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REVIEW ON MECHANICAL INVESTIGATION ON SUGARCANE AND GLASS FIBRE COMPOSITE MATERIAL

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ABSTRACT:

Recently the interest in composite materials reinforced with natural fibers has considerably increased due to the new environmental legislation as well as consumer pressure that forced manufacturing industries to search substitute for the conventional materials, e.g. glass fibers. Although composites provide excellent mechanical properties, certain applications demand improved mechanical behavior also because the presence of additional properties. Recent developments in polymers have developed nanocomposites, which are composites reinforced by Nano powders. In these materials, the Nano powders have shown great enhancements in mechanical properties, thermal properties, and electrical properties. Never the less, these composites lack the strength for applications where FRP‟s are currently used. The addition of Nano powders as reinforcement to standard composites shows great promise to not only enhance the prevailing properties of those composites, but also add many other properties that might maximize their applications. Results showed improve the tensile, flexural and impact strength of the composites in comparison to the polymer pure.

INTRODUCTION:

Natural fibers have different origins such as wood, pulp, cotton, bark, bagasse, bamboo, cereal straw, and vegetable (e.g., flax, jute, hemp, sisal, and ramie). These fibers are mainly made of cellulose, hemicelluloses, lignin and pectin's, with a small quantity of extractives. The concept of „eco-materials‟ has gained key importance thanks to the necessity to preserve our surroundings. The meaning of eco-material includes „safe" material systems for human and other life forms in the least times. Past experiences have shown that it's necessary to characterize materials and determine those which are safe for both short and long-term utilization. Selection of a cloth system that satisfies not only industrial requirements but also this wider definition of eco-materials, as described above, is an urgent necessity. Here, the foremost appropriate concept for material selection is composite materials with natural fibre reinforcement.

One or more discontinuous phases are, therefore, embedded during a continuous phase to make a composite. The discontinuous phase is typically harder and stronger than the continual phase and is named the reinforcement, whereas, the continual phase is termed because the matrix.

Also the natural fibers present some drawbacks, such as the incompatibility between fibers and polymer matrices, the tendency to form aggregates during processing and the poor resistance to moisture, reduce the use of natural fibers as reinforcements in polymers

The matrix materials are often metallic, polymeric or can even be ceramic. When the matrix may be a polymer, the composite is named polymer matrix composite (PMC).Over the past few decades; it's found that polymers have replaced many of the traditional metals/materials in various applications. this is often possible due to the benefits like simple processing, productivity, cost reduction etc. offered by polymers over conventional materials. In most of those applications, the properties of polymers are modified by using fibers to suit the high strength/high modulus requirements.

Fiber reinforced composite materials contains fibers embedded in or bonded to a matrix with distinct interfaces (boundaries) between them. during this form, both fibers and matrix retain their physical and chemical identities, yet they produce a mixture of properties that can't be achieved with either of the constituents acting alone.

Generally fibers are the principal load-carrying members, while the encompassing matrix keeps them within the

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desired location and orientation. The matrix also acts as a load transfer medium between them and protects the fibers from environmental damages thanks to elevated temperatures, humidity etc. Thus, albeit the fibers provide reinforcement for the matrix, the latter also serves variety of useful functions during a material. Many fiber reinforced polymers (FRPs) offer a mixture of strength and modulus that are either like or better than many traditional metallic materials additionally, fatigue strength also as fatigue damage tolerance of the many composite laminates are excellent.

METHODOLOGY:

If fibers are wont to strengthen a polymer material, optimal adhesion between the fibers and therefore the polymer matrix is important. to enhance adhesion, the surface of the fibers are often silane-treated.23 aside from the adhesion of the fibers, the number of fibers and their behavior during a polymer matrix even have an impact on the mechanical properties of the fiber-polymer composite construction, which, however has not yet been fully clarified.

This study determined the effect on fracture resistance of acrylic-fiber composite test specimens with different quantities of continuous fibers during a heat-cured acrylic matrix. The acrylic used because the polymer matrix was heat cured acrylic (PMMA) commonly used as a denture base material. it had been allowed to undergo short time polymerization during a water bath consistent with the manufacturer‟s instructions. The mold was placed in boiling water and remained at 60˚ C for 45 minutes. The test specimens (3 X 4.5 X 50 mm).

The interest in natural fibre reinforced composites is growing rapidly both in terms of their industrial applications and fundamental research. Their availability, renewability, rarity and price also as satisfactory mechanical properties make them a beautiful ecological alternative to glass, carbon and other man-made fibers used for the manufacturing of composites. Basically, composites are materials consisting of two or more chemically distinct constituents, on a macro-scale, having a definite interface separating them.

The classification of the groups studied in each group consisted of 30 test specimens. All of the fibers were placed longitudinal to the specimen and perpendicular to the loading force. Concentration of fibers within the test specimens was calculated consistent with the load of PMMA matrix (798 mg) and therefore the weight of fibers incorporated. The dimensions of the test specimens were measured by micrometer. Differences in dimensions of the test specimens used were eliminated by grinding the specimens to the predetermined dimensions. The control group had no fiber reinforcement.

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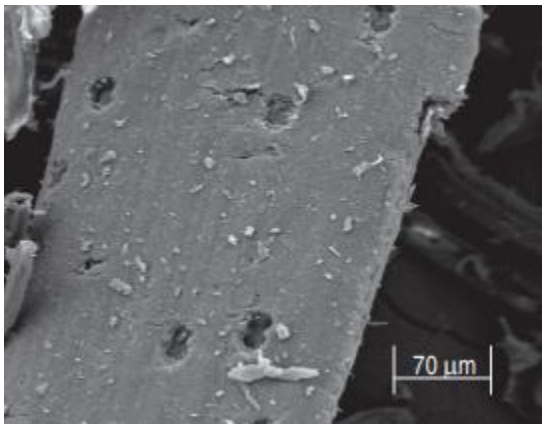
Differences in dimensions of the test specimens used were eliminated by grinding the specimens to the predetermined dimensions. The control group had no fiber reinforcement. Variance was wont to determine the interaction of type and amount of fiber on the fracture load.

RESULT AND DISCUSSION:

Effect of Fiber Parameters on Lastingness of Composites:

Tensile strength of a cloth is defined because the resistance offered by the fabric to urge broken under tension. Effect of fiber loading and fiber length on lastingness of composite.



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Tensile strength during this case varies with varying composition and it's found that the strength goes on increasing with increasing percentage of fiber within the composite for every length of fiber. The tensile properties measured within the present work are well compared with various earlier investigators though the tactic of extraction of sugarcane fiber is different. The tensile modulus indicates the relative stiffness of a cloth and may thus be obtained from stress strain diagram. Optimum value of lastingness for the composite is found to be at 30% fiber loading for every length of fiber. The very best value for lastingness is for 30% fiber loading for a fiber length of seven mm.

Effect of Fiber Parameters on Flexural Strength of Composites:

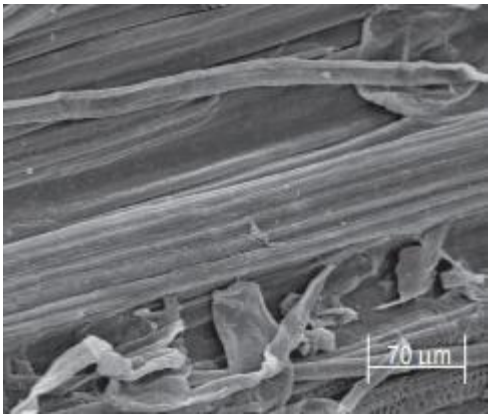
Flexural strength is defined because the ability of a composite by virtue of which it opposes the deformation likely to be imparted thereto under the appliance of load. The effect of fiber loading and fiber length on flexural strength of composites the test uses a flat specimen of rectangular cross section where the load is gradually applied with a speed of 1mm per minute until the specimen fails at the given load. The test is amid three point bend test. Flexural strength for sugarcane reinforced polymer composite increases with increasing fiber loading then decreases.

Samples	Impact Strenght ($J.m^{-2}$)
PP	36,1 ± 1,1
PP/FSB5%	32,7 ± 6,0
PP/FSB10%	45,0 ± 0,1
PP/FSB20%	52,5 ± 0,6

The same results comply for fiber length also. The linearly increasing trend of flexural strength with increasing fiber contents suggests that the bonding between the fibers and therefore the matrix is comparatively good. The lower value of flexural strength at higher fiber content could also be due to insufficient matrix within the composite which couldn't be ready to transfer the load to the fibers.
The effect of weight fraction of fibre on mean flexural strength for other fibre reinforced composites as compared to sugarcane composites are more. consistent with Ismail et al. and Yao and Li this decrease is attributed to the lack of the fiber, irregularly shaped, to support stresses transferred from the polymer matrix and poor interfacial bonding generates partially spaces between fiber and matrix material and as a result generates weak structure.

Effect of Fiber Parameters on Hardness of Composite:-

Surface hardness of material is sometime a matter of concern when the material so produced is encountered for space application. Surface hardness of material is sometime a matter of concern when the material so produced is encountered for space application.



Effect of Fiber Parameters on Impact Strength of Composites:-

Impact strength refers to a shock absorbing capacity of material. This is often entirely associated with a toughness of the material. The effect of fiber loading and fiber length on impact strength of composites is shown. Effect of fiber

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parameters on impact strength of composites the decrease in impact strength or smaller variation in strength could also be thanks to induce micro spaces between the fiber and matrix polymer, and as a result causes numerous micro-cracks when impact occurs, which induce crack propagation easily and reduce the impact strength of the composites. Generally, the impact strength of composite materials increases with the increasing fiber content however the lower values of impact strength at higher composition of fiber could also be due to improper adhesion between the matrix and therefore the fibers. Higher content of fibers in composite requires higher matrix material but it's unlikely to be so. Hence it's more likely that matrix isn't ready to transfer load to its fibers.

Samples	Tensile strength (MPa)	Tensile Modulus (MPa)	Flexural strength (MPa)	Flexural Modulus (MPa)
PP	19.3 ± 1.1	955.1 ± 93.3	27.5 ± 0.9	906 ± 35.8
PP/FSB5%	22.9 ± 1.4	1105.5 ± 22.6	34.8 ± 2.9	1047.3 ± 234.5
PP/FSB10%	23.0 ± 0.6	1027.1 ± 82.9	35.5 ± 3.6	960.7 ±139.2
PP/FSB20%	22.3 ± 0.8	1442.5 ± 68.7	37.2 ± 2.1	1200.8 ± 112.9

CONCLUSION

The feasibility of utilizing the agro-residue as alternative reinforcement in thermoplastics was studied. Chemical modification of cellulose fibers from sugarcane bagasse was studied to demonstrate the effect of modification on the mechanical properties of the composites and to study the practicability of processing these agro-residue with thermoplastics. The modification of fibers from sugarcane bagasse was successfully accomplished and it was verified that effectively improves the tensile, flexural and impact strength in comparison to the polymer pure. Short sugarcane fiber reinforced epoxy based polymer composite was fabricated and its mechanical behavior was studied. The conclusions drawn from this experimental investigation are as follows: Epoxy based material reinforced with short sugarcane fibers are successfully fabricated. This causes the disruption in transfer of load to the bonding fibers. Lower values of impact strength and flexural strength at higher composition of sugarcane fibers could also be due to this reason. this study reveals that impact strength, lastingness and flexural strength increases with increasing content of fiber in composite materials.

REFERENCES

1. Sethy S.R, "A study on mechanical behaviour of surface modified natural fiber based polymer composites" Thesis, NIT Rourkela, (2011).
2. Sastra H Y, Siregar J P, Sapuan S M, Leman Z & Hamdan M M, Polym-Plast Technol Eng, 45 (2006) I-8
3. John M. J and Anandjiwala R. D, (2008). Recent Developments in Chemical Modification and Characterization of Natural Fiber-Reinforced Composites, Polymer Composites, 29(2), pp.187-207.
4. Handbook of Engineering Polymeric Materials," edited by N. P. Cheremisinoff(Marcel Dekker, New York, 1997).
5. Gassan J, Blendzki AK. Influence of fiber surface treatment on the creep behavior of jute fiber-reinforced polypropylene. J Thermoplast Compos Mater 1999;12:388–97.
6. Saheb DN, Jog JP. Natural fiber polymer composites: a review. Adv Polym Technol 1999;18(4):351–63.
7. Buehler FU, Seferis JC. Effect of reinforcement and solvent content on moisture absorption in epoxy composite material. Composites: Part A 2000;(31):741–8.
8. Peijs T. Natural fiber based composite. Mater Technol 2000;4(15): 281–5.
9. Tanahashi M, Takada S, Aoki T, Goto T, Higuchi T, Hanai S. Characterization of explosion wood. Wood Res 1982;(69):36–51.
10. Tanahashi M, Higuchi T, Kobayashi H, Togamura Y, Shimada M. Characterization and nutritional improvement of steamexplosion wood as ruminant feed. Cellulose Chem Technol 1985;19:687–96.
11. Mueller D.H and Krobjilowski A, "New Discovery in the Properties of Composites Reinforced with Natural Fibers", Journal of Industrial Textiles, 33(2), 2003, pp.111-129.
12. Lilholt H and Lawther J.M, "Comprehensive Composite Materials", chapter 1.10, 2000, Elsevier Ltd.
13. Mohanty K, Misra M and Drzal L. T, (2005) Natural Fibers, Biopolymers and Biocomposites, Boca Raton, FL, CRC Press, Taylor & Francis Group, 2005, pp. 875.

ISSN- 2394-5125 Vol 8, Issue 1, 2021

14. Z. Zhikai, Z. Sixun, H. Jinyu C. Xingguo, G. Qipeng, and W. Jun, Phase Behavior and Mechanical Properties of Epoxy Resin Containing Phenolphthalein Poly ether ether Ketone, Journal of Polymer, 39 (5), (1997), pp. 1075–1080.
15. H. Shangjin, S. Keyu, B. Jie, Z. Zengkun, L. Liang, D. Zongjie and Z. Baolong, "Studies on the Properties of Epoxy Resins Modified with Chain-Extended Ureas" , Journal of Polymer, 42 (2001), pp. 9641–9647.
16. W. G. Potter, Epoxide Resins, New York: Springer, 1970.
17. C. A. May and G. Y. Tanaka, "Epoxy Resin Chemistry and Technology". New York: Marcel Dekker, 1973.
18. R. S. Bauer (ed.), "Epoxy Resin Chemistry I", ACS Symposium Series, no. 114. Washington, DC: American Chemical Society, 1979.
19. R. S. Bauer (ed.), "Epoxy Resin Chemistry II", ACS Symposium Series, no. 201. Washington, DC: American Chemical Society, 1983.
20. R. S. Drake, D. R. Egan, and W. T. Murphy in "Epoxy Resin Chemistry II", (ed. R. S. Bauer), ACS Symposium Series no. 221. Washington, DC: American Chemical Society, 1982.