BIOFILAMENTS DERIVED 3D PRINTED MEDICATED SKIN PATCH: DESIGN TO DELIVERY

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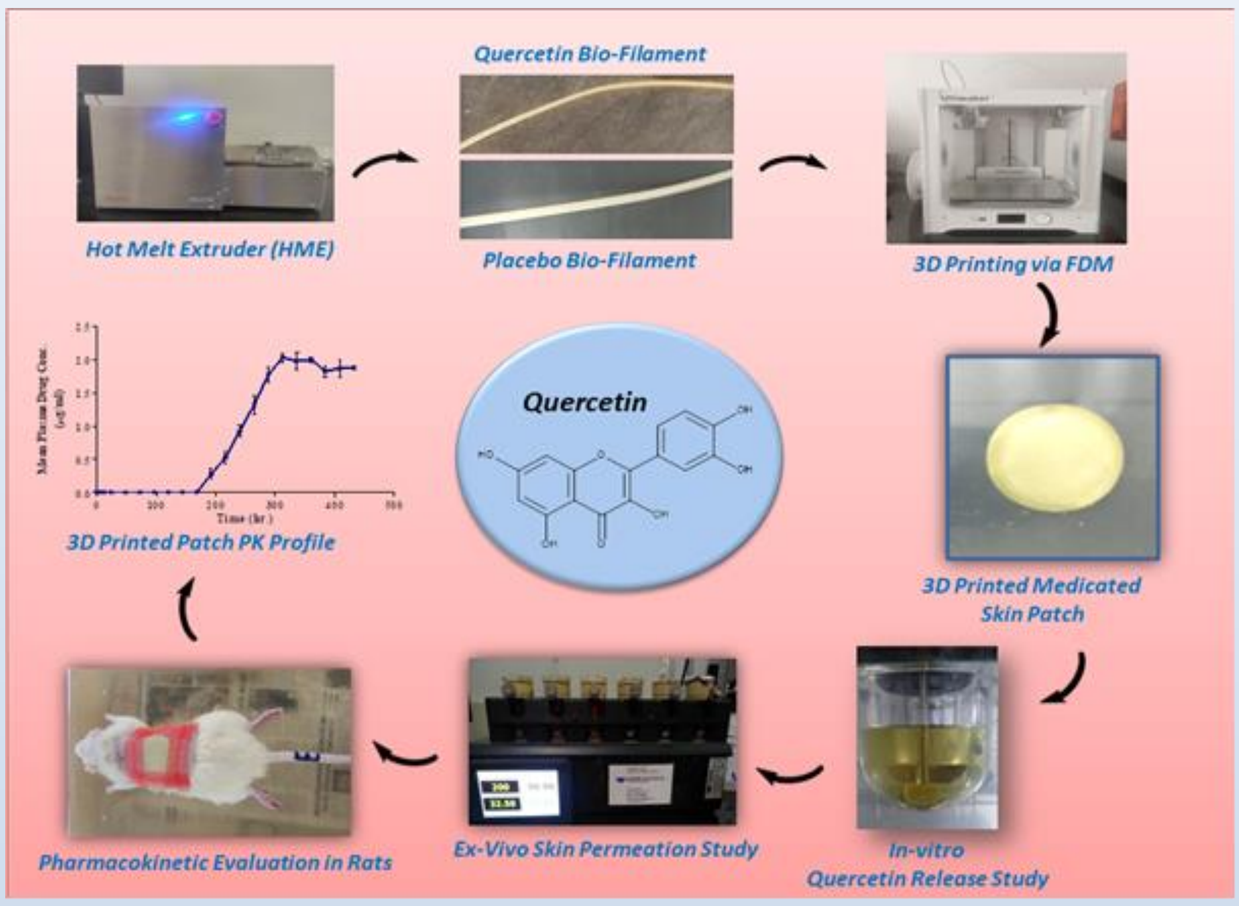
INTRODUCTION

- Quercetin in combination with polyvinylpyrrolidone (PVP) was found to limit the spreading of necrosis to unaffected tissues in tuberculosis infected mice. Therefore, we hypothesized that 3D printed medicated skin patch incorporated with quercetin-PVP concentration would provide an appropriate therapeutic drug concentration with desired sustained release profile.
- We fabricated quercetin-PVP bio-filaments by hot melt extrusion (HME) technique along with Eudragit® RSPO and tri-ethyl citrate as plasticizer and further 3D printed it to make medicated skin patches using fused deposition modelling (FDM). Various characterizations were performed to optimize the 3D printed patch formulation.

METHODOLOGY



Sample Code	Quercetin (%w/w)	PVP 40 (%w/w)	Eudragit® RS PO (%w/w)	TEC (%w/w)	Total Weight (%w/w)
T_1	1.0	49.0	38.0	12.0	100
T_2	1.0	37.0	50.0	12.0	100
T_3	1.0	25.0	62.0	12.0	100
T_4	0.0	50.0	38.0	12.0	100
T_5	0.0	38.0	50.0	12.0	100
T_6	0.0	26.0	62.0	12.0	100

Table 1: Formulation design table for 3D patches

RESULTS AND DISCUSSION

Code	% Loading of filament	% Entrapment of 3D patch
T1	101.30 ± 1.57	96.56 ± 3.19
T2	102.05 ± 2.40	98.11 ± 4.08
T3	125.97 ± 3.00	86.55 ± 4.88

Table 2: Percentage loading & entrapment values of quercetin

Pharmacokinetic Parameters	Quercetin Value
C_{max} (µg/ml)	2.07 (±0.05)
t_{max} (h)	328 (±13.86)
AUC_{0-t} (µg.h/ml)	368.11 (±12.71)
$AUMC_{0-t}$ (µg.h^2/ml)	122712.53 (±3829.21)
k_{el} (h^{-1})	0.00092 (±0.0005)
$T_{1/2}$ (h)	1025.09 (±771.31)
MRT (h)	333.38 (±1.30)

Table 3: PK parameters of quercetin (n = 3)

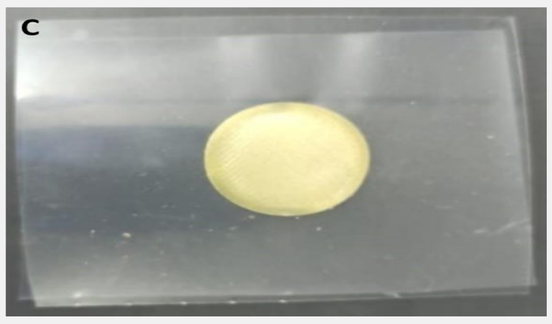


Figure 1 Fabrication of (A) Quercetin-loaded filament, (B) Blank filament and (C) 3D printed patch.

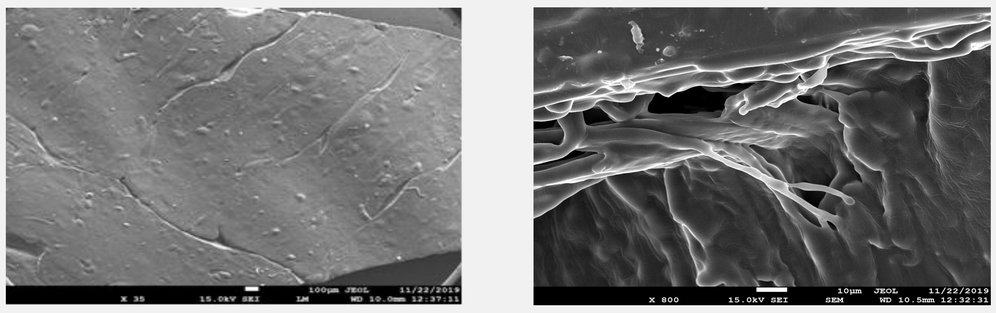


Figure 2 SEM micrograph of fabricated 3D patch

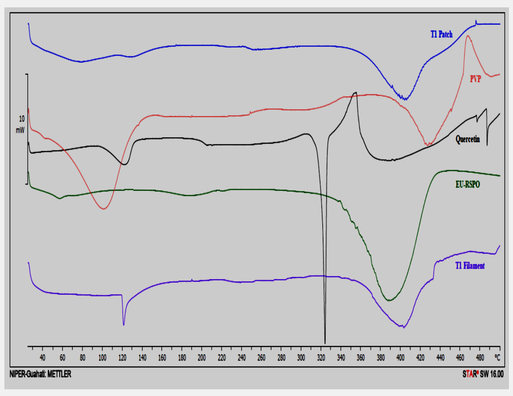


Figure 3 DSC thermograms

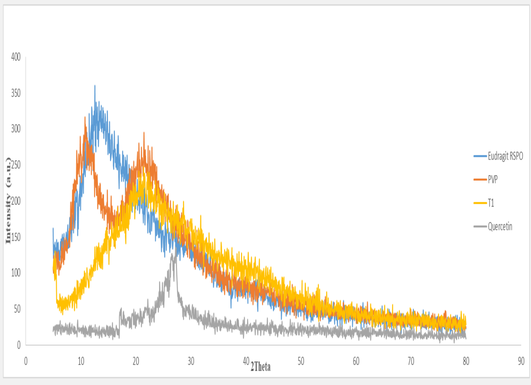


Figure 4 X-ray diffractogram

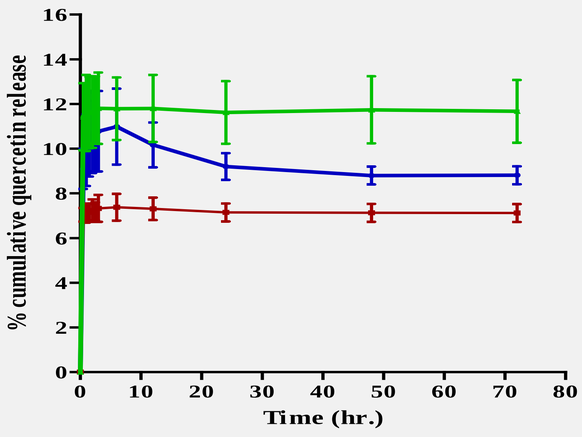


Figure 5 *In vitro* quercetin release (n=3)

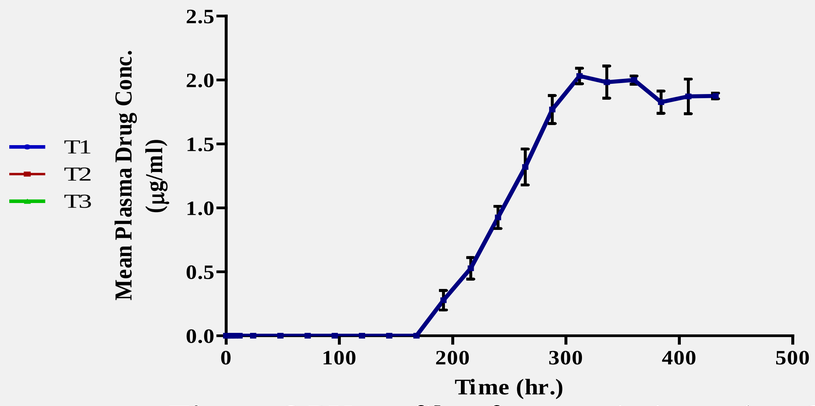


Figure 6 PK profile of quercetin in rat (n = 3).

CONCLUSION

Overall data confirmed the feasibility of developing 3D printed medicated skin patches to provide plasma levels for continued 18 days in rats after a single application.

ACKNOWLEDGEMENT

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REFERENCES

❖ ***Subham Banerjee***, Vishal Sharad Chaudhari, Tushar Kanti Malakar, USN Murty. *"Medicated skin patch, use and method of making thereof."* Application No. 202031018293. FER Response Filed: 4 Sept, 2020, FER Issued: 28 May, 2020, Published: 15 May, 2020, Date of Filing: 29 April, 2020.