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Fabrication, characterization and biocompatibility of wheat arabinoxylans and Chaetoceros muelleri sulfated polysaccharides nanofibers

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Statement of the Problem: There is an opportunity to exploit polysaccharides extracted from cereals and microalgae, as is the case for wheat arabinoxylans (AX) and sulfated polysaccharides from Chaetoceros muelleri (CMSP). Research on this type of biopolymer has gained traction because of its bioactive properties and ability to be transformed into biomaterials. This comprehensive study thoroughly investigated the fabrication and characterization of AX and AX+CMSP nanofibers.

Methodology & Theoretical Orientation: AX and CMSP macromolecular characteristics were studied using size exclusion chromatography multi-angle laser scattering (SEC-MALS). The molecule identity of AX, CMSP, and nanofibers was identified using Fourier-transformed infrared (FTIR) spectroscopy. Nanofiber morphology was determined using scanning electron microscopy. Cell viability of the nanofibers was measured indirectly using an MTT assay. Findings: The AX and CMSP possess a molecular weight of 875 kDa and 4239 kDa and a viscosity of 5.43 dL/g and 4.22 dL/g, respectively. These biopolymers can be electrospun at a concentration of 6% (w/v) only when they are dissolved in acetic acid at 50% (v/v). AX and AX+CMSP nanofibers have 177 nm and 220 mm diameters, respectively, with a significant difference ($P<0.05$). The absorption bands of the infrared spectra are consistent with the ones reported for these polysaccharides, the IR absorption bands spectra of AX+PSCM nanofibers being a combination of both. The MTT assay showed that every treatment of material and concentration had more than 85% cellular viability.

Conclusion & Significance: Both polysaccharides' molecular characteristics favor nanofibers' formation. With long deposition times, manipulable textiles can be manufactured. This research represents the first report about fabricating electrospun nanofibers made entirely of AX and their use alongside sulfated polysaccharides. These nanofibers could be used as drug transport or as wound dressing materials.

Biography

Manual Robles graduated with a bachelor's degree in physics from the University of Sonora, Mexico, with a focus on statistical physics and simulation of multi-particle systems. He obtained a master's degree in science from the Food and Development Research Center (CIAD), having obtained an honorific mention. Has participated in several research stays; has extensive experience in scientific divulgation and coordination of large-scale events such as the March for Science in Hermosillo, Sonora; and has worked in environmental education at the Ecology Center of the state of Sonora (CEDES). Currently pursuing a doctorate focused on developing polymeric biomaterials for use in tissue engineering.

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