EXPERIMENTAL INVESTIGATION OF ALOEVERA AND AL_2O_3 REINFORCED POLYMER MATRIX

B.Arun Kumar[1],M.Chittibabu[2],V.Dinesh Prabahar[3],M.Ramesh[*].
1,2,3, UG Students,Department Of Mechanical Engineering,K.Ramakrishnan College Of Engieering,Trichy-621 112.
** Assistant Professor,Department Of Mechanical Engineering,K.Ramakrishnan College Of Engineering,Trichy-621 112.*

ABSTRACT

Todays applications in polymer for strength and usage had become a necessary factor of the future. This study explores the possibility of the use of Aloe Vera fiber based composites in low strength materials. Contact hand lay-up technique was used to fabricate the composite mats. The samples were made with a composition of Resin reinforced by aloe vera. Further this specimen is mixed with 5, 10 and 15% alumina particulates. The fabricated natural fiber polymer composite samples were subjected to impact testing by IzodImpact test, Flexural, Tensile and water absorption test. The change in composition of alumina powder in aloe Vera fiber mat and the impact on properties have been studied.

KEYWORDS: *Aloe Vera, Alumina powder, Handlay- up method, Natural composite, Material testing.*

INTRODUCTION:

The light weight and higher performance has become a leading factor in selection of materials. Owing to research development in the area of polymer composite materials, the focus is to bring more multifunctional composites in the field of Automotive, avionics and product development. The researchers are keen in increasing the strength of the polymer composite and also the degradation factors which is to be considered for the upcoming generations. Due to increase in light weight applications to improve performance the metal matrix composites have been tailored to design and weight properties. This focus area is shifted towards polymer with metal reinforcement to bring a significant change in the upcoming era.

Materials are considered as the base elements of natural and manmade structures. The composite materials properties are developed by combining several materials in the research of improvement. Earlier Investigation shows that the addition of alumina in aluminium for volume fractions varying from 5-30% had shown the decrease in fracture toughness in a metal matrix composite. The woven mat structures had provided greater strength and mechanical properties than the non-woven fibres.

Epoxy is a copolymer formed from two different metals. It can also be called as the resin or compound or hardener or activator in a composite fabrication. Here we used epoxy as resin in the fabrication of aloe Vera fiber mat reinforced with metal powder called alumina. Here we used the one of natural fiber called aloe Vera fiber. The mechanical and physical properties of aloe Vera fiber are listed below:

MATERIALS AND METHODS:

Aloe Vera fiber and epoxy [LY556] was purchased from the local dealer and are used to prepare the composite plate in random orientation. The compositions of reinforcement with respect to the epoxy, resin are listed below:

FIBER PROCESSING:

Aloe Vera fiber cannot be used in the raw form for composite fabrication. Hence, it must be converted into yarns and the process used for yarn formation is called spinning. The process involves the twisting fibers together to form a structure like thread, rope or cable. Then the yarn is weaved in the form of mats. The structure with equal thickness is required and so in random mats care should be taken to ensure that lumping of fibers in a particular place does not occur. If the mat consists of uneven bumps it will results in the non-uniformbehavior of the final composite which is undesirable.

Fig 1 Aloe vera mat

COMPOSITE FABRICATION:

The most commonly used matched die molding method is the compression molding. It involved in the fabrication of automobile body panels, housings, for electrical appliances and machines, covers, sinks and several other parts.

In order to fabricate a composite plate of 28*28*0.3 cm^3, initially the mould is polished with a (car body wax) polish to a very smooth, high quality finish. Then, a very thin film of a liquid release agent is applied in the molding process. The wax and the release agent are applied to prevent the aloe Vera fiber product from sticking to the mould. A layer of epoxy resin mixed with a hardener, alumina powder[0%,10%,20%,30%] is then applied all over inside of the mould. This layer is known as gel coat. The curing of a product takes 5 hours and is dependent on the size, thickness and complexity of the product. The composite is roughly trimmed to shape after which is released from the mould tool, which is then cleaned. The reasons for choosing hand lay-up technique are simple

processing,allows for all shapes and sizes, provides good surface finish, cores can be molded in, investment is low.

Fig 2 Composite plate

TESTING METHODS:

1)TENSILE TEST:

The test was conducted on two specimens for every composite sample at a room temperature of 30 degree Celsius using universal testing machine ASTM D638.The specimens were prepared in the rectangular and square shape according to the standards. The test was carried out by clamping the specimen in the required fixture of the machine then the load was applied until the specimen break. The machine generates the stress-strain relationship graphs and load- displacementrelationship graphs during the test are presented.

2)IMPACT TEST:

The performance of the fabricated aloe Vera fiber composite plate were evaluated by it into IZOD impact test. The reasons go for IZOD impact test is its versatility and accuracy in predicting the relative roughness and also they are economical and quick. The standard adopted was . According to the standard, specimens were prepared having 28*28*5 mm. The two specimens for each sample were tested and the results were noted.

3)FLEXURAL TEST:

The bending test was carried out using Universal Testing Machine according to the ASTM standard . Two specimens from each sample were tested. Under the compression load the deflection of the specimen was measured until the specimen breaks or cracks. The graph obtained gives the relationship between the stress and strain. Thus the flexural behavior was analyzed until the failure of the composite specimen takes place due to the combination of bending and shear.

4)WATER ABSORPTION TEST:

To determine the water absorption behavior of the composite, the two samples were taken in the form of square shape of dimensions 28*28*5 mm. Initially the samples were sundried for 24 hours to eliminate any moisture present and weighed. The test was carried out by sample soaked in water for 24 hours at room temperature 30 degree Celsius. Before and after immersing the sample into water the weight was taken. Thus the variation in sample weight after soaked into water was noted.

RESULT & DISCUSSION:

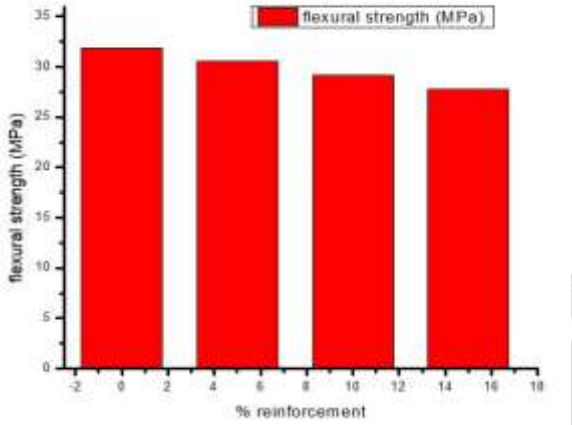

Fig 3 Flexural strength result

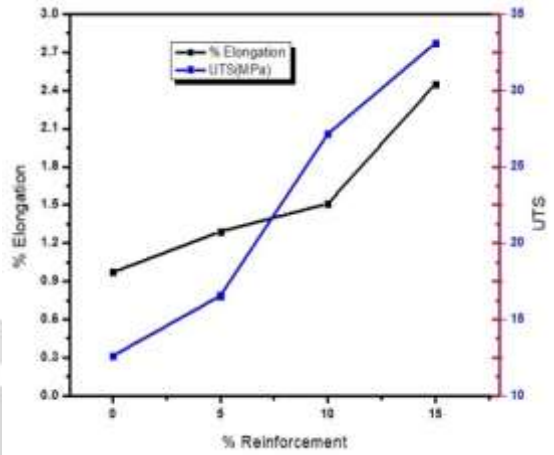

Fig 4 Tensile strength result

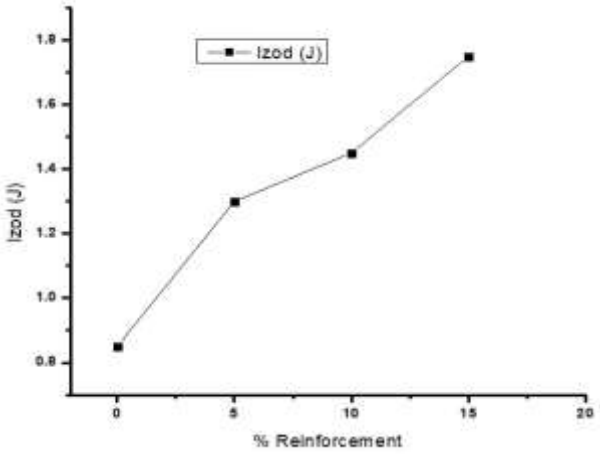

Fig 5 IZOD strength result

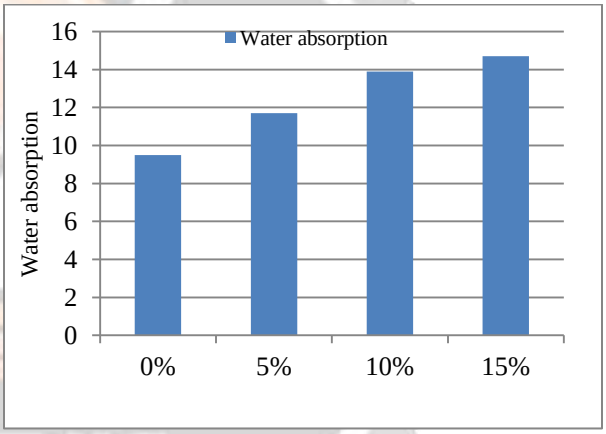

Fig 6 Water absorption test result

From fig 3. The Flexural strength results have been observed, the sample with 15% addition of Alumina had lesser energy absorption than the samples without alumina. The difference is less when compared with each other. This states that the nature of flexural is reduced in specimens without alumina. The bar graph is noticeably reduces linearly with minimum difference as the reinforcement increases.

From fig 4. The tensile strength is observed, the results show that the Ultimate Tensile Strength and % elongation are taken on the y axis and the percentage reinforcement is taken on the x axis.The Reinforcement has increased the properties of aloe vera fiber. The tensile strength of 15% addition had given more strength. The 10% results have given good tensile strength with the ratio of elongation %. The increase shows the addition of Alumina with Aloe vera had an impact

The improvement in graphs had shown the influence of Alumina on the polymer matrix(Aloe vera +resin) in the Impact strength test of IZOD. The graph increases as the addition of weight percentage of alumina increases. The percentage of difference is less when compared to specimen without reinforcement of alumina.

CONCLUSION:

Based on the results obtained from various tests that have been conducted, the mechanical properties of the composite were obtained and analyzed. From the results obtained, the following things were concluded.

1) The Tensile strength was higher in 15 % reinforcement as the elongation percentage was also high when compared with the other reinforced specimens

2) The Flexural strength is slightly unvaried, the alovera with resin gave higher value of flexural then the specimens with Alumina reinforcements.

3) The Impact strength from IZOD test showed greater strength in the higher amount of reinforcement (15%) and the increase percentage is also high when compared to specimen without alumina reinforcement.

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BIOGRAPHIES

	Main Author-V.Dinesh prabahar Organization/institution – K.Ramakrishnan college of engineering Biographical note – Presently studying bachelor of engineering in Department ofMechanical Engineering
	Co Author-B.Arun kumar Organization/institution – K.Ramakrishnan college of engineering Biographical note – Presently studying bachelor of engineering in Department ofMechanical Engineering
	Co Author-M.Chittibabu Organization/institution – K.Ramakrishnan college of engineering Biographical note – Presently studying bachelor of engineering in Department ofMechanical Engineering
	Co Author-M.Ramesh,M.E. Organization/institution – K.Ramakrishnan college of engineering Biographical note – Presently studying bachelor of engineering in Department ofMechanical Engineering GUIDE OF THIS PROJECT