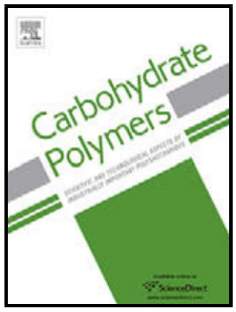

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Morphology, transport characteristics and viscoelastic polymer chain confinement in nanocomposites based on thermoplastic potato starch and cellulose nanofibers from pineapple leaf

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Highlights

- Synthesis of cellulose nanofibers from waste pineapple leaf: a reuse of agricultural waste
- Modification of potato starch composites by nanofibers from pineapple leaf
- Morphological characterization nanocomposites and reinforced material.
- Water transport properties shows pseudo fickian behavior
- Viscoelastic characterization of prepared nanocomposite films and detailed evaluation of various parameters
- Mathematical modelling of diffusion data.

Abstract

Eco-friendly "green" nano composites were fabricated from potato starch and cellulose nanofibers from pineapple leaf. Nanocomposites of starch/cellulose nanofibers were prepared by solution mixing followed by casting. The investigation of the viscoelastic properties confirms starch macromolecular chain confinement around the nano scale cellulose surface, superior dispersion and very good interaction between thermoplastic starch and cellulose nanofibers. The degree of chain confinement was quantified. The chain confinement was associated with the immobilization of the starch macromolecular chains in the network formed by the nano-scale cellulose fibers as a result of hydrogen boding interactions. From the results, it was assumed that the starch glycerol system exhibits a heterogenous nature and cellulose nanofibers tend to move towards glycerol rich starch phase. Barrier properties also improved with the addition of nanofiller up to 3 wt.% but further addition depreciated properties due to possible fiber agglomeration. The kinetics of diffusion was investigated and typical kinetic parameters were determined and found that the