Research on Fabrication & Recycle of Natural Waste Composites

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Abstract— Due to the increased environmental awareness, there is a strong trend to reduce the generated amount of solid wastes and attempt to reclaim them. In particular, two types of solid waste appear to have a great economic potential for utilization; fibers and plastics. Last year, 230 million tons scrap fibers were generated all over the world. Only 33% of the waste fibers are utilized in useful products. The carpet industry has its share of solid waste production. Re- and postconsumer waste were estimated to be 3 million tons/year in the United States. Indeed, there is an essential need to efficiently utilize these wastes via a fundamentally different approach that provides a substantial added value to the waste materials. In the present work, we introduce the notion of developing reinforced composite materials from waste fabric and waste plastic. The composite material developed from this combination provides adequate mechanical and chemical characteristics. First, we discuss the technical challenges involved in developing composites from wastes then, the processing steps are outlined. Finally, a study and comparison of strength of different composites formed and some application. In addition, we will assess the mechanical, chemical and economic criteria of the devised composite mater. Composites consist of one or more discontinuous phases embedded in a continuous phase. The discontinuous phase is usually harder and stronger than the continuous phase and is called the 'reinforcement,, or 'reinforcing material', whereas the continuous phase is termed as the 'matrix'. Properties of composites are strongly dependent on the properties of their constituent materials, their distribution and the interaction among them and mechanical properties, reduced tool wear, unlimited availability, low price, and problem free disposal. Wood fibre/particle provides a sufficient reinforcement at much lower cost than synthetic and mineral filled thermoplastic.

Key words: Composites, Embedded, Reinforcement, Thermoplastic

I. INTRODUCTION

Environmental awareness is growing daily. The Earth Summit, EE held in Rio in 1992, brought together 150 nations and 1,400 nongovernmental agencies. The Summit participants declared that environmental protection should be an integral part of production and development. On the national level, the Environmental Protection Agency is regularly updating its regulations for a safer environment with minimum waste. These activities impose pressure on industries to address and solve environmental concerns. Over the past decade, there has been a tremendous increase in the amount of generated solid wastes. Due to the increased environmental awareness, there is a strong trend to reduce the generated amount of solid wastes and attempt to reclaim them. In particular, two types of solid waste appear to have a great economic potential for utilization; fibers and plastics. Last year, 230 million tons scrap fibers were generated all over the world. Only 33% of the waste fibers are utilized in useful products.

A. Material Used

1) Rice husk

The rice husk (or hull) is the outermost layer of the paddy grain that is separated from the rice grains during the milling process. Around 20% of paddy weight is husk and rice production in Asia produces about 770 million tons of husk annually.

Fig. 1: Rice husk

2) Coconut husk

Coconut husk also known as are the container which extracted from the outer surface of coconut. Coconut Husk provides useful products and this is also one of the good product from the coconut tree. Coconut tree is another miracle tree and this tree produces the greater production to entire market.

Fig. 2: Coconut husk

3) Paper pulp

Fig. 3: Paper pulp

Pulp is a lignocelluloses fibrous material prepared by chemically or mechanically separating cellulose fibres from wood, fiber crops or waste paper. The wood fiber sources

required for pulping are "45% sawmill residue, 21% logs and chips, and 34% recycled paper".

4) Binders

Synthetic binders – synthetics binders mainly comprise with epoxy glue, resin etc. There bonding property adds additional strength to the material. As these binders have good capacity of holding surfaces together it provides the material with great strength at a cellular level.

Fig. 4: Epoxy resin and Fevicol

II. Literature Review

A. Physical and Mechanical Properties of Coconut Shell Particle Reinforced-Epoxy Composite J. Bhaskar, V.K. Singh

The natural fibre reinforced composites are being developed to save environment. Objective of investigation was to evaluate the physical property-density and mechanical property-tensile properties. Coconut particle reinforced composites were fabricated by reinforcing shell particle (size between 200-800µm) by wt% of 20, 25, 30 & 35 into epoxy matrix. Composites panels were made by casting method in open mould in very easy way. Experimental results showed that density, ultimate strength, modulus of elasticity and % elongation decreases with wt% of shell particle with in this range wt% 20-35 of reinforcement. Tensile strength of 25 MPa and modulus of elasticity of 654 MPa were retained even after of 35% reinforcement. Properties were comparable for application only with compromising slightly with matrix property.

B. A comparative study of concrete properties using coconut shell and palm kernel shell as coarse aggregates by E.A. Olanipekun, K.O. Olusola, O. Ata.

The high cost of conventional building materials is a major factor affecting housing delivery in Nigeria. This has necessitated research into alternative materials of construction. This paper presents the results of an investigation carried out on the comparative cost analysis and strength characteristics of concrete produced using crushed, granular coconut and palm kernel shells as substitutes for conventional coarse aggregate in gradation of 0%, 25%, 50%, 75% and 100%. Two mix ratios (1:1:2 and 1:2:4) were used. A total of320 cubes of size 100100100mm were cast, tested and their physical and mechanical properties determined. The results of the tests showed that the compressive strength of the concrete decreased as the percentage of the shells increased in the two mix ratios. However, concrete obtained from coconut shells exhibited a higher compressive strength than palm kernel shell concrete in the two mix proportions. The results also indicated cost reduction of 30% and 42% for concrete produced from coconut shells and palm kernel shells, respectively. Considering the strength/economy ratio, it was concluded that coconut shells were more suitable than palm kernel shells when used as substitute for conventional aggregates in concrete production.

III. Methodology

A. Fabrication of Composite

All the materials stated above are first grinded to bring it to the size of about 200- 800. Micro meters. They are mixed in equal proportions and then are bind with the help of natural and synthetic binders. After that the mixture is poured into the moulds and set aside till it's completely dries and becomes a solid slab. A composite material can be defined as a combination of two or more materials that results in better properties than those of the individual components used alone. In contrast to metallic alloys, each material retains its separate chemical, physical, and mechanical properties.

Fig. 5: Fabricating Composite

Fig. 6: Slabs of Composite formed

IV. Results & Discussions

Following are the result of several tests we have performed-

Sr. no.	Composite Materials (used synthetic binder)	Along the grain (Results are in kN)	Cross the grain (Results are in kN)
1.	Paper pulp + Rice husk + Coconut shell	0.16kN	0.56kN
2.	Coconut shell+ Rice husk(Discontinuous)	0.28kN	0.7kN
3.	Coconut shell +Rice husk (continuous)	0.28kN	0.53kN

Table 1: Result

A. Compression test on U.T.M.

1) Izod test

Sr. no.	Composite Materials (Used natural binder)	Readings in joule
1.	Paper pulp + Coconut shell + Rice husk	2 joule

2.	Coconut shell + Rice husk (Discontinuous)	2 joule
3.	Coconut shell + Rice husk	2 joule

Table 2: Izod test

V. CONCLUSION

The following conclusions we have drawn:

1) The composite we have made provide an option for making new material from the natural waste.
2) From the test conducted we have found that high strength composite can be fabricated such as for example the high compressive strength is made by coconut husk, and rice
3) Husk and synthetic binder used.
4) That mixture formed composite has high compressive strength, high torsion strength high shear strength depicted in results.
5) Using waste raw material such as rice husk, coconut husk, natural binder etc and these formed composite have a wide range of application and is very cheap and eco-friendly in comparing other substances.
6) The composite formed by us was a rough sketch of the actual. Composite fabrication method and process still it gave us satisfactory strength and if performed in the way it is actually fabricated it will give more colorful results.

VI. FUTURE APPROACHES

Following can be the applications of the composites formed.

The scope of composites fabricated using raw material is very vast and a growing field of research. Cheaper and more eco-friendly composite can be fabricated which will replace costlier and polluting substances.

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