INVESTIGATION OF DIFFERENT TECHNIQUES OF SYNTHETIC FIBER

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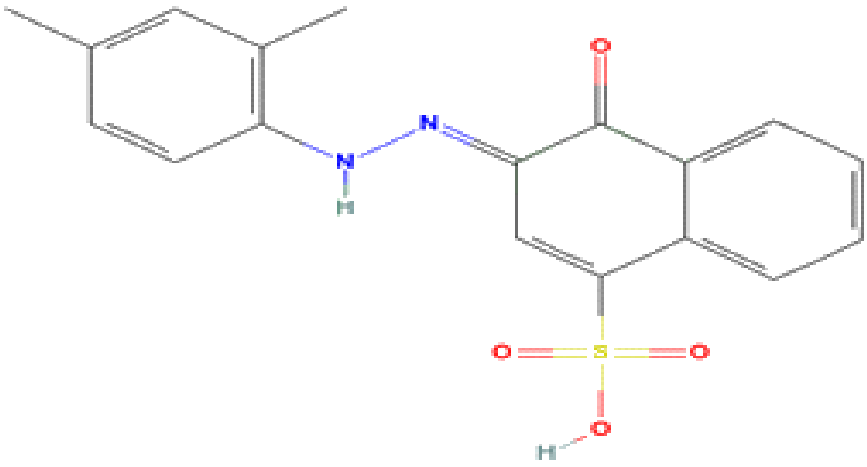
ABSTRACT

This paper presents a review summary of reinforcement of jute fiber in plastic lumber. Jute fiber is polypropylene combination fiber which is include blending and compounding resins Jute made plastic is very strong and low density of 0.90ng/cc. Jute fiber reinforcement plastic is 33% lighter than PVC. During the reaction recycled polypropylene is mixed with different chemical like stearic acid and calcium stearate with in melted position, at the same time interval added jute fiber with compatibilizer to maintain physical, chemical and thermal properties of polypropylene. The major applications are used in industries like bulk drugs, pharmaceuticals and chemical and paint industries.

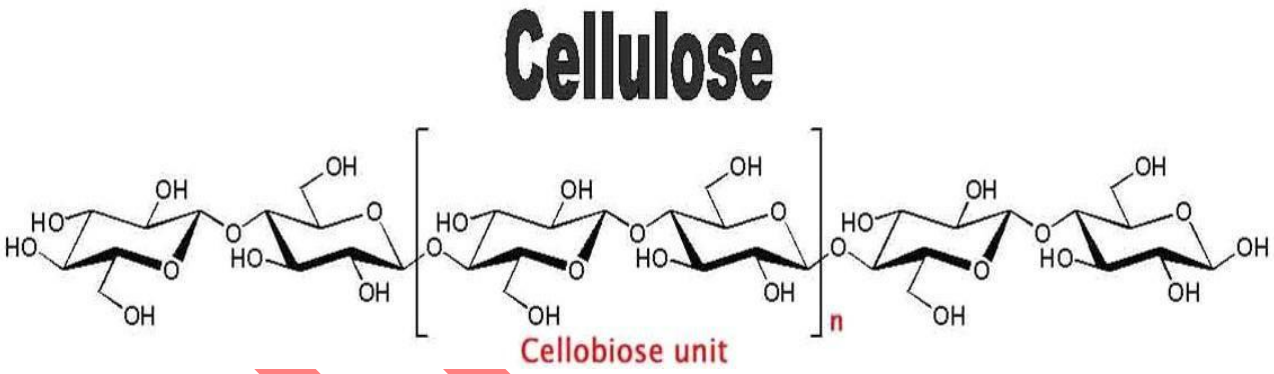
Keyword:- *Dirking straws, foams, reinforcement; polypropylene; Insulation, medical soft tubing, surgical gloves.*

INTRODUCTION

Fiber of jute is made of thee chemical constitutions are cellulose, hem-cellulose and lgnin. Also contain minor constitution of fat and wax, inorganic metals, nitrogenous matter. Due to this application of jute fiber, it is reinforcement in plastic to utilize it in various applications. Polypropylene also has high melting(165-170 o c).The fiber of jute made plastic is non toxic and lighter in weight than other plastic Product as well as lower the manufacturing cost. Jute fiber due to its adequate tensile strength and good specific modulus enjoys the right potential for usage in composites. Jute composites can thus ensure a very effective and value-added application avenue for the natural fiber.



Jute Scarlet R Molecular Structure



MATERIALS

Recycled PP was purchased from plastic west industrial area & jute was purchased from the local market. Various processing aids such as stearic acid, calcium stearate, DBLS (Di-butyl lead stearate) & Irganox-1010was used as an anti-oxidant. 5% NaOH solution was used for removing contaminants from waste packaging. EPDM of extrusion grade PR-96 with Mooney viscosity of 45 and talc. The compatibilizer that was PP grafted maleic anhydride was purchased from Pluss polymers.

Equipments Used:

1] *Fiber cutting machine:* To cut the fibers in small pieces.

2] *Air-Oven:* For drying the fiber to exclude moisture

3] *Melt-Kneader:* Kneader was used for melting PP and blending.

4] *Extruder:* Single screw extruder to obtain a homogenous composition.

5] *Scrap cutter:* To cut the extruded material into small pieces.

6] *Compression molding machine:* for mechanical characterization.

Experimental Work:

A] Cutting of fiber: Jute fibers washed with water and dried for 24 hours at room temperature followed by drying at 85ºC for 8 hours in an air oven, were cut into small segments of size 3-4 mm for incorporation into the composites.

B] Melt blending: Recycled PP mixed with processing aids such as stearic acid and calcium stearate was melted at 190ºC in a kneader. As it started melting other additives such as compatibilizer & talc or EPDM were added. After it has melted the chopped jute fibers were added at regular intervals of time in small quantity. After it has been mixed, the composites lumps were taken out and cut into smaller lumps. The various compositions prepared are formulated in the table in section.

C] Extrusion: The lumps obtained in the above step were extruded in a single screw extruder (L/D = 12) at 190ºC for homogenous mixing and the extrudate was cut into small pellets with a cutter at the die opening.

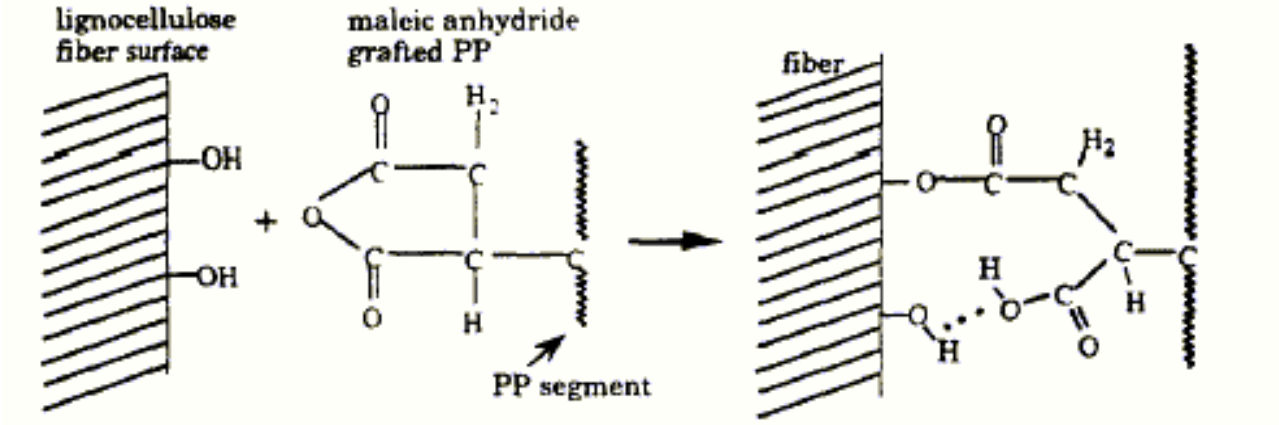
D] Compression molding: The pellets obtained in the above step were compression-molded at 190ºC and 150 Kg/cm pressure for 45 minutes followed by water cooling to room temperature, to result in 3 mm thick sheets for mechanical characterization.

METHODOLOGY

There are many procedures for the preparation of jute fiber reinforced plastic lumbered. The application of such types of plastic are in agriculture manufacturing industries, like agriculture products packaging, agriculture equipment and instrument., piping industries also large number of application.

Reaction:

The adhesion is poor at the interface between jute fiber and non-polar polymer matrix, which is provided only by vander Waals forces due to the lack of reactive groups in the molecule of the polymers. In this study, matrix modification was carried out by using MAHgPP to improve the adhesion of the jute fiber and polypropylene matrix. The coupling agent is able to act as a compatibiliser for polar natural fiber and non-polar polymer matrix systems. A hypothetical model of the interface between MAHgPP with hydroxyl groups of jute fiber is shown in Figure. The interfacial interaction mechanisms can be understood from this model, in which likely both chemical (ester bond) and physical interactions (hydrogen bond) should be formed between the hydroxyl groups of cellulose fiber and the maleic anhydride group of the coupling agent. The PP chain of MAHgPP diffuses into the PP matrix through interchain entanglements. These cause better adhesion between the fiber and the matrix better adhesion between the fiber and the matrix.



Reaction mechanism of maleated PP with the surface of the lignocellulosic fiber. Note potential of both covalent and H-bonding.

Procedure:

For jute/polypropylene composite systems, the specimens were prepared by two steps:

1) Compounding and then injection moulding. The materials consist of jute yarn from Spinnerij Blancquaert NV and polypropylene (PP1 and PP2).

2) Coupling agents:
Maleic anhydride grafted polypropylenes (MAHgPP). Three kinds of MAHgPP were used for pre-investigation. Their properties are shown in Table 6 in terms of densities, melt flow rate (MFR), melting points, prices and maleic anhydride graft level of MAHgPP.

RESULT AND DISCUSSION

The matrix treatment of PP by coupling agent maleic anhydride grafted polypropylene has been found to be the most efficient in improving interfacial adhesion of nature fiber composites. The MAHgPP's ability to enhance the composite properties depends on many factors, such as type factors, such as type of MAHgPP (graft level, random or block copolymer, molecular weight), miscibility of MAHgPP with the PP matrix, PP grade, composite processing conditions, etc. In order to chose the most economic and technological suitable one, three kinds of MAHgPP namely Ex-xelor PO 1020 (Ex), Polybond 3200 (PO) and TPPP 8012 (TP) were used for preinvestigations. It was found that all the MAHgPP grades result in improved tensile strength and impact toughness of jute reinforced PP except that in the case of using 2 wt% of TPPP the impact toughness decreased. It is also observed that the improved degrees of these coupling agents are different and depend on their content. Ex-xelor revealed better mechanical properties than the other ones. That can be explained due to lower molecular weight of Ex the mobility of the MAHgPP molecule is higher and the MA group is more likely to reach the polar group on the fiber surface - this can say for the same kind of MAHgPP mean homopolymer, random or block copolymer. MAHgPP homopolymer tends to mix better with a PP homopolymer than with a PP copolymer [160]. The Ex-xelor amount of 2 wt% was expected to be the optimal content for PP matrix treatment. The content higher 2 wt% hardly contributes to a further increase. Therefore 2 wt% Ex was chosen to be optimum condition of treatment for investigating in detail the effect to the properties of jute reinforced polypropylene composites.

SUMMARY

The addition of 2 wt% Ex to polypropylene matrices significantly improved the adhesion strength with jute fibers and in turn the mechanical properties of composites. The PP grade also significantly affected the improvement of jute/PP composite by MAHgPP coupling agents. Higher molecular weight PP1 with less melt flow rates improved the mechanical properties to a greater extent than lower molecular weight PP2. The tensile modulus of jute/PP composites increased with increasing fiber content and showed less sensitive the variation of interfacial adhesion. Taking into account the interfacial properties, a modified rule of mixture (ROM) theory was formulated which fits well to the experimental tensile strength results.

Thermal behavior of the jute, PP and composites was determined different under nitrogen and air flows. The thermal resistance of PP1 composites decreased with increasing fiber content in nitrogen atmosphere. However, the TG curves of these composites in air shift towards a lower temperature region and the thermal resistance of composites was found to increase with increasing fiber content. Using 2 wt% Ex as a coupling agent has a positive effect on the thermal resistance of the composites.

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