AN ANALYSIS OF CASHEWNUT SHELL COMPOSITE COMPARED TO EPOXY AND CNSL RESINS

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Abstract – In this investigates the potential of cashew nut shell composite (CNSL) as a reinforcement material in comparison to traditional epoxy resin. The mechanical properties, including tensile strength, flexural strength, and impact strength, are evaluated for CNSL composites and contrasted with epoxy and CNSL resin composites. The analysis aims to identify CNSL's viability as a cost-effective and ecologically friendly alternative in composite applications.

Index Terms - Analysis, material properties, testing, comparison, synthetic resin, natural resin.

I. INTRODUCTION

Cashew nut shells, a byproduct of the cashew nut industry, pose a significant environmental challenge. Finding sustainable ways to utilize this waste is crucial. Cashew nut shell composite (CNSC) is a promising material created from cashew nut shells and a binding resin. This study examines the properties of CNSC and compares them to those of epoxy and CNSL (cashew nut shell liquid) resins. The goal is to assess the potential of CNSC as a viable alternative to traditional resins in various applications. Cashew nuts, a popular and versatile food source, generate a significant amount of waste in the form of their shells. Discarded shells often pose environmental concerns due to improper disposal methods. However, recent research has explored the potential of utilizing these waste materials in the development of novel composite materials. Cashewnut shell composite (CSC) has emerged as a promising option, offering a sustainable and potentially cost-effective alternative to traditional materials like epoxy and CNSL (Cashew Nut Shell Liquid) resins. This study aims to conduct a comparative analysis of CSC, epoxy resin, and CNSL resin. We will evaluate their mechanical properties, including tensile strength, flexural modulus, and wear resistance. By understanding the performance characteristics of these materials, we can determine their suitability for various applications and promote the development of sustainable composite materials.

II. LITERATURE SURVEY

Cashew Nut Shell Composites: Reinforcement Material: CNS composites often use natural fibers like kenaf or cellulose nanofiber alongside the resin [1, 3]. **Properties:** Studies suggest CNS composites can achieve tensile strength and Young's modulus comparable to traditional resins [1, 3]. In some cases, CNSL content can improve properties like elongation at break [2]. **Comparison with Epoxy Resins:** Mechanical Strength: CNS composites might exhibit tensile strength comparable to epoxy resins depending on composition [1]. **Environmental Impact:** CNS composites are derived from renewable resources, making them a more sustainable alternative to epoxy (typically derived from petroleum) [1]. **Comparison with CNSL Resin:** Composite vs. Resin: CNS composites are a combination of CNS resin and reinforcing fibers, offering potentially improved mechanical properties compared to pure CNSL resin [1, 4]. **Reinforcement Effect:** Studies haven't extensively compared pure CNSL resin with CNS composites, but the addition of fibers can significantly enhance the mechanical properties of the final material [2, 3]. **Additional Points:** CNSL can be used as a modifier or additive for epoxy resins, potentially improving certain properties like flexibility [2]. Processing techniques and fiber/resin ratios can significantly impact the final properties of CNS composites [2, 4].

Here are some resources to explore further: Comparison of Cashew Nut Shell Liquid (CNS) Resin with Polyester Resin in Composite Development [1]: This study compares CNSL resin with a traditional resin (polyester) for composite development.

Analysis of Cashew Nut Shell Resin With Kenaf Natural Fiber Composite Treated and Untreated [2, 4]: These studies explore the use of CNSL resin with Kenaf fibers as reinforcement in composites. Cashew Nut Shell Liquid (CNSL)-Derived Epoxy Composite Reinforced by Cellulose Nanofiber [3]: This research investigates the use of CNSL as a modifier for epoxy resin and the impact of cellulose nanofiber reinforcement on the composite. **Comparison Points:** Mechanical Properties: Studies are needed to directly compare the mechanical properties (tensile strength, flexural strength, impact strength) of CNS composites to both pure epoxy and CNSL resins. Processing: The processing techniques and requirements for fabricating CNS composites compared to epoxy and CNSL resin composites should be explored. **Cost Analysis:** A cost analysis comparing CNS composites, epoxy, and CNSL resin composites would be valuable, considering the potential economic benefits of CNS as a natural resource.

III. PROBLEM IDENTIFICATION

- Traditional composite materials often rely on synthetic resins like epoxy. While these materials offer good mechanical properties, their dependence on non-renewable resources and potential environmental impact during production and disposal raise concerns about their sustainability. Additionally, the reliance on a single source material can lead to price fluctuations and potential supply chain disruptions.
- Furthermore, CNSL resin, though derived from a renewable source, may require extensive processing and modifications to achieve desired properties, potentially negating the environmental benefits of its origin.

IV. AIM AND OBJECTIVE

AIM: This study aims to conduct a comparative analysis of cashewnut shell composite (CSC) with established resins, epoxy and CNSL (Cashew Nut Shell Liquid), to assess its potential as a sustainable and viable alternative for various applications. The specific aims of the study are to:

- Evaluate the mechanical properties of CSC with epoxy resin, and CNSL resin, including tensile strength, flexural modulus, and wear resistance.
- Compare the performance of these materials to identify the strengths and weaknesses of CSC relative to traditional resins.

OBJECTIVE: The following are the some objectives of our Project

- Evaluate the mechanical properties of cashewnut shell composite (CSC), focusing on key parameters such as tensile strength, flexural modulus, and wear resistance.
- Compare the performance of CSC with established resins, namely epoxy and CNSL (Cashew Nut Shell Liquid), in terms of the aforementioned mechanical properties.
- Identify the potential advantages and drawbacks of CSC compared to traditional resins, considering both performance and environmental impact.

V. METHODOLOGY OF THE WORK

VI. EXPERIMENTAL WORK

Selection of Raw Materials:

- Here we are selected teak wood powder, Cashewnut Shell powder, Epoxy Resin & Hardner, CNSL Resin, H2SO4, Formaldehyde(CH2O), Toluene(C6H5CH3)

Design and Prepare mould box:

- Here we are using Acrylic Sheet to make the mould box
- AutoCAD Software is used to draw required dimension/Design (250mm x 250mm) & export it as dxf file format.
- CO2 Laser Cutting Machine is used to cut the design and suitable adhesive used to stick the mould box.

Preparation of Composite

- Teak wood as powdered to 0.2mm also Cashew nut shell as powdered to 2-3mm by the help of pulverizer.
- For Synthetic Composite we tried 1:1, 2:1, 3:2 ratio of Epoxy (R:H 10:1) and Teak wood powder.
- For Natural Composite we planned 1:1, 2:1, 3:2 ratio of CNSL and Cashewnut Shell Powder (Including Catalsyt)
- Using Resin Transfer Moulding the required shape as been obtained.

Remove / Cut the Composite for testing

- Drawn the dimension on the composite material (plate) as per ASTM Standard.
- We cut the material using Hacksaw machine as per the dimensions.

Testing & Compare the properties

- Here we performed the following test over the composite material.
- Tensile & Compression Test
- Impact & Water Absorption Test

VII. CONCLUSIONS

In this study, we aimed to analyze the properties of cashew nut shell composite and compare them to those of epoxy and CNSL resin. Our findings revealed that cashew nut shell composite exhibited the properties are similar to to while changing the ratio of the mixing composite. These results are consistent with previous research by google scholar, which also found that the properties of the CNSL resin as quite differs from the previous investigation.

VIII. REFERENCES

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