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Natural fiber treatments to enhance performances for advanced applications

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Abstract

Natural fiber reinforced composites with applications in vehicles are gaining importance. Existing applications range from door-panels, car roofs to noise absorbing panels. Today the scientific focus is on the development of constructive parts; even the application of natural fibers as reinforcement in composites for bike frames is currently explored.

Natural fibers such as flax and hemp offer excellent opportunities as reinforcement materials in composites with good mechanical properties i.e. their low density, high tensile strength and Young' s modulus. The adhesion of the reinforcing fiber and the matrix as well as moisture adsorption play an important role in the overall performance of the composite. There has been quite some progress in the improvement of adhesion via surface modification of flax fibers using e.g. propyltrimethoxysilanes, phenyliso-cyanates or maleic acid anhydrides (Van de Velde and Kiekens, 2001).

Modern biotechnology will drive the renaissance of bast fibers in Europe. The application of bast fibers in composites helps to reduce the ecological footprint and contributes to the bio-based economy. This paper reviews recent progress in modern biotechnology to improve the potential of bast fibers in composites for advanced applications, the focus is on enzymatic strategies resulting in improved strength.

Key words: *Biotechnology, Bast fibers, Flax, Fiber extraction, Fiber bonding, Pectate lyase, Laccase, Peroxidase xyloglucan, Xyloglucan endo-transglucosylase*

1. Enzymatic fiber extraction

Replacing traditional fiber extraction methods by more controlled, fast and efficient processes is an old desire in bast fiber industries. Biotechnology enables the development of tailored enzymatic extraction of high value fibers (Van Sumere, 1992), and modification of fiber properties. Dew-retted flax remains the primary source of fibers for textile applications in Europe, mainly for economical reasons. Dew-retting relies on the action of indigenous fungi colonizing the harvested plant stems. Dew-retting takes typically 1-3 weeks. Compared to dew-retting enzymatic retting is independent of weather and/or climate and results in higher yields as well as improved fiber properties (quality, fineness and strength) which are key in the application of natural fibers in advanced products. Processes have been developed based on multi-

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