PREDICTING CONTROLLED DRUG RELEASE FROM INTRAOCULAR LENS USING A GENETIC ALGORITHM

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Abstract:

Cataracts, an opacification of the crystalline lens, are the leading cause of blindness worldwide, affecting about 25% of individuals over 65 and resulting in significant vision loss. Surgery is the primary treatment, but complications such as posterior capsule opacification can arise, especially in children, necessitating the use of intraocular lenses (IOLs) to restore vision. The intraocular lens was designed using SolidWorks® Premium 2022, ensuring its dimensions matched those found in literature. A master model was created and saved in STL format, followed by preparation for 3D printing using Chitubox software, which defined essential printing parameters. The lens was fabricated using PDMS, with a controlled curing process in a vacuum chamber and an oven to enhance its mechanical properties and optical transparency. IOL was impregnated with hydrophobic solutions of chloramphenicol in concentration of 10 mg/ml. Spectrophotometry was used to monitor drug release over time at the wavelength at which chloramphenicol shows absorption. Based on measured concentration, we used Genetic Algorithm (GA) method for creating computation model for in silico testing. Based on these results, we can conclude that the GA method shows excellent potential for accurate estimation. Its performance in modeling the current dataset indicates strong predictive capabilities. Therefore, it can be considered a useful tool for estimating drug release at other concentrations as well.

Keywords: intraocular lens, 3D printing, PDMS, chloramphenicol, Genetic Algorithm