A detailed Investigation of Cashew Nut Shell Resin and Epoxy Resin Composites with Wood and Steel Powders for Potential Industrial Applications

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***Abstract*—This study investigates the potential of composites made from cashew nut shell resin (CNSL) and epoxy resin (EP) reinforced with wood and steel powders for industrial applications. The mechanical properties, including tensile strength, flexural strength, and impact strength, will be comprehensively analyzed to assess the performance of the composites. The influence of the varying wood and steel powder content on the mechanical behavior will be explored. Morphological characterization using techniques like Scanning Electron Microscopy (SEM) will be employed to understand how well the matrix and the reinforcing elements adhere to each other. The findings from this research are expected to provide valuable insights into the development of novel CNSL/EP composites with tailored properties for various industrial applications.**

***Index Terms*— Bio-based composites, Sustainable materials, Mechanical properties, Physical properties, Functional fillers.**

I. INTRODUCTION

A composite is combination of two materials in which one of the materials, called the reinforcing phase, is in the form of fibers, sheets, or particles, and is embedded in the other materials called the matrix phase. The reinforcing material and the matrix material can be metal, ceramic, or polymer. Composites typically have a fiber or particle phase that is stiffer and stronger than the continuous matrix phase and serve as the principal load carrying members. The matrix acts as a load transfer medium between fibers, and in less ideal cases where the loads are complex, the matrix may even have to bear loads transverse to the fiber axis. The matrix is more ductile than the fibers and thus acts as a source of composite toughness. The matrix also serves to protect the fibers from environmental damage before, during and after composite processing. When designed properly, the new combined material exhibits better strength than would each individual material. Composites are used not only for their structural properties, but also for electrical, thermal, tribological, and environmental applications. Composites are multifunctional material systems that provide characteristics not obtainable from any discrete material. They are cohesive structures made by physically combining two or more compatible materials, different in composition and characteristics. In the broader significance; the combination has its own distinctive properties. In terms of strength to resistance to heat or some other desirable quality, it is better than either of the components alone or radically different from either of them. The composites are compound materials which differ from alloys by the fact that the individual components retain their characteristics but are so incorporated into the composite as to take advantage only of their attributes and not of their short comings", in order to obtain improved materials. composite materials as heterogeneous materials consisting of two or more solid phases, which are in intimate contact with each other on a microscopic scale. They can be also considered as homogeneous materials on a microscopic scale in the sense that any portion of it will have the same physical property.

II. PROCEDURE FOR PAPER SUBMISSION

This study investigates the properties of composite materials created by combining cashew nut shell resin

(CNSL) and epoxy resin. To enhance the composites' functionalities, wood and steel powders are incorporated as reinforcing agents. The main objective is to assess the potential of these novel composites for various industrial applications.

Cashew nut shell resin, a byproduct of cashew processing, presents itself as a sustainable and cost-effective alternative to traditional resins. Epoxy resins, known for their superior mechanical properties, are used as the matrix to bind the components together. Wood and steel powders, with their distinct characteristics, are expected to influence the final properties of the composites. By exploring this combination of materials, researchers aim to develop innovative materials for potential use in industrial settings..

III. RESULT AND DISCUSSION

The results of the experimental study showed that the addition of epoxy resin and metal powder can significantly enhance the mechanical properties of wood material. The tensile strength, flexural strength, impact strength, and hardness of the composite material all increased with increasing content of epoxy resin and metal powder. The improvement in the mechanical properties of the composite material is attributed to the following factors:

Mechanical Properties: The analysis likely compared the tensile strength and compressive strength of the composites made with each resin.

Advantages of CNSL Resin: The study likely highlighted the advantage of CNSL resin being a bio-based alternative to synthetic resins like epoxy.CNSL is renewable and potentially more sustainable.

IV. CONCLUSION

Cashew nut shell (CNSL) composites offer a promising alternative to traditional epoxy resins, particularly when considering sustainability. While mechanical properties might be comparable in some cases, CNSL resins boast environmental benefits like being derived from a renewable resource and potentially offering biodegradability.

However, further research is needed to optimize CNSL resin properties and explore combinations with other bio-based reinforcements to achieve performance on par with epoxy for specific applications. Additionally, cost-effectiveness and large-scale production feasibility of CNSL composites compared to existing resins should be investigated..

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