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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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Abstract: 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 were characterized through FTIR, SEM, DSC, and TGA analysis. Due to the high surface-area-to-volume ratio of nanofibers, FTIR analysis showed that the therapeutics interacted strongly 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 the drug release study, where nanofibers showed a slower, sustained release of therapeutics compared to 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 improves the thermal properties of the biomaterial, where fibers did not degrade until temperatures reached 160°C, but films degrade earlier at 130°C. Finally, the biocompatibility of zein was confirmed by culturing HEK293 cells on different zein films and fibers for 72 hours. An MTT assay confirmed good biocompatibility and an improved density of fibers and films compared to a blank control. These promising results demonstrate that corn zein has a large potential in the field of drug delivery and biomaterials.

Keywords: biomaterial; corn zein protein; drug release; composite material; air-jet spinning; nanofiber; film; sodium citrate

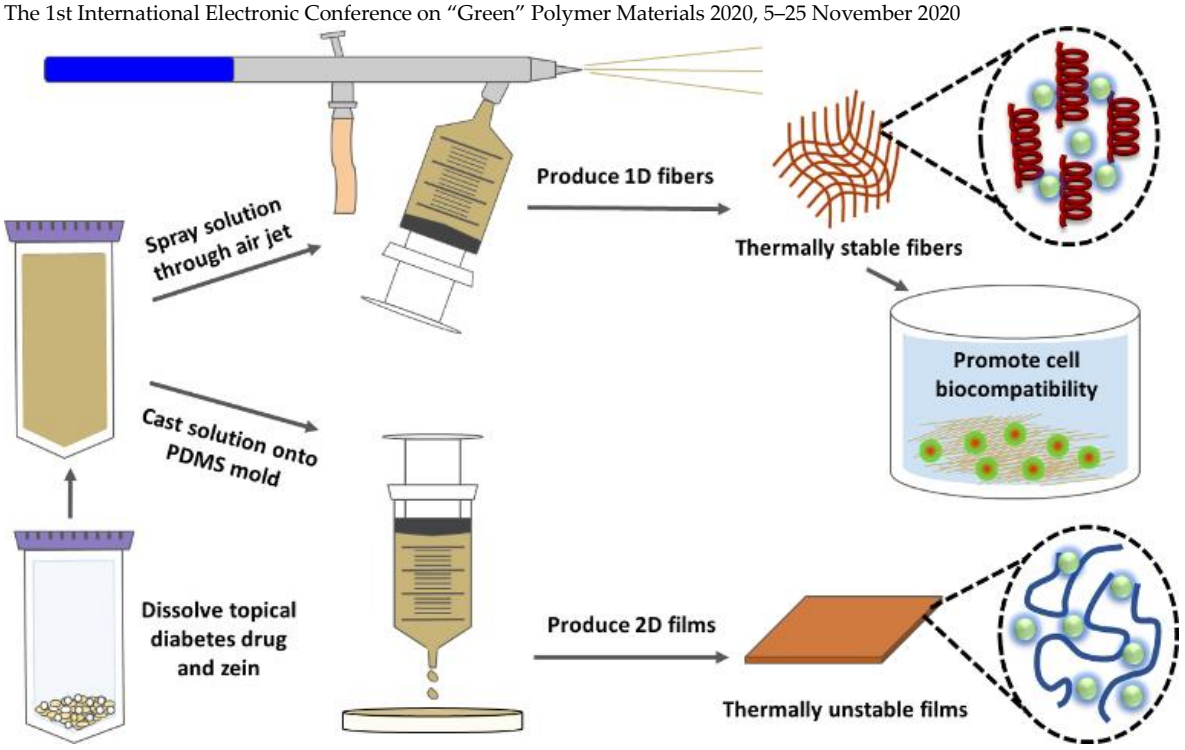

Figure 1. Graphical abstract[1]

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References

1. Gough, C.R.; Bessette, K.; Xue, Y.; Mou, X.; Hu, X. Air-Jet Spun Corn Zein Nanofibers and Thin Films with Topical Drug for Medical Applications. *Int. J. Mol. Sci.* **2020**, *21*, 5780.