The effect of a plasticiser on the printability and solubility of a poorly soluble drug in a 3D printed tablet

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Introduction

ORAL SOLID DOSAGE FORMS

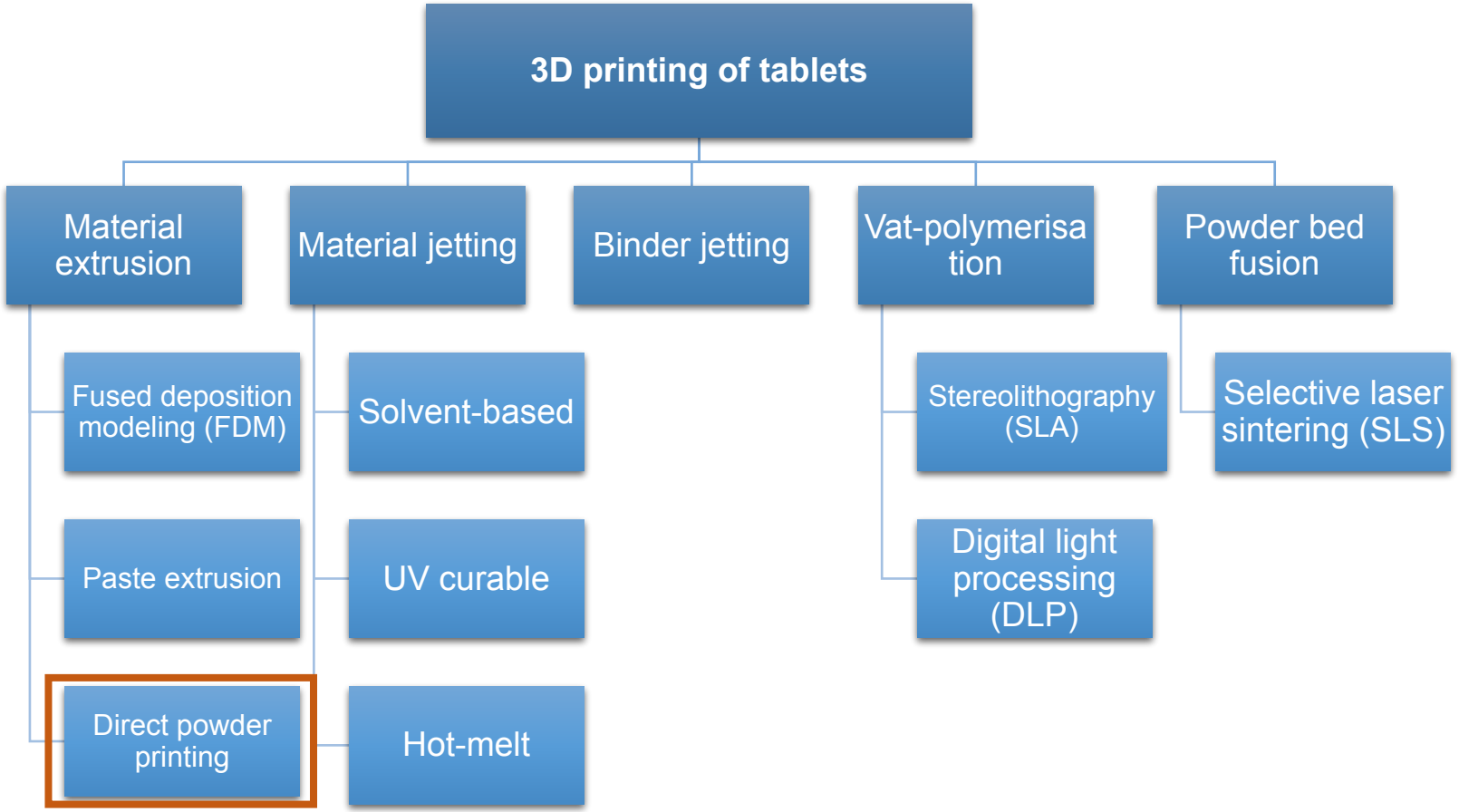
Traditional manufacturing

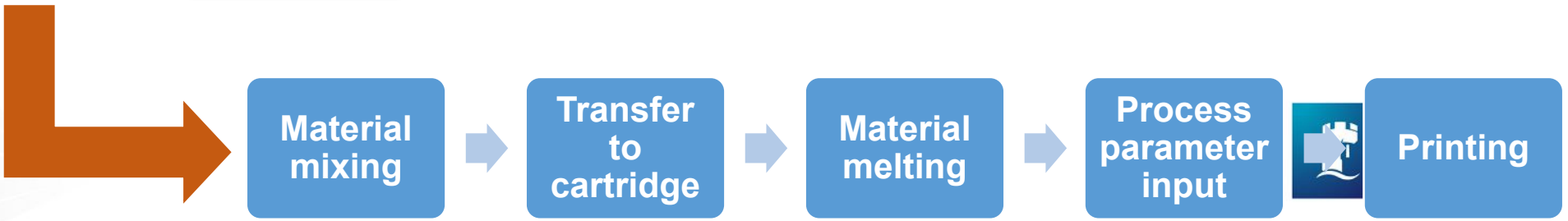
- Complex formulations
  - Large number of excipients
- Big batch production
- Little possibility of personalisation

3D printing

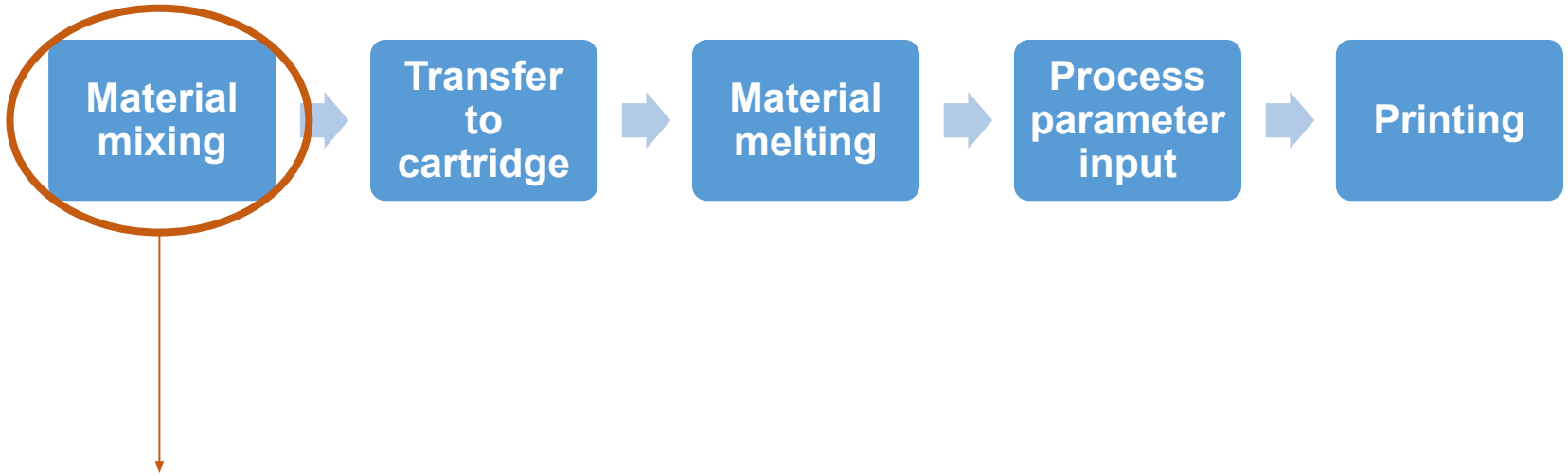
- Simpler formulations
  - Less excipients required
- Smaller batch production
- Personalisation
  - Drug loading
  - Shape
  - Release profile
  - Polypill

Introduction





Introduction



Example: **Surfactants**

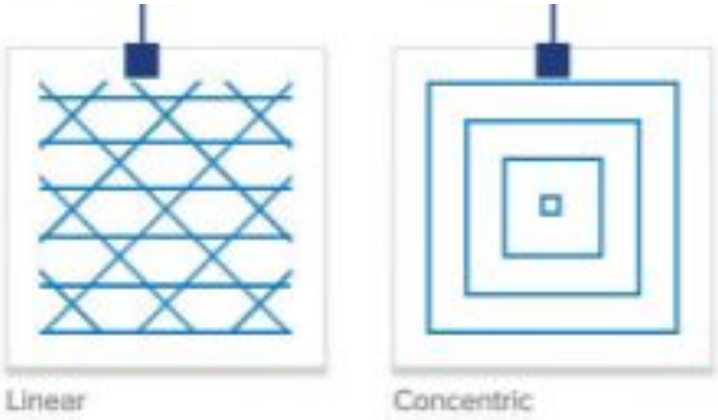
Purpose: Act as a plasticizer, decreasing T_g and melt viscosity

But with concentrations that can go up to 25% w/w, could plasticizers play a part in the solubilisation of the API and consequently effect drug release rate?

Materials and Methods

Cellink BioX printer

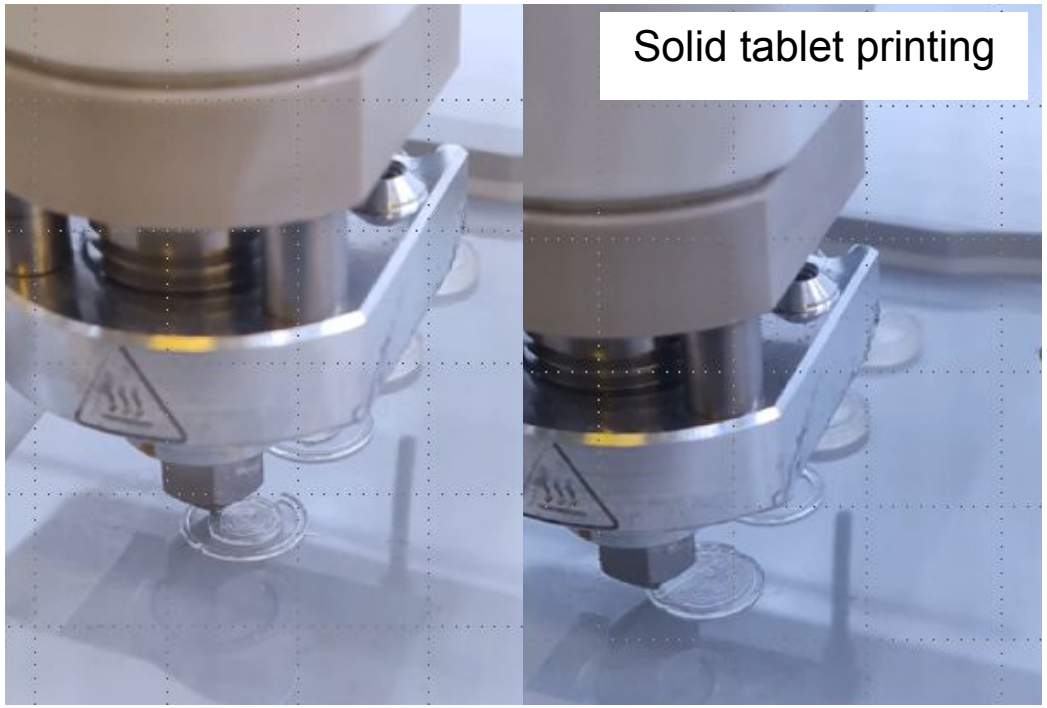
Thermoplastic printhead and cartridge



Infill types

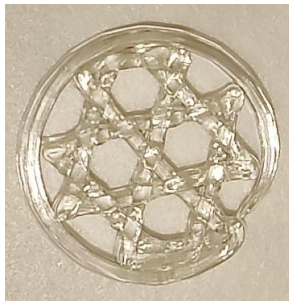
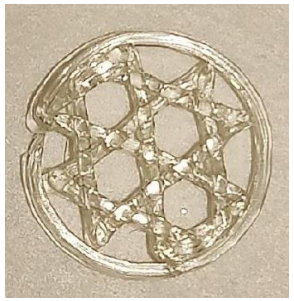
Material	Function	Composition (wt%)
Fenofibrate	API	10
Eudragit RL PO	Polymer carrier	80 - 90
Tween 80	Plasticiser	0 - 10

Results



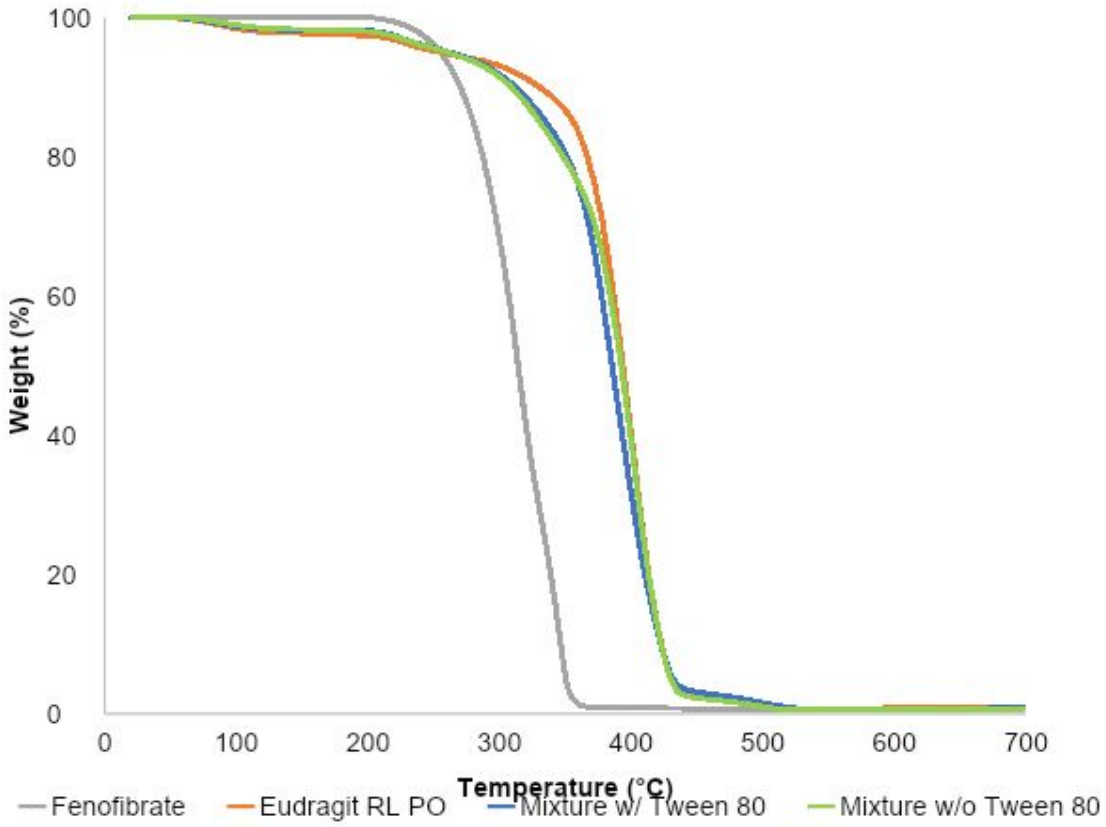
Common process parameters

- Printing temperature, 150 °C
- Printbed temperature, 65 °C

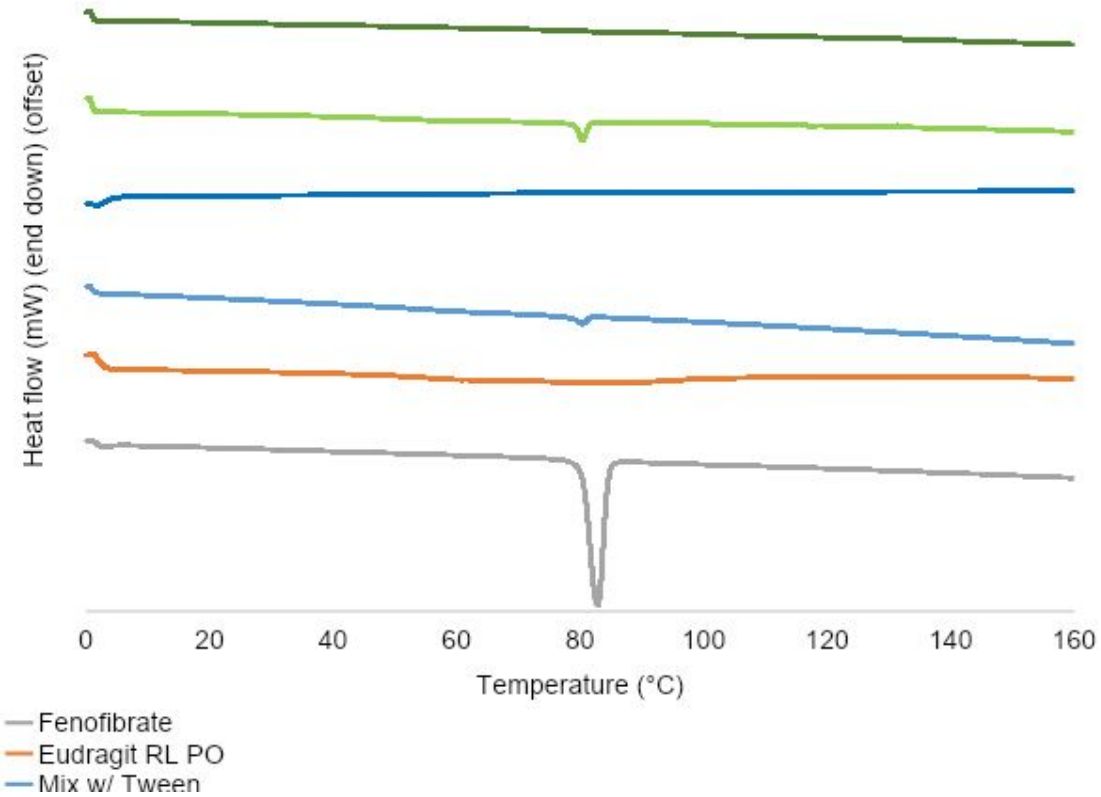
	≠ Printing parameters	Solid tablets	Mesh tablets
W/ Tween 80	Speed 14.5 mm/s		
W/o Tween 80	Speed 1 mm/s		

Images of 3D printed tablets

Results: Thermal Analysis

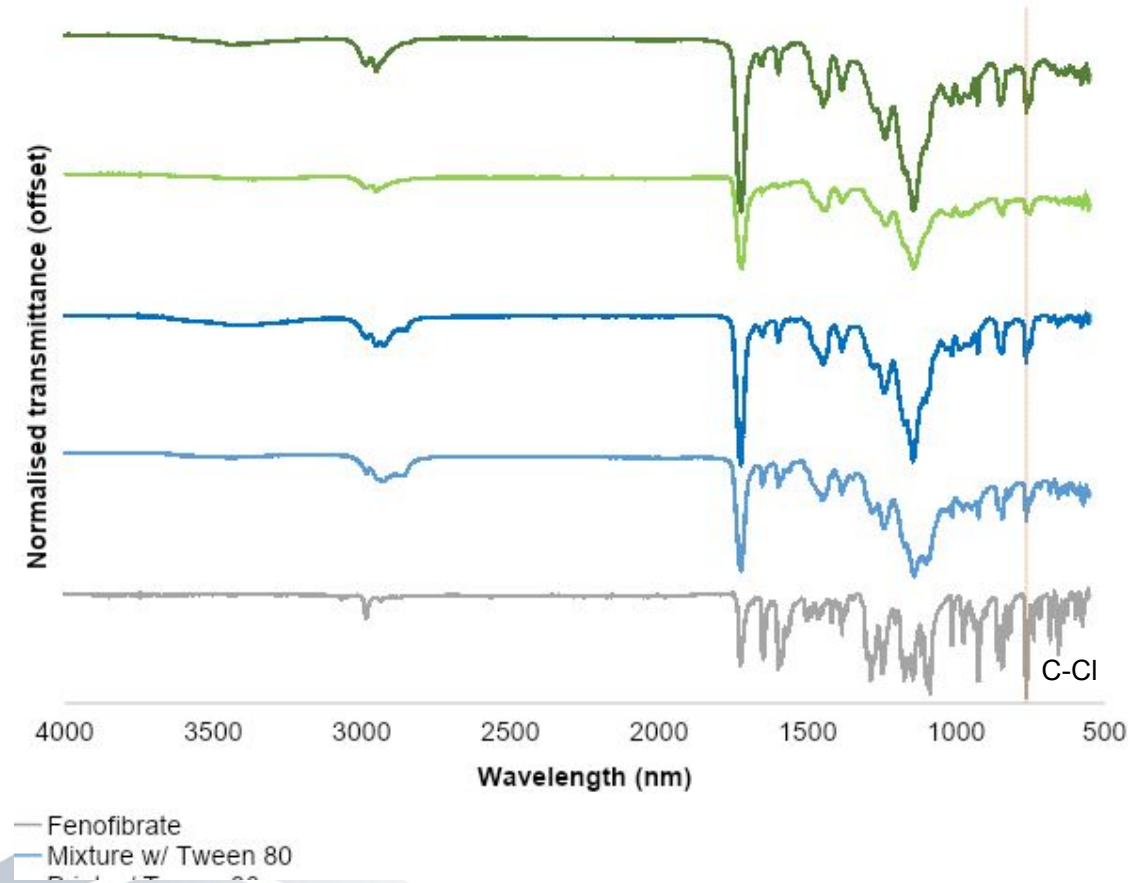


TGA curves of materials and mixtures

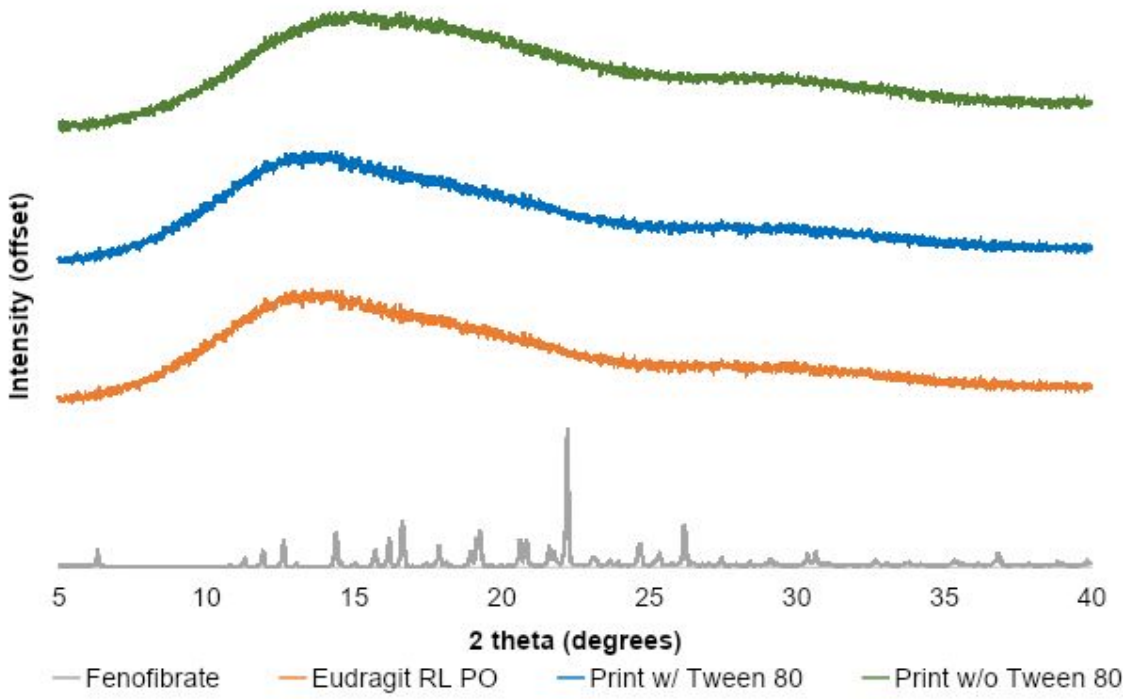


DSC thermogram of materials, mixtures and prints

Results: Analysis



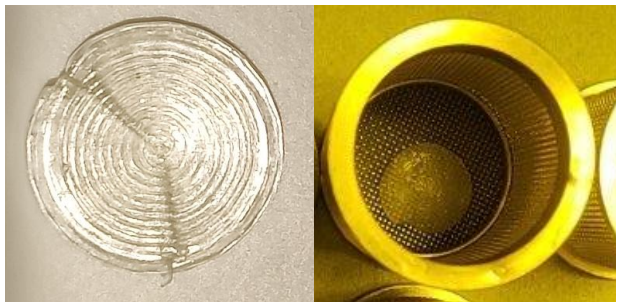
FTIR spectra of materials, mixtures and prints

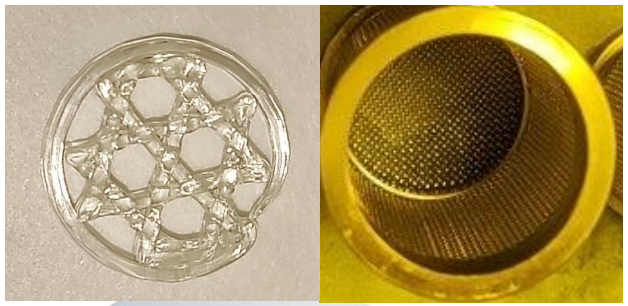


X-Ray diffraction patterns of materials and prints

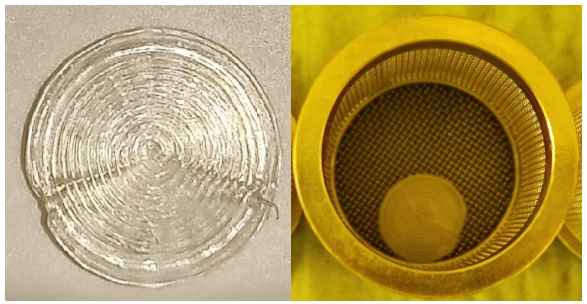
Results: Dissolution

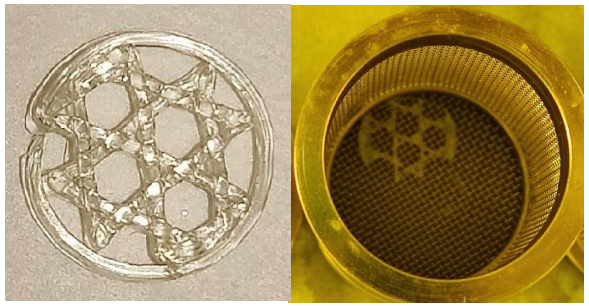
Formulation w/ Tween 80

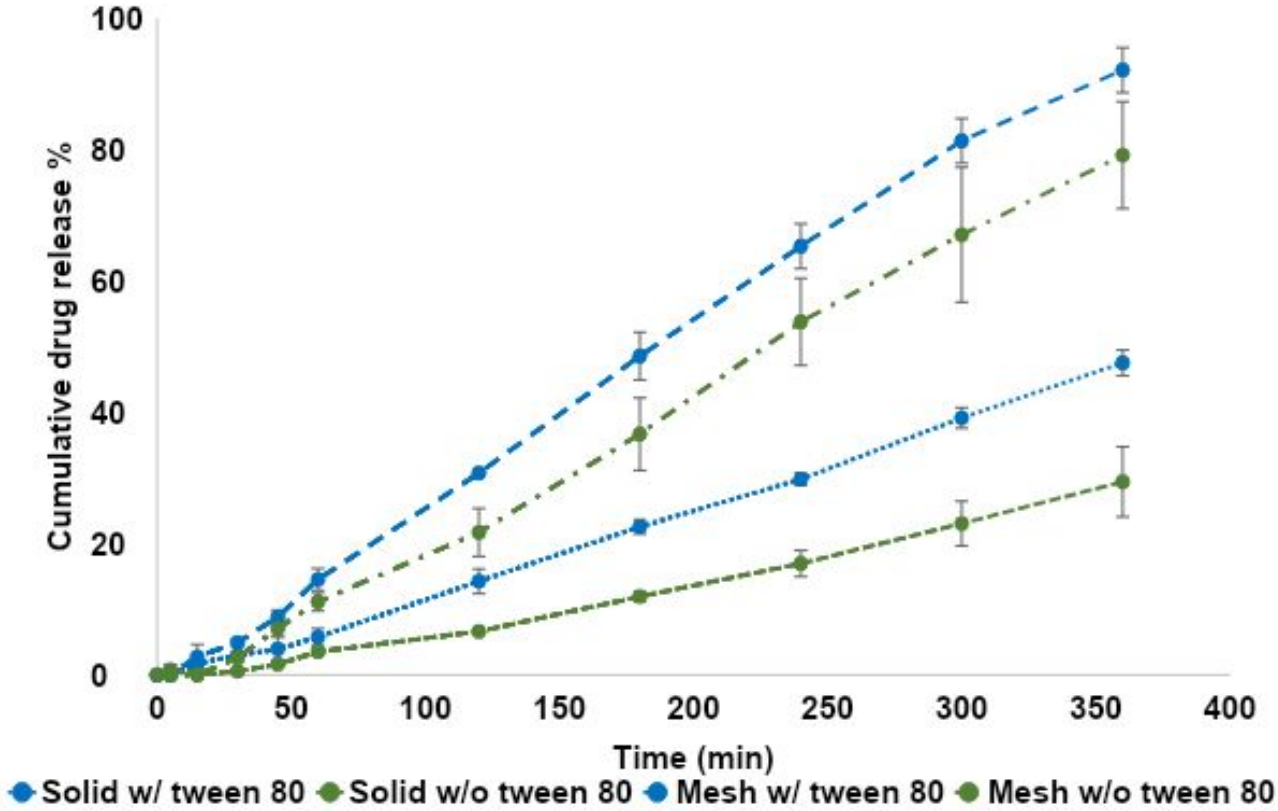




Formulation w/o Tween 80







Conclusions & Future work

Conclusions

- DPP is a modality of extrusion printing that does not require prior production of a filament and amorphous solid dispersions can be achieved making this manufacturing approach well suited to poorly soluble drugs
- Eudragit RL PO as a polymer matrix and Tween 80 as a plasticiser can be used as feedstock to 3D print oral solid dosage forms with a sustained release rate that can be controllably altered (*in vitro*) with a change in tablet geometry
- The use of Tween 80 has a significant effect on printability and the release of fenofibrate

Future work

- Assess whether the use of Tween 80 has an impact on the stability of the printed amorphous solid dispersions

Acknowledgements

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Thank you!

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