Microstructural design of 3D printed polypills

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3D printing of pharmaceuticals is a potential manufacturing solution for distributed healthcare offering unparalleled personalisation and sustainability[1]. 3D printed polypills can accommodate personalised doses of different drugs of varied functions and allow synergistic effects to improve treatments[2]. However, precise control of drug release relies on rational design of polypills[3]. Here, we present a parametric study of polypill microstructure design in terms of their dimensional precision and mechanical integrity. By direct control of optimised toolpaths, we designed a capsule polypill model with continuous and consistent extrusion to ensure the microstructures are predictably consistent. The polypill models consist of single-filament walls of variable wall thickness, since the wall erosion can be controlled by the geometry of the printed filaments[4], the basic building unit for 3D printing (Figure *1* a). Greater wall thickness (0.8 mm versus 0.4 mm) showed fewer interlayer geometric defects, which are usually regarded as the weakness point for mechanical and chemical attack. Additionally, greater wall thickness exhibited more rigid with greater compression force than thinner walls (Figure *1* b). We 3D-printed pharmaceutical-grade polymers and demonstrated a thickness-dependent model for rapid and slow release (Figure *1* c). This study highlights the importance of controlled deposition and microstructures of 3D printed polypills and provides new knowledge about structure-dependent drug release models.

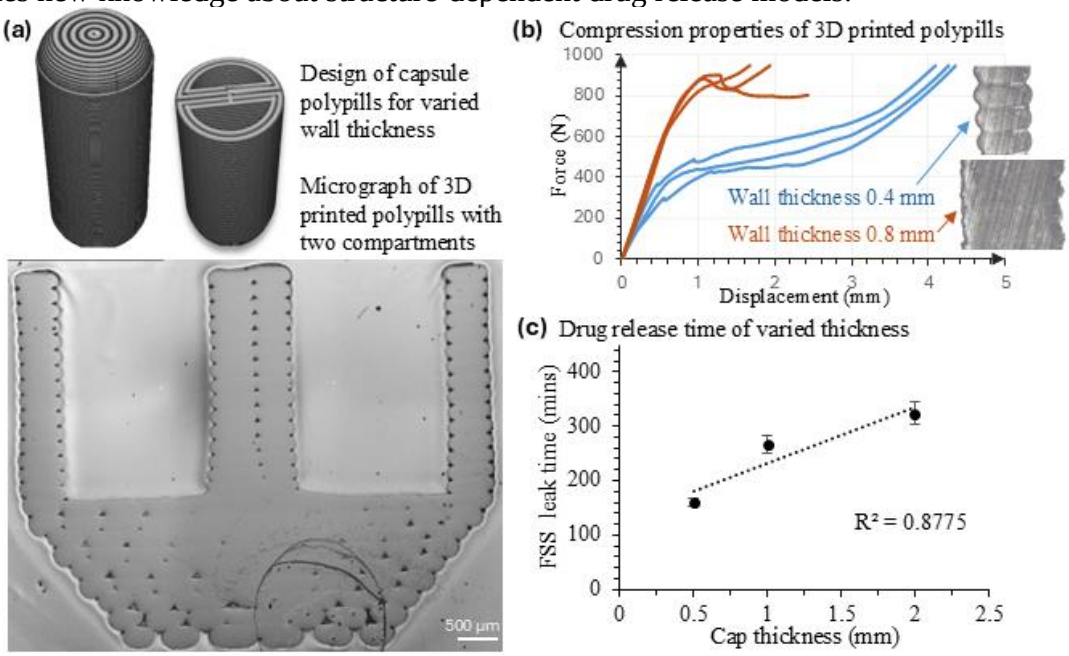

Figure 1. 3D printed polypills (a) structure design of polypills with controlled thickness. (b) Compression properties of pills with different thickness. (c) Drug release time with different thickness.

References

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