

Enzymatical methods for producing innovative biofibers from banana pseudostem waste

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Non-edible components of banana plants represent about 88% of plant weight which is otherwise discarded and processed as waste[1]. The exploitation of wastes, such as banana pseudostem waste, as alternative materials, provides new industrial materials from renewable sources with multiple advantages over synthetic materials.

Suitability of banana tree pseudostem to be used as biosource of weaving yarn, was improved by an enzymatic process. An enzymatic pretreatment was applied to decrease fiber cohesion, remove non-cellulosic constituents and obtain longer fibers, thus avoiding fiber breakage of conventional-chemical methods. Banana fibers were enzymatically treated in Ugolini lab exhaustion machine with two commercial cocktails: *BiopectinaseM01* and *BiopectinaseK*. The pretreatment was optimized using Box-Hunter Central experimental design. Using the design of experiments (DoE) approach, we studied two variables (enzyme concentration and process time) at two different levels and the correlation between the effect of these variables to SEM, tensile strength and fiber fineness. To determine final bioprocess conditions, we applied a second DoE approach in order to study the enzymatic cocktail stability. We concluded that *BiopectinaseK*, mainly composed by polygalacturonases, was more adequate for undesired compounds removal. After digesting during 6h under optimized conditions (enzyme dilution 1:40, 100% over fiber weight of *BiopectinaseK*, 45°C, pH 4.5 and bath renewal after 3h), the obtained fiber presented desirable properties. The optimum enzymatic bioprocess was scaled up to retrieving 1 kg of fiber in an ICYMSA garment dyeing machine.

The textile trials showed that enzymatic pre-treated fibers are suitable to be used for yarn production and derived technical fabrics.

[1] N. Reddy and Y. Yiqi, "Fibers from Banana Pseudo-Stems." *Innovative Biofibers from Renewable Resources*. Springer Berlin Heidelberg, (2015) 25-27.

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