

## Towards Sustainable Agriculture: Preparation and Characterization of Biodegradable Composite Films for Agricultural Mulching

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Over the past 20 years, the world's population has grown exponentially<sup>1</sup>. Consequently, the demand for agricultural products has increased annually. To meet this need, the prolonged use of mulching films based on low-density polyethylene resulted in significant environmental pollution events, leading to serious side effects on human health<sup>2</sup>. Based on this, there is a great interest in developing biodegradable polymeric films that can be tilled directly into the soil after use thus improving their environmental sustainability. Here, we present the preparation and characterization of biodegradable sodium carboxymethyl cellulose, chitosan, and sodium alginate-based composite films in the presence of glycerol as a plasticizer and calcium chloride as cross-linker and their enrichment with the  $\text{NH}_4\text{H}_2\text{PO}_4$  salt, as N and P are generally the most deficient nutrients in the soil. The effects of the composition and the cross-linking agent on some water interaction properties and the thermal and mechanical properties were evaluated. To rationalise the macroscopic behaviour of the films, infrared spectroscopy, and X-ray diffractometry were applied to gain information on the interactions and structural changes induced by the salt and the cross-linker. This approach allowed for the identification of the best quality films for which the release kinetics of  $\text{NH}_4^+$  and  $\text{PO}_4^{3-}$  ions as a function of film thickness were studied. The latter aspect is of great importance as the release of N and P helps to improve the nutrient supply to the soil, reducing the use of synthetic fertilisers.

### Bibliografia

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<sup>2</sup> Akhtar, H.M.S. et al.; *Int. J. Biol. Macromol.*, **2018**, 118, 469-477