# Enzyme-mediated tuning of cellulose surface reactivity for innovative compounding purposes

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**Keywords**: Bacterial cellulose, tyre, polymers functionalization,

**Abstract**:

Cellulose is the most abundant natural polymer occurring on the Earth, and it can be produced with high purity by various bacterial species. It has a highly diverse application: the modification of its functional groups is thus a key factor for properties tuning. Moreover, the hydroxylic moieties' intra- and intermolecular hydrogen bonding ensure this polymer a high crystalline structure whose preservation is of great importance if used as reinforcing material.

In this study, *Komagataeibacter sucrofermentans* is used as natural cellulose producing strain, and the bacterial cellulose obtained has been enzymatically modified with organic acids by using lipases from *Pseudomonas cepacia* and *Candida antarctica* (PCL and CaLB). The formation of an ester bond starting from acrylic, octanoic and methacrylic acids has been assessed by Attenuated Total Reflectance Fourier-Transform Infrared (FTIR-ATR). The retention of crystallinity pattern and the polymer thermal stability has been assessed through Wide-Angle X-Ray Diffraction (WA-XRD) and Thermogravimetric Analysis (TGA) respectively.

Subsequently, cellulose modified with acrylic acid has been used into a model elastomeric compound and a commercial peroxide used as vulcanizing agent. The mechanical and dynamic properties of the compound have been tested, resulting in a general reinforce of the system compared to the control sample. Here we present the main data collected both on the functionalized polymer and from the obtained elastomeric compound, showing that this is a promising approach for fine tuning the final desired properties of the materials.