Mechanical, barrier and thermal properties of hydrocolloid-based bioplastics from amylose and argan proteins prepared in the presence of transglutaminase and magnetic nanoparticles

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The work exploited amylose, obtained by RNA interference technique from barley plants, and proteins, derived from argan oilcake, to produce novel blended bioplastics.
Amylose is a biopolymer that provides added-value functionalities to the normal starch for bioplastics production, reducing the need for subsequent chemical modification or blending with synthetic polymers [1]. Argan proteins-based oilcake is a byproduct of argan oil extraction that is currently used for animal feeding or disposed of. In this work proteins were recovered from this high-added value product with the aim to prepare novel hydrocolloid bioplastics blending amylose (AM) and argan proteins (APs). Three different kinds of film were prepared, AM-based films, APs-based films and AM-APs-blended films, and characterized for their mechanical, barrier, and thermal properties.
Moreover, additives were used to further enhance the performance of the films, such as the enzyme microbial transglutaminase (mTGase) as reticulating agent for protein components, and ferromagnetic nanoparticles (NPs) as fillers [2][3].
The films showed suitable properties for application in the bioplastic industry. The presence of APs influences the water vapor permeability in composite films, providing a higher barrier effect which notably increases when mTGase is used as a reticulating agent, while the presence of NPs seems to increase the thermal stability of the films.
Finally, the degradation of the films was studied by the burial test method using three different soils: a loamy textured soil of volcanic origin; a flood soil with a sandy clay loam texture; an alkaline flood soil. The performed tests have underlined that the novel bioplastics can be easily degraded in all the soils tested.

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[2] Famiglietti, M. et al. (2023) Sustainable Food Science - A Comprehensive Approach: Volumes 1-4, pp. V4-110–V4-128
[3] Liu, S. et al. (2020) Adv. Colloid Interface Sci. 281, 102165