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DETERMINATION AND ANALYSIS OF TENSILE STRENGTH FOR EPOXY REFINED COCONUT FIBER COMPOSITE WITH RICE HULLS AND SAWDUST AS REFINEMENTS

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ABSTRACT:

An experimental investigation has been carried out to study the effect of rice hulls at various weight percentages in the composite made with epoxy resin as matrix material and coconut fiber, rice hulls, and sawdust as fabric materials. The tensile test has been conducted on the universal testing machine to determine the tensile strength of the composite. The analysis of the composite material has been carried out using the ACP module in Ansys 2022 R1. Based on the overall study, it is observed that the tensile strength is improved for the composite containing more percentage of rice hulls.

Keywords: Coconut fiber, Epoxy resin, Ricehulls, Sawdust, Ansys 2022 R1, etc.

1.Introduction

Nowadays the solid waste problem is increasing day by day which increases the necessity for biodegradable materials the composite materials play an important role in replacing the materials which cause the solid waste problem. Natural fibers like coconut fiber, sisal fiber, etc are widely used in the fabrication of composite materials. The hand layup method is used to prepare the composite of epoxy refined coconut fiber composite with rice hulls and sawdust as refinements. Mechanical testing is conducted on the materials to determine the various properties of the material like tensile strength etc. After mechanical testing, the materials can be analyzed by using software like Ansys, etc. In ansys software, a separate module is present for the analysis of composite materials which is the ACP module in this module we can get the features of using different materials which are specified in the engineering data by entering the properties of the materials like youngs modulus, Poisson's ratio, etc. This ansys software is used to estimate the values of other materials by simply changing the materials in the engineering data this reduces the fabrication cost for the analyses of other composite materials.

2. Materials AndMethodology

The materials used for the fabrication of composite materials are classified as fabric material and matrix material. In this composite material coconut fiber, rice hulls, and sawdust are used as a fabric materials. Araldite epoxy resin is used as matrix material. The resin and hardener are used in a 10:1 ratio respectively. The hand layup method is used for the fabrication because it is easily available and low cost when compared to other fabrication methods. For the hand layup method, the mold is prepared with sheet metal in this mold some amount of resin and hardener mixture is applied as a layer on this layer a layer of coconut fiber is placed and after this again some amount of resin and hardener mixture is applied then rice hulls are poured as a layer then some amount of resin and hardener mixture is applied on it and after this sawdust is poured as a layer on it, at last, the remaining amount of resin and hardener mixture is applied on it by this the fabrication of composite material is completed. This process is repeated for the fabrication of other two specimens in which the amount of rice hulls is varied. The prepared test specimens with a volume proportion of 20-30% of fiber and 70-80% of resin, have a maximum thickness of 10mm. For each ratio three specimens are prepared by this the tensile test is carried out on these nine specimens.

Fig 2.1 specimen as per ASTM D638

Fig 2.2 specimen after testing

3. Data Analysis And Interpretation

3.1 Mechanical testing

S.NO	SPECIMEN	ULTIMATE LOAD (N)	ULTIMATE TENSILE STRENGTH (N/MM^2)
1	SPECIMEN 1	425.3	3.15
2	SPECIMEN 2	883.6	10.32
3	SPECIMEN 3	1347.6	15.06

Table 3.1 Ultimate Tensile Strength

3.2 Simulation Results:

The specimen are recreated in Ansys 2022 R1 as per ASTM D638 standards and the mechanical properties of each constituent is added. After generating adequate meshing and imparting necessary boundary conditions, The solution is obtained and later tensile strength is yielded from the results for each specimen which are shown in below figures.

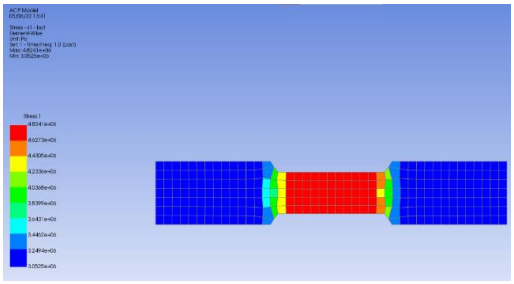


Fig 3.1 Tensile Strength of specimen 1

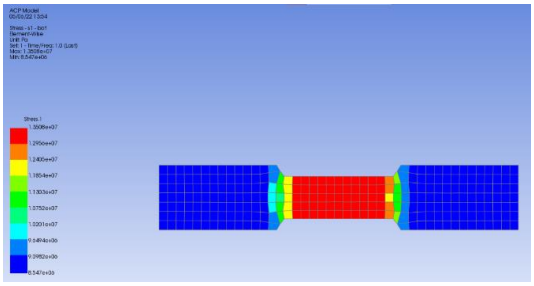


Fig 3.2 Tensile Strength of specimen 2

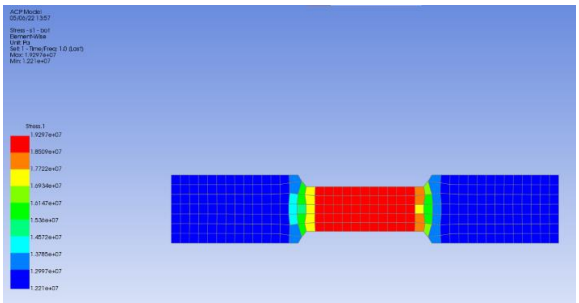
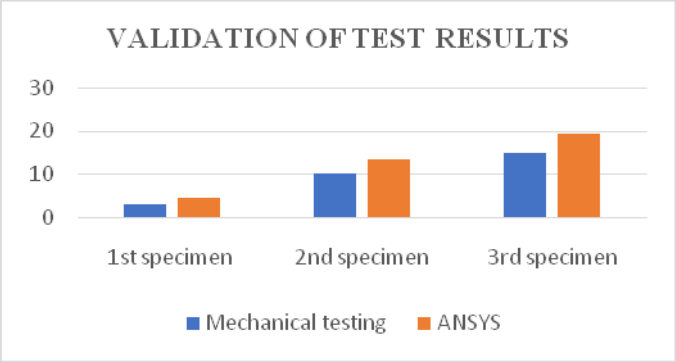


Fig 3.3 Tensile Strength of specimen 3

Finally, these values are tabulated as shown in below table and compared with results obtained from mechanical testing.

S.NO	SPECIMEN	MAXIMUM STRESS (N/MM^2)
1	SPECIMEN 1	4.82
2	SPECIMEN 2	13.50
3	SPECIMEN 3	19.29

Tabel 3.2 Tensile strengths as per Simulation



Graph 3.1 Mechanical Testing vs Simulation Results comparision

4. Conclusion

In this paper, the properties of the composite material are determined using a tensile test on a universal testing machine and the analysis is done in the ACP module of Ansys 2022 R1 by including the properties of materials in engineering data. Based on the overall studywe can conclude that the tensile strength is more for the composite containing more percentage of rice hulls. The properties of other materials can also be estimated in the ACP module by varying the materials and their mechanical properties in engineering data.

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