PRESENTER INFORMATION

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BIOGRAPHICAL SKETCH

Jéssica D. C. Santos is a PhD student at the University of Aveiro, working on the Materials and Ceramic Engineering Department of University of Aveiro (Portugal) and the Center for Food Technology and Packaging of ZHAW School of Life Sciences and Facility Management (Switzerland). She obtained a Master's degree in Food Biotechnology and a Bachelor's degree in Biotechnology, both courses earned at the University of Aveiro. Then, she was a research fellow in the "PLASTICOLIGHT" project that aimed to develop lightweight fillers for plastic formulations from egg byproducts in collaboration with industry partners. She also had the opportunity of participating in various international scholarship exchange programs, including THE PROM PROGRAMME (PPI/PRO/2018/1/00021/U/001), CIRCUL-A-BILITY STSM cost action (CA19124), and NETPORE STSM cost action (CA20126). Her interests include the exploration and characterization of biomolecules from agrifood industry byproducts and their further application for the development of porous particles and bioplastic composites for food packaging applications. Scientific achievements: - Papers in international/national scientific journals: 4; Oral communications in national/international conferences: 12; Poster communications in national/international conferences: 13; International internships: 4; Participation as chair in a conference session: 1.

Porous ethylene scavengers derived from agrifood byproducts for active fruit packaging

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ABSTRACT

Ethylene, a naturally occurring compound, plays a crucial role in ripening fruits and vegetables, but excessive levels can cause significant food loss and waste. Recent research focuses on developing porous particles to scavenge ethylene and preserve food freshness. Agrifood byproducts, abundant and often discarded, contain valuable biomolecules for creating bio-based materials. This study explored repurposing pine nut skin and brewery spent grain, byproducts from the dried fruit and brewing industries, to develop ethylene-scavenging particles.

Aerogel particles were derived from pine nut skin's cellulose and a cellulose/lignin fraction through an emulsion-coagulation process followed by supercritical CO2 drying. The influence of lignin on the textural properties and ethylene adsorption of these particles was assessed, using commercially available microcrystalline cellulose for comparison. The porous aerogel particles achieved surface areas of 358 m^2/g and 282 m^2/g, respectively, comparable to those from commercial microcrystalline cellulose (328 m^2/g). Ethylene adsorption isotherms showed that both types of particles can absorb ethylene, with lignin enhancing adsorption capacity.

Brewery spent grain-derived activated carbons were obtained through microwave pyrolysis with different activating agents and subsequently functionalized with oxygen, nitrogen, or sulfur groups. These activated carbons demonstrated superior surface areas (up to 1169 m^2/g), microporosity, ethylene adsorption kinetics, and ethylene/carbon dioxide selectivity compared to commercially available activated carbon. Calculations based on fruit ethylene production rates suggested that the most promising brewery spent grain-derived activated carbon requires six times less material than commercial activated carbon per ton of food for effective ethylene removal, highlighting its practical feasibility.

Overall, this work highlights the potential of pine nut-derived aerogel particles and brewery spent grain-derived activated carbons for ethylene adsorption, opening opportunities for preserving fruits and vegetables while valorizing these byproducts.