SYNTHESIS AND CHARACTERIZATION OF PHENOL BASED RESIN EXTRACTED FROM CASHEW NUT SHELL LIQUID (CNSL) OIL FOR INDUSTRIAL APPLICATIONS

40S_B_MTECH_008

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ABSTRACT

Most plastics and polymer are produced from the petroleum industry; the volatility of oil markets and diminishing petroleum reserves has motivated a desire to reduce dependence on petroleum products. The growing interest in replacing petroleum-based products by inexpensive, renewable, natural materials is important for sustainable development. Bio-based oils represent the most promising renewable source for the development of polymeric materials and composites from plant oils, Nano-composites and fiber-reinforced composites producing new class of bio-plastics composites with tailored multifunctional properties due to their unique chemical structure. Depending on their application various bio-based materials used are soybean and corn protein-based biopolymers, bio-coatings, cashew nut shell liquid (CNSL) as polyurethane resins, polyester amides, thermosetting polyolefins, and cyanate ester resins.

CNSL which is the liquid extracted from the cashew nut shell. CNSL finds use in flame-retardant applications due to its chemical structure, which includes an aromatic ring. Other applications include synthetic polymers, resole and novolac resins, thermosets, and CNSL-formaldehyde resins. The main objective of this project was to synthesise and characterise CNSL from which cardanol is extracted which is phenolic polymeric resin; and to investigate the performance of the polymer composite made from jute reinforced cardanol matrix. The comparative study was focused on the mechanical properties of the composites made from epoxy/jute, polyester jute, phenol formaldehyde/jute and cardanol/jute.

The synthesis of CNSL to Cardanol involves a decarboxylation of 200gm of CNSL followed by a two stage vacuum distillation process, in a laboratory scale to yield 65-75% of cardanol, which used as polymeric resin in preparation of composites with jute fibre and compared the mechanical properties of the composites made from phenol formaldehyde resin, which showed increase in ultimate tensile strength and youngs modulus by 3% and 20% of cardanol respectively and also resulted increase of flexural strength of cardanol by 10%. From the interpretations made it can be said that cardanol which is also a thermoset resin can adequately replace other phenolic resin extracted from the petroleum industry as this is one of the bio-sourced polymer exhibiting similar chemical and physical properties. The future scope involves

process optimization of the cardanol extraction from CNSL and as cardanol displays a similar reactivity than phenol, and is thus a promising renewable substituent to petroleum-based phenolic compounds. Cardanol has three different sites available for panoply of chemical reactions [10] and used in a wide range of applications (plasticizers, surfactants, curing agents, antioxidants), depending on its chemical modification and also synthesis of cardanol based phenolic resins, polyols and non-isocyanate polyurethane.