residues. Coconut are commercial base naturally producing resource which can be converted into various Industrial products and also it is environmentally friendly. So at the same time it gives more industrial products and also food and domestic products with no environmental effects. For more understanding and clarity hereby I am showing some value added products along with my research work on the same topics as well as available natural resource throughout an India. Main residues obtain from naturally occurring resource as coconuts are-1.Wet shell coconut 2. Dry shell coconut 3. Coconut husk 4 Coconut shell powder Coir Bark husk 6.Others -which would give us more valuable value added products? So it's our duty to enhance the value of these naturally producing raw materials by converting it into eco-friendly, commercial needful products

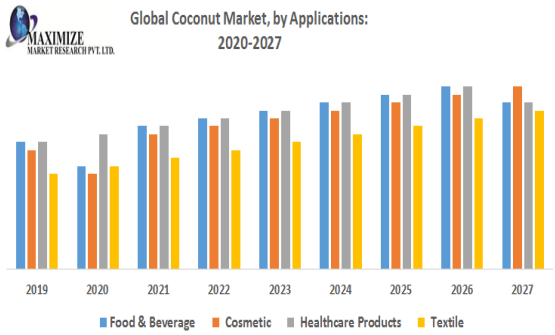
2. AREA AND PRODUCTION OF COCONUT IN MAJOR COCONUT GROWING STATES

States /Union Territories	AREA ('000 Hectares)	Production (000 metric ton)*	Production (Million Nuts)	Productivity (Nuts/ha)
A & N Islands	21.80	72.30	113.00	5184
Andhra Pradesh	142.00	1270.00	1985.01	13979
Assam	18.80	101.00	157.86	8397
Chhattisgarh	0.80	6.30	9.85	12309
Goa	25.70	88.70	138.58	5394
Gujarat	20.90	217.90	340.58	16296
Karnataka	506.80	3770.00	5892.51	11627
Kerala	766.00	3973.00	6211.21	8109
Lakshadweep	2.70	40.00	62.52	23156
Maharashtra	21.00	120.00	187.56	8931
Nagaland	0.90	0.30	0.47	521
Orissa	53.90	258.00	403.25	7482
Puducherry	2.10	20.00	31.26	14886
Tamil Nadu	420.70	3692.00	5770.60	13717
Tripura	5.90	8.60	13.44	2278
West Bengal	29.10	367.50	574.40	19739
All India	2039.10	14006.50	21892.16	10736

Source: Advisor, Horticulture Division, Ministry of Agriculture, Govt. of India

Having determined approximately available resource of naturally producing coconut as raw materials for Industrial products and as per India Gov."Entreprenurship development programme" scheme as we can generate new jobs opportunity for young generation also boost up them to become self-reliant which is Indian Government\s one of big mission for the energetic people.

3. CURRENT MARKET STRATEGY ON COCONUT AND its RESIDUE



4. VALUE ADDED PRODUCTS

Now a day self-reliant India is one of the missions of central governing body and I am sure such type of products would help to complete the dream of this mission. Throughout the world some the companies are already working on this naturally producing valuable resource and proving the beauty of residues yielded from coconut. Also the world's people are more demanding such naturally producing resource which is ecofriendly than manmade materials.

Natural Resource	Industrial Products	
Coconut Residue	1.Carbon black	9. Coconut fiber
	2. Activated Carbon	10.Fiber string, thread
	3.Food Industry	11.Coir Mats
	4.Incense stick	12.Coir Matters
	5.Cocopeat	13. Coir Bags
	6. Carbon block filter	14.Coconut water-milk-oil-flour
	7.Teeth whitening	15. Furniture
	8. Carbon brush	16.Others-etc

5. ACTIVATED CARBON AND CARBON BLACK

Some companies are already manufacturing Activated carbon specially derived from coconut residue as 'Jacobi Carbon 'of Shrilanka.All these companies are working for the activated carbon and which are derived only from coconut residues. And activated carbon has huge number of application in every field of manufacturing sector.

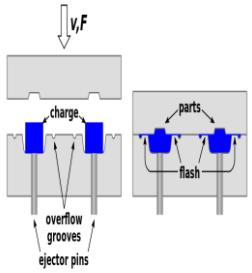
6. EXPERIMENTAL WORK

Industrial Products made with utilization of coconut residues. The moulds are cleaned and dried before applying matrix (epoxy). The carbon black was laid uniformly over the mould before applying any releasing agent. After arranging the carbon black uniformly, they were compressed for a few minutes in the mould. Then the compressed form of carbon black is removed from the mould. This was followed by applying the releasing agent on the mould, after which a coat of epoxy was applied. The compressed powder was laid over the coat of epoxy, ensuring uniform distribution of carbon black. The epoxy and carbon powder mixture is then poured in the die uniformly and compressed for a curing time of 16 hrs. with a load of 70 kg, specimens are made as per ASTM standards and epoxy resin to enhance the value of the naturally producing coconut residues as

1. Carbon black and epoxy resin composites
2. Coconut shell powder and epoxy resin composites
3. Coconut fiber and epoxy resin composites
4. Carbon black and ceramic powder and epoxy resin composites

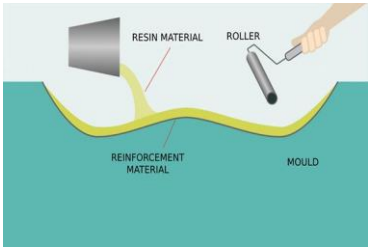
7. COMPRESSION MOULDING PROCESS

Compression moulding is a precise and potentially rapid process for producing high-quality composite parts in a wide range of volumes. The material is manually or robotically placed in the mould. The mould halves are closed, and pressure is applied using hydraulic presses. Cycle time ranges depending on the part size and thickness. This process produces high-strength, complex parts in a wide variety of sizes. The composites are



commonly processed by compression moulding and include thermosetting prepregs, fiber-reinforced thermoplastic, moulding compounds such as sheet moulding compound (SMC), bulk moulding compounds (BMC), and chopped thermoplastic tapes.

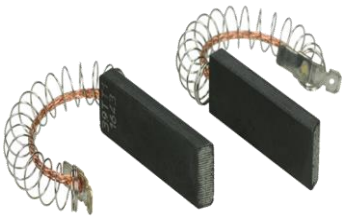
8. HAND-LAY UP PROCESS-Wet Lay-up/Hand Lay-up Manufacturing Process for Composites. Simple, low cost, open mold **fabrication process** using liquid epoxy resin to position layers of laminations in a mold until desired shape/thickness is achieved.



9.SAMPLE PREPERATION

The moulds are cleaned and dried before applying matrix (epoxy). The carbon black was laid uniformly over the mould before applying any releasing agent. After arranging the carbon black uniformly, they were compressed for a few minutes in the mould. Then the compressed form of carbon black is removed from the mould. This was followed by applying the releasing agent on the mould, after which a coat of epoxy was applied. The compressed powder was laid over the coat of epoxy, ensuring uniform distribution of carbon black. The epoxy and carbon powder mixture is then poured in the die uniformly and compressed for a curing time of 16 hrs. with a load of 70 kg, specimens are made as per ASTM standards.

10. CARBON BLACK AND EPOXY RESIN COMPOSITES BASE PRODUCTS



11. COCONUT SHELL POWDER AND EPOXY

The moulds are cleaned and dried before applying matrix (epoxy). The coconut shell powder was laid uniformly over the mould before applying any releasing agent. After arranging the coconut shell uniformly, they were compressed for a few minutes in the mould. Then the compressed form of coconut shell powder and Epoxy are removed from the mould. This was followed by applying the releasing agent on the mould, after which a coat of epoxy was applied. The compressed laminate fiber was laid over the coat of epoxy, ensuring uniform distribution of coconut shell powder.

12. CARBON SHELL POWDER AND EPOXY RESIN COMPOSITES

13. FABRICATION OF HELMET-Composite materials with thermoplastic matrices and a reinforcement of natural fibers are increasingly regarded as an alternative to material replacement for various applications.

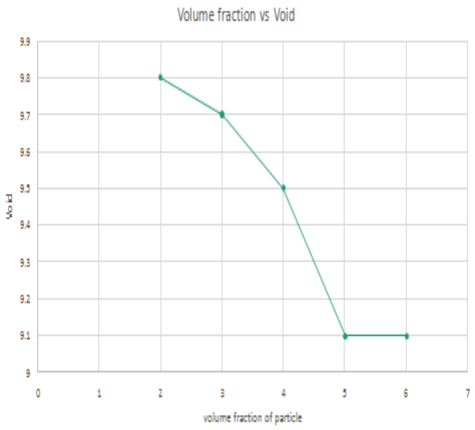
The substitution of the traditionally used composite of natural fibers such as sisal, banana and jute can lead to a reduction of the component's weight and furthermore to a significant improvement of specific properties like impact

strength, compression strength. One of the major fields of application for such materials can be found in structural components manufacturing of construction helmets. In this project work natural fiber particle reinforced materials like coconut fiber reinforced polymer composite material with epoxy resin has been used for fabrication of construction helmet. We have done some experiment utilizing coconut residues to fabricate some useful products and tested some useful physical properties.

14. EXPERIMENTAL RESULT AND PROPERTIES TO BE TESTED-

For my above mentioned products I used the manufacturing technology like Hand-lay process and Compression molding process to get the composites. I have tested the smaple using ASTME standards and found the followimg properties as -1.mass fraction 2.Volume fraction 3. Void content 4. Density of composites 5.Thermal expansion coefficient 6.Moisture expansion coefficient using TSAI-HILL crireria.

Graph for Volume Fraction Vs Void contents in the sample
It is also possible to test the various result as electrical conductivity, moisture content, and thermal coefficient of



Volume fraction of particle increases
Where void content decreases.
At volume fraction of 48.8%,
The void in coconut shell powder is 9.1

expansion by changing the volume fraction along with using different resin as phenol resin, alloy of phenol resin of different properties

Tested Mechanical Properties	
Mass fraction – Mc= Mm+ Mr	Mass fraction of composites –Mc Mass fraction of Matrix-Mm Mass fraction of reinforcement-Mr

Volume fraction-Vc=Vm+Vr	Vc=Volume fraction of composites Vm= Volume fraction of matrix Vr=Volume fraction of reinforcement
Density of composites -ρ_c = Vr ρ_r + Vm ρ_m	-
Void content in composite $-V_a = \frac{\rho_{ct} - \rho_{c\,exp}}{\rho_{ct}}$	Va= Void content Va= $\frac{Theoretical - Experimental}{Theoretical}$
Thermal expansion coefficient $\alpha_t = \alpha_p V_p$ + (1+ Vm) Vm α_m	α_p = thermal expansion coefficient for einforcement
Moisture expansion coefficient (β) a)Matrix $\beta_m = \frac{1}{3}(\frac{\rho_m}{\rho_w})$ b)Reinforcement $\beta_r = \frac{\rho_c}{\rho_m}$ (1+ Vm) β_m	ρ_m = Density of matrix ρ_w = Density of water
Transport properties a) Conductivity b) Dielectric constant. c) Diffusivity d) Permeability K_c = Vr K_r + Vm K_m Halpin Sai Relation $\frac{K_r}{K_m} = \frac{1+\xi\eta V_p}{1-\eta Vp}$ Where η = $\frac{\frac{K_p}{K_m}-1}{\frac{K_p}{K_m}+\xi}$ $\xi = 1$ for circular section	K_c = Thermal conductivity of composites Kr = Thermal conductivity of reinforcement K_m= Thermal conductivity of matrix

CONCLUSION-After having experimental view and current scenario of various industrial products manufactured utilizing the coconut residue we can improve the value of naturally producing resource and can give the various opportunity for young generation to establish their own set up at local-National and International level. Also such types of technology give boost up for younger generation and can take various financial benefits from the Indian Government under the scheme of 'Entrepreneurship development programme' which are currently running by state and central Government under the guidance of AICTE Delhi.

FUTURE SCOPE-There are number industries are working on the same theme of utilization of naturally producing resource and this is also dream of Indian government to make the people as a self-reliant. We can improve the productivity; quality of products with the help of advanced technology, advanced machineries, equipments etc. Why this is more beneficial as we are utilizing low cost and eco-friendly resource to give best output in the form on economy or others worthy products One of the most benefit means it is renewable resource and can give maximum profit as per yours potential and advanced technology.

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