

# Effect of Euphorbia Coagulum on Flexural Property of Polyester Banana Fiber Composite

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**Abstract:** Presently composites are being made using either both the binder and the reinforcing fibers are synthetic or either one of the material is natural or synthetic. In the present study coagulum (dried latex) of *Euphorbia royleana* has been used for replacing polyester resin as a natural binder in polyester banana fiber composite. The influence of addition of different weight fraction of the coagulum on flexural property in the composite is studied. It was observed that with the increase in the coagulum fraction in matrix, the flexural property of the polyester banana fiber composite increases. The flexural strength increased by 25% and flexural modulus by 15% at 40% of coagulum weight fraction. This study presents the possibility of preparation of composites using coagulum of *Euphorbia* latex. The developed composite may be used in partition walls, roof tiles, interior linings of automobiles, etc as wood substitute.

**Keywords:** Euphorbia coagulum, Banana fiber, composites, renewable resource, biodegradable.

## 1. INTRODUCTION

Fiber reinforced polymer composites becomes more popular as they are in use for structural and load bearing application due to their high strength. But the problems associated with these petroleum-based composites are voluminous waste generation after disposal due to non-biodegradable nature. To overcome this problem from 1980's onward, extensive work has been carried out on the preparation of composites reinforced with natural fibers [1-4]. The natural fibers used in the composite preparation get biodegraded when disposed to the environment after use. Although the composites made with natural fibers are friendlier compared to conventional fiber composites but most of the commercially available polymers are derived from petroleum resources and are non-biodegradable in nature. Therefore, composites based on natural fibers are still a burden to the environment. Due to this reason currently researchers are focusing towards use of plastic materials based on hybrids or blends of biopolymers with petroleum derived polymers and have been successfully developed this type of alternative matrix material for natural fiber reinforced composites [5, 6].

In the present study we are focusing to develop composite by incorporation of different proportion of euphorbia coagulum as a matrix in polyester resin banana fiber composite and flexural properties of the

composites have been evaluated and discussed. Euphorbia latex is a milky emulsion, main constituents of these latex are resinous mass (60-80%), protein (5-8%) and isoprene (10-20%) [7, 8].

## 2. MATERIALS AND METHOD

### Chopping of Banana Fiber

Based on the previous study [9] banana fiber was chopped in 4mm length.

### Latex Coagulation

Latex of *Euphorbia royleana* was collected from Sahashtradhara, Dehradun, India and coagulated by using 5% aqueous solution of tannic acid [7]. The coagulated latex was washed several times by water till its pH become neutral and dried in hot air oven at 60±2°C.

### Coagulum Characterization

Iodine value of the coagulum was determined as per ASTM D1959 for determination of degree of unsaturation.

For identification functional group present in coagulum powder of Euphorbia coagulum was compressed in KBr to form pellets and FTIR spectra of the coagulum was recorded in a FT-IR Bomem spectrometer model no. FTLA - 2000-100.

Thermo gravimetric analysis (TGA) of Euphorbia coagulum was carried out for its thermal stability using TA instrument (Model TA 2960) under nitrogen

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atmosphere. The flow of nitrogen gas was 100 ml/min and heat flow rate was 10°C/min.

### Preparation of Composite

*Euphorbia* coagulum has been incorporated in varied proportions in unsaturated polyester resin and mixed homogeneously along with accelerator (cobalt naphthenate solution 1% by wt) and peroxide initiator (0.5% by wt.). Different composites of banana fiber were prepared by wetting 40% by wt. of banana fiber (based on previous study [10]) by hand lay-up method with the different solutions of polyester euphorbia coagulum in different proportions and by pressing these wetted banana fiber on compression molding machine (Hydraulic press, Santec India) at 130°C for 30min at 20 MPa pressure.

### Flexural Strength and Flexural Modulus

Flexural strength and flexural modulus of coagulum modified polyester banana fiber composites specimens were tested on the test specimens having size 127mm x 12.7mm x 3.4 mm using Universal Tensile Machine (Instron, 4302 model, UK) at the crosshead speed of 5 mm/min.

### 3. RESULTS AND DISCUSSION

Iodine value of the Euphorbia coagulum is 150, which shows the presence of high degree of unsaturation in coagulum. Presence of unsaturation was also confirms by IR study (Figure 1), which shows the peaks at 3400 cm<sup>-1</sup>, and around 1650 cm<sup>-1</sup> for hydroxyl group and unsaturation respectively. TGA graph in the Figure 2 shows that coagulum has

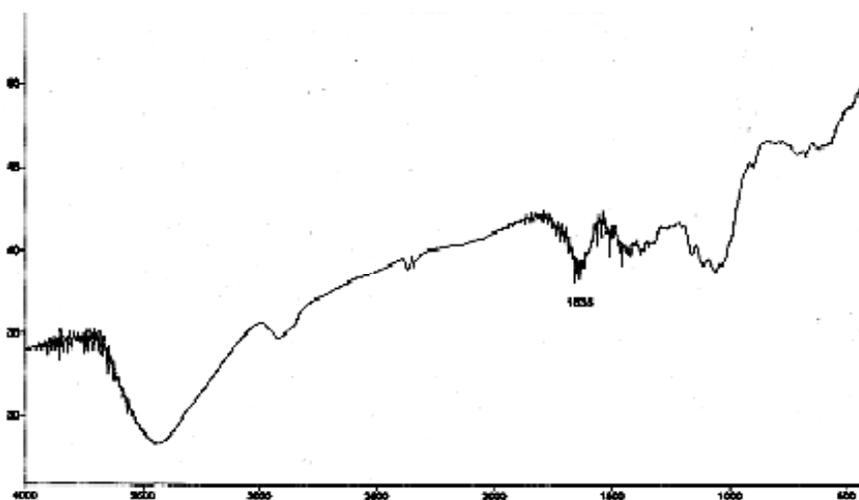


Figure 1: FTIR spectra of Euphorbia coagulum.

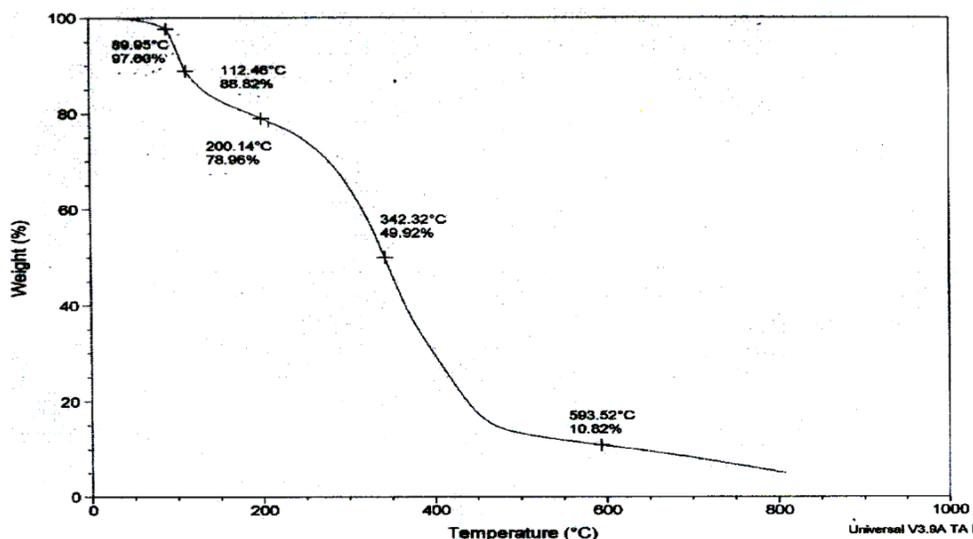


Figure 2: Thermogram of Euphorbia coagulum.

sufficient thermal stability to withstand the processing conditions.

Effect of varying weight percent of *Euphorbia* coagulum on flexural strength and flexural modulus of banana fiber reinforced polyester composites are given in the Figure 3 & 4. An increase of up to 25% in flexural strength and 15% in flexural modulus have been observed on incorporation of coagulum up to 40% in the polyester banana fiber composites this might be due to increase in resinous mass present in the coagulum. Resinous mass of euphorbia coagulum consist of euphol, a tetracyclic triterpenoid [7, 8] contains unsaturation and hydroxyl group which may be take part in cross linking of polyester and hydrogen bonding with fiber respectively and act as compactabliser Further increase of coagulum content in the compositions resulted in decrease of flexural properties of coagulum modified polyester banana fiber composites this might be due to increase in rubber content present in coagulum.

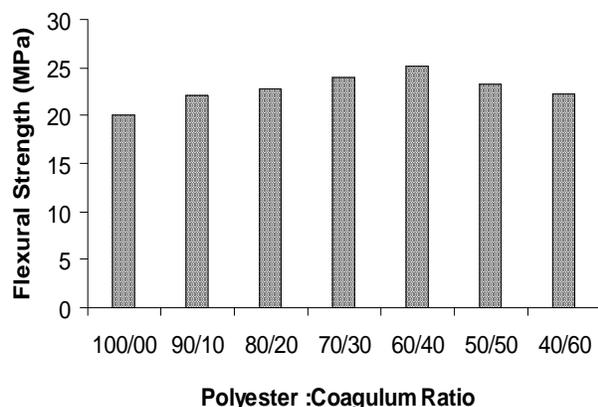


Figure 3: Effect of coagulum content on flexural strength.

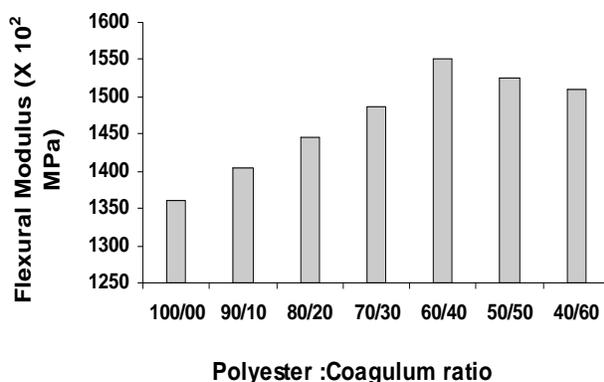


Figure 4: Effect of coagulum content on flexural modulus.

## 4. CONCLUSION

From above study, it was observed that the *Euphorbia* coagulum has high degree of unsaturation which shows the presence of reactive groups and has sufficient thermal stability to with stand the processing condition. Incorporation of up to 40 weight percent of *Euphorbia* coagulum in banana fiber reinforced unsaturated polyester composites shows an improvement in the flexural properties of banana fiber reinforced unsaturated polyester composites. In this way composites can be developed which will reduce global energy crisis and environmental concerns due to increase use of fiber and resin from natural resource.

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