INVESTIGATION OF TAMARIND SEEDS WITH VARIOUS GRAIN SIZES OF POWDER REINFORCEMENT AND EPOXY RESINS

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Abstract

The tamarind seeds are used in this research as powder form. The various proportions were used to prepare different composites with epoxy resin. The matrix materials are Epoxy-LX 550 and hardener. The Compression moulding techniques employed to prepare the composite plates. Tamarind seeds powder is natural filler, Usually seed fiber obtained from the outer shell. The Natural particulates are biodegradable, easily available, and low cost and provide an opportunity for the development of natural material as reinforcement material. The performance tests of fiber composite products are to be carried out to commercialize products. The environmental friendly composite material can be made with tamarind seed and hardener. The compression strength, tensile strength are found it. The best composite was identified based on the application requirements.

Keywords: Tamarind Seeds, Epoxy-LX 550, Compression, tensile strength machines.

1. Introduction and literature

The reinforcement of tamarind seed powder of various grain size and hardner also used for getting maximum tensile strength and compressive strength by using a mechanical testing machines. A nano powder of tamarind with epoxy resins were tested and used in different applications.

The maximum materials addition can be made with help of composite i.e. waste materilas as raw material [1, 2]. The tamarind seed usually a agricultural waste, but recently found some medical drug applications [3], preparing gum solution [4], biomedical i.e. Bio-inspired nanocomposites for bone tissue engineering field [5], the composite films using polyvinyl alcohol and carboxymethyl tamarind solution and the developed films can be explored for skin tissue engineering field and drug delivery applications [6]. It was prepared by [7] with whey protein isolate (WPI) and tamarind seed mucilage (TSM) and the WPI-TSM complex coacervate can be used as an economic and nutritionally valuable alternative for food additives. spice fused tamarind seed starch edible films for meat packaging [8]. The environmental friendly composite material can be made with tamarind seed gum and banana fibre. It is biodegradable also. The composite strength varies with kind of banana fibre. The red banana fibre used composites are more stronger than poovan banana tee fibres[9]. The green composite can be manufactured by Using biopolymer cellulose as the matrix and 25 wt.% tamarind nut powder as filler must be loaded [10]. This research also made such attempt of preparing eco friendly green composite and also bio degradable composite with tamarind nut powder with epoxy matrix. The objective of the research is to fabricate different composite specimens and explore of its characteristics.

2. Experimental study

The details of the composite matrix are Reinforcement material – Tamarind seeds powder; Matrix material - Epoxy-LX 550 and Hardener. The tamarind seeds are considered as Reinforcement Material for this composite synthesis and exploration. The tamarind seeds were collected from tamarind, which are seen as unused in road sides from various village areas. Tamarind seeds powder is natural filler. Usually seed fiber obtained from the outer shell, or husk, the fruit of Cocas nucifera etc. The course, stiff, reddish brown Filler is made up of smaller threads, each about (a micrometer is about 0.004 in.) in diameter, composed of lignin, a woody plant substance, and cellulose. The individual fiber cells are narrow and hollow, with thick walls made of cellulose. They are pale when immature but later become hardened and yellowed as a layer of lignin is deposited on their walls. Mature brown coir fibers contain more lignin and less cellulose than fibers such as flax and cotton and are thus stronger but less flexible. Brown fiber is obtained by harvesting fully mature Tamarind Seeds when the nutritious layer surrounding the seed is ready to be processed into copra and desiccated Tamarind seeds. The fibrous layer of the fruit is then separated from the hard shell (manually) by driving the fruit down onto a spike to split it. Machines are now available which crush the whole fruit to give the loose fibers. The Tamarind seeds with shell was shown in the figure.

Fig 1: Raw Tamarind seeds

2.1. **Physical Properties** A tamarind seed is very similar to peat in appearance. It is light to dark white in color and consists primarily of particles in the size range 0.2-2.0 mm (75-90%). Unlike sphagnum peat, there are no sticks or other extraneous matter. Tamarind seeds powder has a similar dry density, water holding capacity and available water content as sphagnum peat. The air-filled porosity (AFP) is slightly lower but this is compensated for more even distribution of moisture in the mix.

2.2. **Chemical Properties** Tamarind seed powder is less acidic than or sphagnum peat and smaller amounts of lime are needed to achieve a pH suitable for growing plants.

Materials	pH	Moisture content	EC dS/m	N%DWt	P	K	CI
Tamarind seeds powder	6.001	10%	0.85	0.55	0.4	0.45	0.002

2.3 Composite fabrication A steel mould having dimensions of 350 × 350 ×4 mm3 is used for composite fabrication. The Tamarind seeds particulates are mixed with polyester resin by the simple mechanical stirring and the mixture is poured into Moulds in the Compression Moulding Machine (35 Ton capacity) conforming to the requirements of various testing conditions and characterization standards. The prepared die for making polymer composites. There are many composites with different proportions. The mould is compressed by upper jaw in the Compression moulding machine at temp of 78°C with the pressure of 2.85Mpa for three hours.

Different composite plates	1	2	3	4	5	6	7
Tamarind seeds powder Weight Percentage	0	5	10	15	20	25	30

Epoxy Resin with Hardener Weight Percentage	100	95	90	85	80	75	70

2.4 Tensile Test:

The tensile behaviour of particulate composites was measured using the Universal Testing Machine Range of testing=0KN to 100KN.Power supply=1PH, 230V A.C and 50 Hz. As per the ASTM D638-08 standard. The specimens were cut from the fabricated composite material in the approximate length, Width and thickness of 200 mm, 20 mm and 3 mm respectively. Five identical specimens were tested to obtain the average tensile strength.

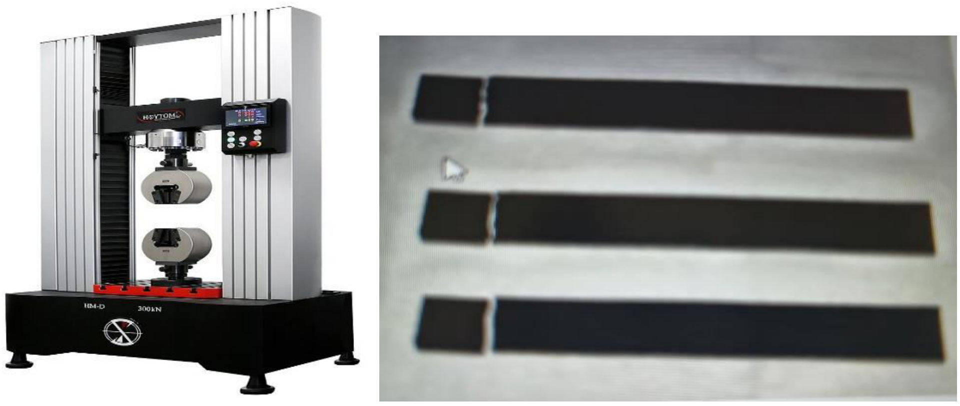

Fig 2: a) UTM Machine b) Specimens

2.5. Compression Test The Compressive strength was conducted according to ASTM E 3410 standard using universal testing machine. The plot shows interaction between compressive strength and no of experiments. Compressive strength of polymer composites were performed in digital display with compression load of 5kg.It should be noted that the Compressive results of the composites reported in this work are the average of five independent specimens.

Fig 3: a) Compression Machine b) Specimen

3. Results and Discussions

Tensile Strength

Tensile strength of The Tamarind Seeds Filled Epoxy Composites. The Tensile strength was conducted according to ASTM D 656 in using universal testing machine. The plot shows interaction between compressive strength and samples. Tensile strength of Epoxy composites were noted in digital display with load of 1 to 2.5 kg. It should be noted that the tensile results of the composites reported in this work are the average of five independent specimens.

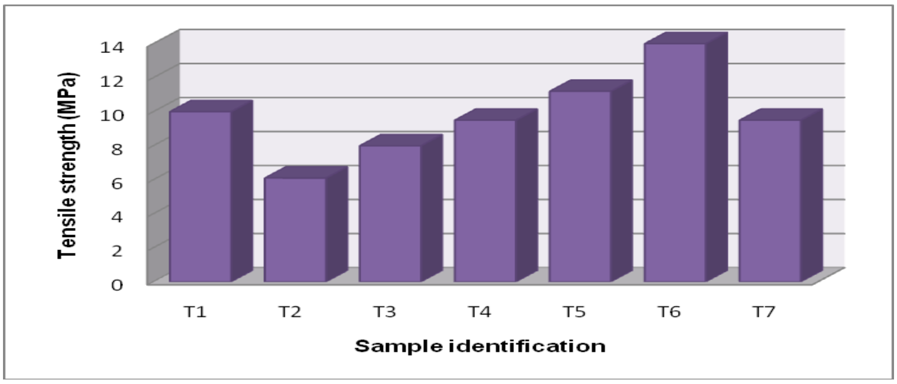

Fig3.1 Tensile Strength

The maximum tensile strength was obtained in 25wt % of tamarind seeds and 75 wt % of epoxy composites at 14.5MPa.The maximum and minimum tensile strength was 7 and 14.5 MPa respectively. When compare to neat epoxy resin, the strength of the polymer composites increased gradually. The figure shows the tensile strength of different particulate composites. The adhesion between tamarind increasing the strength of the composites.

Compressive Strength

The Compressive strength was conducted according to ASTM E 3410 standard using universal testing machine. The fig shows interaction between compressive strength and no of experiments. Compressive strength of polymer composites were performed in digital display with compression load of 5kg. It should be noted that the Compressive results of the composites reported in this work are the average of five specimens.

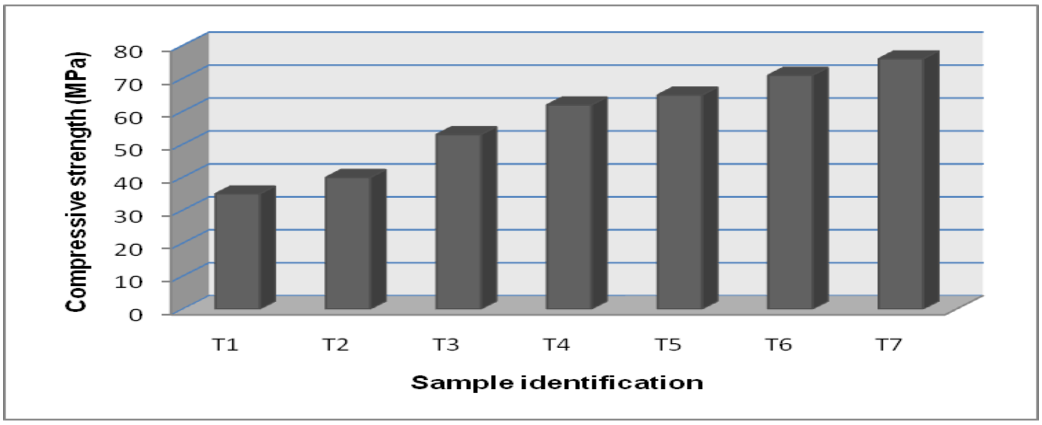

Fig3.2 Compressive Strength

The figure shows the compressive strength of five different particulate composites. The maximum compressive strength was 75 MPa with 30 wt % of tamarind seeds and 70 wt % of epoxies. This is due to the more amount of cellulose presence in the tamarind; moreover, particulate tendency has to withstand more. compressive comparatively to tensile load, the least compressive strength was observed with 39 MPa in 5 wt % of tamarind and 95 wt % of Epoxy composites.

4. **Conclusion: -**The mechanical behaviors of Tamarind seeds particulate were studied in this investigation. The particulate composites were fabricated as per the different combinations of the fabrication parameters.

The composites were fabricated through 30 wt % of particulate content and 100-70 wt % of resin content and finished surface has examined through roughness value.

The maximum Tensile strength was 14.5 MPa attained with 20 wt% of Tamarind seeds with 80 wt % of Epoxy composites. The maximum compressive strength was 75 Mpa with 30 wt % of Tamarind seeds and 70 wt % of Epoxy resin.

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