

Multilayer structures to improve the barrier properties of egg white protein films for the packaging of fresh fruits and vegetables.

Víctor Baquero-Aznar^{1,2}, María Luisa Salvador^{2}, Jaime González-Buesa^{1,2}.*

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

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

* Corresponding author: mlsalva@unizar.es

Protein-based polymers can be a sustainable option to replace petroleum-based plastics currently used for food packaging. However, some of these materials, such as egg white protein films (EWP), have poor water vapor barrier capacity, limiting their use for the packaging of fresh fruits and vegetables. Multilayer structures in which layers of hydrophobic materials are combined with others of egg white protein could be an alternative to solve this drawback. The aim of this work was to evaluate the effect of adding layers of zein or beeswax on the barrier properties of EWP films and assess their applicability to the packaging of fresh fruits and vegetables. The beeswax was applied as a coating in one side of the compression moulded EWP film, while zein was incorporated between two EWP layers. All films developed in this study were sensitive to water vapor. The water vapor transmission rate (WVTR) was significantly reduced for all cases. At 23°C and 90% of relative humidity, the WVTR were reduced with zein layer from 2076.25 ± 43.25 to 465.98 ± 109.31 g m⁻² day⁻¹. Furthermore, the use of a beeswax layer led to a greater reduction in the WVTR, reaching values of 18.66 ± 2.97 g m⁻² day⁻¹. Nevertheless, the use of multilayer structures led to an increase in the opacity of the films, especially in EWP films coated with beeswax. The multilayer materials mitigated, compared EWP films, the weight loss of products as cherry tomato and celery during storage under refrigeration until reaching, in some cases, values similar to those obtained with commercial bio-based films like PLA.

Keywords: barrier properties, beeswax, egg white protein, packaging, zein.