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Effect of Weight % of Natural Fiber on Mechanical Properties of NFRPC Made By Injection Molding Process

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ABSTRACT

Fibres as reinforcement in plastic to substitute conventional natural fibres in some structural applications has become one of the main concerns to study the potential of using natural fibres as reinforcement for polymers. In the light of this, researchers have focused their attention on natural fibre composite which are composed of natural or synthetic resins, reinforced with natural fibres. Polymeric materials reinforced with natural fibres such as jute and wood provide advantages of high stiffness and strength to weight ratio as compared to conventional construction materials, i.e. concrete, and steel. Despite these advantages, the widespread use of natural fibre-reinforced polymer composite has a tendency to decline because of their high-initial costs, their use in non-efficient structural forms and most importantly their adverse environmental impact.

Fibres as reinforcement in plastics to substitute conventional natural, accordingly, manufacturing of high-performance engineering materials from renewable resources has been pursued by researchers across the world owning to renewable raw materials are environmentally sound and do not cause health problem. The present work includes the processing, characterization of jute and wood fibres reinforced epoxy composites,

Keywords:- Polypropylene, Natural fibre (jute, wood powder), Injection molding, UTM, Hardness and Impact testing.

I. INTRODUCTION

Modern composite materials constitute a significant proportion of the engineered materials market ranging from everyday products to sophisticated niche applications. The efforts to produce economically attractive composite components have resulted in several innovative manufacturing techniques currently being used in the composites industry The composites are compound materials which differ from alloys by the fact that the individual components retain their characteristics but are so incorporated into the composite as to take advantage only of their attributes and not of their short comings", in order to obtain improved materials.

As stated earlier, FRPCs are made by combining fibers and PP. PP is a binder or 'matrix' and holds the fibers in place. A brief description on both of them is given in this section.

Fibre

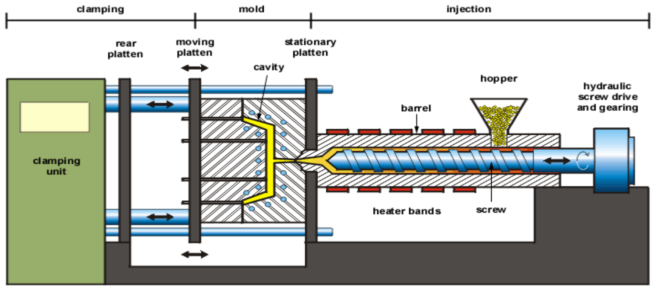
Fiber is a class of material that is a continuous filament or discrete elongated pieces, similar to the lengths of thread. They can be spun into filaments, rope or string. The two main sources of natural fibers are plants and animals. The main component of animal-based fibers is protein82: examples include mohair, wool, silk, alpaca, angora, and so on.

II. POLYPROPYLENE

It is derived from three major sources. Globally, most propylene monomer comes from the steam-cracking process using naphtha which is a valuable fraction of crude oil. Usually, the target product of naphtha cracker's is ethylene monomer. Propylene is a byproduct of the cracking process and is produced at various ratios depending on the crude oil feedstock. Many cracking processes have a propylene plant intimately connected to effectively collect the propylene that comes from naphtha cracking. The second largest production of propylene is from the gasoline refining process. Finally, and most recently, a new process by which propane is dehydrogenated to propylene monomer is being used to produce propylene.

Fabrication of NFRPCs

NFRPCs are mainly fabricated by Injection Molding Method



schematic of thermoplastic injection molding machine

Injection molding is a process that generally involves forcing or injecting a plastic material into a closed mold of desired shape. The molding compound is fed into injection chamber through the feed hopper. In the injection chamber, the molding compound is heated and therefore it changes into liquid form. It is forced into the injection mold by the plunger. This method is normally used for high-volume and lowcost component manufacturing. Both thermoplastic and thermoset are subjected to injection molding. removed. But in thermoset injection molding, high A thermoplastic material is first melted and then forced through an orifice into the mold which is kept relatively cool. The material solidifies in the mold from which it can then be temperature is required for solidification This method is suitable for high-volume and low-cost component manufacturing. But the method is limited to short fibre Composites of five different compositions i.e.20 gm, 30gm, 40gm, 50gm, 60gm are made. Specimens of suitable dimension are cut for different tests

Material Used:

This chapter describes the details of processing of the composites and the experimental procedures followed for their characterization and evaluation. The raw materials used in this work are

1. Natural Fibre
   - Jute Fibre
   - Wood Fibre
2. Polypropylene

Specimens

Fibre Treatment

The procedure involves water washing and drying. Natural fibres are extracted from their parent plant. The Jute are extracted from the back of their stems, while wood are extracted from their plant. The natural fibres, after being extracted, are washed with water to remove gums. The fibres are then treated with sodium hydroxide solution and rammed. The treated fibre was allowed to dry in the sun for 3 days. After which the fibres are laid in the mold with the resin at the ratio of 20% to 60%.

III. RESULTS

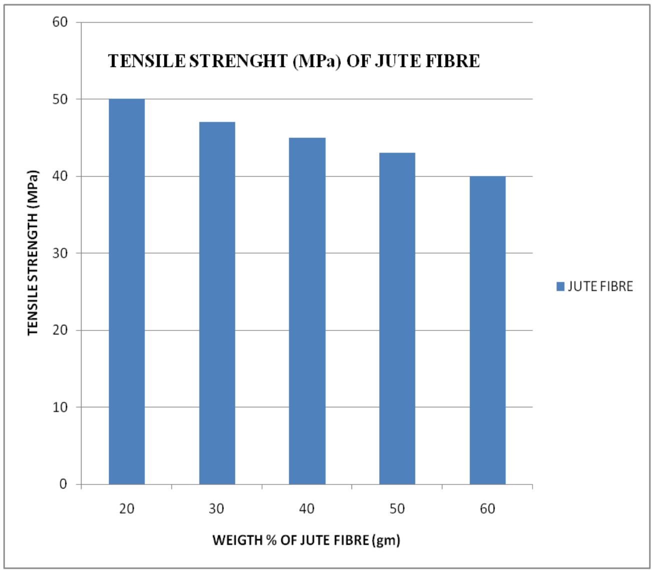
The test results are shown and discussed in this section. Average values of three replications of the Tensile test, Hardness test and the Impact test.

Tensile Strength

The tensile tests were performed using a testing machine model 8889. The width and the thickness of the specimens were measured and recorded (360 mm by 20 mm by 5 mm). The tensile tests were carried out according to ASTM D 038-01. The tensile strengths were calculated from this test.

Tensile Properties of Jute fibre

S NO.	Weight of jute fibre (gm)	Weight of PP (gm)	Maximum Stress (MPa)
1	20	250	50
2	30	250	47
3	40	250	45
4	50	250	43
5	60	250	40



Tensile Properties of wood fibre

S NO.	We ight of wood fibre (gm)	Weight of PP (gm)	Maximum Stress (MPa)
1	20	250	35
2	30	250	37
3	40	250	40
4	50	250	43
5	60	250	45

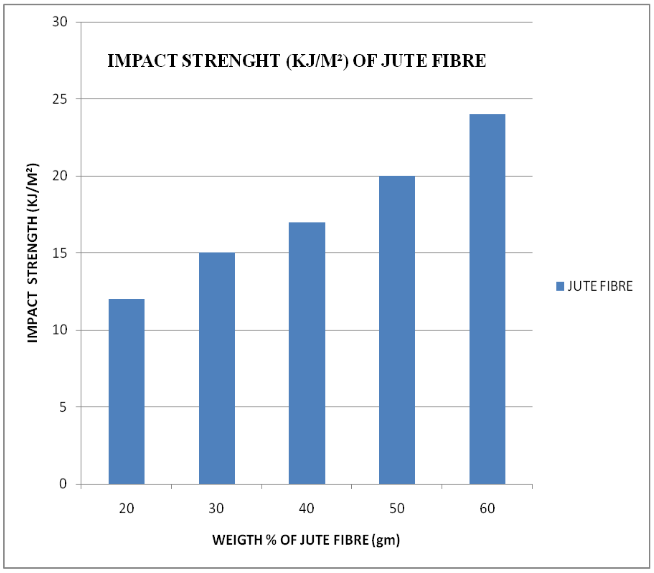
Ultimate Tensile Tests with Specimen

Impact Strength

The impact strength of jute laminate hybrid composites is presented in Table 2. It is observed that the laminate composite is exhibiting higher impact strength than the wood reinforced composite. The jute hybrid composite impact strength is higher than wood reinforced composite but lower than glass fiber reinforced composite.

Impact Properties of jute fibre

S NO.	Weight of jute fibre (gm)	Weight of PP (gm)	Impact Strength (KJ/m2)
1	20	250	12
2	30	250	15
3	40	250	17
4	50	250	20
5	60	250	24



Impact Properties of wood fibre

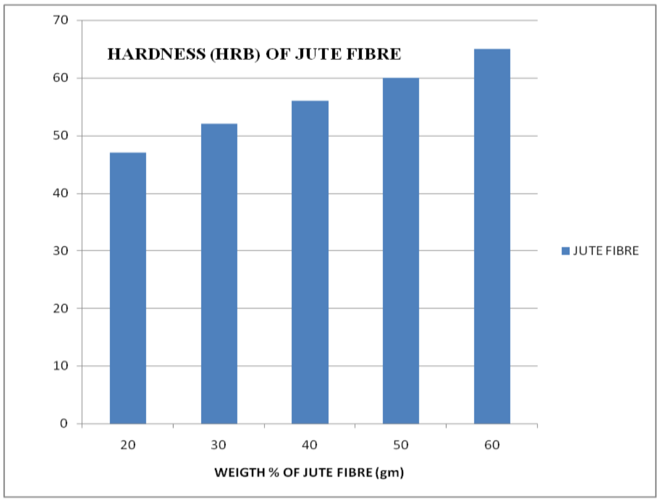
S NO.	Weight of wood fibre (gm)	Weight of PP (gm)	Impact Strength (KJ/m2)
1	20	250	30
2	30	250	27
3	40	250	25
4	50	250	22
5	60	250	20

Hardness Test

The Hardness test of jute and wood fibres composites is presented in Table 3. It is observed that the laminate composite is exhibiting hardness.

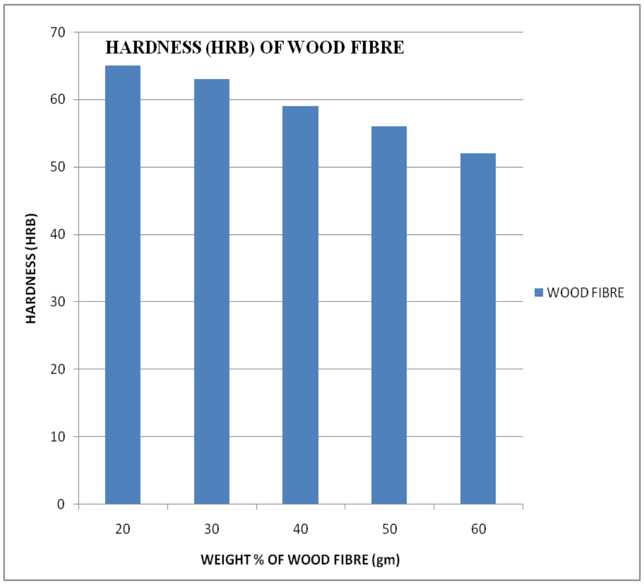
Hardness Properties of Jute fibre

S NO.	Weight of jute fibre (gm)	Weight of PP (gm)	Hardness (HRB)
1	20	250	47
2	30	250	52
3	40	250	56
4	50	250	60
5	60	250	65



Hardness Properties of wood fibre

S NO.	Weight of wood fibre (gm)	Weight of PP (gm)	Hardness (HRB)
1	20	250	65
2	30	250	63
3	40	250	59
4	50	250	56
5	60	250	62



Hardness Test with Specimen

IV. CONCLUSIONS

The future of FRPCs appears to be bright, because PP is a low-cost matrix. Future research should focus on the improvement of mechanical properties of FRCPs. Future research should also focus on the replacement of synthetic fibres by natural fibres considering the environmental fact. Increase in the strength of natural fibres reinforced polypropylene composites through various treatments of natural fibres to get best adhesion between natural fibres and PP will help to replace natural fibre reinforced polypropylene composites.

NFRPCs have received considerable attention over the past few decades. PP is a low-cost thermoplastic polymer, which has some excellent properties. Various fibres are reinforced with PP to prepare composites. Among natural fibres are mostly used as reinforcement with PP. Jute and wood with composites have very good mechanical properties. Among natural fibres, flax fibres are very strong and when reinforced with PP produce composites having good mechanical properties. Fibre modification can increase the mechanical properties of FRPCs satisfactorily. Surface of fibres can be modified by treatments like alkalization/mercerization, oxidation, diazotization and so on to improve fibre-PP adhesion which will result in greater mechanical strength. Incorporation of coupling agent like MAPP in appropriate amount in the fabrication of FRPCs will increase the mechanical properties of FRCPs.

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