

Scholar Student : **Saeib A. Alhadi Faroun**
Supervisor : **Dr. Mohammad Islam**
Co-Supervisor : **Aas Mohammad**
Department of Mechanical Engineering

STUDY OF FLUID AND PHYSIO-MECHANICAL PROPERTIES OF FLY ASH BASED HIGH STRENGTH POLYMERIC MATERIALS

Synopsis

Polymers are being used in variety of items in domestic, industrial and research fields. The use of polymers in any specific field for any specified items depend on its physiochemical and physiomechanical properties. In this proposed work, we wish to prepare a polymeric composite. The main objective of this research project is to utilize vegetable oils in manufacturing of polymeric products. Such utilization of vegetable oils can help to reduce the cost of these novel polymeric materials as well as to find an alternate of petrochemicals based polymeric products. Moreover, utilization of vegetable oils as polymeric products formation will be of low cost. Thus the utilization of vegetable oils will be an asset if it is used in the direction of proposed research work. The prepared polymeric composite material will also characterized by determining its physio-mechanical and physiochemical tests such as viscosity of castor oil mixed with different fly ash percentages, moisture content, tensile, compression, hardness, impact, bending and flexural strength and stability in aqueous and some organic solvents.

Polymers are being used in variety of items in domestic, industrial and research fields. The use of polymers in any specific field for any specified items depend on its physiochemical and physiomechanical properties. In this proposed work, we wish to prepare a polymeric composite. The main objective of this research project is to utilize vegetable oils in manufacturing of polymeric products. Such utilization of vegetable oils can help to reduce the cost of these novel polymeric materials as well as to find an alternate of petrochemicals based polymeric products. Moreover, utilization of vegetable oils as polymeric products formation will be of low cost. Thus the utilization of vegetable oils will be an asset if it is used in the direction of proposed research work. The prepared polymeric composite material will also characterized by determining its physio-mechanical and physiochemical tests such as viscosity of castor oil mixed with different fly ash percentages, moisture content, tensile, compression, hardness, impact, bending and flexural strength and stability in aqueous and some organic solvents.

Polyurethane is a condensation product of the reaction of an isocyanate Polymers preparation technique is multi channel and sophisticated, with general formula $R-N=C=O$ and alcohol (ROH).

However, our endeavor will be to simplify polymer composite preparation method so as to make it most viable, feasible and economic. The proposed research work will be taken under the following steps with polyurethane and comparative study with unsaturated polyester (GP resin are sold as a liquid in market) based polymeric composite.

1. Modifications of vegetable oils to achieve high strength material.
2. Characterization of composite material by analytical methods.
3. Testing and analysis of prepared polymeric composite products and finding their areas of applications.

The proposed polymeric composite will be formed with base of polyurethanes and unsaturated polyester.

Castor oil contains 80% ricinoleic acid, it is the only oil nature which having hydroxyl groups in backbone. Due to hydroxyl groups in its molecular structure, it is a natural polyol. Hydroxyl group containing compound (Polyol) reacts with isocyanate to yield polyurethane (polymer).

This important class of polymers discovered by O. Bayer has been applied in fibers, elastomers, foams and other plastics materials. The basic reaction is that of an isocyanate group with an alcohol group:

Diisocyanate + Polyol Resin ----- Polyurethane polymer

Castor oil will be further chemically modified with hydroxyl compounds such as glycerol diethylene glycol (DEG) etc. Physiochemical properties of castor oil based polyols will be measured such as viscosity and moisture content. After measuring the Physiochemical properties the prepared polyol will be further formulated by adding cross-linking agent, additives, catalyst, filler and antioxidant. Filler like Fly ash which is collected in electrostatic precipitators as a product from combustion. The recycling of FA has become an increasing concern in recent years due to increasing land fill costs and current interest in sustainable development. The curing cycle is really the cross linking reaction, and the low molecular weight molecules become part of giant macromolecule by cross linking. Usually only a very small amount of catalyst is needed to initiate the curing reaction. Finally formulated polyol will be reacted with polymeric 4,4'-diphenyl methyl diisocyanate (PMDI), Toluene diisocyanate (TDI), with (NCO/OH) ratio 1:1 to produce the polymeric composite materials. The other useful property of polyurethane is their ability to form foams. This is particularly useful in sprayed foam insulation in building. Thick, rigid foam insulation achieved. No thermal treatments are required to complete the cure. If soft, flexible foam is desired, this can be obtained by varying the reacting chemicals. Most furniture pads are soft polyurethane foams. Dense foams are used in automobile dashboard pads. Hard rigid foams are used in furniture as a replacement for wood.