MODELLING AND OPTIMIZATION OF COMPRESSIVE STRENGTH OF 3D PRINTED PLA SCAFFOLDS FOR BIOMEDICAL APPLICATIONS

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In this work, the compressive strength of 3D printed poly-(lactic acid) (PLA) scaffolds, designed for biomedical applications, was optimized. Three quantitative variables (porosity, in the interval 20 to 70%; printing temperature, in the interval 210 to 220 °C; and layer height, in the interval 0.05 to 0.15 mm) and one qualitative variable (scaffold structure, which can be G, D or P-type) were considered as decision variables and, consequently, as experimental factors. A Box-Banhken response surface design was chosen for carrying out the experimental study. Test specimens were designed by following the ASTM D695-15 standard, through the software CAS Wolfram Mathematica (version 11.2). Second order regression models were fitted the obtained data, showing a significant influence of the studied variables at a 90% statistical confidence level. P and G-type structures showed higher compressive strength values, being the most proper for biomedical application where forces are compressing the scaffold. The obtained optimal printing temperature value was 214 °C and the optimal layer height, 0.12 mm.

Keywords: Scaffolds, Poly-(lactic acid), Optimization

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