Mechanical Testing of Poly Hydroxy Butyrate Co Valerate and Natural Fiber by Varying Fiber Length

M. Selwin, N. Rajini

Abstract: ***The knowledge of 3D printing material used in 3D printing technique is so abundant. Even though there are many critical issues in practical applications. This paper reports the mechanical properties of Environmental friendly Bio composites. This composite material is intended to be used as a replacement for the current 3D printing material. The composite was prepared in compression molding technique under 150 kg/cm2 pressure. The composite consists of Poly Hydroxy Butyrate co Valerate (PHBV) and Sansevieria Roxburghiana. The tensile strength of the given specimen is found to be increased by the change in the volume fraction of fibers. Initially composite plates composed of both PHBV and Sansevieria Roxburghiana are prepared with different weight percentage of PHBV and different lengths of fiber such as 20mm, 30mm, 40mm and 50mm.***

Keywords**:** ***Environmental friendly Bio composites, Poly Hydroxy Butyrate co Valerate (PHBV), Sansevieria Roxburghiana, Compression molding.***

I. INTRODUCTION

A list of data obtained by conducting several experiment for both neat PHBV and wood PHBV composites of 10%, 20%, 30%, 40% wood content were examined by Luigi-Jules Vandi, Clement Matthew Chan. [2] The diffusive turning of PHBV filaments which were spun from arrangement utilizing a scope of polymer fixations, turn speed and spinneret to gatherer separates by Sarah J Upson. [3] The effect of using a combination of substrates on the synthesis of PHBV which indicates that PHBV was synthesized only when fructose was used as the sole carbon source by Asieh Aramvash. [4] Selective laser sintering was developed for fabricating interconnected porous biodegradable PHBV scaffolds with large surface area and relative porosities upto 80% by Sven H. Diermanna. [5] Demonstrating the interest of preparing PHBV/PBS blends and the possibility to control their structure and thermal properties by compatibilization with PHBV-g-MA by Salima Kennouche. [6] The impact of mixing and the expansion of little measure of TiO2 nanoparticles on the dynamic mechanical properties of PLA/PHBV mixes by J.P. Mofokeng A.S. Luyt B. [7] Biodegradable curcumin-stacked electrospun PHBV nanofibers were acquired with imperfection free morphology and their normal distances across extended from 207±56 to 519±15 nm by Gozde Mutlu. [8] PHBV films with dynamic fundamental oil mixes were exceptionally compelling against L. innocua and E.coli in vitro tests, yet they were significantly less viable in the genuine sustenance tried, except for the impact against E. coli in cheddar tests covered with PHBV- EU or PHBV-CLO films by Raquel Requena.[9] The impacts of g-illumination on PHBV/PLA: 50/50 w/w mixes brought about solid adjustments in the substance structure, particularly after 100 kGy of assimilated portion by Idris Zembouai. [10] Responsive expulsion convention for blending PHBV-g-GMA with a high GMA joining rate and few side responses by Ting Zheng.

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II. MATERIALS

A. Properties of Poly Hydroxy Butyrate Co Valerate

PHBV is obtained from bacteria which is biodegradable, non-toxic and bio compatible. It is very brittle in nature. It possess low elongation. The impact resistance of PHBV is also very low. When disposed it degrades into carbon dioxide and water. PHBV just like fats to humans it is the energy source to micro-organism. Enzymes produced by them degrades it and are consumed. The thermal stability of PHBV is very low with primitive mechanical properties. It has very high processing difficulties.

Fig.1. Extracted Sansevieria

B. Properties of Sansevieria Roxburghiana

The warm conductivity of the fiber diminishes with the expansion of fiber content. The expansion of Sansevieria decreases the Heat Release Rate. At the point when consumed it discharges more carbon dioxide than pitch composite.

The rigidity of Sansevieria fiber is 2.55 occasions more prominent than gum and the effect quality is 4.2 occasions more prominent than the pitch. Elasticity of composite is expanded by 18.16%, 36.49%, 102.97%, and 155.24% over virgin polyester at 0.12, 0.21, 0.28, 0.36 volume division of filaments individually.

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III. PROBLEM DEFINITION

The previous material which is utilized in the 3D printing strategy is for the most part made out of a material which is a standout amongst the most boundless biomass-based, biodegradable (compostable) and biocompatible polymers. It is water-insoluble, can be either straightforward or semi-straightforward relying upon polymer crystallinity, and optically dynamic. The primary downsides of the material are high fragility, moderate crystallization rate, and high penetrability to gases. The ways for beating these issues are to utilize plasticizers, copolymerization with different segments, making composites, and mixing with different polymers. So in order to find out an alternative to the pre-existing 3D printing material, a new composite has to be prepared which overcome its defects. Therefore a composite consisting of both Sansevieria Roxburghiana and Poly Hydroxy Butyrate co Valerate (PHBV) is to be prepared. PHBV also possess the properties of brittleness and low impact resistance and the tensile strength of composite increased with the change in the volume fraction of fibers. Apart from this, to decrease the utilization of cost of the printing material and also to reduce the toxicity in the pre-existing material, this composite of PHBV and Sansevieria Roxburghiana will be more needful. Thus a biodegradable replacement can be made thereby reducing all the environmental impacts that the previous materials has incurred. Thus it can be opted as a better replacement in order to eliminate all the health hazards. It can also be considered as a cost effective when compared to the currently using material as it composed of both PHBV and Sansevieria fiber which accounts for the low production cost if the composite plate. Thus it eliminates all the drawbacks of the currently used material.

IV. METHODOLOGY

The fabrication and mechanical testing PLA and Sansevieria based composite specimen is done by the methodology given

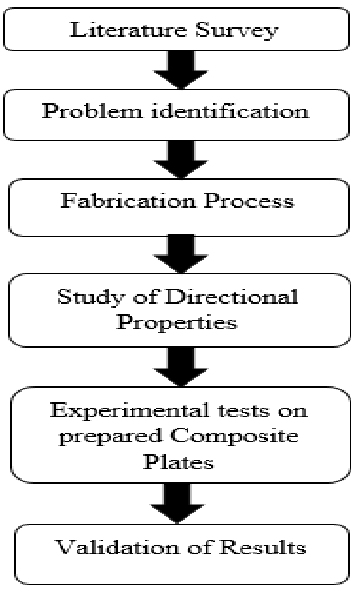

Fig.2. Methodology

V. PROCESS OF FABRICATION

A. Compression Molding

It is a shut form composite that utilizes coordinated metal molds with the use of outside weight. In this strategy a composite layup is set in the open form depression, the shape is shut and drive is connected. The weight stays in the form all through the cycle, which generally happens in a broiler. In this way a composite part with low void substance and high fiber volume portion is created with the mix of warmth and weight. It frequently yields composite parts that have the ideal mechanical properties conceivable from the specific mix of constituent materials.

B. Fiber Preparation

Initially Sansevieria fiber is prepared to be cut on different lengths such as 20mm, 30mm, 40mm, 50mm. Pure fiber is separated which does not contain green shades left over. Moreover, fine hair like structured fibers are separated in order to ensure that there are no thick pieces of fiber. This is done because such fibers can leads to improper plate preparation. The separated hair like fine fibers are eventually cut into different lengths.

Fig. 3. Extracted Sansevieria

C. Composite Standards

Table.1 Specimen details

Standard	Specification (mm)	Test	Fiber Length (mm)
ASTM D638	165*13*3	Tensile	20, 30, 40, 50
ASTM D790-92	127*13*3	Flexural	
ASTM D256	60*13*3	Impact	

Fig.4. Specimen Preparation

VI. RESULTS

The test results are plotted on graph having X-axis as sample number and the Y-axis parameter is taken as strength obtained in each test results in N/mm2. Three specimen for each testing gives twelve results in total. The average of the results is calculated and it is considered for the final conclusion. Thus the results are obtained and are plotted in the form of a graph which helps in providing a clear knowledge on the outcome of the results. The following table 2 consists of the list of results obtained from the appropriate test samples with PHBV with fibers of varying length.

Table 2. Test Results

S.no	Test parameters	20mm	30mm	40mm	50mm
1	Tensile Strength, N/mm^2	18.65	11.65	14.07	14.22
2	Flexural Strength, N/mm^2	33.42	35.68	39.46	39.22
3	Impact, Joules	3.4	2.5	2.5	2.8

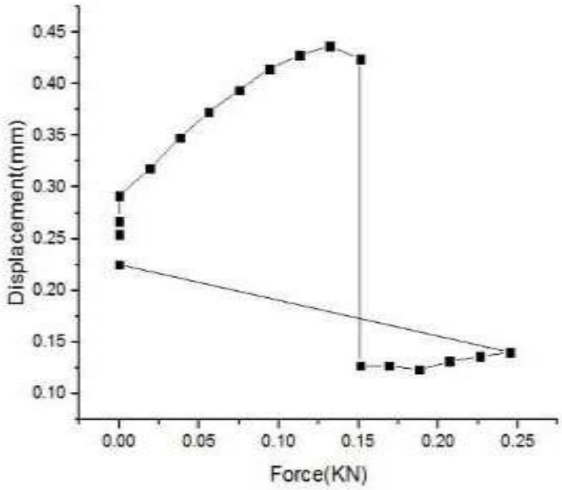

Fig.5. Load vs Displacement (20mm)

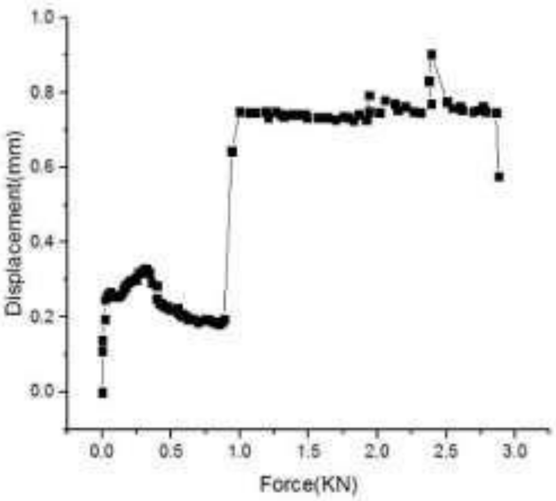

Fig.6. Load vs Displacement (30mm)

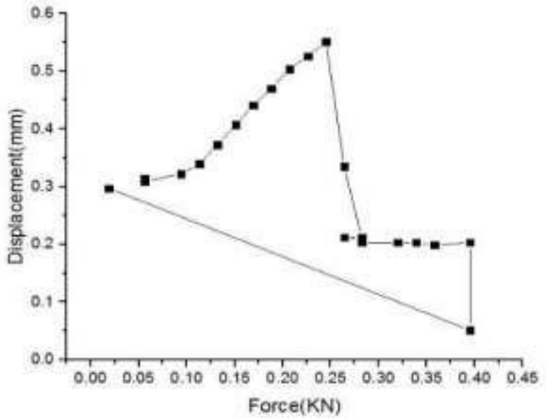

Fig.7. Load vs Displacement (40mm)

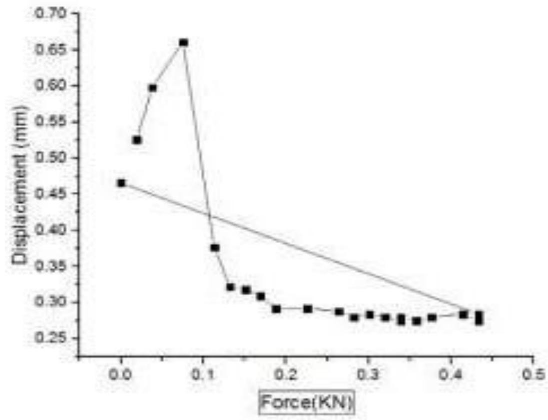

Fig.8. Load vs Displacement (50mm)

VII. CONCLUSION

This study focuses on utilizing Sansevieria Roxburghiana fiber and Poly hydroxyl butyrate co- Valerate powder as reinforcement towards producing bio degradable composites, thus bringing economic values to the Sansevieria Roxburghiana fiber. Composite plates of different length variation were prepared and the results shows that the sample with 20mm fiber has the highest tensile strength when compared to 30mm, 40mm and 50mm samples. Similarly, 40mm and 50mm plates contain high flexural strength and eventually 20mm sample contain high impact strength than the remaining samples.

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