PhD Research Seminar Talk- I

Presenter: Mr. Suganth V (ME21D0010)

Supervisor: Dr.N.Rino Nelson

Title: A characterization study on the influence of sustainable fiber treatment and bio-resin on the water absorption behaviour of bio-composites.

Abstract:

Glass fibre-reinforced composites are widely used in automotive components because of their high strength-to-weight ratio and excellent structural performance. In this work, the influence of different thermosetting matrices, namely epoxy, polyester, cashew nut shell liquid (CNSL), and bio-epoxy, on the water absorption and mechanical behaviour of glass fiber composites. Water absorption followed Fickian diffusion, while tensile performance decreased after prolonged moisture exposure due to interfacial debonding and fiber–matrix degradation. Among the investigated matrices, bio-epoxy exhibited the lowest water uptake (1.37%), the highest contact angle (113.2°), superior thermal stability, and stronger interfacial adhesion, demonstrating excellent hydrophobicity and moisture resistance. Owing to its sustainable nature and enhanced overall performance, the glass fiber-reinforced bio-epoxy composite was identified as the most suitable material and selected as the matrix system for subsequent natural fiber composite fabrication.

Natural fibre composites offer significant potential for lightweight and sustainable engineering applications; however, their high moisture sensitivity limits long-term performance. Water absorption causes fibre swelling, weakens fiber–matrix interfacial bonding, and degrades the mechanical properties of the composites. To address this limitation, banana fibers were chemically treated using bio-acetic acid and NaOH . The effect of treatment concentration was optimized and compared with conventional NaOH treatment. Comprehensive mechanical, flexural, thermal, and wettability characterizations demonstrated that bio-acetic acid treatment effectively reduced hydrophilicity, improved interfacial adhesion, and enhanced overall composite performance, making it a sustainable alternative to alkali treatment.