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

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17 ABSTRACT

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Edible films nanostructured with mesopouros silica nanoparticles or with its amino-functionalized 19 20 derivative were prepared from seed bitter vetch proteins, before and after their crosslinking by 21 microbial transglutaminase, and characterized for their physicochemical, morphological and bioactive properties. Film tensile strength and elongation at break significantly increased in the 22 presence of both kinds of nanoparticles, even though the amino-functionalized ones resulted more 23 effective, determining a two-fold increase of the mechanical properties. Transglutaminase-catalyzed 24 protein crosslinking counteracted these nanoparticle induced effects while, conversely, it further 25 increased film barrier properties to gases and water vapour obtained by nanoparticles alone. AFM 26 27 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 28 29 including more homogenously both nanoparticles into the crosslinked protein network. Finally, all 30 films exhibited antimicrobial and antifungal activities, probably due to phenolic compound(s) 31 present in the bitter vetch protein concentrate, and the addition to the film forming solutions of the 32 bioactive oligopeptide nisin significantly enhanced these properties.

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

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