

Experimental Investigation of Epoxy Resin Bar with Natural Filaments and Plastic Waste

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Abstract— Due to light weight, high performance and excellent mechanical properties the composite material is considered as a key material in the 21st century. These are extensively used in many industries for structural usages, such as aerospace, aeronautical, sporting goods applications, home furniture, and automotive and medical devices, due to their desirable strength to weight properties.

Objective: - To prepare reinforced epoxy resin bars with natural filaments (jute fibers, coconut fiber) as well as Plastic waste (Crush of bottles) by hand-lay-up method. Also to study tensile strength using Computer operated Universal Testing Machine.

Method: - carbon fiber/epoxy resin composites will be prepared using the hand-lay-up method. For the destructive testing, a universal testing machine will be used to test the tensile strength of composite bars.

Conclusion: Preparation and testing of epoxy resin composites are carried out and the prepared laminates exhibit good mechanical and physical properties. Hence, the laminates with natural filament and epoxy resin can be used in many industrial and commercial applications

Keywords— Epoxy resin, Natural Fibre, Reinforcement, Tensile Strength, Testing.

I. INTRODUCTION

A composite is composed of two or more individual materials, which comes from the categories such as metals, ceramics, and polymers. Due to light weight, high performance and excellent mechanical properties, composites are considered a key material in the 21st century. These are extensively used in many industries for structural usages, such as aerospace, aeronautical, sporting goods applications, and automotive and medical devices, due to their desirable strength to weight properties. Now, these are globally accepted as a high performance and high-strength material. These materials have the potential for fire hazards caused due to heat, smoke, electric short circuit, etc.

The immense research has been done on flat plate multi-layered composites and got higher yield strength due to higher phase continuity. So there is a research gap to study the mechanical properties of epoxy resin reinforced bars.

In this paper, tensile strength of resin composites with natural filaments as well as plastic waste has been calculated by experimental analysis. The tensile strength was calculated and compared with neat epoxy resin bar and reinforced matrix bar composite.

So this research concentrates to make a epoxy bars with Natural laminates as well as plastic waste and then to find out their characterization and all the physical properties using Universal Testing Machine.

II. METHODOLOGY

The methodology and concept of this research is shown in Fig.2

A. Specifications of Specimen

The specimen of epoxy composite with 30 mm diameter and 250 mm length was prepared using hand-lay-up method as shown in fig.1.

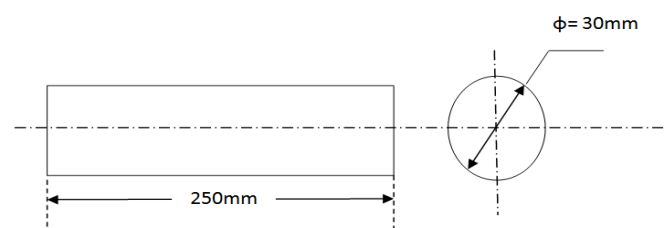


Fig.1. Specification of rod

B. Material

Standard Epoxy Resin (AW 106 IN) was used as epoxy resin matrices. Epoxy hardener (HV 953 IN) was used as hardener. Natural composites like coconut fiber and jute and plastic waste of bottle was used for composite reinforcement.

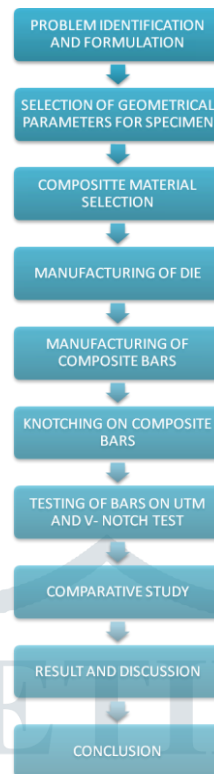


Fig. 2. Methodology Flow Chart

C. Preparation of Epoxy resin composite laminate bars

An epoxy resin composite bar has been prepared by casting technique. Die of polyester resin has made for this purpose. Natural laminates such as coconut fiber and jute has taken to cast the bar. This laminates is arranged in such a way that, the fibers are parallel to the tensile force acted on bar. Epoxy resin and hardener were mixed with each other by considering the ratio 1:1 Coconut fiber and jute fiber/ epoxy composites were fabricated using hand lay-up method and dried at a room temperature. Reinforced material is used in order to increase the strength of composite bar. Also waste plastic bottle crush has also taken for experimentation purpose. After casting die is removed and then specimen dried properly.



Fig.3. Specimens made for tensile test

III. RESULTS AND DISCUSSION

The prepared specimens of pure epoxy-resin, epoxy resin with natural laminates (Jute and Coconut Fiber), epoxy resin with waste plastic bottle crush has been tested on computer operated Universal Testing Machine (UTM). The tensile strength results obtained from test are as given in table no. II.

The specimen was fixed to the UTM machine by pushing the top grip upwards and inserting the specimen into the bottom grip. Then the load is applied slowly up to the fracture of bar. This load is considered as ultimate load and the strength is called as tensile strength. The ultimate load is given in table no. I.

TABLE I
ULTIMATE LOAD

Sr.No.	Specimen	Ultimate Load in KN			
		SP-I	SP-II	SP-III	Average
1	Pure Epoxy- Resin	10.29	11.11	10.50	10.64
2	Epoxy resin with jute fiber	12.54	13.64	14.49	13.55
3	Epoxy resin with coconut fiber	5.24	7.53	6.75	6.56
4	Epoxy resin with plastic waste	7.66	8.33	7.68	7.90

TABLE II
TENSILE STRENGTH OF EPOXY RESIN WITH LAMINATES

Sr. No.	Specimen	Tensile Strength in MPA			
		SP-I	SP-II	SP-III	Average
1	Pure Epoxy- Resin	14.75	15.92	15.04	15.245
2	Epoxy resin with jute fiber	17.95	19.53	20.74	19.40
3	Epoxy resin with coconut fiber	7.42	10.78	9.78	9.393
4	Epoxy resin with plastic waste	10.97	11.93	11.00	11.31

The tensile strength recorded in universal testing machine is represented in table no. II. Jute fiber reinforced specimen shows superior tensile strength among other composite bars as shown in fig. 3.

The strength of reinforced bars is better to neat epoxy-rein bars. This shows that the reinforcement is important for to increase the material's mechanical properties of epoxy resin composite material as shown in fig. 4.

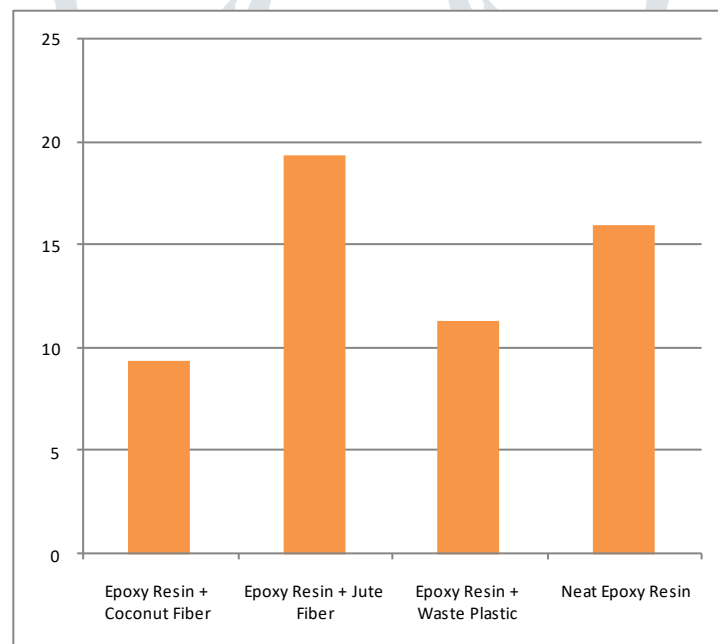


Fig.4. Comparison graph of Tensile strength



Fig.5. Specimen loaded on UTM

IV. CONCLUSION

Tensile strength is the capacity of a material or structure to withstand loads tending to elongate, as opposed to compressive strength, which withstands loads tending to reduce size. So it's important to test the metal for right strength and ductility. In this paper the specimens of epoxy resin with natural fibers and waste plastic bottles are prepared and tested on computer operated Universal Testing Machine. The results show the tensile strength of epoxy resin with jute filaments was superior to other reinforced and neat epoxy composites. Also to increase the mechanical properties of composite material reinforcement plays very important role.

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