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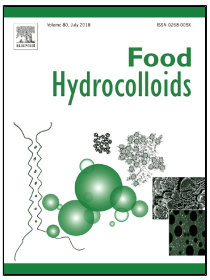

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Bioactive mesoporous silica nanocomposite films obtained from native and transglutaminase-crosslinked bitter vetch proteins

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ABSTRACT

Edible films nanostructured with mesopouros silica nanoparticles or with its amino-functionalized derivative were prepared from seed bitter vetch proteins, before and after their crosslinking by microbial transglutaminase, and characterized for their physicochemical, morphological and bioactive properties. Film tensile strength and elongation at break significantly increased in the presence of both kinds of nanoparticles, even though the amino-functionalized ones resulted more effective, determining a two-fold increase of the mechanical properties. Transglutaminase-catalyzed protein crosslinking counteracted these nanoparticle induced effects while, conversely, it further increased film barrier properties to gases and water vapour obtained by nanoparticles alone. AFM and SEM analyses indicated a more compact structure of the nanocomposite film matrix with more evident continuous zones compared to control films, as well as an effect of transglutaminase in including more homogenously both nanoparticles into the crosslinked protein network. Finally, all films exhibited antimicrobial and antifungal activities, probably due to phenolic compound(s) present in the bitter vetch protein concentrate, and the addition to the film forming solutions of the bioactive oligopeptide nisin significantly enhanced these properties.

Key words: *edible film; mesoporous silica; nanocomposite; bitter vetch; transglutaminase*