Data Article

Dataset on mechanical properties of natural fiber reinforced polyester composites for engineering applications

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A B S T R A C T

This dataset comprises the mechanical properties of sisal, sorghum bicolor and coconut coir reinforced polyester composites. The mechanical dataset illustrates the tensile, flexural, impact and hardness strength of natural fiber composites by varying the weight percentages from 5 to 25 wt.% of sorghum bicolor and coconut coir. The composites samples were fabricated by hand layup process. The mechanical properties were determined from in-plane tensile, flexural, impact and hardness of the natural composites. The dataset here helps the readers to understand the important properties of the natural fibres reinforced polyester composites. However, it is revealed that the addition of sisal and coconut coir fiber can enhance the properties.

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1. Data

The dataset presented herein were obtained from the mechanical tests of various percentages of natural fibers sisal, sorghum bicolour and coconut coir reinforced polyester composites. This data presents in this article constituted of polyester composites. All the data's (tables and figures) are presented by experiments.

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2. Experimental design, materials and methods

2.1. Materials

The polymer used in this work development was unsaturated terephthalic polyester resin in the pre-accelerated form, produced by Royal Polímeros under the commercial name of Denverpoly 754. The matrix material was utilized in this study Araldite-LY 556 with Amine Hardener HY 951, supplied by New scienti fi c Chemicals, Hyderabad, India. The natural fi bers were purchased from Ebenezer fi bre products, Coimbatore, Tamil Nadu, India.

2.2. Methods

The sisal and sorghum fi bers are cut into 260mm and 110mm respectively, and retting in water for cleaning about 3–4 days. Finally, both fi bres kept for dried to utilizing sunlight.

2.3. Preparation of specimens

The mould used in this work was made of plywood in dimensions given in Table 1. Fabrication of the composite material was done in this mold by the hand lay-up process. The mould is placed at atmosphere condition for preparing to make a composite material.

The top and bottom surfaces of the mold and walls were coated with wax, remover and allowed to dry. Initially, de-wax is applied as primary cote of mold and the releasing agent is spread over the bottom and wall of the wooden mold. The natural fi bers were distributed uniformly at the bottom of the mould which is prepared before. However, Hardener and catalyst are mixed together on a weight percentage of 1:0.5 to form a matrix. The natural fi bers are used in this composites as shown in Fig. 1.

The composite specimen consists of total 5 layers in which polyester resin layers are coated bottom, middle and top of the specimen. Second and fourth layers are formed by sisal, sorghum and coconut fi bers. The sisal, sorghum and coconut fi bers were cut into 30 mm, 30mm and 10mm length respectively and dispersed uniformly at the second and fourth layer of the mould. The matrix is dispensed above the natural fi bers consistently then compelled and pushed down with the iron roller to avoid and
eliminate the air bubbles [1,2]. After fabrication the composite specimen kept for several hours in sunlight for removing the moisture content [3,4]. As per the dimensions of mechanical tests, excess resin and edges of specimen are properly removed. Fabricated designation of specimen and weight % of fiber composition for hybrid composites as shown in Table 2.

2.4. Tensile strength

The tensile test was conducted on a Tinius Olsen 10 KN Universal testing machine (UTM) with a gauge length of 75 mm and cross-head speed of the machine was set at 5 mm/min. The specimen size for tensile test is 115 mm x 20 mm x 3 mm according to ASTM D638 [5]. Figs. 2 and 3 shows the tensile strength of polyester composites. Maximum tensile strength was achieved by the E specimen 90.4 MPa. When the natural fiber contents were increased in the polyester, the tensile strength and tensile modulus of the composites were increased.

2.5. Flexural strength

The size of specimen for flexural test is 110 × 15 × 3 mm according to ASTM D790 [5]. From Fig. 4 the results evidently proved; inclusions of natural fiber the flexural capability of the composite have been

| Table 1 |
| Dimensions of mould. |
| Specification of mould | Dimensions (mm) |
| Outer length | 255 |
| Inner length | 250 |
| Outer breadth | 255 |
| Thickness | 3 |

| Table 2 |
| Designation of composite specimen. |
| designation of specimen | weight % of natural fiber composition |
| | Sisal | sorghum bicolor | Coconut coir |
| A | 90 | 5 | 5 |
| B | 80 | 10 | 10 |
| C | 70 | 15 | 15 |
| D | 60 | 20 | 20 |
| E | 50 | 25 | 25 |

Fig. 1. a. Sisal, b. Sorghum, and c. Coconut coir.
Fig. 2. Tensile strength of Hybrid composites.

Fig. 3. Flexural strength of Hybrid composites.

Fig. 4. Impact strength of Hybrid composites.
increased to the specimen — E (40.3 MPa). The uniform distribution of natural fiber results may be in the variation of flexural strength value.

2.6. Impact strength

The Izod test specimen as per dimensions are 65 mm x 5 mm x 3 mm according to ASTM D256 standard [5]. Good adhesion between the fiber and matrix is also responsible for the good resistance to crack propagation during impact test. The increased fiber content will increase the contact area between the fiber and matrix, if there is good impregnation of fibers in the resin (Specimen E = 23.6 J/m²).

2.7. Hardness

As per the ASTM D2240 standard the specimen was prepared for the size of 35 mm x 15 mm x 3 mm [5]. Here, highest hardness was reached the Specimen E = 77.8. The reason of increasing the hardness is the better dispersion of fibers into the polyester matrix stronger interfacial adhesion to the fiber matrix. Hardness values of the composites as shown in Fig. 5.

2.8. Thermogravimetric analysis

The TGA (Thermogravimetric Analysis) and DTA (Differential Thermal Analysis) of test data is used to predict the effect of thermal stability and degradation of natural fibre composites (Figs. 6 and 7). This test is carried for the maximum mechanical strength achieved the composite specimen E (Sisal 50%, sorghum 25% and coconut coir 25%). For this test, the sample was prepared into powder form about 5mg. As expected, the two stages of degradation are evident in both the profiles which correspond to temperature regions of different constituents like moisture evaporation (upto 100 °C) and degradation of the hybrid composite material (100–400 °C). The depolymerization of composites usually occurs between 400 and 430 °C. The initial peak of fibers reinforced polyester composites was found at 93 °C which obviously represents the loss of moisture and other volatiles at the first degradation. It is observed between room temperature and 100 °C. The next peak which is obtained around 465 °C which denotes DTA degradation of natural fibers and the prominent peak appears at the temperature corresponding to the maximum degradation rate. Moreover, natural fiber reinforced with polyester composites increases the degradation temperature (400 °C–450 °C) due to retaining and improving the structural order to minimizing the amorphous content. A greater crystalline structure essentially requires a higher degradation temperature which is clearly evident in optimal natural fibers with polyester composites. The derivative thermo – gravimetric (DTG) curve shows the decomposition temperature of polyester composite material value which is above 400 °C.
Fig. 6. TGA of Hybrid composites.

Fig. 7. DTA of Hybrid composites.
This type of composite materials will not affect the environment. Natural fibres will be helpful for eco-friendly environment and biodegradable. These composites can be useful for automobile, industrial applications and construction fields.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.105054.

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