ABSTRACT

Due to its low weight, high specific strength, high specific stiffness, and non-corrosive properties, Fiber Reinforced Plastic (FRP) composite materials are employed in a variety of applications. Several conventional materials, including steel and aluminium, have indeed been substituted by these FRP composites.Commercial aviation, automotive, sports goods, and aerospace industries all use FRP composites in the creation of their products. However, the production of these synthetic fibres took more energy, entailed the use of chemicals, weren't recyclable, and seriously harmed the environment. Researchers and scientists are working to find novel fibres that can replace synthetic fibres as a result of environmental degradation and the energy crisis.Since natural fibres are simple to work with and recyclable, they can be utilised as reinforcement in polymer composites in place of glass fibre.In addition, minerals, animals, plants, and their derivatives can all be used to harvest natural fibres. Alternative sources of fibre are preferable over natural fibres made from plants.This is due to the fact that a variety of plant parts, including as the root, leaf, stem, and fruit, could be used as fibre in a polymer matrix.

Incorporating a characteristic natural fibre as reinforcement in a polymer matrix is the goal of this study.One of the species from which lingo-cellulosic material may be readily isolated is Acalipha Indica.There are numerous Acalipha Indica plants in India and around the world.In this work, the raw Acalipha Indica root fibre is treated with fresh water to remove impurities from the fibre surface before being extracted utilising a water degradation procedure. Acalipha Indica root fibre is examined by chemical

composition analysis, thermogravimetric analysis (TGA), X-ray diffraction, surface morphology (SEM), and Fourier Transform Infrared Spectroscopy (FTIR) (XRD).

The chemical composition analysis and FTIR analysis of the Acalipha Indica root fibre supported the presence of cellulose, lignin, and wax content in the fibre based on the characterization studies.The crystallinity index (CI), which was found to be 46.62 percent, was obtained by X-RD analysis. A tensile strength of 12.50 MP and 1.356 g/cm^{3}was noted as the density. The fiber's thermal stability is listed at 298.6 ºC, whereas, the average diameter of the raw AH leaf fibre is obtained100µm.

Using epoxy glue and randomly oriented fibres of 3 mm length in varied weight ratios of 10%, 20%, 30%, and 40%, composites were constructed by hand layup followed by compression. To create matrix, epoxy and hardener are combined in a weight ratio of 3:1. The testing specimens are created in accordance with American Society for Testing and Materials (ASTM) standards for Acalipha Indica root fibre reinforced epoxy composite plates. Tests on the specimens include flexural, tensile, and impact ones.

These specimens were put through tensile, flexural, and impact testing. In tests of mechanical qualities, fibres placed in the matrix at a 30 percent weight percentage outperformed other weight percentages. Scanning Electron Microscopy (SEM) images demonstrated good fibre matrix adhesion properties for fibres up to 30%, but it was shown that these attributes diminished after this point.

Acalipha Indica root fiber-epoxy composite specimens of the various types were manufactured in line with ASTM standards in order to evaluate the wear behaviour of the materials. Using a pin-on-disc machine, specimens were made to slide against a stainless steel disc while being subjected to a range of weights, sliding velocities, and sliding distance conditions.

The findings showed that the composite containing 30% Acalipha Indica root fibre had stronger resilience to wear than other fibre composites. Wear resistance, wear rate, and coefficient of friction were calculated for samples. The wear behaviour and bonding strength were evaluated using a scanning electron microscope. The results revealed that samples with a 30% fibre content exhibited increased wear behaviour and better fibre matrix adhesion.

The outcomes of extensive tests employing root fibre from the Acalipha indica plant and epoxy resin reinforcing are summarised here. According to the experiments stated above, epoxy matrix-reinforced fibres with a weight percentage of 30% were recommended for reinforcing in epoxy resin. According to the findings of the SEM analysis, the composite loses bonding and interfacial strength beyond 30 percent fibre content.