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AN INVESTIGATION OF THE MECHANICAL PROPERTIES (TENSILE STRENGTH AND IMPACTTEST) OF BAGASSE FIBRE RAINFORCED PLASTIC USING PRESIN AS MATRIX

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Abstract:
In current era of improved performance that may be specified by various criteria such as light weight, better strength and lesser cost currently used materials frequently reach the limit of their utility. Thus today's emphasisis on newer material which is low cost and have high strength. Composite materials can be the solution. Composite materials are light weight and durable. There is great application of composites in today's day and age. We have tried to develop a composite materials using locally available materials which might be fit for the manufacturing material. We have completed this project with our knowledge and experience. We also hope to experiment on other materials to develop composites.

I.Introduction

1. COMPOSITES

Due to the various applications and working criteria conventional materials often reach their limit of modifications and deployment. They sometimes are no longer applicable in advanced and challenging working conditions. To compensate their inabilities composite materials are being developed and research has been conducted on them. The main characteristic of composites is they are light weight. Other properties such as tensile strength, compressive strength, shear strength; corrosion resistance etc. can also be modified accordingto need. In this day and age composites have able to place its mark in manufacturing industries. They are widelyused in various applications from a small chair to the nose of the rockets and missiles. Composite materials are also a form of recycled material because many natural materials which would be waste can be reused as a fiber. Main consideration is to develop economical composites with required properties. Extensive research has been conducted on composites as its application is growing day by day.

2. WHAT IS COMPOSITE?

Composite material or simply a composite is a material made from two or more different materials having distinct properties. The composites have unique properties then the materials it was made from. All the individual constitutes are combined together but remains separate and can be physically separated. The main constitute is called matrix and the additional material is called reinforcement material. The matrix and reinforcement material are selected according to the required characteristics of new material i.e. composite.

3. WHY WE NEED COMPOSITES?

"The lighter the better" well, yes composites are lighter. In today's context reducing the weight of the components is main consideration in manufacturing. And being lighter composites can be made stronger too. So why not use it everywhere if possible? In most of the conventional materials we do not have the facility to modify its properties. Some materials have good compressive strength but fails in tensile loading. But composites can be developed having satisfactory compressive strength as well as better tensile strength. This versatility has made composite a widely applicable material. Design flexibility can also be attained with the use of composites because they can be molded in intricate shapes. The process of making composite can be economical too.

4. COMPOSITION OF COMPOSITES

Composites consist of two main constitutes matrix and reinforcement material. Matrix may be of materials like metals, plastics, rubber etc. Reinforcement material can be in two forms, particulate or fiber. The strength is imparted by reinforcement and the matrix material holds them together. Binders are also sometimes used to bond the matrix and reinforcement.

Matrix

The main function of matrix is to transfer the stresses between the fibers and protect them from environmental and mechanical damages. The matrix material provides ductility and toughness and supports and blinds the fiber. It is necessary that the strain at break should be larger than the fiber.

Resins like Epoxy, Phenol, Polyester, Polyurethane, Vinyl Easter etc. are commonly used as matrix material because of their properties variation and low cost.

Fiber

Fibers bear the loads along their longitudinal direction. A reinforcing fiber should have high modulus elasticity, high strength, low density, satisfactory ductility and should be easily wetted by matrix. Fibers may be in different forms such as, Filaments, Yarns, Roving, Whiskers, Woven fabrics etc. Fibers can be of metals, carbon, graphite, glass, ceramics, polymers etc. Molybdenum may also be used.

Fig1.1: Bagasse fibres.

II. OBJECTIVES OF THE WORK

The main objective of the work is to set up a composite utilizing bagasse fiber as support and PU as lattice material and to explore its malleable properties under different extents of fiber. The other target incorporates:

1. To propose the utilization of normal fiber baggase as a support material in PU Resin base.

2. To use the advantages presented by sustainable assets for the improvement of composite materialsdependent on normal filaments.

3. To determine the tensile & impact property of the composite so that its future benefits can be explained.

III. RESULTS AND DISCUSSIONFACTOR CONSIDERED

In the present study Effect of fiber fraction were taken as working parameters and tensile strength & impact strength were taken as response variable. The effects of the fibre fraction were studied.

TENSILE TEST

Tensile test was carried out on UTM machine on standard D-638 specimens. Data obtained from the experiment was tabulated as in table 4.1. This data is further analyzed to investigate the effect of fibre %age on the tensile strength.

Table 4.1: Tensile Strength of the specimens

Sr. No.	Bagasse fibre %age	Tensile Strength in Mpa
S1	2.5	2.31829
S2	5	1.5608
S3	7.5	1.90889
S4	10	6.4932

Here S1, S2, S3, S4 are the number of specimens.

STATISTICAL ANLYSIS OF DATA

There are a lot of methods that has been used by the researchers for analyzing the data obtained from theexperiments. In the present study, graphical analysis and mean method has been used to find out:

1. The influence of the process parameters such as weight fraction of the fiber on the tensile andimpact strength of the composite.

2. To find out the best possible composition of the composite for the maximum strength.Average or mean control charts are used for analyzing data for individual factors.

ANALYSIS AND DISCUSSIONS FOR STRENGTH

The data obtained from the tensile tests has been tabulated in the table no. 4.1. This table is reproduced herein as table no. 4.2 for the purpose of further analysis. Minitab 16.1 statistical software is used to form graph for the analysis purpose.

Table 4.2: Tensile Strength of the specimens

Sr. No.	Bagasse fibre %age	Tensile Strength in Mpa
S1	2.5	2.31829
S2	5	1.5608
S3	7.5	1.90889
S4	10	6.4932

It is clear from the above table the percentage of bagasse fiber in a composite plays a significant role. % ageof the fiber contribute significantly towards the tensile strength of the composite.

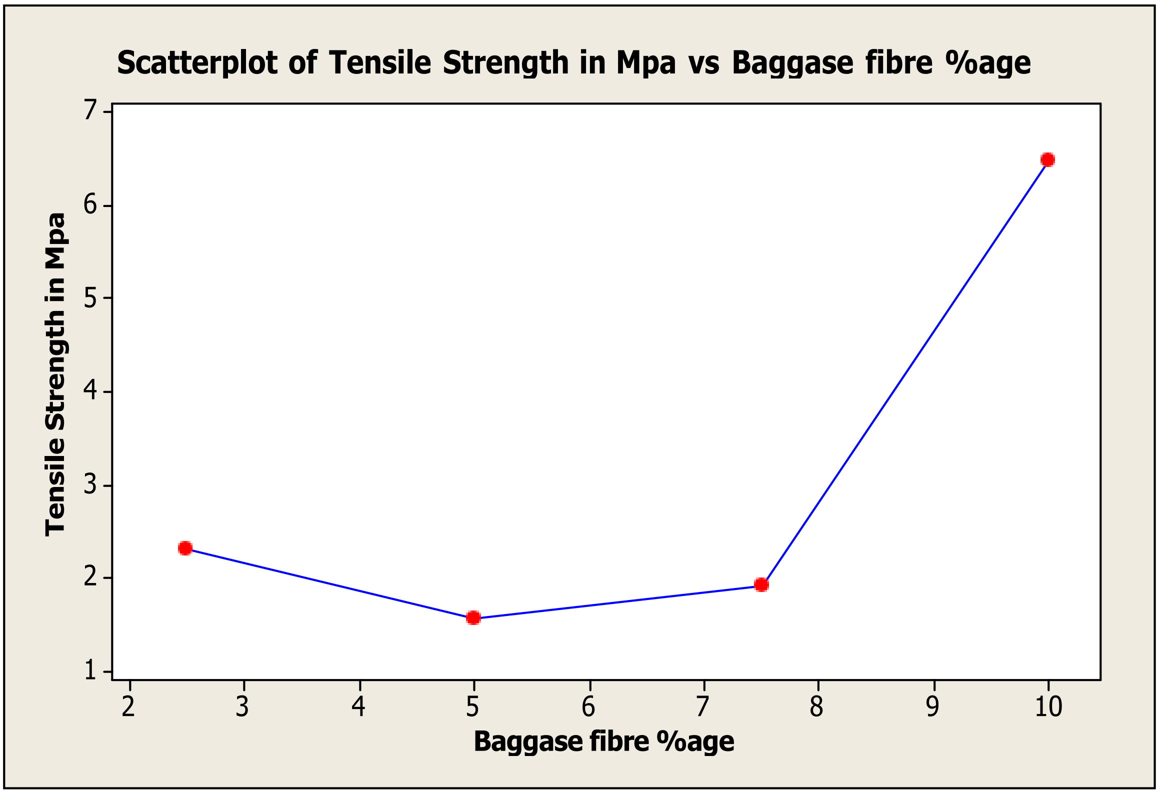

Fig: 4.1: Plot between %age fiber and Tensile strength of the composite

Value of the tensile strength is approximately 2.31 Mpa when 2.5% bagasse fiber is added to the matrix. This value increases upto 6.50 Mpa when the percentage of the fiber is increased up to 10 percent. The graph shows a slight decrease in the value of tensile strength at 5% and 7.5% fiber level. However this change is very less and may occur due to the lesser expertise in specimen formation and work piece formation. Valueat 5% level is 1.56 Mpa which further increases to 1.90 Mpa at 7.5% level.

So from the above result we may conclude that tensile strength of the composite increases with increase in fiber percentage in a composite. However the maximum value of the fiber level remains a matter of concern always. Higher percentage of the fiber will lower the amount of binding agent i.e. matrix. This may tend to cause the rupture of the composite well before the expected value. Whereas a higher percentage value of the matrix material will soften the composite. Also the composite will lack of tensile properties. It will behave more of a plastic than a composite. So an optimum value of fiber is recommended which is expected to be in between the range of 5-15 percent of the fiber. However this value may change according to the type and nature of the fiber.

Lengthy fibers such as baggase and jute fiber may need lesser percentage in the matrix material whereas short fiber such as rice husk may be consumed in higher percentage.

IMPACT TEST

Impact test is an important test to determine the ability of a material to withstand the falling loads. This propertyof the material plays very important role when a sudden collapse takes place as composite finds its applications

in the automobile industries and aero plane industries. Impact test was carried out on izod impact testing machine having 25 joule (Company Tinnius Olsen). Data obtained from the experiment was tabulated as in table 4.3. This data is further analyzed to investigate the effect of fibre %age on the impact strength.

Table 4.3: Impact Strength of the specimens

Sr. No.	Bagasse fibre %age	Impact Strength in KJ
S1	2.5	1.2251
S2	5	1.84
S3	7.5	1.0969
S4	10	1.5678

Here S1, S2, S3, S4 are the number of specimens.

ANALYSIS AND DISCUSSIONS FOR STRENGTH

The data obtained from the tensile tests has been tabulated in the table no. 4.3. This table is reproduced herein astable no. 4.4 for the purpose of further analysis.

Table 4.4: Impact Strength of the specimens

Sr. No.	Bagasse fiber %age	Impact Strength in KJ
S1	2.5	1.2251
S2	5	1.84
S3	7.5	1.0969
S4	10	1.5678

It is clear from the above table the percentage of bagasse fiber in a composite plays a significant role. % ageof the fiber contribute significantly towards the impact strength of the composite.

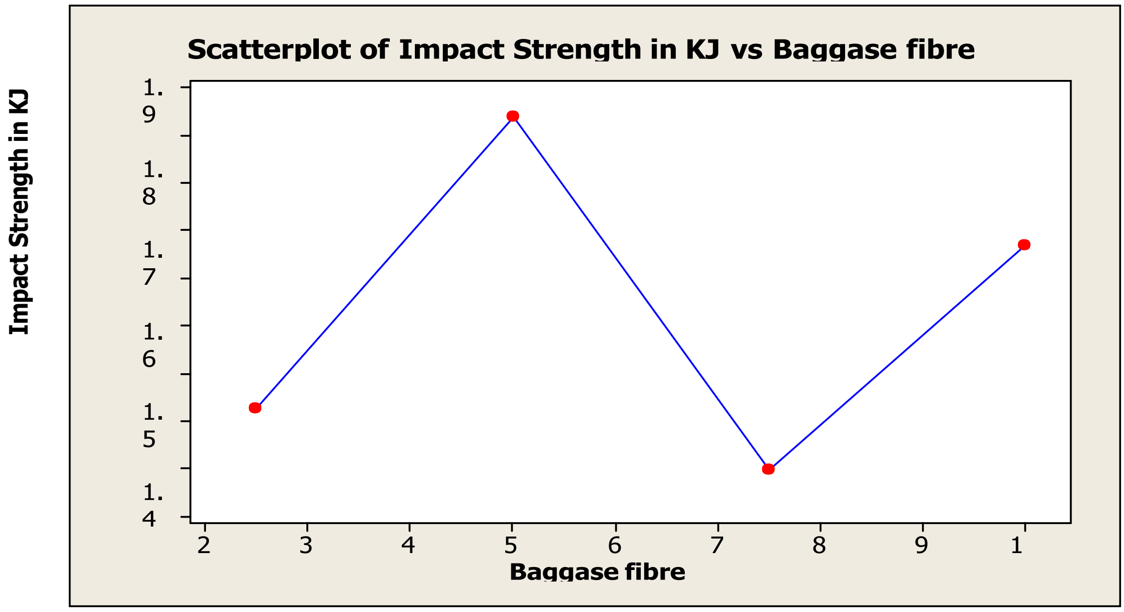

Fig: 4.2: Plot between %age fiber and Impact strength of the composite

Value of the impact strength is approximately 1.23 KJ when 2.5% bagasse fiber is added to the matrix. This value increases upto 1.56 KJ when the percentage of the fiber is increased up to 10 percent. The graph shows a slight increase in the value of tensile strength at 5% and and a decrease at7.5% fiber level. However this change may occur due to the lesser expertise in specimen formation and work piece formation. Value at 5% level is 1.846 KJ which further decreases to 1.09 KJ at 7.5% level.

IV. CONCLUSIONS

The following conclusions are drawn from the above study given below:

1. The successful fabrication of Polyurethane based bagasse reinforced fiber composites has been done.

2. Fabrication of PU based composites is cheaper than the epoxy based composites. Market price for the PU resin is Rs.450 per litre which is much lower than the epoxy resin which cost approx. Rs. 700 per litre.

3. Strength of the PU based composites is found to be comparable to the other composites.

4. Trend analysis for the tensile strength vs bagasse fiber percentage shows that tensile strength increase with the increase in bagasse percentage in the sample. Higher the bagasse in samples better the strength.

5. Specimen having 10% bagasse was found to be most strong. Tensile strength of this work piece was 6.5 Mpa.

6. Trend analysis for the impact strength vs bagasse fiber percentage shows that impact strength increase with the increase in bagasse percentage in the sample. However a proper trend cannot be predicted.

7. Specimen having 5% bagasse was found to be most strong. Impact strength of this work piece was
1.84 KJ.

So work pieces having higher fiber fraction may be assumed to have higher strength.

V. FUTURE SCOPE

In the present investigation only fiber percentage was take as working parameters and tensile strength and impact strength was taken as response variable for the composites. There is an exceptionally immense degree for future researchers to investigate this space of examination. This work can be additionally stretched out to examine other tribological perspectives like scraped spot, wear, hardness and flexural conduct of this composite. We can likewise concentrate on different parts of such composites like utilization of other expected strands for the manufacture of the other half and half composites and assessment of their mechanical and disintegration conduct and the subsequent exploratory discoveries can be broke down in comparative style.

Additionally the machining tasks like penetrating, processing, cutting and others machining cycles should be possible and might be investigated.

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