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Compressive & impact properties o sisal / glass fibre reinforced hybrid composites

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ABSTRACT

The Hybrid composites of unsaturated polyester based sisal/glass fibre Hybrid composites were prepared. Sisal is a natural fibre and Glass fibre is a synthetic fibre. These two natural and synthetic fibres are combined in the same matrix (unsaturated polyester) to make Sisal/Glass fibre Hybrid composites and the Compressive and Impact properties of these hybrid composites were studied. A significant improvement in Compressive and Impact properties of Sisal/Glass fibre Hybrid composites has been found. The Chalk powder (additive) is also added to the resin (unsaturated polyester) in proportions of 1%,2%,3% by weight of resin respectively and Sisal/Glass fibre Hybrid composites were prepared by using this resin to study the effect of Chalk powder on Compressive and Impact properties of these hybrid composites. It is also observed that as the Chalk powder quantity increases Compressive and Impact properties are decrease.

KEYWORDS

Hybrid composite;
Unsaturated polyester,
Sisal fibre;
Glass fibre;
Impact strength;
Compressive strength.

INTRODUCTION

Many modern technologies require material, with unusual combinations, which exhibits superior properties then the individuals. Fibre rein forced Composite is one such material, which has revolutionized the concept of high strength. Composite materials are formed by a combination of two or more distinct materials. The combination results in superior properties not exhibited by the individual materials. Many composite materials are composed of just two phases one is termed as matrix phase, which is continuous and surrounds the other phase often called the dispersed phase[1-4]. The matrix phase binds the fibres together and acts as medium by which an externally applied stress is transmitted and distributed to the fibers. Only a very small portion of an applied load is sustained by the matrix phase and major portion of is sustained by the fibres. The fibres are basically two types, they are Natural and Synthetic Fibres. Cotton, Jute and Sisal are some examples for Natural Fibres and Glass, Nylon and Carbon are some examples for Synthetic Fibres. The Natural fibres are

renewable[5] and cheaper but their mechanical properties are much lower than the synthetic fibers. The synthetic fibres exhibit good mechanical properties but they are costlier and non renewable[6]. In present work to take advantage of both Natural and Synthetic fibres, they can be combined in the some matrix to produce hybrid composite and their impact and compressive properties are studied[7-13]. The Chalk powder (additive) is also added to the resin (unsaturated polyester) in proportions of 1%,2%,3% by weight of resin respectively and Sisal/Glass fibre Hybrid composites were prepared by using this resin[8], The effect of chalk powder, which is added to the matrix is also studied.

MATERIALS USED

The unsaturated polyester resin obtained from Allied Marketing co, Secunderabad, A.P, India, Sisal (Agaves Veracruz) fibre (2cm long short fibre) obtained from local sources and the chopped strand mat of Glass fibre (2cm long short fibre)[9] were used for present work. Methyl Ethyl Ketone Peroxide as accelerator and Cobalt Naphthenate as catalyst, which are obtained from M/S Bakelite Hylam Hyderabad, A.P, India, were used. The Chalk powder is used as additive for present work.

PREPARATION OF COMPOSITES

The matrix of unsaturated polyester and monomer of styrene are mixed in the ratio of 100:25 parts by weight respectively. Later the additive chalk power is mixed thoroughly and then the accelerator of methyl ethyl ketene peroxide 1% by weight and catalyst of Cobalt Naphthenate of 1% by weight were added to the mixture and mixed thoroughly. In present work the composites were prepared by hand lay-up technique, the releasing agent of silicon is sprayed to glass mould and the matrix mixture is poured in to the mould. The fibre is added to matrix mixture, which was poured in the glass mould. The excess resin was removed from the mould and glass plate was placed on top. The castings were allowed to cure for 24hrs at room temperature and then casting is placed at a temperature of 80^{o} for 4 hrs. The composite is released from mould and are cut to prepare test specimens.

SPECIMEN PREPARATION AND TEST MACHINE

The test specimens for both Compressive and Impact test were cut as per American standard testing method (ASTM) D256 specifications. The Instron Universal Testing Machine (UTM) (supplied by Instron Corporation, Series 9, automated testing machine) used for compressive test and Izod Impact testing machine is used for Impact Testing. Five samples were tested in each case and average value is tabulated.

RESULTS AND DISCUSSION

Compressive strength of sisal / glass fibre hybrid composites

The compressive strength of sisal / glass fibre hybrid composites is presented in TABLE-1. It is observed that the glass fibre composite is exhibiting higher compressive strength[10] than the sisal fiber reinforced composite. The sisal / glass fibre hybrid composite compressive strength is higher than sisal reinforced composite but lower than glass fibre reinforced composite. The increase in compressive strength of hybrid composite is because of glass fibre content. The variation of compressive strength with fibre content is shown in Figure 1.

The effect of chalk powder on compressive strength of Sisal /glass fibre hybrid composite is shown Figure 2. It is observed that the composite without chalk pow-

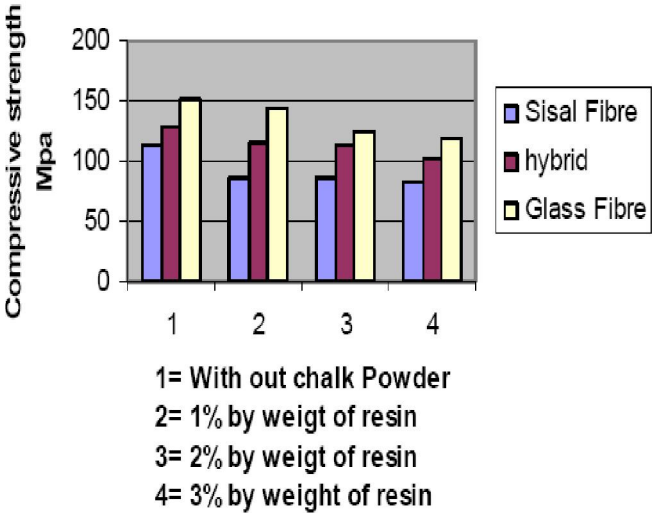

Figure 1 : Effect of fiber content on compressive strength of sisal/glass hybrid composites.

TABLE 1 : Compressive properties of sisal/glass fibre hybrid composite

S. No.	Fibre	Compressive strength MPa			
		Chalk powder % by weight of resin			
		0%	1%	2%	3%
1	Sisal fibre	113.07	86.99	85.906	82.31
2	Sisal / Glass fibre hybrid composite	128.165	114.832	113.654	101.086
3	Glass fibre	151.497	144.152	125.931	118.816

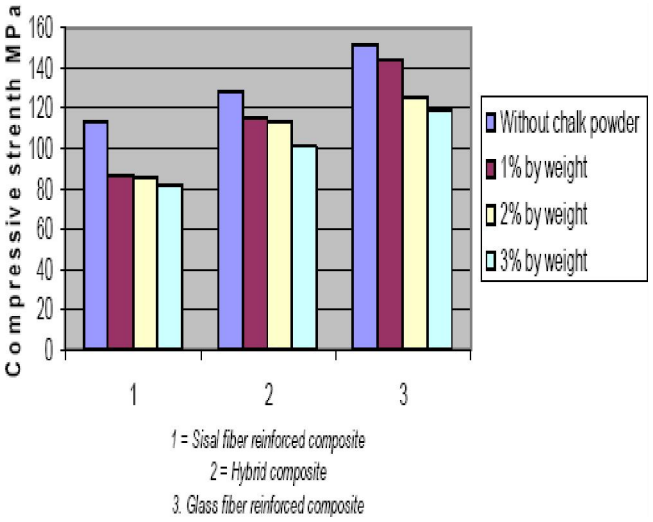

Figure 2 : Effect chalk powder content on compressive strength of sisal/glass hybrid composites.

der addition is exhibiting higher compressive strength, as the chalk powder quantity in sisal / glass fibre hybrid composite increases then the compressive strength is decreases.

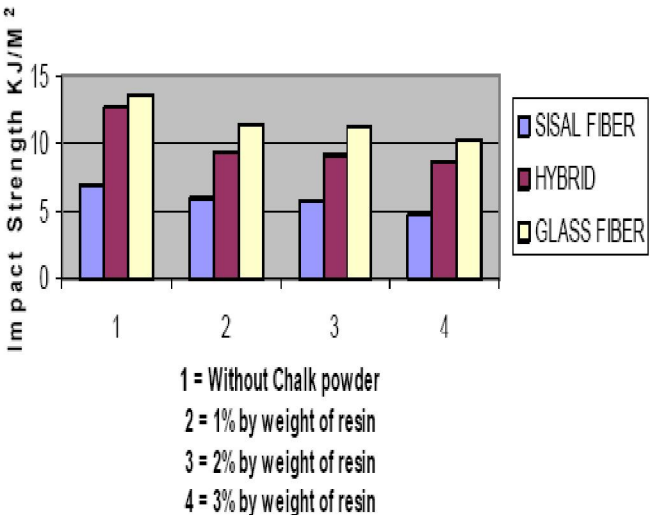

Figure 3 : Effect of fiber content on impact strength of sisal/ glass hybrid composites.

IMPACT STRENGTH OF SISAL / GLASS FIBER HYBRID COMPOSITE

The impact strength of sisal / glass fibre hybrid composites is presented in TABLE-2. It is observed that the glass fibre composite is exhibiting higher impact strength[10] than the sisal fibre reinforced composite. The sisal / glass fibre hybrid composite impact strength is higher than sisal reinforced composite but lower than glass fibre reinforced composite. The increase in impact strength of hybrid composite is because of glass fibre content. The variation Impact strength with fiber content is shown in Figure 3.

The effect of chalk powder on impact strength of sisal /glass fibre hybrid composite is shown in Figure 4. It is observed that the composite without chalk powder addition is exhibiting higher impact strength, as the chalk powder quantity in sisal / glass fibre hybrid impact increases then the impact strength is decreases.

TABLE 2 : Impact properties of sisal/glass fiber hybrid composite

S. No.	Fibre	Impact strength KJ/M^2			
		Chalk powder % by weight of resin			
		0%	1%	2%	3%
1	Sisal fibre	6.9	6.076	5.828	4.836
2.	Sisal / Glass fibre hybrid composite	12.770	9.424	9.176	8.680
3.	Glass fibre	13.64	11.532	11.315	10.168

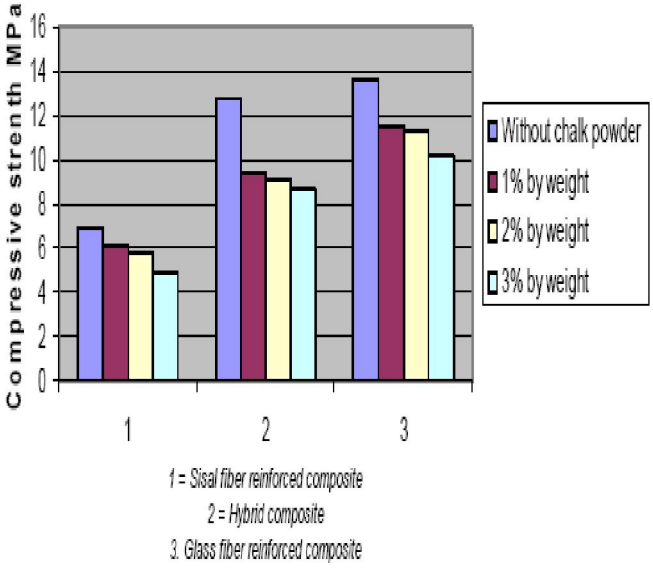

Figure 4 : Effect of chalk powder content on impact strength of sisal/glass hybrid composites.

CONCLUSION

The compressive strength and impact strength of unsaturated polyester based sisal/ glass hybrid composite have been studied as a function of fiber content. It is observed that the compressive and impact strength of sisal/glass fibre hybrid component is higher than sisal fibre reinforced composite, but lower than the glass reinforced composite. When the load is applied on sisal/ glass fibre hybrid composite, first sisal fiber fails then the load is transferred to glass fibre. So that the presence of glass fibre in the sisal / glass fibre hybrid composite causes to improve the impact and compressive strength. At the same time the presence of sisal fiber in hybrid composite the causes to decrease the compressive and impact strength than the glass fibre composite.

The effect of chalk powder on compressive and impact strength of sisal/glass fibre hybrid composite has also been studied and it is observed that as the chalk powder quantity by weight of resin increases then the compressive and impact strengths decrease. These composites are influenced by so many factors including matrix fracture and fibre/matrix de bonding.

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