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Polystyrene and cellulose nanofibril composites: Fiber dispersion driven by nanoemulsion flocculation in the presence of a fiber or nanofiber suspension

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ABSTRACT

The development of composites and nanocomposites based on conventional thermoplastics and nanocellulose or cellulose pulp fibers is of great interest, however it poses a challenge due to the natural tendency of cellulose fibers to form strong aggregates. Fiber dispersion within the non-polar matrix has been widely studied, however, to date there is no description of a viable low cost process showing the potential of practical applications on a large scale for cellulose fiber or nanofibre dispersion without extensive fiber damage or fiber agglomeration. In this paper, we describe an efficient strategy to produce such composites using polystyrene (PS) as a matrix. The method is based on the co-flocculation of polymer nanoemulsion and fiber or cellulose nanofibril (CNF) suspension. The product can then be processed as a conventional thermoplastic after drying. The results obtained from scanning electron microscopy of fragile fractured surfaces and optical microscopy show the effectiveness of the fiber dispersion method. The simplicity of the method developed together with the fact that all the processing is carried out in aqueous media makes the method feasible for scale up in the production of cellulose composites and nanocomposites. The method, in principle, can be applied to any other polymer produced by emulsion polymerization.

Key Words: *nanocomposites; cellulose fibers, cellulose nanofibrils; emulsion polymerization; colloidal systems.*

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