ESR 6

Project title and research strand:	Biopolymer based Aerogels: from lab to technical scale. Strand 1: Fibers for technical application.
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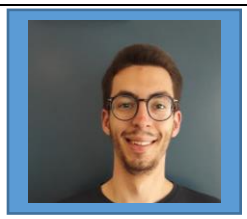

Abstract

This work focused on the synthesis of cellulose aerogels from hemp and flax waste bast fibers for thermal insulation purposes. These aerogels were produced in different shapes and sizes. The best synthesis recipes were chosen for upscaling and were applied using the Jet-Cutter® (beads), the CAProLi (Cellulose Aerogel Production Line, for sheets/films), and wet-spinning technologies (fibers). The aerogel samples were characterized by their chemical composition, morphology, structure, and others. Pure cellulose was extracted from the bast waste fibers and the addition of sodium chloride, and sodium sulfate to the cellulose solution accelerated its gelation while improving the internal structure of the aerogel samples. A smoother cellulose gelation was achieved when weaker organic acids were used as regeneration baths. The aerogels synthesized presented high porosities (over 80%), high specific surface areas (over 200 $m_2 g_{-1}$), and low densities (< 0.21 g cm_{-3}). The upscaling of the synthesis of aerogels was effective for all equipment used with little differences between different scales and sources of cellulose (hemp and commercial). The thermal conductivity of the aerogels ranged from 37 mW m_{-1} K_{-1} to 40 mW m_{-1} K_{-1}, providing space for further improvement. Soda lignin was effective as a coating agent for cellulose wet gels achieving a 40% reduction in water absorption for the coated aerogels. This approach has environmental and economic advantages compared to laboratory batch-wise synthetic routes, which contribute to the development of the industrial aerogel market and a circular bio-based economy.

Visual Summary – Poster