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# Characterization of polyurethane foam reinforced with glass fiber

**Gita Rani[1], Raman Swamy[2], Monika[3]**

*[1,2,3]Department Of Chemistry, Chaudhary Devi Lal University, Sirsa*

**ABSTRACT**

*Rigid Polyurethane foams were synthesized by step-growth polymerization reaction by using castor oil, 4, 4'-diphenylmethanediisocyanate, Methylene chloride, Cobalt octate, Silicon oil, Glass fiber, Ethanol, KOH, Ethyl methyl ketone etc. The morphology were studied by Scanning electron microscopy (SEM) technique.*

***Keywords**: Ethanol, Polyurethane foam, Silicon oil.*

## I. INTRODUCTION

The pioneering work on polyurethane polymers was conducted by Otto Bayer and his coworkers in 1937. The research and development in polyurethane material industry have been observed in recent years thus showing the current situation of the polyurethane industry in the developing direction [1]. The synthesis of vegetable oil based polymeric material with excellent physical and chemical properties has drawn great interest in the recent times [2]. There is a growing worldwide interest in the development of vegetable oil based polyurethane. This interest is economically driven because vegetable oils are relatively inexpensive and a renewable resource [3, 4]. By using enzymes or chemicals to modify the unsaturated fatty acid and introducing hydroxyl functional groups, vegetable oils could be converted into polyols [5]. The polyurethanes are an important and very versatile class of polymer materials [6] Cast polyurethane resins were elastomeric or leathery when cured with aliphatic diisocyanate

## II. EXPERIMENTAL

### 2.1 Chemicals

Castor oil, 4, 4'-diphenylmethanediisocyanate, Methylene chloride, Cobalt octate, Silicon oil, Glass fiber, Ethanol, KOH, Ethyl methyl ketone etc.

### 2.2 Synthesis

Polyurethane polymers are formed through step-growth polymerization reaction. In this process, a urethane linkage is produced by reacting as isocyanate group, -N=C=O with a hydroxyl (alcohol) group, -OH.

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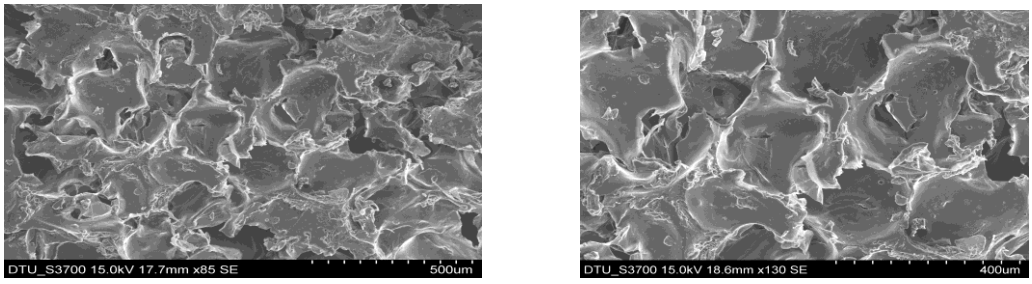
## III. SEM IMAGES

The physical properties of foams not only depend on the rigidity of the polymer matrix, but are also related to the foam cell structure. The cell structures of the samples were characterized with a Hitachi S3700 SEM (Scanning Electron Microscope) using an acceleration of 15 kV. Figure 3 (a) and (b) show the scanning electron micrographs of the castor oil based glass fiber reinforced rigid polyurethane foams (Fig.3.(a) and Normal rigid polyurethane foam (Fig.3 (b). The pore size is reduced in case of glass fiber reinforced rigid polyurethane as compared to normal rigid polyurethane as shown in figures given here. Glass fiber reinforced rigid polyurethane foam indicated that the 3-D structure of foam was more packed and consequently resulted in increased in compressive strength and the same result was reported in former section where results of compressive strength are reported.




(a) (b)

**Fig. 3 SEM of Caster oil based Polyurethanes for (a) Glass Fiber (b) Without Glass fiber**

## IV. CONCLUSION

Rigid Polyurethane foams and glass fiber reinforced rigid polyurethane foams based on modified castor oil were successfully prepared. SEM studies shows the evidence for improved cell morphology and closed packing with the incorporation of glass fiber in polyurethane rigid foam.

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