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Extended Abstract

Fabrication and Characterization of Air-Jet-Spun Nanofibers and Thin Films from Corn Zein Protein for the Delivery of Therapeutic Molecules †

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Corn zein protein is a cheap, widely available biopolymer that is easily extracted from corn and processed into useful forms. In this study, zein was dissolved along with several model drugs or sodium citrate, which was then cast into thin films or air-spun into nanofibers. The molecular weight, solubility, and charge of the selected model drugs are different, and the weight percentage of citrate also varies (1%–30%). The integrity of the loaded biomaterials was characterized through FTIR, SEM, DSC, and TGA. Due to the high surface-area-to-volume ratio of nanofibers, FTIR analysis showed that the therapeutics strongly interacted with the protein structure of zein nanofibers, transforming their structure from a random coil network to a more ordered alpha helical structure. Zein films did not show this obvious shift. This structural change reflects the results of a drug release study where nanofibers showed a slower, sustained release of therapeutics compared with their film counterparts. Statistical analysis by *t*-test proved a significant difference in release from fibers vs. release from films ($p < 0.01$ for low wt%). The structural integration of zein with its therapeutics also improved the thermal properties of the biomaterial, where fibers did not degrade until temperatures reached 160 °C, but films degraded earlier at 130 °C. Finally, the biocompatibility of zein was confirmed by culturing HEK293 cells on different zein films and fibers for 72 h. An MTT assay confirmed good biocompatibility and an improved cell density on fibers and films compared with a blank control. These promising results, summarized in Figure 1, demonstrate that corn zein has a large potential in the field of drug delivery and biomaterials.

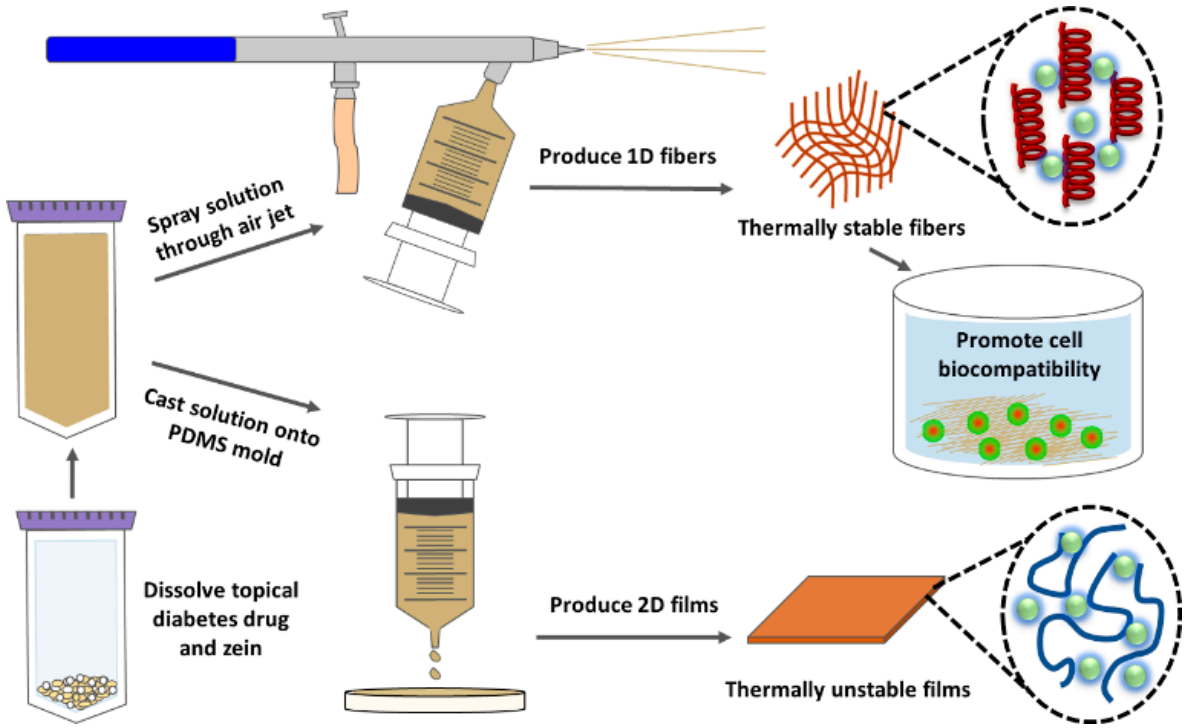

Figure 1. Mechanism of interaction between drug and corn zein nanofibers or protein films [1]**.** Upon addition of the drug, the protein structure of the composite shifts from a random helical structure into an alpha helical conformation. An alpha helical structure is stabilized by hydrogen bonding, which explains how the nanofibers are able to withstand high temperatures before degrading. Since this protein structure transition is not seen in the protein films, and they instead retain a random coil dominated structure, the film samples degrade at a much lower temperature than the nanofibers. Despite the zein–drug interaction, however, the nanofibers can revert back to their original structure after the drug has been released. This makes corn zein nanofibers an interesting candidate for drug delivery; not only does the drug interact with the corn zein to stabilize it, but it does not permanently alter the protein structure of zein [1].

Supplementary Materials: The following are available online at https://www.mdpi.com/2504-3900/69/1/12/s1.

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Data Availability Statement: The data presented in this study are available in [1].

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