

Supercritical CO₂ impregnation of vanillin in to zein electrospun for food packaging application

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Abstract

Antimicrobial packaging materials are obtained incorporating antimicrobial additives to improve food quality, extend shelf-life and reduce the proliferation of undesired microorganism. In the development of such materials, two strategies are possible: one is the incorporation of an antimicrobial agent (either synthetic or natural) in a biodegradable or non-biodegradable polymer matrix, called the direct loading method, the other is the impregnation of the antimicrobial agent into the polymer matrix structure, called as the indirect loading method. Traditional methods for active packaging production are mainly based on the direct loading strategy. However, these techniques have some drawbacks related to the use of solvents, elevated temperatures, low penetration of the active agent in the polymer substrate and reduced loading efficiencies. Supercritical impregnation has recently been used to develop active packaging as a green alternative to other techniques. It is based on the possibility of solubilizing in a supercritical fluid (SCF) different kind of compounds and, then, incorporating into polymer matrices because of high diffusivity of SCF, following an indirect loading strategy. In this paper, zein based film were produced using the electrospinning process. Zein is a vegetable protein extracted from corn, a natural and renewable source. Vanillin was selected as natural antimicrobial agent for its flavoring and food preservative properties.

Vanillin impregnation onto zein electrospun film was obtained using the supercritical impregnation process. Different zein electrospun films were tested as support an also different vanillin/zein loadings were studied. The direct vanillin loading method was also performed for comparison purpose; i.e. vanillin was directly dissolved in the zein solution used for the electrospinning process. The obtained antimicrobial films were characterized in terms of morphology and vanillin real loading. Vanillin migration tests into different food stimulants were also performed.