Precision Medicine: Electrospray/spin Techniques for Fine-Tuned Anti-Inflammatory Release

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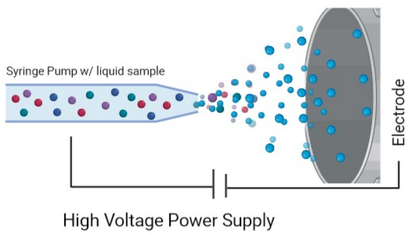
Abstract & Aims

1. Develop novel medication for oral dosage.
2. Use electrospray instrumentation to make polymers nanosized for increased surface area for consistent drug release.
3. Maintain site directed and sustained release of the drug-polymer complex (DPC) over an extended period.

Methodology



Why nanofibers for delivery?

- *Increased surface area*
- *Introduce ideal physical properties for site-specific release*
- *Simple manufacturing*

How? → ELECTROSPRAY

Figure 1: SILS100-Electrofiber Complex

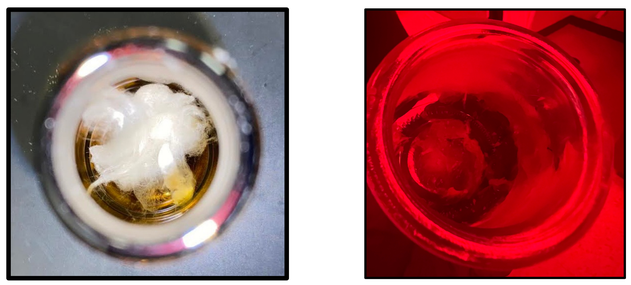
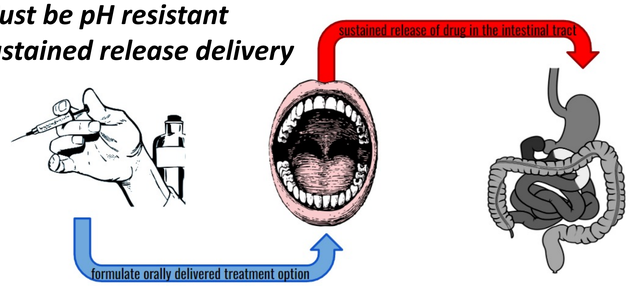


Figure 1 shows the SILS100-Electrofiber Complex after the electrospray process. The fibers are thin and delicate .

Considerations for Oral Delivery Mechanisms:

1) ***Must be pH resistant***
2) ***Sustained release delivery***



Test Principle

Figure 2: FTIR Analysis - Integrity of DPC structure

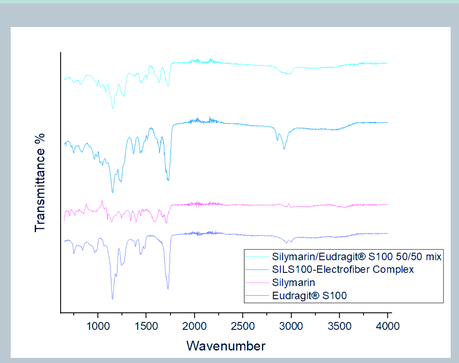


Figure 2 verifies that the silymarin maintains its chemical composition throughout the production process. Additionally, the electrospray method preserves the polymer's composition, as indicated by the comparable peaks observed at these wavelengths for both the SILS-100 Electrofiber Complex and S100.

Figure 3: pH-dependent drug release kinetics

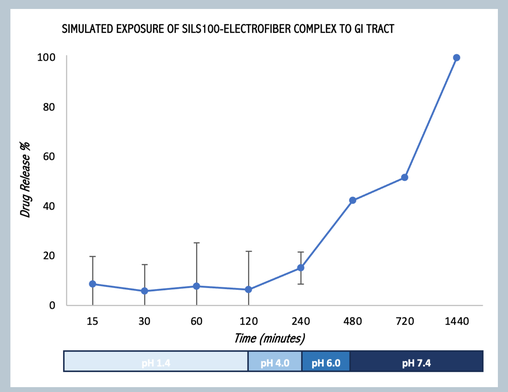
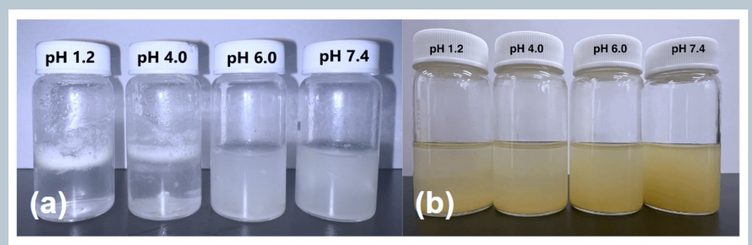


Figure 3 displays the release profile of the SILS100-Electrofiber Complex at different pH levels. It is evident that silymarin release at pH 1.4 (simulated gastric fluid, SGF) was minimal, while at pH 4.0, it doubled compared to pH 1.4. At pH 6, the release of silymarin was four times higher than at pH 1.4, and at pH 7.4 (simulated intestinal fluid, SIF), the release was observed to be nine times higher than at pH 1.4.

Figure 4: Apparent solubility of SILS100-EC



In Figure 4 (a), the apparent solubility of the SILS100-Electrofiber complex is depicted, indicating reduced solubility at pH 1.2 and increased solubility at pH 7.4. In Figure 4 (b), the apparent solubility of the silymarin drug at various pH levels is shown, illustrating moderate solubility across all tested pH values.

Results and Discussion

Figure 5: Antioxidant Assay

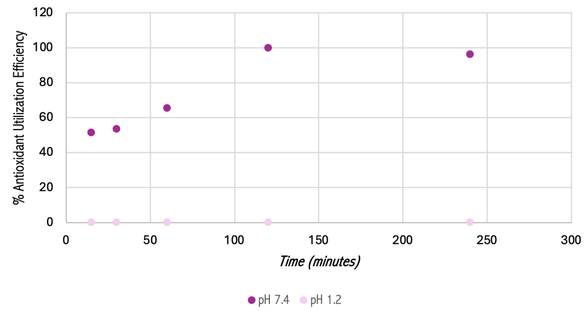
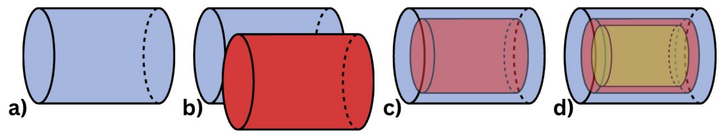


Figure 5 validates that the DPC exhibits a greater antioxidant capacity at pH 7.4, implying the release of silymarin into the solution. At pH 1.2, no antioxidant activity was detected.

Future Directions

Moving forward, we aim to continue our research into designing efficient and cost-effective drug polymer complexes for the treatment of inflammation. In future studies, using different needle setups for the electrospray apparatus will allow us to further manipulate the release and targeted delivery of pharmaceuticals.

Figure 6: Co & Triaxial Needle Diagram



Representative scheme of electrospun fibers: a)uniaxial, b) side-by-side, c) coaxial, d) triaxial

Solution I
Solution III
Solution II

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