

Stereolithography 3D Printing of Bagasse Reinforced Composites

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Abstract

Bagasse is a form of natural fiber which obtained from sugarcane. It's the inner soft layer of the sugarcane stick which can be extracted from sugarcane stick after the removal of the sugarcane juice and sugarcane residue collected from sugar mills and street sugarcane juice producing vendors. Bagasse can be a good alternative of the other widely used natural fibers due to its wide availability, lower in cost, bio-degradability etc. Bagasse needs to be extracted and chemically treated to magnify its mechanical properties as chemically treated bagasse fibers shows better mechanical properties than the untreated fibers. The extracted fibers used to fabricate several composite samples using the additive manufacturing or the 3D printing method by a stereolithography (SLA) type 3D printer. 3D printing is a 3-dimensional object manufacturing method from a programmable digital model by adding material layer upon layer and SLA is a popular type of 3D printing method which is basically a liquid resin photocuring procedure where liquid resin is put in a reservoir placed over a laser beam and photopolymerization is started by scanning a positionally programmed laser over the resin surface. The basic criteria behind using an SLA type 3D printer is that the liquid resin which is the most widely used matrix for fabricating natural fiber composite can be used as the printing material and SLA 3D printed objects has other advantages like high accuracy, good surface quality, fit for testing etc. This paper discusses about the applicability of SLA type 3D printer for the fabrication of natural fiber particularly bagasse fiber reinforced composite. These samples are fabricated following the ASTM standard (ASTM d638, type-4). Mechanical property test like tensile test has been conducted to analyze these samples, to investigate the mechanical properties of these SLA printed bagasse reinforced composites, to observe the impact of SLA type 3D printing on the mechanical properties of bagasse reinforced composites and to determine the applicability of this fabricated composite material.

Keywords

Stereolithography 3D Printing, Bagasse Fiber, Composite and Tensile Test.

Biographies

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).

Rakibul Hasan Raihan is an undergraduate student of Ahsanullah University of Science & Technology from the Mechanical Engineering (ME Program) of the Mechanical & Production Engineering Department. His research interests include the area of computational fluid dynamics, energy science, machine design, Artificial intelligence and robotics, material science, engineering mechanics, fracture of composite materials, Renewable energy, powerplant technology etc. He has experience short time industrial exposure training at Ghorashal Power Station (GPS).

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.

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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