FTIK-P30 PRINTABILITY OF POLOXAMER HYDROGELS: INFLUENCE OF POLYMER CONCENTRATION AND NOZZLE DIAMETER ON SEMI-SOLID EXTRUSION 3D PRINTING

T. Tasevska[1], L. Sharovikj[1], N. Geskovski[1], R. Popeski Dimovski[2], K. Goracinova[1], M. Simonoska Crcarevska[1]
[1]*Institute of Pharmaceutical Technology, Faculty of Pharmacy, Ss. Cyril & Methodius University in Skopje, North Macedonia,*
[2]*Faculty of Natural Sciences and Mathematics, Ss. Cyril & Methodius University in Skopje, North Macedonia*

Semi-solid extrusion (SSE) 3D printing is a versatile platform for fabricating personalized solid dosage forms with precise control over geometry and drug loading. Three P407/cefixime hydrogels containing ~20, ~40 and ~43% P407 (FA-1, FA-2 and FA-3) were prepared using the cold method and stored overnight at 4°C. Rheological characterization was performed by amplitude sweep using cone-plate geometry, measuring storage modulus, loss modulus, loss factor, complex viscosity, shear stress and torque. Printability was evaluated by filament formation through 22G and 25G plastic nozzles, followed by tablet printing and visual assessment of edge definition. The study investigated the influence of P407 concentration on rheology and printability. All formulations exhibited viscoelastic gel-like behavior and shear-thinning properties. Among the evaluated rheological parameters, storage modulus and complex viscosity most closely reflected differences in printability. FA-1 showed the lowest storage modulus ($G' \approx 31.2$ kPa) and complex viscosity ($\eta^* \approx 3.1 \times 10^6$ Pa·s), resulting in droplet formation and poorly defined tablets. FA-2 exhibited increased storage modulus ($G' \approx 37.9$ kPa) and complex viscosity ($\eta^* \approx 3.8 \times 10^6$ Pa·s), producing coherent filaments and improved print quality with the 22G nozzle. FA-3 exhibited the highest storage modulus ($G' \approx 95.7$ kPa) and complex viscosity ($\eta^* \approx 9.6 \times 10^6$ Pa·s) within the linear viscoelastic region, producing continuous filaments and well-defined tablets with both nozzles. Overall, P407 concentration played a critical role in determining printability, with FA-2 showing improved printability using the 22G nozzle, while FA-3 maintained excellent filament formation and printability with both nozzle diameters.

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