International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Study of Properties of Apricot and Rice Husk Fibre Reinforced Composites

Abha Sharma[1], *Vivek Gedam*[2], *T.K.Mishra*[3], *M.Krishna*[4]

[1]M.Tech Scholar and [2, 3,4]Assistant Professor, Mechanical Engineering Department, Gyan Ganga Institute of Technology & Sciences, JBP

ABSTRACT

Awareness about environmental degradation and a need for a consistent sustainable development for the betterment of the environment has a direct influence over replacement of synthetic fibers by natural fibers. Extensive research work has been carried out on plant fiber based bio-composites. Hence our research work is based on fabrication and investigation of mechanical properties of bamboo and jute composite fiber. In the present study, epoxy is as the matrix material. Generally, epoxy has advantages like good adhesion to other materials, good mechanical properties, good electrical insulating properties, good environmental and chemical resistances etc .with help of this matrix material and fiber various composites slabs are formed with varying percentage of fibers and their combination. Simple hand layup technique is being used without changing the orientations; with this we have created 25 samples for various tests as tensile, impact, hardness. Mechanical tests conducted showed that pure apricot based bio-composite was better in tensile strength, pure rice husk based composite was better in impact strength also combined fiber of apricot and rice husk showed better hardness. Yet hardness was almost same among all the composites samples as it is a property exhibited by the matrix material constituted by epoxy resin. Analysis of hybrid composite and single composites showed that properties variation is too much. Hence it is suggested that combination of apricot and rice husk may be included in the composites for specific purpose only.

Keywords: Apricot, Rice husk, Epoxy, Tensile properties, Flexural properties, Impact properties

Introduction

Materials made from two or more constituent materials with significantly different physical or chemical properties which remain separate and distinct at the macroscopic or microscopic scale within the finished structure [1].The term ‘composite’ in material science refers to a material made up of a matrix containing reinforcing agents. Reinforcement is the part of the composite that provides strength, stiffness, and the ability to carry a load. Wood is a natural composite of cellulose fibers in a matrix of lignin. In manufacturing, fibers are the most commonly used reinforcement that yields Fiber Reinforced Composite (FRC). The reinforcement is embedded into the matrix [23, 34]. Common matrixes include mud (wattle and daub), cement (concrete), polymers (fiber reinforced plastics), metals and ceramics. The most common polymer-based composite materials include fiberglass, carbon fiber and kevlar.The beginning of composite materials may have been the bricks fashioned by the ancient Egyptians from mud and straw. The ancient brick-making process can still be seen on Egyptian tomb paintings in the Metropolitan Museum of Art. Commercialization of the composites could be traced to early century when the cellulose fibers were used to reinforce phenolics, urea and melamine resins [36,38].

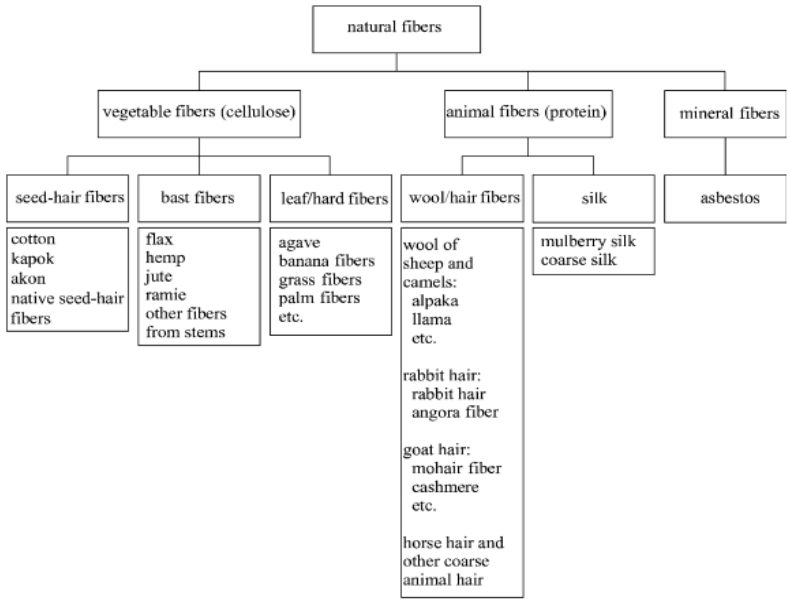


Figure 1.1: Showing classification of natural fibers

2. Literature Review

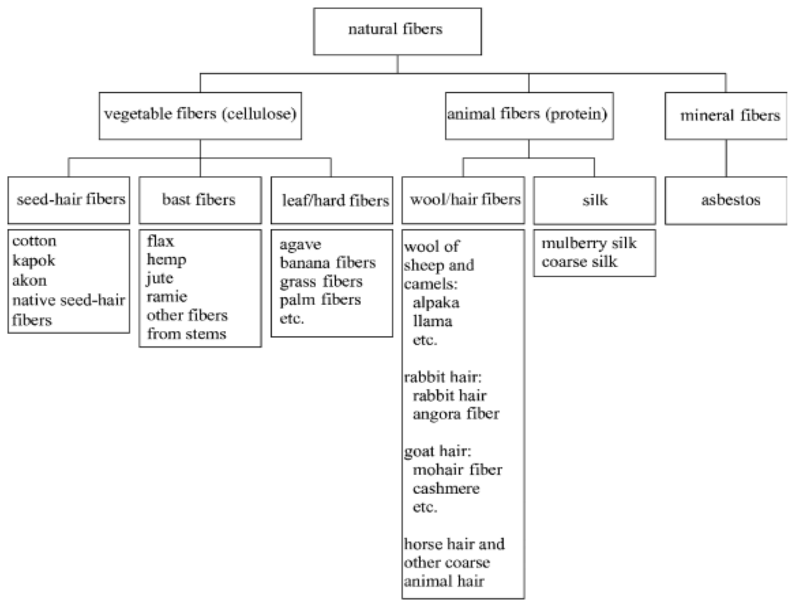
a) Aaqib Nisar et al. [1] Purpose the demand for functional foods has been increasing tremendously throughout the globe and keeping in view the health beneficial properties of apricot fruit. The purpose of this study is to develop wheat flour based cookies enriched with apricot pulp powder in order to improve nutraceutical properties of cookies and dilution of gluten at the same time. Design/methodology/approach Cookies were prepared from wheat flour blended with apricot pulp powder at 0, 10, 15, 20 and 25% level and evaluated for proximate, functional, rheological, nutraceutical and sensory properties. Findings Fibre content of apricot powder-incorporated cookies (3.23%) was significantly ($p < 0.05$) higher at 25% level than control (1.64%). The water absorption and oil absorption capacities decreased significantly ($p < 0.05$) upon increasing level of apricot pulp powder. The ß-carotene content, antioxidant activity and total phenolic content increased significantly ($p < 0.05$) upon incorporation of apricot pulp powder. The thickness of cookies increased, however, diameter and spread ratio decreased with increase in the levels of apricot pulp powder. Lightness (L*) value decreased, while redness (a*) and yellowness (b*) increased when incorporated with apricot pulp powder. Cookies having 25% apricot pulp powder showed maximum hardness and overall acceptability. Originality/value to the best of our knowledge, the scientific literature on incorporation of apricot pulp powder in bakery products is scanty. As such the present research has a tremendous scope for the food industries to produce functional bakery products with antioxidant properties and diluted the gluten content at the same time.

b) Monika Sood et.al [2] Apricot is considered as a rich source of dietary fibre and it possesses both antioxidant and anticarcinogenic properties. The effect of baking on the physical and chemical characteristics of nut crackers incorporated with apricot powder was analyzed. The apricot powder was used for nut cracker preparation. It was incorporated into the traditional recipe to replace wheat flour at levels of 3, 6, 9, 12, 15, 18, 21 and 24% in preparation of nut crackers. It was observed that the ascorbic acid, antioxidant activity and total phenolic content increased with increase in apricot powder. The spread ratio decreased from 6.44 to 5.07 mm. The apricot containing nut crackers were characterized by a darker colour with a higher contribution of redness and yellowness, and by higher hardness. The overall organoleptic assessment showed that up to 18% of apricot powder did not influence the consumer acceptance.

c) Nele Defoirdt.et.al. [3] Proposed a single fiber tensile testing correction approach that has a considerable impact on the results for bamboo and jute fibers, but the need for and impact on coir fiber results is minimal. They employed the Weibull distribution to analyse the strength of natural fibers, which is questionable because the Weibull parameters fluctuate with the test duration and the mean and standard deviation calculated using this distribution are virtually comparable to those computed using the normal distribution.

d) Neeraj Bisht et.al. [4] In the last decade due to ever growing environmental concerns, use of natural fibres as fibre materials has gained momentum and acceptance. Natural fibres provide advantage of being economical and environment friendly at the same time. Rice husk, an agricultural waste is being utilized as a natural fibre for development of bio-composites. Present paper attempts to understand the applicability of rice husk as a fibre with various polymers based on the recent research works. It also throws light on various modification techniques that can further enhance the associated mechanical properties by altering the chemical and physical properties of husk. The paper may assist in understanding the phenomenon associated in manufacture of rice husk based bio-composite and provide a critical insight to the future applications of rice husk.

e) Subhankar Biswas et.al. [5] Jute and bamboo fiber reinforced epoxy resin unidirectional void free composites were studied for their physical, mechanical, and thermal properties. The vacuum technique was used to create the composites. Scanning electron microscopic examination, tensile and flexural testing, and thermo-gravimetric analysis were used to analyse the surface morphology, mechanical characteristics, and thermal behaviour of the unidirectional composites, respectively. They also discovered that jute fiber reinforced epoxy composites had better thermal behaviour than bamboo fiber reinforced epoxy composites using thermo-gravimetric analysis.



3. Materials and Methods

This chapter describes the details of processing of the composites and the experimental, procedures carried out for their characterization and tests which the composite specimens are subjected to. The raw materials used in this work are:

3.1 Materials:

The materials that are used in the present concern of study are:

1. Epoxy Resin
2. Hardener
3. Apricot shell powder
4. Rice husk powder

Araldite(Epoxy Resin and Hardener) Weighing Machine Apricot shell powder Rice husk powder

3.2 Fabrication of composites:

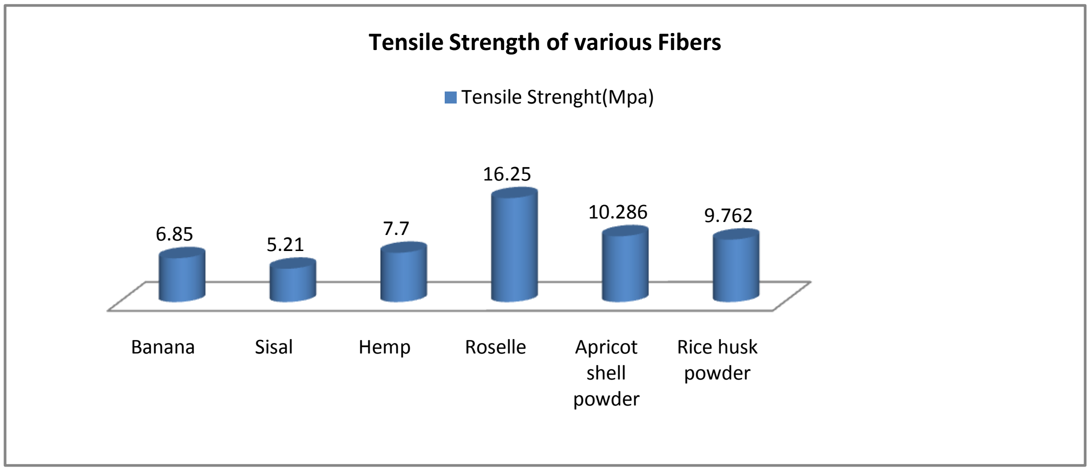
3.2.1 The fabrications of composite slabs

1) The apricot shell bought from the local market, and sundried for 24 hrs
2) Dried apricot shell is grinded into powder with help of mixture grinder
3) The rice husk powder was bought from the local market, was grinded in small particle with the help of mixer grinder and 40% of the total volume of the mould was taken.
4) The epoxy resin and the corresponding hardener are supplied by Ciba Geigy India Limited.
5) For the purpose of testing, in total **15 specimens** were prepared (5 specimens for Tensile, 5 specimens for Bending and 5 specimens for Impact, Compressive and Hardness that are cut from the single bigger specimen).
6) The fabrications of composite slabs are carried out by conventional hand layup technique, three various types are being prepared type 1 consists of apricot shell grinded powder and epoxy is taken as binder material with specific proportion of hardener. Type II consists of consists of rice husk powder used as reinforcement and epoxy is taken as binder material with specific proportion of hardener. Type III consists of consists of apricot shell grinded powder and rice husk powder and epoxy is taken as binder material with specific proportion of hardener.

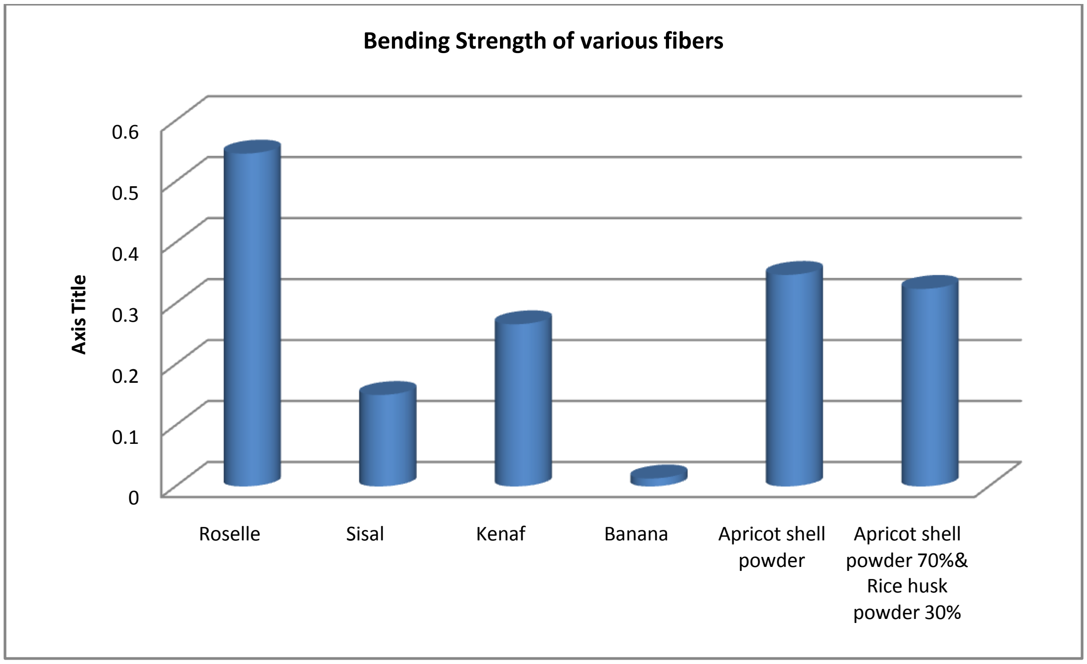
Table 3.1- Weights of fiber for different mould

Mould	**Dimension**	**Weight of fiber**
Mould 1	30 cm x 6 cm x 1.5 cm	50gm
Mould 2	11 cm x 11 cm x 1.5 cm	40gm
Mould 3	20 cm x 5 cm x 1.5 cm	30gm

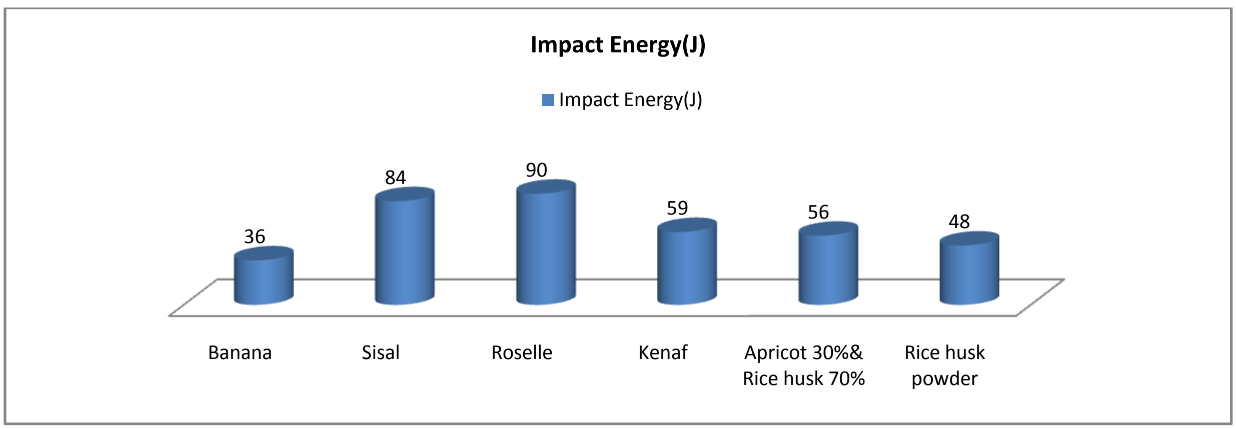
Results obtained



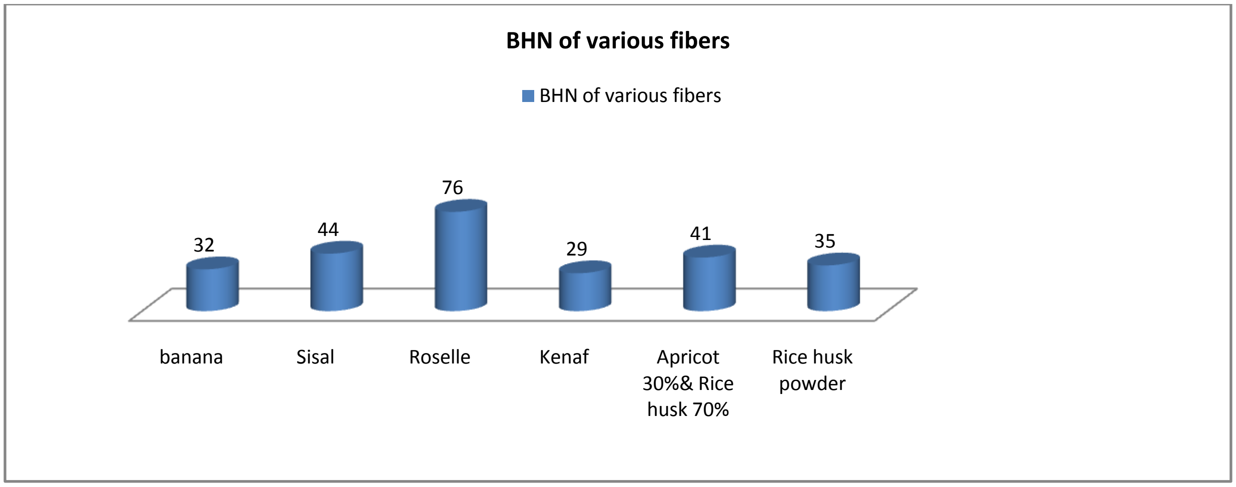
NOTE: Tensile strength in above case varies with varying composition and it is found that the strength goes on increasing with increasing percentage of apricot shell powder in the composite for each length of fiber. The tensile properties measured in the present work are well compared with various earlier investigators, though the method of extraction of rice husk powder and apricot shell powder is different. The tensile modulus indicates the relative stiffness of a material and can thus be obtained from stress strain diagram. Optimum value of tensile strength for the composite is found to be for apricot shell powder (Specimen 1). Therefore now we compare the specimen 1 and specimen 2 with some other natural fibers.



NOTE Optimum value of Flexural strength for the composite is found to be for **pure apricot shell powder (Specimen 6) is 0.347 N/mm^2.** Comparing the two highest value calculated with other natural fiber



Note: The decrease in impact strength or smaller variation in strength may be due 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 decrease 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 may be because of improper adhesion between the matrix and the fibers. Higher content of fibers in composite requires higher matrix material but it is not likely to be so. Hence it is more likely that matrix is not able to transfer load to its fibers Optimum value of BHN for the composite is found to be for **Pure apricot shell powder (Specimen 7) is 56J**. Comparing the two highest BHN calculated with other natural fiber



NOTE: Optimum value of BHN for the composite is found to be for **30% apricot shell powder and 70% rice husk powder (Specimen 10) is 41 BHN**. Comparing the two highest BHN calculated with other natural fiber

3.3 Scope for future work

This area of research can be extended to other varying percentage of rice husk powder and apricot shell powder fibers in order to achieve the desired mechanical properties in composite materials. Presently, epoxy, reinforced with rice husk powder and apricot shell powder is relevant topic of research and can be used to fabricate an eco-friendly products like door panels etc, which can be a substitute for synthetic materials.
Further research in the field of rice husk powder and apricot shell powder can be extended to the fabrication of eco-friendly materials disposable plates and cups by not using epoxy instead using fly ash and charcoal as binder.

References

[1] Aaqib Nisar et al. 'Effect Of The Incorporation Of Apricot Pulp Powder On physicochemical, functional, rheological and nutraceutical properties of wheat flour based cookies'; April 2021,British Food Journal ahead-of-print(ahead-of-print); DOI:10.1108/BFJ-11-2020-1000.
[2] Monika Sood et al. Effect of apricot powder incorporation on physical, textural and organoleptic characteristics of nut crackers; https://www.academia.edu/64228076/2018

[3] Nele Defoirdt (Ugent) , Subhankar Biswas, Linde De Vriese, Le Quan Ngoc Tran, Joris Van Acker (Ugent) , Qumrul Ahsan, Larissa Gorbatikh, Aart Van Vuure And Ignaas Verpoest (2010) Composites Part A-Applied Science And Manufacturing. 41(5). P.588-595
[4] Subhankar Biswas et.al. 'Rice Husk As A Fibre In Composites: A Review', December 2020, Journal of the Mechanical Behavior of Materials 29(1):147-162, DOI:10.1515/jmbm-2020-0015

[5] Vivek Gedam et.al, 'Mechanical Behavior and Model Fitness of the Natural Fiber Composite: A Study on Orange Peel and Charcoal Composite', Publication date: 2018, Journal:International Journal of Composite Materials and Matrices,Volume:4,Issue 2,Pages 33-42
[6] Vivek Gedam et.al, 'Flexural And Hardness Behavior Of Brown Grass Flower Broom Reinforced Composites', Publication date: 2017/3, Journal: International Journal Of Innovation In Engineering Research & Management ISSN NO : 2348-4918, Volume:4,Issue 2