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Effects of rice straw-based polyol on the thermo physical properties of rigid polyurethane foam

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Statement of the Problem: Vegetable oils and lignocellulosic biomass are two major types of bio-based resources gaining interest for bio-based polyols for Poly Urethane (PU) production. However, the consumption of huge amounts of vegetable oils could result in a shortage of vegetable oils and will cause the increase in food prices. Therefore, lignocellulosic biomass is seen as a better alternative raw material for PU production. Various kinds of lignocellulosic biomass have been used for the production of bio-based PU foams but the use of lignocellulosic rice straw is not yet explored. Thus, the study aims to develop PU rigid foam from rice straw-based polyol and investigate the effect of isocyanate index on the thermo physical properties of the foam.

Methodology & Theoretical Orientation: PU foams were prepared by reacting isocyanates in varying indices with polyols containing 15% of rice straw-based polyol and 85% petroleum-based polyol and their thermal conductivity, density and compressive strength were determined.

Findings: PU foams with no biopolyol replacement have superior thermal and mechanical properties over the PU foams with biopolyol replacement. However, those with biopolyol replacement were significant less dense compared to the commercial formulation. This could indicate possible application in industries where lightweight materials are important. Thermal characterization of the foam samples at different isocyanate indices indicate that increasing the isocyanate content improves insulation property of the PU as evident with the decreasing conductivity. This is also true with compressive strength. The index is directly proportional to the compressive strength. Density, on the other hand, is directly proportional to the isocyanate content.

Conclusion & Significance: Successful development of PU rigid foam products using biomass-based polyols obtained from a renewable feed stock rice straw offers a practical and economic procedure for potential scale-up and commercialization.

Biography

Kriztine Magadan-Icalina is a licensed Chemical Engineer and is currently pursuing her Master of Science in Material Science and Engineering in Mindanao State University, Iligan Institute of Technology.

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