PVA/ ALGINATE/ TANNIC ACID CROSSLINKED AEROGELS WITH LOW FLAMMABILITY AND HIGH MECHANICAL RESISTANCE

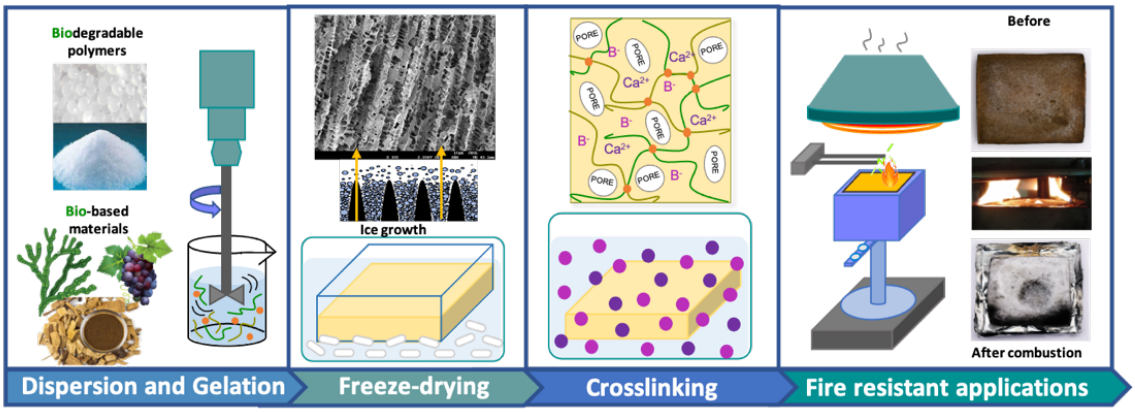
L.G. De la Cruz*, T. Abt, N. Candau, M. Sánchez-Soto

Centre Català del Plàstic, Universitat Politècnica de Catalunya, Barcelona Tech (EEBE-UPC), Av. d'Eduard Maristany, 16, 08019, Barcelona, Spain.

* lucia.de.la.cruz@upc.edu

☒ Oral presentation ☐ Poster presentation

ABSTRACT



Aerogels are ultra-light, highly porous materials derived from gels in which the solvent has been replaced by gas. Aerogels based on renewable and biodegradable materials are gained attention as environmentally friendly alternatives to conventional foam [1]. This study focuses on the mechanical, thermal, and combustion behavior of a polyvinyl alcohol (PVA), sodium alginate (SA) and tannic acid (TA) aerogel obtained by freeze-drying and ion crosslinking (Ca^{2+} and B^{-}). Aerogels containing 5g of PVA, 3g of TA, and 2g of SA exhibit the highest compressive resistance, which was increased by 30% after crosslinking (87.4 MPa/gcm^{-3}). In comparison to pure PVA, the addition of TA and SA to the blends decreased its thermal degradation rate. The crosslinking further contributed to an 81% of reduction of the degradation rate (0.16 %/ºC) making samples high thermally stable. Regarding flammability samples burnt after being exposed to radiation due to the presence of the highly combustible PVA. However, the heat release rate (HRR) and fire growth (FIGRA) parameters decreased by 67% and 50% respectively when TA and SA was added to pure PVA aerogel. After crosslinking, an additional decrement of 35% in HRR and 54% in FIGRA respectively was obtained (76 kW/m^2 and 1.96 kW/m^{2}s), which corresponds to a very low flame intensity. These results are down below of previous values reported by Wu et al.[2], who worked on PVA/SA crosslinking aerogels filled with inorganic montmorillonite. Hence, the cross-linked aerogels presented here can be considered a very promising sustainable alternative to conventional fossil-derived foams.

[1] M. Sánchez-Soto, L. Wang, T. Abt, L. G. De La Cruz, and D. A. Schiraldi, "Thermal, Electrical, Insulation and Fire Resistance Properties of Polysaccharide and Protein-based Aerogels," in *RSC Green Chemistry*, no. 58, 2018.

[2] N. Wu, F. Niu, W. Lang, and M. Xia, "Highly efficient flame-retardant and low-smoke-toxicity poly(vinyl alcohol)/alginate/ montmorillonite composite aerogels by two-step crosslinking strategy," *Carbohydr. Polym.*, vol. 221, no. June, pp. 221–230, 2019.