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Editorial

A Note on Bio foams with Natural Fibre Reinforcement

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EDITORIAL NOTE

The principal bio-based and biodegradable polymers with potential industrial availability in the coming decades for "bio" foams applications are starches and Polylactic Acids (PLAs). This research looks into how processing and materials characteristics can improve their morphology and properties. Melt extrusion with water as a blowing agent was utilised to create starch foams. Natural fibres (hemp, cellulose, cotton linter, sugarcane, coconut) were included into the starch foam and resulted in a density reduction of up to 33%, a decrease in water absorption, and an increase in mechanical qualities, depending on the fibre concentration and origin.

Polymer foams are made comprised of a solid and a gas phase that are blended together throughout the manufacturing process. Foams with closed-cell or open-cell air bubbles or cells can be made, with open- cell foams being more flexible than closed-cell foams. A chemical or a physical blowing component is used as the blowing agent. Chemical blowing agents react in the extruder, primarily through thermally induced breakdown processes, to produce foamy gas. Physical blowing agents are gases that do not chemically react with the polymer matrix during the foaming process and are hence inert to it.

Water is utilised as a drying agent in melt extrusion because it converts into steam under the conditions of temperature and pressure of the extrusion. Nucleating chemicals, such as talc, are used to increase the number of cells and to centralise the cellular microstructure. Melt extrusion using a Chemical Blowing Agent (CBA) that disintegrates at the PLA melting temperature produces PLA foams.

The vacuum content of the finished version after extrusion was used to assess the frothing capability of the polymer components. Extrusion circumstances (screw profile and speed, cooling temperature, extrusion temperatures along the screw) and substance compositions (CBA, fibre content and nature) can be optimised based on the testing results to increase void content and foam qualities. The mechanical properties (tensile, bending) and cell morphology (number, size, and shape) are investigated.

The effect of natural fibres on foaming ability, as well as the effect of fibre/matrix adhesion on cell growth rate, must be investigated further. A posterior plasma treatment for PLA-based bio composites foams could be used to stabilise the original plasma treatment and prevent the loss of surface characteristics. It is also possible to improve the silane grafting circumstances (polysiloxane solution preparation, grafting duration, drying conditions, etc.). Other research is being done to learn more about the mechanisms that only mechanical qualities (bending and tensile modes) were examined in this work when it came to foam properties. Trials have been carried out to investigate the impact of different parameters (processing and material parameters) mostly on degree of bioremediation (Biological Demand of Oxygen). Control the creation of open-cells and closed-cells.

Many more studies will be conducted to better understand the competitive mechanisms that govern cell formation during extrusion, particularly for PLA foams, such as the decrease in viscosity due to extrusion conditions that favour gas losses through diffusion through the polymer, the increase in gas yielding with increasing temperature that can induce plasticization by the gas products, and the increase in gas yielding with increasing temperature that can induce plasticization by the gas products.

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