ABSTRACT

In the present work, we studied the modification of the resol using the epoxidised soybean oil. We used the CH_3COOH/H_2O_2 system for epoxidizing soybean oil. Optimized reactions were used, which resulted in a better performance (higher conversion and selectivity). Total double bond conversion and 95% selectivity were obtained in 2 h at 50°C. The reactions were carried out using concentrated H_2O_2 (30%) and CH_3COOH. The epoxidized soybean oil stability was also examined. Peroxyacetic acid generated in situ from hydrogen peroxide and glacial acetic acid in the presence of liquid inorganic acid catalysts were used as precursor. It was possible to obtain up to 78% relative conversion to oxirane with very less oxirane cleavage by in situ technique. Acetic acid was found to be superior than other catalyst for the in situ soybean oil oil epoxidation. There is a growing interest in the development of new materials through utilization of natural resources. This thesis describes preparation of epoxidised soybean oil toughened resol and its application in preparing green composite using cane fiber which is alkali treated and chopped and reinforced to obtain phenol formaldehyde composite. Epoxidized vegetable oils (EVO) have drawn much attention in recent years, especially in the polymer industry as they are economical, available, environmentally friendly, non-noxious and renewable. Vegetable oils can be transformed into useful polymerizable oxygenated monomers by catalytic epoxidation using inorganic acid.Environmental friendly and conversion rate of epoxidation usually exceeds 90%. Bio-based epoxidized vegetable oils from renewable natural resources are potential green materials to partially substitute and toughen petrochemical-based polymers. The epoxidation of alkenes and other unsaturated hydrocarbon chains constitutes one of the most useful reactions in organic synthesis, as the epoxide group is an active intermediate, which can be readily transformed to the required functionality. Epoxidation of long chain olefins, and unsaturated fatty acid derivatives such as soybean oil is carried out on an industrial scale .Fats and oils are renewable resources that can be treated chemically or enzymatically to produce materials that can often act as replacement for materials derived from petroleum . Due to the high reactivity of the oxirane ring, epoxides can also act as raw materials for synthesis of a variety of chemicals.

Phenol–formaldehyde resin was produced in the presence of NaOH catalyst. Detailed structural and quantitative information was provided by 13CNMR spectroscopy. The main interests were the relative quantities of bridge structures, methylol groups, and free phenol and modify the resin using the epoxidised soybean oil.The effects of the condensation F/P molar ratio on the structure and properties of the resins was studied. Resol the (phenol–formaldehyde) prepolymer resins was synthesized by maintaining the formaldehyde/Phenol (F/P) ratio properly and using the basic

catalysts and characterized by 13C NMR spectroscopy in solution.From various works those have been done already to modify the phenolic resins using various bio-based chemicals,it is seen that there is great scope to obtain a epoxidised soybean oil toughened thermosetting resin which have excellent properties like toughness and biocompatibility. The epoxidised soybean oil is an excellent substitute of petroleum based phenol which is totally a biobased raw material and it is having high reactivity with formaldehyde along with phenol to produce tough ESO modified resol. The modification is analysed using nuclear magnetic resonance spectroscopy and IR and its thermal properties , morphology and crystallinity was analysed using TGA,SEM and XRD. The ESO-modified resin was applied to prepare a composite using bio-based cane fiber and OMMT as nano filler. The strength properties was tested using Tensile experiment. Epoxidised soybean oil were utilized to modify the phenol–formaldehyde (PF) resin, respectively by copolymerization. Prior to the reaction, the composition and functional group of epoxidised soybean oil were characterized and used to evaluate their suitability as replacement for the preparation of PF resins. It was found that ESO exhibited high reactivity due to high content of epoxy group. The influence of epoxidised soybean oil for the replacement of phenol on the properties of modified phenol formaldehyde ESO-PF resins was also investigated using Fourier transform infrared spectroscopy (FT-IR), solid state 13C NMR and thermo gravimetric analyzer (TGA).50% phenol could be replaced by ESO without influencing the properties.

There is a growing interest in the development of new materials through utilization of natural resources. This thesis describes evaluation of alkali treated chopped cane fiber reinforced ESO toughened phenol formaldehyde (resol) composite. Here alkali treatment of cane fiber was carried out using sodium hydroxide. The thermal stability of the composite was assessed by thermogravimetric analysis (TGA). Fourier transformation infrared spectroscopic study H1 NMR and C13 NMR study, XRD, SEM and TENSILE strength study of alkali treated cane fiber-phenolic resin composite was performed. Water absorption and swelling behavior of cane fiber phenolic resin composites in water were studied and the alkali treated cane fiber-resin composite showed negligible water absorption and swelling. Composite of different formulations were prepared from alkali treated cane fiber and 55% resin.These composites have showed showed the satisfactory tensile strength at 55% resin content.