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Review of Investigation on Mechanical Behaviour of Hybrid Composite Material

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A B S T R A C T

Based on review of various journal papers about composite material, we had learned more information, and those details were noted over here. Nowadays poultry waste, agricultural waste, animal waste, and natural fibers are using to make composite material. Which are providing sufficient mechanical, physical, chemical, and thermal properties in various application like marine, automobile, aerospace, medical, construction blocks, domestic applications, and packing material etc. These fibers and fillers have been more advantages like less weight, easy to avail, low cost, recycle of waste, nontoxic, and environmentally friendly. And these products are giving better advantages than inorganic materials.

Keywords: Poultry waste, Agricultural waste, Animal waste, and Natural fibres.

1. LITERATURE REVIEW

Mohammad irshad ansari et al.[1] experimentally studied about cement mortar using chicken feathers and eggshell powder. They noted as chicken feather and eggshell can be used effective due to water and it increase the strength and some other properties of mortar which are necessary for the construction. Chicken feather shows more compressive and flexible strength as compared to eggshell. The fibrous part can only be used. At eggshell contain calcium we can't use it in access amount because it results in disturbing the binder property of mortar and it get failed. So, we use eggshell in lesser amount in powder form only. Compressive and flexural property was decreased by increasing the amount of eggshell powder.

A. Asha and V. Chandra Sekhar [2] investigated on the mechanical properties of eggshell powder reinforced polymeric composites. They used polyamide, nylon black, and eggshell powder and conducted test like tensile strength, impact strength and flexural strength. They noted few points as polyamide/nylon black eggshell composites have been successful fabricated by injection moulding. It has been noticed that the mechanical properties of the composites such as tensile strength, flexural strength, and impact strength of the composites are also greatly influenced by the eggshell powder percentage. Tensile strength, flexural strength, impact strength of the polyamide/nylon black eggshell composites increases with increasing of eggshell powder percentage. The tensile, flexural, impact strengths of nylon black composites are more as compared with polyamide composites. Finally, they suggested that these materials are preferred where the combination strengths are required to get good results with low cost.

Pavan Hiremath et al.[3] investigated of the mechanical properties of glass fiber – chicken feather hybrid composite. They used polyester resin, glass fiber plies, chicken feather as filler material to make hybrid composite material by the hand-layup process and tested like tensile strength, flexural strength, impact strength, and Scanning Electron Microscopy (SEM). They noted few information as the hybrid composites possessed good mechanical properties and more chemical uptake/composite loss than unfilled composites. The 10 wt.% chicken feathers-filled hybrid composite showed maximum tensile strength (193 MPa), flexural strength (148 MPa) and impact strength (3.65 Joules). SEM reveals good interfacial bonding between the feather, fiber, and matrix.

Akindapo jacob Olaitan et al.[4] investigated a comparative assessment of mechanical behaviour of groundnut shell and rice husks as reinforcement in epoxy matrix. They used epoxy, groundnut shell, reinforcement, and rice husk. They noted that the groundnut shell – epoxy composites displayed higher mechanical properties as compared to the rice husk - epoxy composites. This behaviour is expected as groundnut shell particulate fibers are relatively harder and more brittle than the corresponding rice husk fibers. The impact strength and composite hardness increases steadily as the content of fibers increases for both composite while the tensile and flexural strengths were observed to decrease with increasing percentages of the fibers. This were attributed to the problem of fiber misalignment and delamination noticed during the experimental work. The optimal composite developed has been employed in the production of Bajaj tricycle rear bumper. The mechanical properties of the bumper compared favorably with that produced using steel and E-glass fiber in Epoxy composite. The mechanical properties of these natural reinforcements in epoxy matrix compare favorably with the results obtained using other natural reinforcements such as coconut fiber, palm kernel fiber as reinforcement in epoxy.

Abdullah A. Hussein et al.[5] investigated, Water absorption and mechanical properties of high – density polyethylene/ egg shell composite. They used high-density polyethylene (HDPE) and eggshell powder. They noted few points that the parameters such as tensile strength, tensile modulus, elongation at break and impact test were carried out on the prepared samples. It was found that the addition of eggshell powder to the polymer leads to decrease the tensile strength, modulus of elasticity, shore-D hardness on other hand it increases the % elongation at break, and for the impact strength. Water absorption of the composites behaviours as function of days has also been investigated, and it increases by increasing exposure time for the same filler content, while the absorbed amount of water increases, by increasing the wt.% of eggshell constant exposure time.

B. Sudharsan et al.[6] investigated on Mechanical Behaviour of Eggshell and Coconut Coir Reinforced Composites. They used coconut coir fiber, eggshell powder, epoxy, and hardener to make composite. They noted few points as the materials of CE composite had taken in different ratios are mixed with resin and hardener and made into geometrical shapes. These have been tested experimentally for impact, compression and tensile tests. The results reveal that high compression strength is obtained for C5 composition, because eggshell has good compressive strength. For tensile test C1 composition has good tensile strength and strain, because coconut coir fiber has good tensile properties. In the C1 composition the coconut coir percentage is more than eggshell powder. So, from the present work it is concluded that the tensile strength of composite depend on coir fiber and compression strength of composite depend on eggshell quantity.

K . Velmurugan et al.[7] studied on mechanical properties of bio material filler and jute fiber feathers reinforced hybrid composite. They used Feather, Jute Fiber, Eggshell Powder, and Epoxy (LY556)+Hardener (HY951) as mentioned in figure 1.

Figure -1 Composition of materials

Specimen	%wt of Jute	%wt of Feather	%wt of Egg shell	%wt of Resin
A	25	5	10	60
B	20	5	15	60

They studied mechanical properties and noted their result as Maximum Ultimate tensile strength of 10% of eggshell powder composite is found to be 17.47MPa when compared to13.48Mpa 15% of eggshell powder composite. Maximum young's modulus of 10% of eggshell powder composite is found to be 2.90Mpa when compared to 1.28MPa 15% of eggshell powder composite. Maximum impact strength of 15% of eggshell powder composite is found to be 4.5joules/mm2 when compared to 4.2joules/mm2 10% of eggshell powder composite. Maximum hardness of 10% of eggshell powder composite is found to be 6193.83 BHN when compared to 4115.46BHN 15% of eggshell powder composite.

Santosh A. Goudar, and Vidyasagar Shetty [8] comparatively studied on Mechanical Properties of tamarind shell and groundnut shell particles reinforced epoxy composite. tamarind shell, groundnut shell, Epoxy composites. They made composition as below in figure 2 and got result of mechanical test as below in figure 3.

Figure - 2 Designation of Composites

Particles	Compositions
Tamarind	Epoxy (40wt. %) + Tamarind shell particles (60wt. %)
Groundnut	Epoxy (40wt. %) + Groundnut shell particles (60wt. %)

Figure - 3 Mechanical properties of Composites

Composite	Tensile Strength (N/mm^2)	Peak bending Load(N)	HRM
Tamarind	12.36	176.5	78
Groundnut	10.86	98.1	74

And they noted few information as the variation of tensile, bending and harness properties of the tamarind shell particulate composite and groundnut shell particulate composites were studied. From experimental results, it is found that, compared with groundnut shell particulate composite, the tamarind shell particulate composite provides better mechanical properties. This behaviour is because of tamarind shell particulates are relatively harder and more brittle than the groundnut shell particulates.

2. CONCLUSIONS

Based on literature review, we learned more information as eggshell powders are providing better tensile strength, flexural strength, and impact strength up to certain percentage of weight. after that, it is losing their properties because of improper bonding. The 10 wt.% chicken feathers-filled hybrid composite showed maximum tensile strength (193 MPa), flexural strength (148 MPa) and impact strength (3.65 Joules). Impact strength, hardness flexural strength, and tensile strength for groundnut shell reinforced epoxy composite material and rice husk reinforced epoxy composite are greatly influenced by the percentage of reinforcements present in the composite.

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