

Effect of Bagasse fiber extraction process on mechanical properties of 3D printed Bagasse reinforced Composite Material

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Abstract

Sugarcane bagasse fiber is a good renewable and biodegradable substitute for the most prevalent synthetic reinforcement because of its minimal cost, high specific mechanical qualities, and availability. Better quality and performance composites with a lower weight-to-strength ratio are now required for a wide range of mechanical applications. To enhance their performance, natural fibers are sometimes modified using chemicals or blended with other materials. The main goal of this research is to represent the fabrication and evaluation of different mechanical properties of composite made from alkali-treated (1% and 5 % NaOH solution) bagasse fiber reinforced with UV resin using 3D printing technology and to analyze the effect of fiber extraction process on mechanical properties. Bagasse can be made from sugarcane residue collected from sugar mills and street vendors selling sugarcane juice. Bagasse must be thoroughly extracted from the sugarcane residue after collection. In this research, four different bagasse fiber extraction processes are used to achieve better mechanical properties. A chemical process utilizing sodium hydroxide solution has been used to extract bagasse fibers that are smoother and enhance the mechanical qualities of the fibers. The mechanical characteristics of this bagasse-reinforced composite material have been assessed using the tensile test. UV resin is used to reinforce composite samples made from treated bagasse fibers as part of additive manufacturing, also known as

3D printing. These samples of polymer matrix composites are made in accordance with applicable ASTM guidelines (ASTM d638, type-4). Several composite samples have been created after the fibers were extracted utilizing these procedures. It has been found that the 3D printing methodology does not result in bubble formation during the manufacture of the composite sample. Among the composite samples fabricated following four different extraction processes, one of them shows better tensile properties than the others.

Keywords

3D Printing, Tensile Test, UV resin, Industry 4.0, Composite, Alkali treatment, Fiber extraction.

Biographies

Nabil Chowdhury is an undergraduate student of Mechanical Engineering (ME) under the Department of Mechanical and Production Engineering (MPE) at the Ahsanullah University of Science and Technology (AUST). His research interest includes the area of Renewable Energy System, Composite materials, Computational Aerodynamics, Advance manufacturing, Thermo-Fluids. He is a member of IMechE (UK). He has participated along with his team (Team Primus) for the very first time from Bangladesh in “Formula Student UK 2019”(FSUK 2019) and achieved two awards- Allan Stainforth Award for Best Newcomer 2019 and RACE TECH Spirit of Formula Student 2019. He served as the executive for the tech festival "MINDSPARK 2019" which was international collaboration between AUST IDC and COGNIZANCE, IIT ROORKEE. He has taken part in different tech-based competitions and achieved prizes in Bangladesh like Macceleration'18, Mindsparks'19 etc. He is also a member of EMK Center. He is quite competent in Solidworks, Matlab, Fusion 360, Microsoft office, Autocad, XFLR5. He aspires to conduct in-depth research in his field of interest.

Kazi Ahasan Ekram is an undergraduate student of Ahsanullah University of Science & Technology from Mechanical Engineering program under the department of Mechanical & Production Engineering. His research interests include the area of natural fiber reinforced composites, material property analysis, mechanical behavior of materials, mechanical properties, aerodynamics, modeling and simulation. He experienced a short time industrial attachment at Bangladesh Industrial Technical Assistance Center (BITAC).

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Md. Ershad Khan is an Associate Professor in Textile Engineering under the department of Textile Engineering (TE) at Ahsanullah University of Science and Technology (AUST), Dhaka, Bangladesh. He has 16 years of professional experience in several industries as well as academia. He has completed his B.Sc. in Textile Technology and M.Sc. in Textile Engineering degree from Bangladesh University of Textiles (BUTEX). He is currently pursuing his Ph.D in Chemistry from Bangladesh University of Engineering and Technology (BUET). He was former member of Society of Dyers and Colourists (SDC, UK) and American Association of Textile Chemists and Colorists (AATCC). He is an active member of the Institution of Engineers, Bangladesh (IEB). He has authored a book titled ‘Technology of Denim Manufacturing’. Moreover, He has a good number of research articles published in various Journals and conference proceedings. His research interests include sustainable textile processing, smart textile materials, antimicrobial textiles, composite materials.

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