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Fabrication and Testing of Composite Powder Materials from Shrimp Powder Epoxy

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Abstract

Prawns shell powder (shrimp powder) is an extremely covered source of protein, yet are very low in fat and calories, making them a very healthy choice of food. In this article, we have discussed the use of the bio-degradable wastes as a composite material. The discarded waste of the prawn shell wastes is used for making a composite material.as the composite material, which is mostly treated as waste in our day to day life. As the composite material consists of matrix and reinforcement, in this the particulates shrimp powder is used as reinforcement and matrix used is Araldite Standard Epoxy resin Araldite Resin XIN 100 along with hardener Araldite Hardener XIN 900. The reinforcement used is shrimp powders are mixed with the matrix taken in the fixed ratios, with different proportions. Then the composite is fabricated and tested for strength and hardness. The tests performed are impact and Rockwell hardness test. Different compositions of the matrix and epoxy is fabricated and compared among composites prepared and result is shown. Composite materials are substitute for the conventional plastics and possess higher mechanical properties then those materials.

Keywords- ***Composite materials, shrimp powder, epoxy resin, Impact test, hardness test, Strength of composite material.***

INTRODUCTION

Over the last thirty years composite materials, plastics and ceramics have been the dominant emerging materials. The volume and number of applications of composite materials have grown steadily, penetrating and conquering new markets relentlessly. Modern composite materials constitute a significant proportion of the engineered materials market ranging from everyday products to sophisticated niche applications. While composites have already proven their worth as weight-saving materials, the current challenge is to make them cost effective [1]. The efforts to produce economically attractive composite components have resulted in several innovative manufacturing techniques currently being used in the composites industry. It is obvious, especially for composites, that the improvement in manufacturing technology alone is not enough to overcome the cost hurdle. It is essential that there be an integrated effort in design, material, process, tooling, quality assurance, manufacturing, and even program management for composites to become competitive with metals.

BENEFITS OF COMPOSITES:

In comparison to common materials used today such as metal and wood, composites can provide a distinct advantage. The primary driver and advantage in the adoption of composites are the lightweight properties. In transportation, less weight equates to more fuel savings and improved acceleration [2]. In sporting equipment, lightweight composites allow for longer drives in golf, faster swings in tennis, and straighter shots in archery. While in wind energy, the less a blade weighs, the more power the turbine can produce.

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Besides weight savings, the most important benefits of composites include:

- Non-corrosive
- Non-conductive
- Flexible, will not dent
- Low maintenance
- Long life
- Design flexibility

Application and composition of composite materials:

- Weight reduction up to 20 to 50%.
- Single-shell moulded structures provide higher strength at lower weight.
- High impact resistance. For instance, Kevlar (aramid) armour shields planes have reduced accidental damage to the engine pylons that carry fuel lines and engine controls.
- High thermal stability
- High damage tolerance enhances accident survivability
- Resistant to fatigue/corrosion
- Structural components made of composite materials are easy to assemble.
- Recycling used parts from decommissioned aircrafts is another option available when using aerospace composites.
- The Boeing Company is especially associated with enhancing the ecological execution of the planes by embracing reusing of all the air ship materials made utilizing composites.
- Although reusing of an air ship structure is a mind boggling and costly process, it might spare cash in buying costly direct parts
- With expanding fuel costs, business aviation producers are under strain to upgrade the execution of flying machines, for which weight decrease is a key factor.
- Based on the advance that is being made in composite development strategies, it is likely that the plane of tomorrow will be fabricated utilizing composite materials.
- However, there are still a few obstacles to overcome before composites can supplant aluminium and other metal compounds totally, especially if there should arise an occurrence of substantial planes.

LITERATURE REVIEWOF COMPOSITES REINFORCED WITH SHRIMP POWDER

Many researches are made on the development of the polymer composite reinforced with shrimp powder with the combination of different composite material's among them. There ain't no reason why we can't replace plastic with something biodegradable. Here's one option: a material called shrilk [3]. It is made from a chemical in shrimp shells called chitosan, a version of chitin--the second-most abundant organic material on the planet, found in fungal cells, insect exoskeletons, and butterfly wings. Researchers at Harvard's Wyss Institute for Biologically Inspired Engineering said the material could be relatively easily manufactured inmass quantities and used to make large 3D objects. The material breaks down within a "few weeks" of being thrown away, and provides nutrients for plants, according to a statement [4].

According Researchers at Egypt's Nile University are developing a way to turn dried shrimp shells that would otherwise be thrown away into thin films of biodegradable plastic they hope will be used to make eco-friendly grocery bags and packaging.Six months into their two-year project, the research team has managed to create a thin, clear prototype using chitosan, a material found in the shells of many crustaceans.Egypt imports around 3,500 tonnes of shrimp, which produce 1,000 tonnes of shells as waste... Instead of throwing the shells away, we can make biodegradable plastic bags," Hani Chbib, a researcher on the project, told Reuters [5]. The project is a collaboration between the Nile University team of four and another research group at the University of Nottingham in Britain, where Samy conducted her post-doctoral research and first started experimenting with the idea.The team has only produced small samples and the project is not yet ready to go into

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commercial production but the team is working hard to develop properties that would allow the material to go into widespread use. In this editorial as discussed the scheme is complete out of shrimp powder. In everyday use we utilize prawns for our diet and its shell is detached out as desecrate and dumped away. In a regular of nearly of prawn's 2, 23,095 metric tons are in use a day in a country. And its desecrate is surplus out as desecrate. Shrimp powder has a high-quality power and resistance concerning the composite substance knowledge. Previously the discarded wastes of crab shells, sea shells, and fish shells are used as recyclable resources in composites [6]. These natural ecological resources are supplementary with matrix and are prepared into a composite material.As the free availability of the shells that are surplus as desecrate and which are ecological are used for manufacture composites. Yet the dried out prawn shells have a high-quality expandable modulus and critical potency. From the time when there is a quick raise in the stretchy moduli of prawn shell & one-off crab chitin on exposure to air, as in supplementary arthropod missiles, it is completed that below usual useful use during life, cuticle water significantly reduce the embrittling special effects of the dead salt stage. It would come into view then that a live wet cuticle is a composite fabric which exhibit together reasonable suppleness and sufficient power and hardiness.

Araldite Resin XIN 100 / Araldite Hardener XIN 900 are a multipurpose, two components (Epoxy, Hardener), good at room temperature curing, liquid adhesive of high strength and toughness. Araldite Resin XIN 100 / Araldite Hardener XIN 900suitable for materials like metals, ceramics, glass, rubber, plastics and most other materials in common use. It is a good adhesive for the craftsman as well as most industrial applications [7].

	Araldite Resin XIN 100	*Araldite Hardener XIN 900*	Mix
Colour (visual)	neutral	pale yellow	pale yellow
Specific gravity	ca. 1.15	ca. 0.95	ca. 1.05
Viscosity at 25°C (Pas)	30-50	20-35	30-45
Pot Life (100 gm at 25 C)	-	-	ca. 100 minutes

Table: 1 Specification of epoxy resin Processing

Pre-treatment

If the strength and durability of a bonded joint depends on what kind of treatment on the surface is done before bonding. At least, joint surfaces should be cleaned with a good DE-greasing agent such as acetone, iso-propanol (for plastics) or other DE-greasing agents in order to remove all traces of oil, grease and dirt. Low grade alcohol, gasoline (petrol) or paint thinners should never be used, because it reacts quickly and can be harmful. The strongest and most long-lasting joints are obtained by either mechanically abrading or chemically etching the DE-greased surfaces.

Application of adhesive:

The resin/hardener mix may be applied manually or by using robot to the dry joint surfaces. A layer of adhesive 0.06 to 0.12 mm thick will normally impart the greatest lap shear strength to the joint [8]. The joint components should be placed and dried in a fixed position as soon as the adhesive has been applied.

Mixing ratios of Epoxy and Hardener:

The best case is a 1/1 ratio with even viscosity, worst case is a 10/1 ratio with a wide viscosity difference. It also depends on the type of epoxy resin/Hardener used. The type of cartridge can also have a dramatic effect on dispense quality, especially when used in a pulsing mode. Larger and thin walled cartridges can induce a lead/lag effect where resin/hardener shows an extreme ratio change in a very short period due to the expansion and relaxation of the cartridge barrel. The thicker walled cartridges show much less tendency to produce this lead/lag effect which is a primary cause on intermittent tacky on small, Potting or casting [9].

Mix ratio	Parts by weight	Parts by volume
Araldite Resin XIN 100	100	100
Araldite Hardener XIN 900	80	80

Table: 2 mixing ratio of epoxy resin

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Look and odour: Clear slight yellow, slightly viscous liquid with a slight ammonia-like odour Solubility in water: slight.

Experimental Procedure

Reinforcement Preparation

Manufacture of Shrimp powder from prawn wastes. Prawn shells that are surplus as wastes are taken in a necessary quantity. Prawn shell waste was in detail washed numerous times with cooled fresh water.Shrimp powder components (skull, thoracic and abdominal shell, cover, appendages, antenna, and maxillary case) were estranged and wash again. Shells were dried under the sun for 2-3 existence along with any kind of drier. The full wetness content is detached by drying the shells under the sun and also via a drier as fine **Figure** show the dried out prawn shells.

Mixing Ratios of Epoxy and Hardener

In all-purpose finest case is a ratio 1/1 with even viscosity, worst case is a 10/1 ratio with a wide viscosity difference. The kind of sealed unit can too have a theatrical result on give out excellence, particularly when used in a pulse mode. Larger and thin walled cartridges can persuade a lead/lag effect where A and B Demonstrate an great ratio alter in a extremely short era due to the growth and reduction of the preserved unit barrel. The thicker walled cartridges show much less tendency to produce this accompany/enfold because which is a main reason on uneven nasty area on little.

Boiling range: IBP 432°F (222°C) (IBP=Initial Boiling Point)Form and smell: Clear small yellow, somewhat glutinous fluid with a minor ammonia-like smell.
Solubility in water: small.

Figure 1: Dried prawn shells

Figure 2: Epoxy resin Araldite AW106, hardener HV959

Molding:

When hand mixing the epoxy resins and the hardeners, it is best to pour the resin into the mixing vessel first in a container. The resin and hardener are added in the ratios and mixed in the container for a time until we get a good vertex in the middle of the solution in the container. When a good vertex is obtained in the solution then the seeds powder is added to the vertex of the matrix in the container. The powder mixed into the matrix is stirred using a stir stick manually or by using mechanical machine until it forms a good mixture. It doesn't require any temperature or heat. The mixture should be mixed without any bubbles and it must be clean and free from dust as well. It should make a uniform distribution throughout the composition by scraping the sides and bottom of mixing vessel frequently.

Figure 3: Ratio epoxy resin and hardener

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Figure 4: Epoxy resin, hardener & shrimppowder

Figure 5: After curing natural composite panels

Figure 6: Test specimen after curling

Testing

Impact testing:

In actual practice, engineering components during the examination are invariably subjected to various kinds of loads namely static and dynamic loads. Dynamic loads are distinguished by high rate of change in load magnitude and direction. Reverse happens in case of static loads. In the hardness test and tensile tests, load is increased very slowly that corresponds to the behaviour of material under more or less static loading condition. Very wide range rate of loading can be used in tensile test. Rate of loading leads the strain rate and so rate of hardening which can affect mechanical behaviour of material.

Figure 7: Specimen shown for Impact Test

Figure 8: Specimen shown for impact test.

Tensile Test:

This test is carried out with accordance of IS 1608:2005. This testing process involves the test specimen to be placed in a testing machine and applies tension to it till it get fractured. The tensile force recorded as function of increase in the gauge length. A point load was applied along the centre of the span of the corrugation. The maximum load at the point was noted, which gives the splitting load for the corrugated specimen.

Figure 9: Specimen shown UTM

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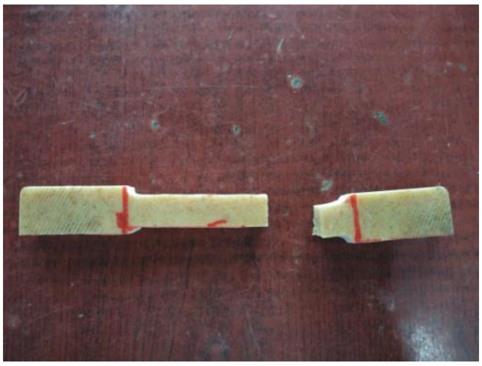
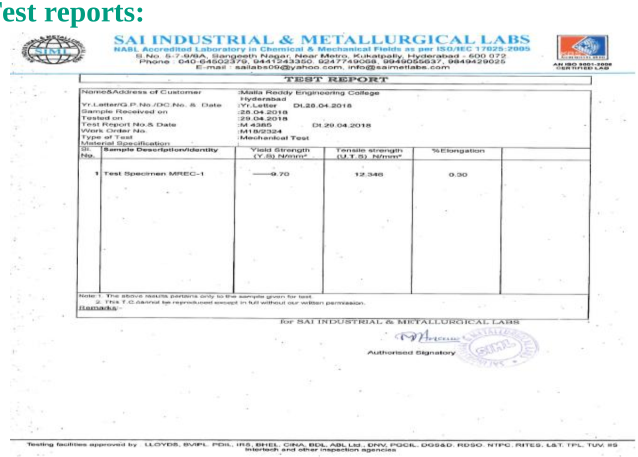


Figure 10: Specimen shown after tensile testing.

Rockwell Hardness Test:

The figure shows the Rockwell shore hardness tester and figure shows the process of Rockwell hardness tester. The Rockwell hardness test method consists of indenting the test material with a diamond cone or steel ball indenter. The indenter is forced into the test material under initial minor load F0 usually 10 kgf. When equilibrium has been reached, an indicating device, which follows the movements of the indenter responds to changes in depth of penetration of the indenter, is set to a datum position. While the initial minor load is still applied an additional major load is applied with resulting increase in penetration.At what time balance has again reached, the additional major load is removed but the initial minor load is still maintained. Removal of the additional major load allows a partial recovery, so decreasing the depth of penetration the permanent raise in depth of penetration, is used to compute the Rockwell hardness number.

Test reports:



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E-mail : sailabs09@yahoo.com, info@saimetlabs.com

TEST REPORT

Name&Address of Customer	:Malla Reddy Engineering College Hyderabad
Yr.Letter/G.P.No./DC.No. & Date	:Yr.Letter Dt.28.04.2018
Sample Received on	:28.04.2018
Tested on	:29.04.2018
Test Report No.& Date	:M 4385 Dt.29.04.2018
Work Order No.	:M18/2324
Type of Test	:Mechanical Test
Material Specification	

Sl. No.	Sample Description/Identity	Yield Strength (Y.S) N/mm²	Tensile strength (U.T.S) N/mm²	%Elongation	
1	Test Specimen MREC-1	9.70	12.346	0.30	

Note: 1. The above results pertains only to the sample given for test.
2. This T.C.cannot be reproduced except in full without our written permission.
Remarks:-

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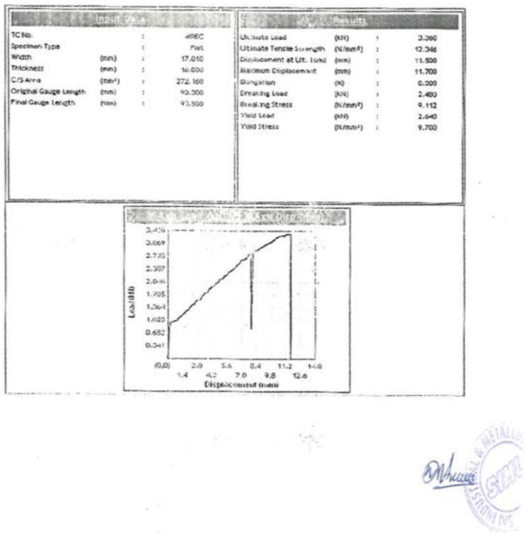
Authorised Signatory

Testing facilities approved by : LLOYDS, BVIPL, PDIL, IRS, BHEL, CINA, BDL, ABL Ltd., DNV, PGCIL, DGS&D, RDSO, NTPC, RITES, L&T, TPL, TUV, IIS Intertech and other inspection agencies



Input Data

TC No.		:	MREC
Specimen Type		:	Flat
Width	(mm)	:	17.010
Thickness	(mm)	:	16.000
C/S Area	(mm²)	:	272.160
Original Gauge Length	(mm)	:	93.200
Final Gauge Length	(mm)	:	93.500

Results

Ultimate Load	(kN)	:	3.360
Ultimate Tensile Strength	(N/mm²)	:	12.346
Displacement at Ult. Load	(mm)	:	11.500
Maximum Displacement	(mm)	:	11.700
Elongation	(%)	:	0.300
Breaking Load	(kN)	:	2.480
Breaking Stress	(N/mm²)	:	9.112
Yield Load	(kN)	:	2.640
Yield Stress	(N/mm²)	:	9.700

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TEST REPORT

Name&Address of Customer	Malla Reddy Engineering College Hyderabad
Yr.Letter/G.P.No./DC.No. & Date	Yr.Letter Dt.28.04.2018
Sample Received on	28.04.2018
Tested on	29.04.2018
Test Report No.& Date	M 4388 Dt.29.04.2018
Work Order No.	M18/2324
Type of Test	Mechanical Test
Material Specification	

Sl. No.	Sample Description/Identity	Impact Joules Charpy 'V' at Room Temp.	Shore Hardness
1	Test Specimen MREC-1	0.5 Joule	62 Shore D
2	Test Specimen MREC-2	0.5 Joule	62 Shore D
3	Test Specimen MREC-3	0.5 Joule	62 Shore D

Note: 1. The above results pertains only to the sample given for test.
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Results and FUTURE SCOPE

As per above testing results it is proved that this material can with stand up to the 3KN Load comparative to other composite materials fillers such as coconut shell powder,tamrid seed powder.

Water Test: An observational experiment is also experimented by placing the above composite in water for 48 hours and it is observed that there is a not much absorbance of the water by the composite; minute moisture can be seen on the internal structure of the composite. This shows that this composite material there is an advantage of using this as water proofing material where it can be treated as roofing material, internal automobile accessories and many other various uses can be found.

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Conclusion

It is also tested roughly by placing the above composite in water for 48 hours and it is observed that there is a slight absorbance of the water by the composite. The weight of the composite is compared before and after placing in water, there is a minute increase in the weight (i.e. 0.1%). This shows the fabricated composite is a slow absorbent of water. But compared to the other composites it shows better results. From the above results the above prepared, composite can be used as the as false roofing instead of the thermocol and Plaster of Paris. The above natural composite prepared can also bear the fire while the thermocol cannot withstand under fire conditions. The shrimp powder composite can be a best replacement for thermocol, Plaster of Paris and it give a grandeur look to the sealing.

The figure shows how we can use the composite as the false roofing. Further testing of the above composite material in various aspects, such as automobile industries, construction industries, it can be of great use in the market in various fields

Figure 11: Showing the example of false roofing

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