Development of a sustainable process methodology for degumming of flax fiber based on an advanced oxidation process

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Degumming lignocellulosic fibers is a pivotal step in utilizing cellulosic fibers for industrial applications. The high non-cellulosic content, such as lignin and hemicellulose are barriers to developing fibers with desired properties. Here, a catalytic advance oxidation technique based on Fenton oxidation chemistry was employed to isolate micro cellulosic fibers (MCF) from raw flax fibers. This study aimed at assessing the impact of the Fenton oxidation process on the physicochemical properties of the fibers. Compared to traditional methods, the Fenton reaction can be introduced as an environmentally friendly technique that consumes less amount of water and chemicals. To evaluate the characteristics of the degummed fibers, TGA and FT-IR spectroscopy were utilized for assessing the degumming efficiency and composition of the developed fibers. Raman optical microscopy was also employed to assess the impact of Fenton oxidation treatment on fiber diameter distribution. The results revealed that Fenton oxidation treatment can effectively remove the fibers' non-cellulosic content and reduce the fiber diameter's size distribution. The treatment of fibers by the Fenton process affords a methodology to modify the fiber composition and diameter to enable biomass use for fiber-based filtration applications.