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THREE COMPONENT-BASED BI-LAYER AND ECOFRIENDLY MULCHING FILMS

Sanchez, L.M.[1,*], Benítez, J.J.[2], Domínguez, E.[3], Heredia, A.[1]

[1]*Instituto de Hortofruticultura Subtropical y Mediterránea "La Mayora", Universidad de Málaga-Consejo Superior de Investigaciones Científicas (IHSM, UMA-CSIC), Departamento de Biología Molecular y Bioquímica, Facultad de Ciencias, E-29071 Málaga, Spain.*

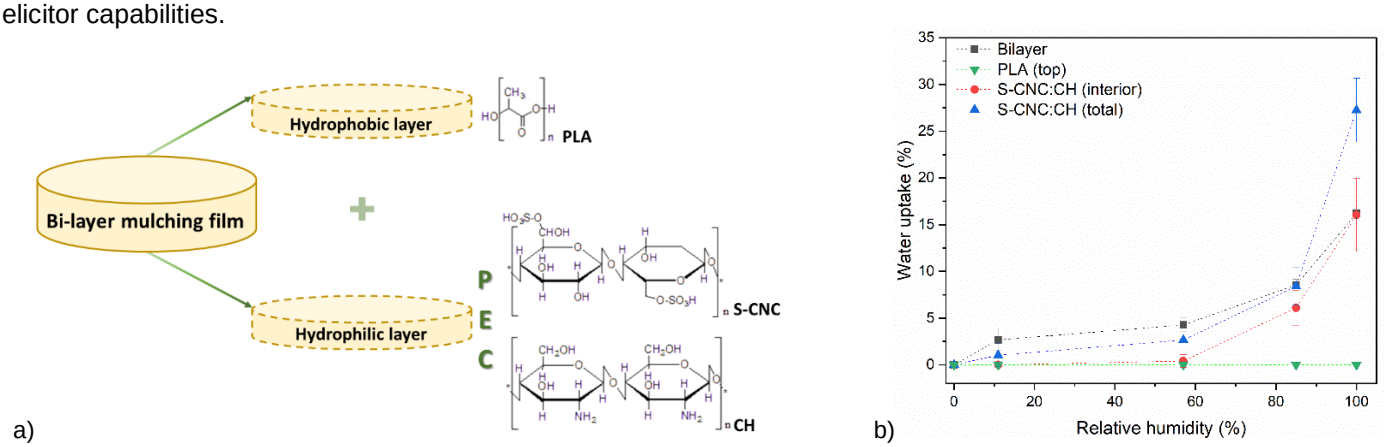
[2]*Instituto de Ciencia de Materiales de Sevilla (ICMS), Centro Mixto CSIC-Universidad de Sevilla, Americo Vespucio 49, Isla de la Cartuja, 41092 Seville, Spain.*

[3]*Instituto de Hortofruticultura Subtropical y Mediterránea "La Mayora", Universidad de Málaga-Consejo Superior de Investigaciones Científicas (IHSM, UMA-CSIC), Estación Experimental "La Mayora", E-29750 Algarrobo-Costa, Málaga, Spain.*

*Corresponding author e-mail: laura.sanchez@fulbrightmail.org

Among the agronomic practices usually employed to achieve more successful culture results, mulching (M) has been applied using a variety of materials. In particular, the employment of plastic M films has made a revolution since they offer an evapotranspiration decrease whereas the soil temperature is also controlled, thus leading to an earlier crop maturation. Additionally, pests are more easily controlled, as well as both the possible soil erosion and farming products lose due to rainfalls are minimized. Then, less herbicides and pesticides use, and a more efficient employment of water resources is achieved. As a result of this, M improves the soils organic and nutritional characteristics even though investing fewer resources than in traditional culturing. However, although plastic M has multiple benefits, some negative impacts are also associated with this farming implement. Since most plastic mulches are non-biodegradable and non-reusable, there is a necessity to remove them from the fields, and further stockpile, transport or even burn them.

In the present research work bi-layer M films (**Figure 1a**) were prepared through simple and low-cost procedures from biodegradable, natural and renewable resources, minimizing the employment of both energy and auxiliary substances. Thus, the global objective was to straightforwardly improve agronomical practices by introducing the use of materials complying with the green chemistry, green engineering and circular economy principles. For this, poly-lactic acid (PLA), sulfated cellulose nanocrystals (S-CNC) and chitosan (CH) were employed as starting materials to develop a bi-layer eco-friendly system composed by a top hydrophobic layer (PLA) and an interior hydrophilic one (S-CNC:CH). The hydrophilic layer was prepared by forming polyelectrolyte complexes (PEC). CH was included to offer anti-microbial and elicitor capabilities.



a) b)

Figure 1. a) Bi-layer mulching films prepared from PLA, S-CNC and CH; **b)** Water uptake capabilities.

The bi-layer, the corresponding individual layers (PLA top and S-CNC:CH interior) and the blank hydrophilic (S-CNC:CH total) materials were characterized determining their water vapor permeability; water uptake capabilities under five different relative humidity conditions (**Figure 1b**); mechanical and thermal properties as well as their morphological characteristics. Fourier transform infrared spectra and Water contact angle determinations were also conducted. The results have shown an improvement in the bi-layer material properties regarding the analogous single hydrophilic layer.