# Additive Manufactured Intelligent Patches For Wound Management

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I. Introduction

Inflammation results in observed changes in pH and temperature as a means of the body's natural method in wound management. Additive manufactured wound healing patches may utilize these variables to effectively deliver drugs.
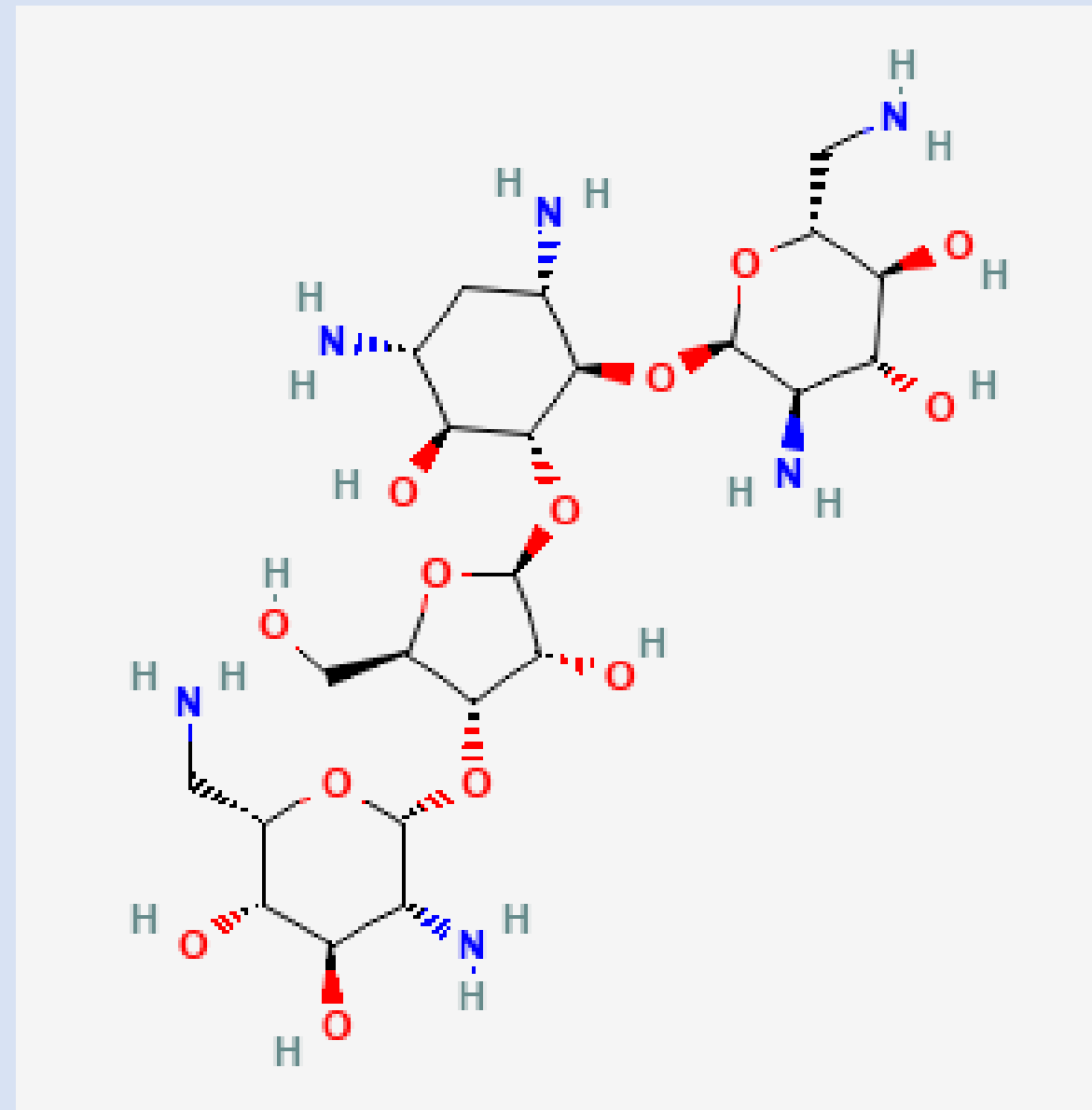
- Patches detect and respond to natural inflammation
- Cost-effective to fabricate
- Wide range of applications

II. Materials and Methods

Patches are developed in two major steps:
- Preparation of Drug Additive (Neomycin)
- Preparation of Drug Polymer Complex
- Synthesis of Intelligent Patches

Currently, the drug additive of choice is neomycin. Neomycin is a proven drug of choice in most wound management procedures.
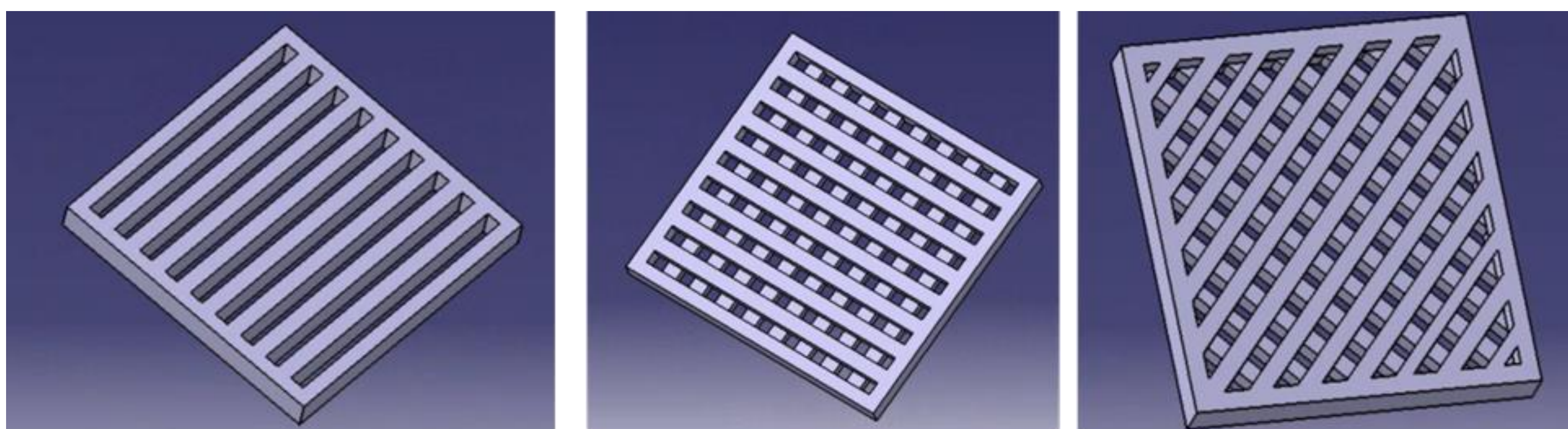

Fig 2: Designs for the 3 D printed wound healing patch (a) Parallel (b) Crosshatched (c) 45 cross-hatched

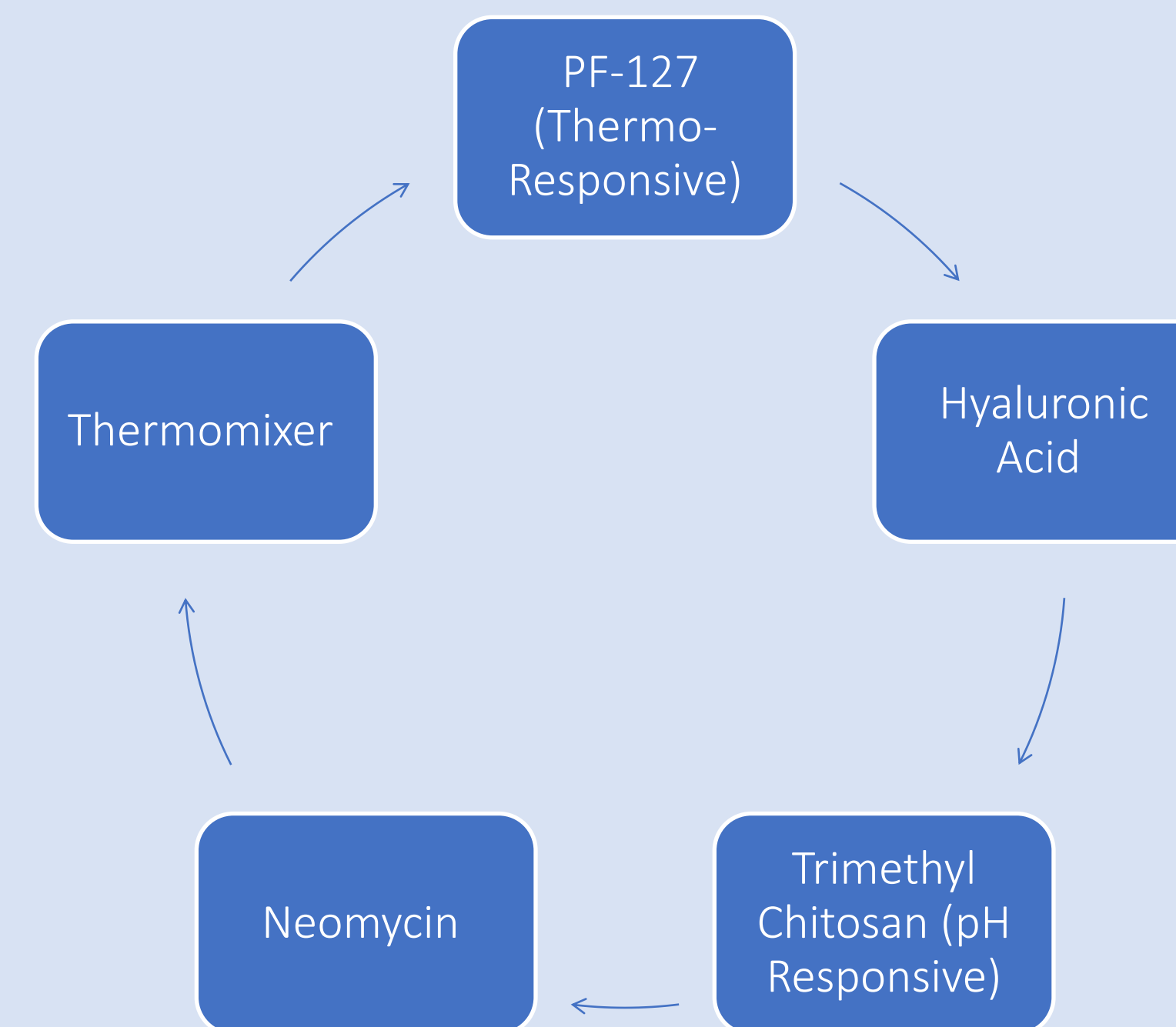## III. Drug Polymer Complex

Fig 3: The main components of the drug polymer complex include the drug (neomycin) and the additive polymer solutions. PF-127 is a thermo-responsive polymer and trimethyl chitosan is a pH responsive polymer.
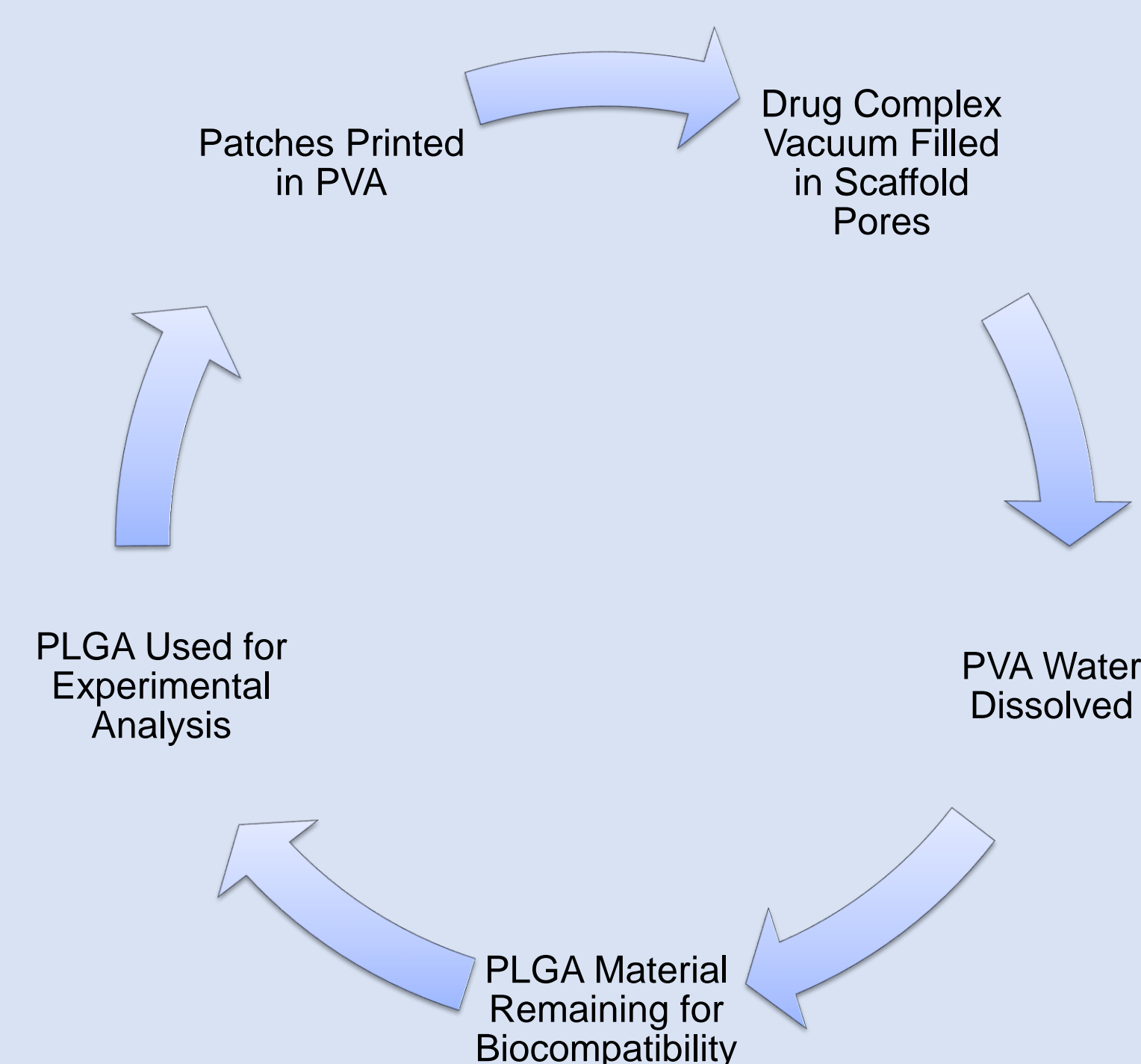
IV. 3D Patch Printing

Fig 4: Patches are designed using three different 3D printed scaffold designed. Each drug polymer complex is added to scaffold pores.

V. Future Applications

Objective: Characterize and assessment of patch thermo and pH responsiveness behavior

Future Characterization Methods of Polymer Complex
- SEM analysis of hydrogel samples
- Zeta Potential Measurement of hydrogel samples
- Analysis of pH-responsiveness (7.4 pH) through degradation measurements of the polymer complex as a factor in swelling ratio
- Analysis of thermo-responsiveness (38.5C-39.5C) through dynamic viscosity measurement of the polymer complex.
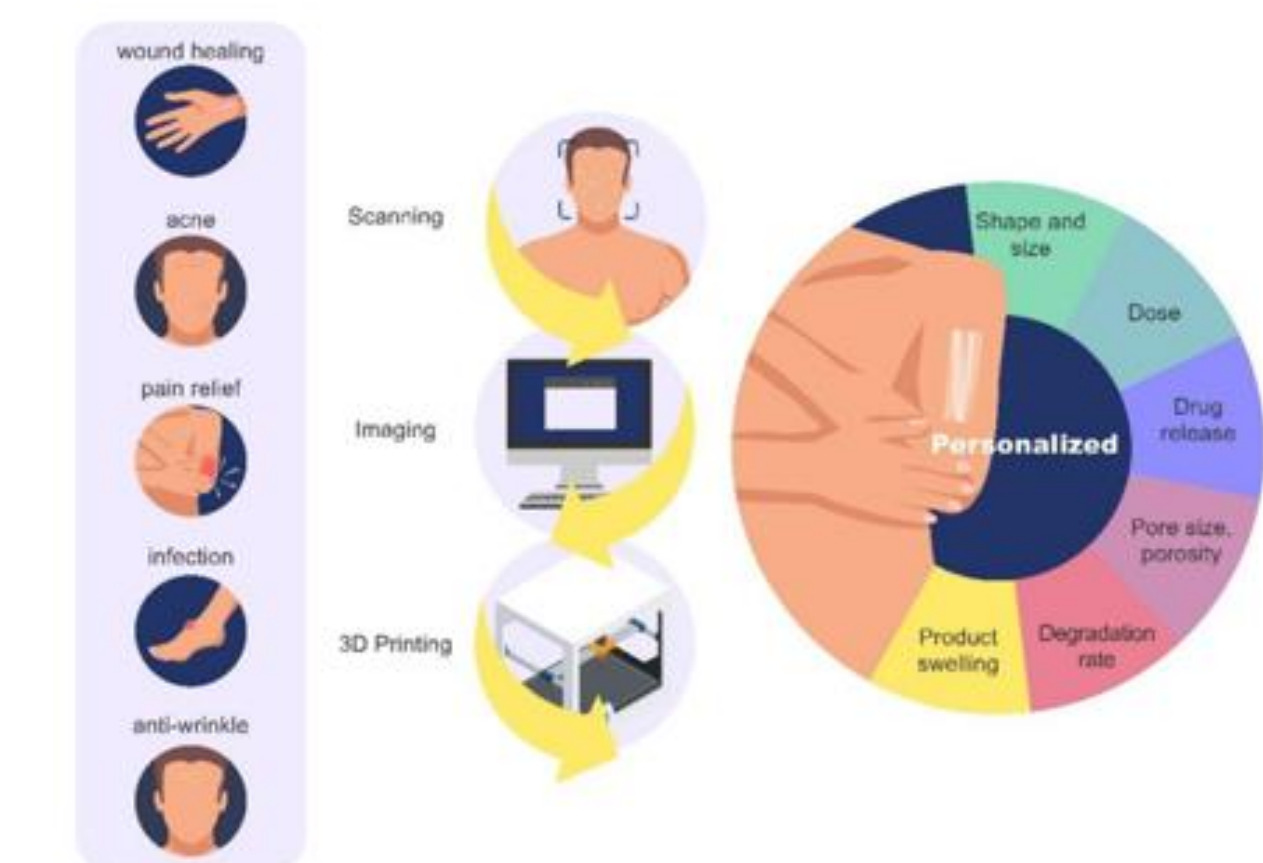

Figure 1: An overview of the applications of 3D printer topical skin products. Image reused from the reference..

Fig 5: Schematic image of additive patch applications

VI. References

[1] I. B. Almeida et al., "Smart Dressings for Wound Healing: A Review," Adv. Skin Wound Care, vol. 34, no. 2, pp. 1–8, Feb. 2021, doi: 10.1097/01.ASW.0000725188.95109.68.
[2] M. Farahani and A. Shafiee, "Wound Healing: From Passive to Smart Dressings,"Adv. Healthc. Mater., vol. 10, no. 16, p. 2100477, Aug. 2021, doi: 10.1002/adhm.202100477.