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TITLE: A FEASIBILITY STUDY ON DEVELOPMENT AND CHARACTERISATION OF 3D PRINTED COTTON POLY LACTIC ACID BIOCOMPOSITE

KEYWORDS: Additive Manufacturing (AM); 3D Printing (3DP): Fused Deposition Modelling (FDM); Poly Lactic Acid (PLA); Medical Surgical Cotton fabric.

Findings

The 3D printing method of Additive Manufacturing has significant role in the development and modernization of industrial revolution. Numerous technologies, such as stereolithography, selective laser sintering and fused deposition modelling are able to develop 3D structures for various demands. The FDM 3D printing is considered an advanced AM manufacturing method for the development of thermoplastic based parts. Researchers studied FDM 3D printing of PLA with whole biomass and biomass resources such as lignin, hemicellulose, and cellulose. These composites are environmental friendly and widely used in health care sector. Therefore development of the 3D printing of biocomposite with medical surgical cotton fabric and PLA is supporting and unique for such manufacturing. The development and characterisation of FDM 3D printed medical surgical cotton fabric- PLA biocomposite is the primary objective of this work. Experimental methods used for the development of biocomposites using three types of cotton fabric of pore sizes 0.6 mm x 0.6 mm, 0.8 mm x 0.8 mm and 1.0 mm x 1.0 mm with three different 3D printing pore sizes 0.5 mm x 0.5 mm, 1.0 mm x 1.0 and 1.5 mm x 1.5 mm. Tensile strength and percentage extension from tensile test and water absorption capacity from absorption behaviour tests has been analysed. It has been found that the development of biocomposites is feasible and tensile strength, percentage extension and

water absorption capacity increases with increase in 3D printing pore size and pore wall width for each fabric. The maximum 235.40 N and minimum 123.20 N tensile strength with maximum 2.288% and minimum 1.506% extension from tensile test, and maximum 7.63% and minimum 3.57% absorption capacity from water absorption test has been observed for the developed biocomposite. These behaviours of the biocomposite are adequate for the medical applications of medical surgical cotton fabric- PLA biocomposite. Low printing speed is the main limitation. However more works are required before considering this innovative material at common place. A combination of more fabric pore size and 3D printing size may be used and effect of variation in printing layer thickness can be tried and analysed.