Polyurethane is the most versatile group next to unsaturated polyester resins. These materials are important block co-polymers. Properties of end product can be designed according to its application. Due to potential large volume of applications combined with high versatility in the properties, these materials require a thorough understanding of synthesis and properties as well as update of knowledge. Polyol synthesized from renewable resources and their possibility for industrial polyurethane application gained a considerable attention in recent times.

The polymer known as polyurethanes are widely used in the fields of daily life due to its excellent wear resistance, toughness, mechanical properties and chemical resistance. It is an important class of block polymer in which the properties of the end product can be designed according to the user need.

The ability of a synthetic chemist to maneuver numerous possibilities and combinations ideally suits the synthesis of polyurethanes and their development. Indeed the manufacture of polyurethanes involves a greater degree of control of chemical reactions than most other polymers. Their properties range from liquid, soft and rubbery solid to rigid thermoplastics and thermoset materials. The chemical modification of well known and widely used polymers gives the possibilities of obtaining of new materials with advantageous properties and new range of application.

Another class of polymer i.e. phenolic resin is used widely as an industrial material because of its good heat resistance, electrical insulation, dimensional stability, and flame and chemical resistance. However, Phenolic resin is brittle and not very tough, like many other thermosetting resins. To be able to modify phenolic is an important subject for its further application. Some research publications show that phenolic resins have been used to in order to get the modified polyol for polyurethane formation. Phenolic polyurethane used as composites, coatings, adhesives, foams, etc.
Therefore, it was thought to work on combining modified phenolic and polyurethane to get new polymer composition on the base of rosin ester modified Phenolic resin, castor oil, modified castor oil and different aliphatic and aromatic diisocyanates. Thus, the new class of coating will obtain with all possible benefits of excellent wear, chemical, and scratch resistance, good flexibility, and adhesion with excellent toughness.

As per objective, the Ph.d work was carried out and the whole work is distributed into six chapters of the proposed thesis.

The literature review pertaining to surface coating based on polyurethanes, rosin, castor oil, modified castor oil etc. Following this objectives and the present work are illustrated in chapter-1.

(a) Blending of rosinified phenolic resin with castor oil and modified castor oil was carried out at varying % age ratio to obtain different hydroxyl values (-OH) respectively.

(b) Polyurethanes resins were synthesized by reaction of blended polyol (Rosinidified phenolic resin with castor oil or modified castor oil) with diisocyanates (Aromatic and Aliphatic) in different NCO/OH mole ratio in presence of dibutyltindiluarate catalyst. (Scheme-I and -II) All the above system were characterized by hydroxyl value (-OH) and IR spectroscopy. The detail analysis of all resins has also been included in chapter-2.

The measurement and interpretation of mechanical properties and chemical resistivity of polyurethanes coats on steel panels. Polyurethane cured coatings were prepared on MS (Mild Steel) plates for all the composition at atmospheric temperature for various mechanical tests like Scratch hardness, Pencil hardness, Impact strength, Flexibility, and X-hatch adhesion. All data are described in chapter-3.
Thermo-gravimetric analysis (TGA) and Differential Scanning Calorimetry (DSC) methods of have been adopted. All the data have been interpreted in terms of stability of films. The results are discussed in chapter-4.

The Blending of rosinidified phenolic resin and brominated Castor oil at varying % age ratio was carried out to obtain polyols. Polyurethanes were prepared by reaction of above blended polyol with different aliphatic and aromatic diisocyanates. (Scheme-III) These polyurethanes applied on steel panels and all these polyurethane were characterized by mechanical and chemical properties. All the data are furnished in chapter-5.

The polyurethane thick liquids material mentioned in chapter-5 were casted into film of 0.3 mm thickness. All the films were characterized by thermal and flame retardant properties. The results are discussed in chapter-6.

![Scheme-I](image-url)