# PLA-based biocomposites foaming by supercritical $CO_2$ assisted batch process

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In many industrial fields, the development of porous and light polymer composite structure is of great interest. These structures may have several advantages compared to a massive solid of the same chemical nature, such as better mechanical properties, cushioning, insulation, sound and heat absorption. As an example, foams are used in the sport, pharmaceutical, aeronautic and packaging industries. For these applications, petroleum based thermoplastics are widely used as polymer matrix, but, due to the shortage of fossil resources and the rise of environmental concerns, biopolymers (bio-based, bio-degradable and/or bio-compatible polymer) are more and more used.

There are two main routes to produce biopolymer foams depending on the blowing agent used, which can be either chemical (CBA) or physical (PBA). CBA are able to release a gas upon thermal decomposition, but they have some drawbacks, among which the necessity of high process temperatures, the solid residues on the foam and their toxicity. PBA appear as an alternative to these chemical agents, supercritical $CO_2$ and $N_2$ being the most used.

Batch foaming of polymers is a process which can be carried out in an autoclave. The samples are saturated in a pressure vessel a certain time, and their foaming is achieved by inducing an instability into the system. Pressurised gas solubility in polymers increases with pressure but decreases with temperature. Therefore, in the batch foaming process, the instability can be induced by a sudden drop in pressure (pressure quenching) or by a raise in temperature thus causing polymer foaming. [1]

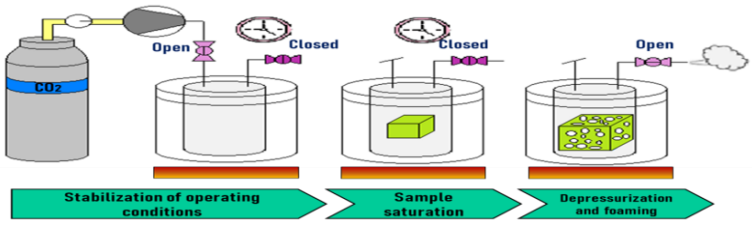


Figure 1. Pressure induced foaming process [1]

This foaming technology has been largely used for different polymers such as polystyrene [2], polycaprolactone [3], polyethylene/polypropylene [4] and, polyethylene terephthalate [5]; among others. This work is focused on the foaming of PLA-based biocomposites using (ligno-)cellulosic fibres by supercritical $CO_2$ assisted batch process by pressure quenching, the study of the operating conditions, the influence of the nature of the fibres and their characteristics on the porosity and morphology of the obtained foams.

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*polyethylene terephthalate*. Cellular polymers 39 (6): 223-237.