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Development and Optimization of Process Parameters of Microwaved Cured Polymer Based Natural Fibre (Coir) Reinforced Composite

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Abstract: *Now a days the processing of natural Fibre reinforced polymer composite through microwave curing going on a fortunate step for better properties. It has been observed that the application of NFRPC is increasing day to day. Due to their low cost and light weight that type of composite is applying at various light load capacity areas. Processing of NFRPC depends on a large no. of factors. Due to practical constraint 3 domen parameters were considered during experimental investigation. The value of the parameter was selected on the basis of material characteristics and experimental available in the Laboratory. Design of Experiment were used for planning the experiments. Optimum process parameter was determined for improvement ultimate tensile strength. The selection of optimum parameter was assured by mechanical testing as well as microscopic structure. Processing of composite by using optimized parameters resulted in improvement in tensile strength by 3 %. Science.*

Keywords: Scientific research, challenges, literature review

I. INTRODUCTION

Natural Fibres, any hair like raw material directly obtainable from a vegetable, an animal or mineral source and converted into such kind of useable product. These fibres are completely renewable, environment friendly, high specific strength, non- abrasive, low cost, and bio-degradability. Due to these characteristics, natural fibres have recently become attractive to researchers and scientists as an alternative method for fibres reinforced composites. Due to the disadvantage of the synthetic and fibre glass as reinforcement, the use of fibre reinforced composite gained the attention of the young scientists.

Their advantages include having low density and cost, high specific strength, and being sustainable and environmentally friendly. The resulting products from those composites can be both reused and incinerated and do not have to be land filled as glass Fibre compounds, which can help in developing cars according to the EU end-of-life directive. Lots of work has been carried out in the production of natural fibre reinforced polymer composites, using natural fibres like coir, hemp, cotton, sisal, kenaf, bagasse, areca, abaca, bamboo etc. and their properties have been studied. Here is an attempt made on the literature survey of areca fibre reinforced polymer composites where different properties of areca fibres, its maturity level, surface treatment effect on properties of fibres.

Natural Fibres: Some of the natural and synthetic fibres that can be used for making composites are discussed below

Jute: Jute is one of the most important natural Fibres now a days, and second only to cotton in the amount produced and variety of uses. Jute Fibres are extract from the plant which contained with Materials cellulose and lignin. The industrial term for jute Fibre is raw jute. The Fibres are off-white to brown, and 1–3 meters (3–10 feet) long. Jute is also called the golden Fibre for its color. The figure 1 shows the sample of jute Fibre used.

Coir: Coir or coconut fibre, is a natural fibre extracted from the husk of coconut and used in products such as floor mats, doormats, brushes and mattresses. Coir is the fibrous material found between the hard, internal shell and the outer coat of a coconut. Other uses of brown coir (made from ripe coconut) are in upholstery padding, sacking and horticulture. White coir, harvested from unripe coconuts, is used for making finer brushes, string, rope and fishing nets. It has the advantage of not sinking, so can be used in long lengths on deep water without the added weight dragging down boats and buoys. The figure 2 shows the coir Fibre used.

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Figure 1: Jute

Figure 2: Coir

Synthetic Fibres: There are so many types of synthetic fibre are available in the market.

Glass Fibre: Glass fibre shown in Figure 3 is made of numerous extremely fine fibres of glass, commonly used as an insulating material. It is also used as a reinforcing agent for polymer products to produce strong and light sheets of Fibre-reinforced Polymer (FRP) popularly known as fibre glass. Glass fibres are not strong and rigid as carbon fibre, but are much cheaper and significantly less brittle. Figure 3 shows a sample of glass fibre. Figure 3 Glass Fibre

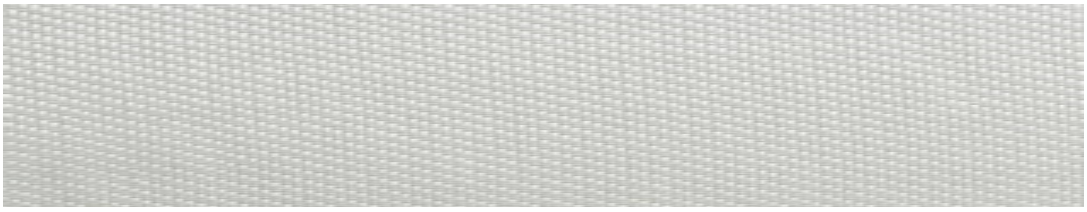

Figure 3: Glass fibre

Matrices:

Polypropylene (PP), widely used, is a thermoplastic polymer seen in packaging and labelling, textiles, stationery, plastic, etc.

Polypropylene (PP), is a thermoplastic polymer used in a wide variety of applications. It is produced through chaingrowth polymerization from the monomer propylene. Polypropylene belongs to the group of polyolefin and is particularly crystalline. Its properties are similar to polyethylene, but it is slightly harder and more heat resistant. It is a white, mechanically rugged material and has a high chemical resistance. Polypropylene is the second-most widely produced commodity plastic (after polyethylene) and it is often used in packaging and labelling. In 2014, the global market for polypropylene was about 65 million tones. The figure 4 shows the polypropylene polymer used.

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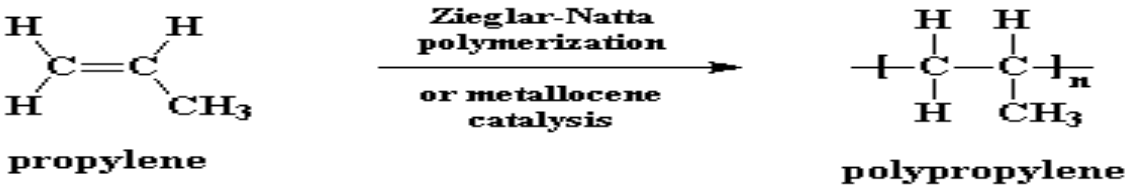
Figure 4: Polypropylene

Reaction of polypropylene:



Materials In the present work, homopolymerized granules of polypropylene were supplied by Seth Plastic Industries, Delhi, India and coir fibre were supplied from India mart website. In this research article i.e. Coir Fibre was used as a raw material. The Fibre was chopped at different size like 20 mm, 30 mm and 40 mm.

1.5 Chemical Treatment Chopped coir fibre (20 mm to 40 mm) were washed by distilled water at 85°C for 80 minutes and then dried it .For alkali treatment 10 wt.% solution of NaOH was prepared and washed fibres were soaked into solution for 4 hours at room temperature. After this, fibres were washed with distilled water and dried into hot air oven at 80°C for 2 hours. 1.6 Manufacturing of composite the following steps were followed for making natural fibre reinforces composite.

Step 1.

Domestic microwave was used as the primary source for making composite. Polymer composites come in the category of mixed microwave absorbing materials as absorption of microwave energy is dependent on the dielectric properties of the matrix as well as reinforcements.

Step 2.

The treated fibre was chopped into 3 categories like 25 mm, 20 mm, and 15 mm.

Step 3.

Bone China was taken as mold material for getting desired shape and size.

Step 4.

Another property like power and time was taken the process parameter.

Step 5.

Power range 720 W, 640 W and 560 W and Time slot 16 min, 18 min, 20 min.

Step 6.

After completed the production process composite was taken and was being ready for mechanical testing.

Taguchi design of the experiment is a simple optimization technique which is used for reducing the no. of conducting experiments. In this experiment procedure, the three factors were selected with their level Depending on different process parameters, the composite was prepared. Nine specimens with unique dimension were ready for tensile test. Tensile test specimens are fabricated as per ASTM standard and a test specimen is shown in fig 2.

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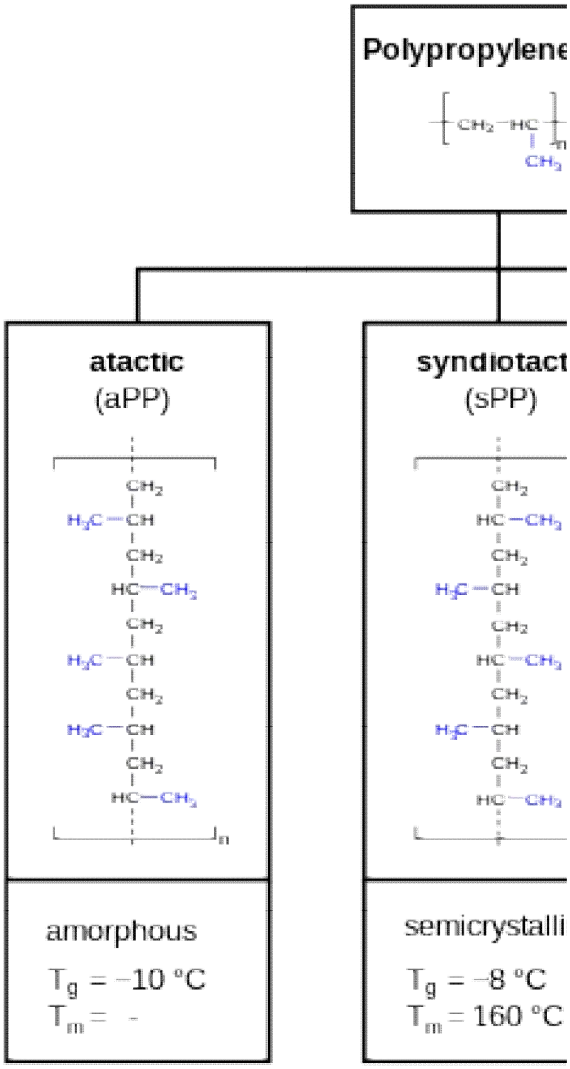

II. CONCLUSION

In this study to investigate the effect of Microwave processes on different process parameters was observed. Power, Fibre size, Operational Time were the variable parameters. Following conclusion was drawn from the experiments and analysis of results. 1. In this experimental work, the selection of the process parameters for microwave curing with better quality has been presented. 2. Surface level is better by this process. 3. It is also observed from experimental work that mechanical properties depend on the fibre strength. 4. Taguchi technique is method power pull tool to discover the effect of microwave process parameters on mechanical quality. 5. ANOVA (Analysis of variance) depicts that operational time having a significant parameter that affects the UTS followed by power and fibre size. 6. Ductile fracture mode observed with fine dimples for tensile test samples.

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