Effect of chitin nanocrystals on the barrier and mechanical properties of egg white protein films.

Víctor Baquero-Aznar[1,2], *Víctor Calvo*[3], *José Miguel González-Domínguez*[3], *Wolfgang K. Maser*[3], *Ana M. Benito*[3], *María Luisa Salvador*[2]*, *Jaime González-Buesa*[1,2].

[1]Departamento de Ciencia Vegetal, Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA), Instituto Agroalimentario de Aragón – IA2, Av. Montañana 930, 50059 Zaragoza, Spain.

[2]Grupo de Investigación en Alimentos de Origen Vegetal, Instituto Agroalimentario de Aragón – IA2 (Universidad de Zaragoza-CITA), C/ Miguel Servet 177, 50013 Zaragoza, Spain.

[3]Instituto de Carboquímica (ICB-CSIC), C/ Miguel Luesma Castán 4, 50018 Zaragoza, Spain.

* Corresponding author: **mlsalva@unizar.es**

There is an increasing pressure to develop more sustainable packaging solutions to replace the current non-renewable fossil-based plastic packages. Proteins have proven to be appropriate raw materials for bioplastics development, but obtained films exhibit weak mechanical and water vapor barrier properties. Egg white protein (EWP) is very processable, and the obtained films are highly transparent but are not exempt from the mentioned drawbacks. Chitin nanocrystals (ChNCs) have been previously used in other studies as reinforcing filler in packaging polymeric matrices, but its functionality in EWP films has not been analysed yet. Thus, the aim of this study was to assess the effect of adding ChNCs on the properties of EWP films forming by compression moulding. ChNCs were added in varying proportions and formats to the film forming solutions: in a liquid dispersion at 1 and 2% (by weight respecting to protein), and in solid state at 2, 2.5 and 5%. The addition of ChNCs did not significantly ($p>0.05$) modify the oxygen transmission rate of the EWP films (determined at 23 ºC). However, the water vapor barrier properties were improved with a 14.5% reduction in the transmission rate by adding the nanocrystals at 2%. The ChNCs also affected the mechanical properties of EWP films: the elongation at break was significantly reduced by 33.7% and 49.5% in the 2.5 and 5% ChNCs samples, respectively; and the films reinforced were more rigid compared to the films without nanocrystals, with the elasticity modulus value doubling in the 5% nanochitin films. From the results obtained in this work it can be concluded that reinforcing EWP films with ChNCs enhances some properties of those films, increasing the possible application as food packaging.

Keywords: *chitin, compression moulding, edible film, egg white protein, nanocrystals.*