

# Analysis of Cashew Nut Shell Resin with Kenaf Natural Fiber Composite (Treated & Untreated)

K Dhilipkumar<sup>1</sup>, S Kiruthika<sup>1</sup>, K Hema Malini<sup>1</sup>, A Thanveer Khan<sup>1</sup>, Suganth V<sup>2</sup>

<sup>1</sup>Department of Plastics Technology, <sup>2</sup>Project Assistant, CIPET: SARP-ARSTPS,  
<sup>1,2</sup>Central Institute of Petrochemical Engineering and Technology, Chennai, Tamil Nadu, India

## ABSTRACT

India is fast emerging as a global hub for petrochemical activities. As we know, there is a quite rise in cost and demand for petrochemicals and also on ecological concern we are planning for the alternative way for it. Our idea is “**GREEN COMPOSITE (BIO-COMPOSITE)**”. Green composite is the combination of plant fiber with natural resin to create a natural composite that matches synthetic composites in properties. Green composites are environmentally safe and recyclable. When they are Dumped, they decompose by the action of micro organism. It gets Converted into H<sub>2</sub>O, CO<sub>2</sub> which are absorbed by plants.

**KEYWORDS:** Natural Composite, Natural Fiber, CNSL Resin, Alkaline Treatment, cashew nut shell resin

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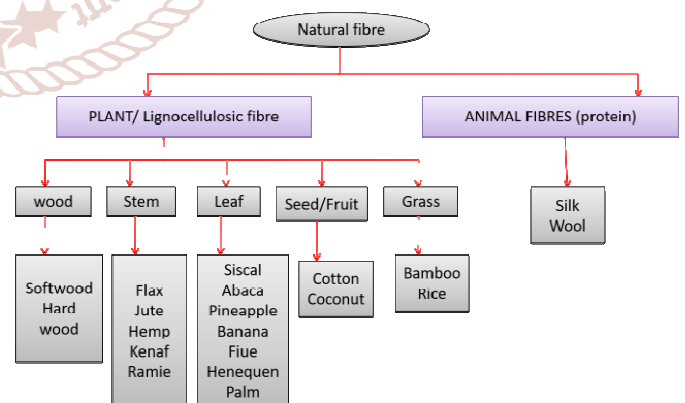


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## INTRODUCTION

Natural fibers are often used for high performance reinforcement of polymer matrix composite. kenaf is the fiber from hibiscus cannabinus of Malvaceae family. It is commercially available in mat and filament form. cashew nut shell liquid (CNSL) is one of the sources of naturally occurring phenols obtained from shell of cashew nut. CNSL resin is a viscous resin in dark brown colour. It contains Anacardic acid & cardol. we are using kenaf fiber as a matrix and CNSL as the filament into make a natural composite by Hand layup process. The fiber was brought from Fiber Region, valasaravakkam, Chennai in mat form and bidirectionally oriented and Purchased CNSL resin from kumarasamy industrials, panruti, cuddalore.



## Materials and Methods:

### Fiber preparation:

Kenaf fiber is used in this project, its brought as mat orientation because mat orientation has high strength compared to filaments kenaf and we used to cut in square dimension and after cutting the fiber is taken into alkaline treatment for enhance their mechanical properties, for preparing alkaline solution for fiber treatment 8 gram of NaOH is dissolved in 100ML of distilled water and fiber is soaked into for 48 hrs at

room temperature and after 48 hrs the fiber is taken out and dried for 12 hrs at sunlight.



**Kenaf fiber mat orientation**



**Top Plate**

**Resin preparation:**

The CSNL (cashew nut shell liquid) natural and annually renewable bio materials from shell of cashew and the CSNL is brought as Toluene based CSNL because of de-polymerization, toluene is used to stop polymerization reaction. CSNL is a reddish brown viscous liquid extracted from a soft honey comb structure inside the cashew nut shell. CSNL contains Anacardic acid and small amount Cardol.



**CSNL resin**

**Mould preparation:**

Plate mold is prepared as per the sandwich composite requirement. Mild steel is used for making plate mold. Dimension of the mold cavity is 225 x 225 x 3 mm and top mold is 3mm flat steel plate. Before using the mold, it was polished and cleaned with WD-40. Before Hand lay-up process the mould has been applied with a releasing agent(Wax) to insure that the art will not adhere to the mould. The top and bottom plates are covered with OHPS sheet because of easy removing



**Bottom Plate**

**Fabrication of Composites:**

The natural fiber KENAF fiber mat was taken as reinforcement material and natural resin CSNL resin as a matrix material to fabricated natural composite “GREEN COMPOSIT” by process of Hand layup methods to fabricated. Mould was prepared as per the standards to fabricate composite. The composite sample are prepared by different proposition to analysis. Fiber weight content such as 10% 20 %40% in this material and CSNL resin and catalyst agent is HMTA(Hexamethaline tetramine) and formaldehyde are mixed in the different ratios for experimental and analysis for the proposition. Then place the OHPS sheet in top and bottom of the mould and wax-releasing agent is applied on both sides of mould, 1<sup>st</sup> resin is applied on that, after place fiber this process is taken one by one alternatively of resin and fiber. To form laminated composites with 7 or 8 layers of kenaf fiber. The entrapped air bubbles (if any) are removed carefully with a sliding roller. The mould was closed for curing at a temperature of 75°C/85°C/100°C/110°C for 4hours at a constant load. After curing composite are extracted from mould plate and sample is taken out and again repeated the same process.

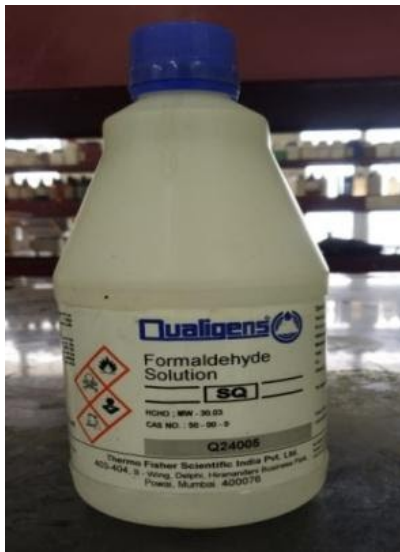
**Catalyst:**



**Hexamine**



**HMTA Solution**



**Formaldehyde**

**Fiber treated with alkaline treatment:**



**1. Cutting of fiber sheet**



**2. Preparing NaOH bath**



**3. Soaking of fiber sheet**



**4. Soaked fiber sheet**



**5. Drying at Room temperature**



**6. After Drying of fiber**

**Fiber Composites:**

The natural fiber composite is our idea to make green composite for biodegradable. we make 6 samples and used in different fibers weight and resin weight.

The 1<sup>st</sup> experiment we made without using any hardener there is only fiber and resin. inference we found that there is no obtained of solid state there is only in slurry state.

The 2<sup>nd</sup> experiment we made using hardener Formaldehyde was mixed with resin at the ratio of 3: 1 rein: formaldehyde inference we found there is Completely brittle and very soft.

The 3<sup>rd</sup> experiment we made using hardener Formaldehyde was mixed with resin at the ratio of 5: 1 rein: formaldehyde with curing time of 4hours. inference we found there is Completely brittle and breaks occurs

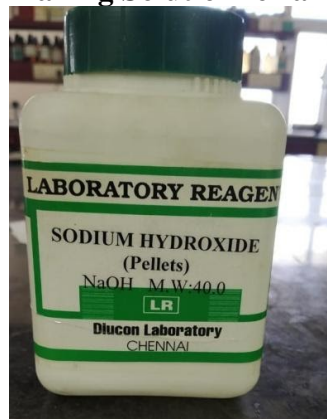
The 4<sup>th</sup> experiment we made using ratio of CNSL to formaldehyde is 1: 1.33 (50g Of CNSL and 66.5g of formaldehyde ), 2 mole of NaOH(10 ml of NaOH) and Hexamine hardener(2ml of hexamine). Inference we found that the proposition of Kenaf with CNSL at the temperature 120°C for 4 to 6 hours.

**Result and Discussion:**

**Alkaline chemical Treatment:**

We are prepared 6 sample out of that 3 sample is alkaline treatment and another 3 is non-alkaline treatment. The samples we analysis the alkaline treatment fibers has more mechanical properties when compared with the non-alkaline treatment fibers. The important of alkaline treatment is used to break the hydrogen bond and the surface is rough and the chemical treatment is used to remove wax, lignin pigment, oils covering with external surface of fiber cell wall

**Making Solution for alkaline treatment:**



**NaOH**



**NaOH distilled in Water**

### Experimentation of CNSL resin for Binding with Fiber

1. Virgin cashewnut shell liquid resin with toluene. The resin is poured and the hand layup process is done but curing is done 4 hrs. in sunlight still in jelly condition not in solid form. Toluene is vaporized so resin in the intermediate stage.
2. cashew nut shell liquid resin with Formaldehyde (3: 1) ratio -brittle like cracks obtained The same process is repeated with formaldehyde as hardener and mixed with csnl resin in the ratio of

3: 1 for solidifying the component. Timing. After the solidification of the composite it is found that it still needs a hot air oven for temperature. From the experiment it is analyzed that resin pouring 4: 1 ratio is the appropriate proportion for rectangular plate.

3. Cashew nut shell liquid resin is mixed with 5: 1 ratio then it is kept oven for 4 hours for 120° - foam like Structure obtained
4. CNSL Resin and MEKP Catalyst were mixed in the ratio of 5: 1.

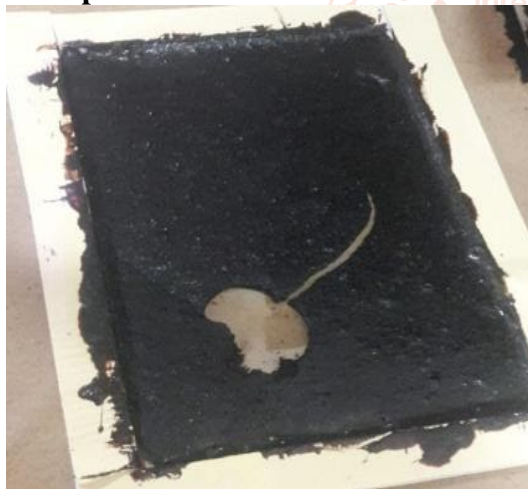
**Sample 1 Virgin CNSL Resin**



**Sample 2 CNSL resin with 3: 1 ratio**



**Sample 3 CNSL resin with 5: 1 ratio**



**Sample 4 CNSL resin with 5: 1 ratio with catalyst**



### Fiber for sample:



**Treated fiber**



**Untreated fiber**

The experiment is taken in various number of Orthogonal array of L9 chosen various proposition

and mixture of resins, hardner and catalyst investigation and analyses for the proposition and mixtures for kenaf fiber with CNSL resin.

### Conclusion

From the experimentation of cashewnut shell resin with kenaf fiber treated NaOH provide good mechanical and tribological behavior property is increased. To improve the mechanical properties alkaline treatment is used with fibers and without alkaline treatment the fibers get less mechanical properties when compared with alkaline treatment. ratios and proposition and finally conclude with the investigation and analyses of natural fiber reinforcement composite (Kenaf fiber with CNSL resin).

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