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Development of Composite Panels Using Fibre from Underutilized Sida Acuta Burm.F (Malvaceae) Plant

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Abstract

The present study is aimed in development of composite panels using fibre from underutilized Sida acuta Burm.F (Malvaceae) plant with epoxy as matrix. After extracting the fibre from Sida Acuta plant by tank retting process it was dried at ambient temperature for 24 hrs. The dried fibre is then laminated using hand layup method with epoxy as matrix in the proportion of 40:60 %.Specimen were cut from the laminate as per ASTM standards. The specimens were subjected to mechanical properties using computerized UTM and impact testing machine. The results indicated that the fluxtural and impact properties of the specimen made of Sida Acuta fibres as reinforced material with epoxy as matrix found to be on far with that of the composites made of natural fibres such as Jute, Sisal, etc as reinforcement materials with epoxy as matrix.

Keywords: Natural fibre, Sida Acuta fibre, Epoxy, Composite, Fluxtural test, Impact test (charpy).

1. Review of Literature

Sida acuta fibre is a natural cellulose fibres and Sida acuta plant species belong to Malvaceae family is an erect, branched, small shrub and grow upto 150 cm height. This plant grows abundantly in the tropical and subtropical regions, in almost throughout the year particularly along the road sides, forest edges and waste lands in India (Mann *et al*. 2003). The plant has a variety of traditional uses. The hot water extract of the dried entire plant is administered orally in India as febrifuge, an abortifacient and a diuretic (Kholkute *et al.* 1978.) It is locally called as Bheemana kaddi gida. The fibres of this plant are polygonal in structure, spheroidal in shape ,generally used for making ropes and also brooms and baskets.

2. Experimental Work

This study aimed in development of composite panel from extracted material cellulose fibre from the stem of Sida acuta plant and performance of Sida acuta fibre composites. The fibre from Sida acuta stem will be extracted mechanically by tank retting method. The extracted fibre will be febrifuge in warp and weft direction. Composite sheets will be made by using ***Epoxy adhesive*** to the aligned fibre randomly arranged lengthwise in the mould.

The composite sheets thus prepared will be subjected to fluxtural and impact (Charpy) tests as per ASTM Standards. The results will be analyzed and compared with a composites largely made from other natural cellulose fibres.

Fluxtural specimen where developed according to ASTM-D 790 (size: 125x25.4x5mm) and Impact (Charpy) specimen where developed according to ASTM-D 256 (size: 55x10x10mm). Generally epoxy, polyester and poly vinyl are used in the industries. In this study the Epoxy L-12(3202) and Hardner (K-6) was used and the composite is made by hand layup process. The composite consists of sida acuta fibre mat are cut and laid in the mould up to the required thickness (contains 3-layers) of the composite and it acts as reinforcement and Epoxy as matrix material. The ratio of mixing epoxy and hardener is (5:1). Figure 1. showns Sida acuta fibre fabric developed and Figure 2 shows composite panel developed.

Figure 1: Sida acuta fibre fabric.

Figure 2: Cured composite panal.

3. Fluxtural Test

Three point bend flexural tests on composite specimens were carried out according to ASTM-D 790 standard to determine the 3pt bend flexural strength and flexural modulus for Sida acuta FRP and to observe behavior of FRP under load. Test specimens shown in Figure 3 are made as per ASTM standards. Figure 4 indicates the testing of specimen using UTM.

Figure 3: Test specimens.

Figure 4: Fluxtural test setup.

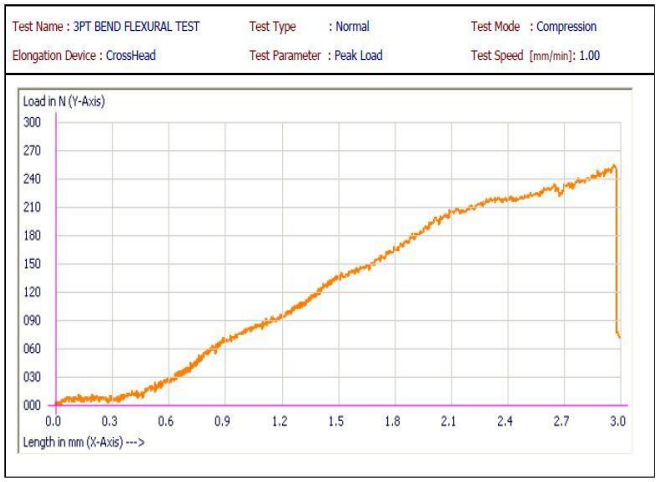

Figure 5: Load-Length (Diflection) curve for fluxtural test.

4. Impact Test

Impact (Charpy) test is conducted according to ASTM- D 256. The specimen is cut into required dimensions (55X10X10) mm using diamond wheel saw and final finishing was done using emery paper. All edges of the specimen are sealed with resin system. Test specimens shown in Figure 6 are made as per ASTM standards. Figure 7 indicates the testing of specimen using Impact testing machine.

Figure 6: Test specimens.

Figure 7: Impact (Charpy) test setup.

5. Result and Discussion

Table 1: Comparison of mechanical properties of composite panels made of sida acuta fibre as reinforcement material with other natural fibres.

Properties tested		SIDA ACUTA (Vf=40%)	SISAL [12] (Vf=40%)	JUTE [13] (Vf=40%)
Fluxtural	Strength Mpa	48.29	171	57.22
	Modulus GPa	4.314	11	8.9
Impact	Strength KJ/m2	31.74	58.5	13.44

The data presented in Table.1. indicates that the strength of composite panel made of sida acuta fibre is very close to that of composite made of Jute as reinforcement as far as impact strength is concerned it is greater than Jute composite and lesser than Sisal composite. Among the three composites under that the composite made of sisal is stronger than that of the composite made of Sida acuta and Jute.

Conclusion

The composite panels made of using Sida acuta fibre as reinforced material and Epoxy as matrix was subjected to mechanical properties.

- The bending (fluxtural) strength of Sida acuta composite material is very close to that of Jute and 3 to 4 times lesser than Sisal.

- The impact strength of Sida acuta composite material is comparatively higher than Jute and lesser than Sisal.
- There is a scope to increase the mechanical properties of composite made of Sida acuta as reinforcement material by improving the fibre extraction process and method of improving manufacturing process.

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