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Evaluation of Izod Impact Strength of Novel Pineapple Fiber Composite Laminate with and without the Reinforcement of Aluminum Wire Mesh

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Abstract

Using an izod impact strength tester, this study aims to evaluate and analyze the impact resistance of innovative pineapple fiber laminates with and without aluminum wire mesh reinforcement. Experimental groups are done using novel pineapple fiber reinforced with aluminum wire mesh of grade (pineapple/aluminum/pineapple/aluminum/pineapple). The control groups are done using novel pineapple fiber without reinforcement of aluminum wire mesh. The drilling operation will use an AlTiN coated drill bit, which was specifically chosen for the task. Feed rate (mm/rev) and cutting speed (m/min) are the input variables. With 80% of total G power, the sample size is calculated to be 40 individuals (20 per group). This research conducted as per ASTM D256-10 standard. The Izod impact strength value for both control and experimental group are determined in this research SPSS software was used to do the statistical analysis, and after plotting the graphs, a significance threshold of $p = 0.000$ ($p < 0.05$) was determined. Regarding the scope of this investigation, novel pineapple fiber laminate reinforced samples with aluminum wire mesh composite exhibits Izod impact strength of and the samples without aluminum wire mesh composite exhibits Izod impact strength.

Keywords

Pineapple fiber, Izod impact strength, Sandwich composite, Novel aluminum wire mesh, Sustainable, Machining

Introduction

The investigation compares and analyses the testing the Izod impact strength of a novel pineapple fiber laminate and a novel pineapple fiber reinforced with aluminum wire mesh sandwich composite [1]. After research on composite manufacturing technology for many years, the process to enhance the machining of their materials based on the many varieties of operation remains a challenge [2]. Presently, various product manufacturers have moved to novel pineapple fiber reinforced composite (FRC) [3]. Due to the advantage in acceleration of tool wear from the usage of synthetic FRC [4]. One of the important types of NFR composite unceasing it is novel pineapple FRC [5]. KFRAC comprises pineapple fiber and aluminum wire mesh Sandwich composite as the composite material and as binder separately [6]. The applications of pineapple fiber are trending in most of the leading fields such as automobiles, cabinetwork, wadding and construction [7].

In this analysis, general properties of pineapple fibre built up composites, as fast as mechanical properties, such as tool wear properties, will be explored. Testing by Izod impact strength tester is a kind of machinability investigation which provides the maximum strength of a material [8]. The Izod impact one key property identifying the composites strength [9]. The machining properties of

composite materials is a challenge than its creation [10]. There is more research and test results being done to identify the machinability of pineapple FRC and its drilling characteristics [11]. In addition, the assembling procedures will be discussed and its specialisations that should be addressed in the future, and the general properties of natural fiber supported composites have been distributed [12, 13]. While analysing the research papers related to pineapple fiber, provides clear results [14].

The innovative composites presented in this research have not been studied for machinability. Cutting and the Izod impact strength investigation left machinability unsolved. The study will compare the Izod impact strength of pineapple fiber reinforced with aluminum wire mesh sandwich composite with plain pineapple fiber using 20 samples per group.

Material and Methods

The fabrication process was done at the university, Thandalam, Chennai. No ethical approval needed since no human samples were used. Using mean and SD, sample size was estimated for 2 groups [15]. Novel pineapple fiber was used for control groups. without reinforcement of aluminum wire mesh. Intervention groups were made using reinforcement of aluminum wire mesh. The published data of mean 0.54387 and SD of 0.25691 were used to calculate sample size [16].

For group 1 sample preparation, pineapple fiber hand stitched by fiber region, Chennai, India. For forming the composite epoxy LY-556 and hardener LH-556 shown, which is used in 10:1 ratio which is collected from Hayavel Aerospace India Pvt. ltd, Chennai, India. It is to measure the Izod impact strength of the PFR with aluminum WMSC and plain pineapple laminated fiber. The composite material strengthened by a lattice of aluminum wire is the hand layup. Dimension of composite is 150 mm x 150 mm and the thickness of the composite laminate is 5 mm [17].

Polished wax is applied all over the mould to remove the sample after fabrication with ease. 80% of epoxy is used in 40% of pineapple fiber for fabrication and aluminum wire mesh. After fabrication, the weight of each sample was calculated and left it for 24 h to cure. For group 2 sample preparation, the same fabrication procedure is followed but aluminum wire mesh is not used. The novel pineapple fiber is laminated by hand lay-up method and the curing time takes up to 6 - 7 h. The samples were cut as per required sizes for drilling.

Testing was performed on the Izod impact strength tester machine under the distinctive machining conditions and safety measures [18]. All the samples were parted as per required sizes. The Izod impact strength results would be useful to compare the EG vs CG in order to determine which group has the best impact quality. Process of machinering samples was done as per the standards. To measure the Izod impact strength the charpy Izod impact strength tester was used. The obtained test results were analysed and allowed to calculate the end results.

Statistical analysis

The relevance of pineapple fiber with and without the addition of Aluminum wire mesh was analyzed using an independent samples T-test. The mean, standard deviation, and standard error were computed using SPSS V.26 for statistical analysis. The hammer's angle and weight serve as the experiment's independent factors; the resulting Izod impact strength (J/m) serves as the dependent variable [19].

Results

First-group samples (PFRCL) and second-group samples (PFRWAWMCL) are completed thinking about the speed and the impact of the fiber. According to the findings, the proposed composite has a weaker Izod impact strength than the unidirectional fiber composite. The sustainable development of materials is focused on this investigation.

The corresponding Izod impact strength values of first-group samples and second-group samples are shown in table 1. Table 2 displays the results of an independent T-test examination of the data collected from each group. Tabular representation of the Levene's test for equality of variances. The first-group sample (PFRCL) after testing the Izod impact strength has been shown in figure 1. Group 2 samples (Pineapple fiber reinforced with aluminum wire mesh composite laminate) which were before testing was shown in figure 2. Figure 3 shows resin used for group 1 and group 2 sample fabrication. Figure 4 shows the Izod impact strength tester which is employed to measure the Izod impact strength on drilled holes. The graph for comparing means of group's samples observations is shown in figure 5.

Table 1: Impact energy (Izod) values.

Trail no.	Izod impact strength (J/m)	
	Laminated composite material made of pineapple fiber	Composite laminate made of aluminum wire mesh with pineapple fiber reinforcement
1	36.06	55.73
2	48.56	54.42
3	37.47	54.39
4	46.11	52.03
5	47.58	57.18
6	44.91	51.67
7	37.15	54.9
8	45.09	53.63
9	36.59	52.1
10	48.42	52.33
11	47.05	57.33
12	45.02	52.15
13	38.35	54.75
14	47.66	51.42
15	38.8	56.31
16	43.23	51.74
17	37.35	52.04
18	42.28	55.44
19	39.23	56.51
20	46.23	51.07

Table 2: Independent T-test plots of group data.

T-test				
Numbers in a group				
Izod impact strength	**N**	**Mn**	**SD**	**SDEM**
With Al	20	53.8570	2.08572	0.46638
Without Al	20	42.6570	4.52628	1.01211

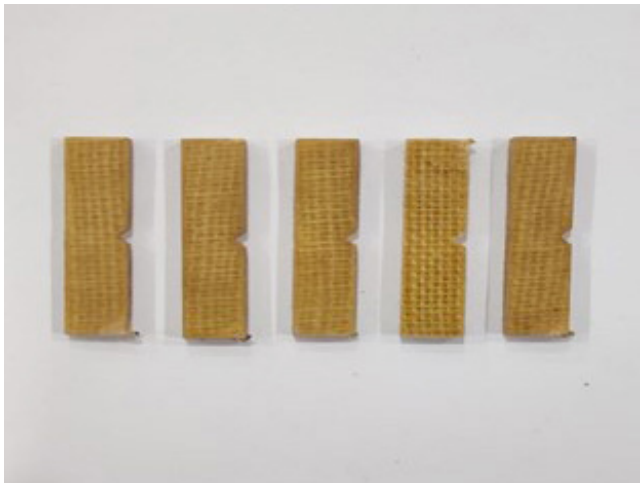

Figure 1: Group 1 (Pineapple fiber with aluminum mesh).

Figure 3: Resin used for group 1 and group 2 sample fabrication.

Discussions

Izod impact strength average of pineapple fiber reinforced with aluminum mesh is 53.8570 J/m and mean Izod impact strength of pineapple fiber reinforced without aluminum mesh is 42.6570 J/m. This finding demonstrates sustainable PFWAMC has a weaker influence strength than plain pineapple fiber composite. Also, the value of 0.000 ($p < 0.005$) was recorded as the significance [20].

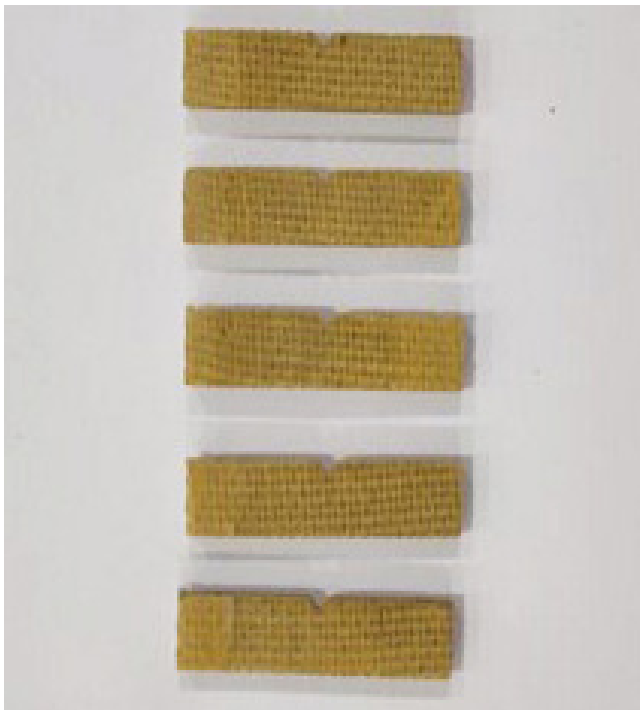

Figure 2: Pineapple fiber group 2 (No aluminum mesh).

Figure 4: Izod impact strength tester.

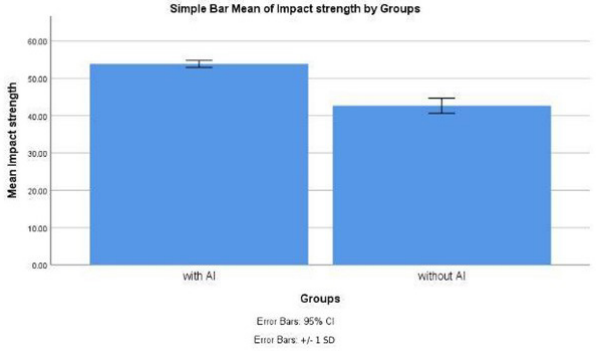

Figure 5: The impact strength of unique pineapple fiber samples reinforced with aluminum mesh (left) and without aluminum mesh (right) is compared using a bar chart. Based on the average values, it can be concluded that innovative pineapple fiber samples made without an aluminum mesh have a weaker Izod impact strength compared to those made with an aluminum mesh. Mean Izod impact strength of new pineapple fiber with and without aluminum mesh is plotted against a blank X. The Y-axis displays the group mean 1 SD with 95% CI error bars.

The testing of pineapple fiber with aluminum mesh and epoxy to deliver high strength, the best Izod impact strength relies upon cutting velocity and feed rate. The samples of pineapple fiber with aluminum mesh composite has an Izod impact strength of 0.60 J/m then without aluminum mesh composite [21]. Expressing that the measurable investigation has uncovered that machining boundaries fundamentally affect differences in machined impact completion and power delivered while cutting [22]. The Izod impact strength was uncovered to a minimum by utilising the aluminum mesh with 55% worth part of pineapple fiber. The impact finish can be improved by increasing the thickness of epoxy [23].

Though the proposed composite performed well, there is a limitation that intensity of an Izod strike for the sustainable combinations of and absence of aluminum wire mesh in pineapple fiber shows just the minor outcomes in this study. In the natural fiber composites can be treated well to avoid the considerable moisture absorption and de-bounding of alkali are the major drawbacks in this research. The Izod impact strength of drilling parameters in the fiber composites can be contemplated as an element of molecule size and content in future.

Conclusion

We found that, within the bounds of this study, novel pineapple fiber composite reinforced samples made with aluminum mesh had a mean Izod impact strength of 53.8570 J/m, while those made with only fibers from the fruit had a mean Izod impact strength of 42.6570 J/m. The average significance value for new pineapple fiber samples drilled using a carbide drill is $p = 0.010$ ($p < 0.050$), according to the Independent t test in SPSS software. In this study, it was found that the Izod impact strength of pineapple fiber samples reinforced with aluminum mesh was greater than that of pineapple fiber samples reinforced with only aluminum.

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None.

Conflict of Interest

None.

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