Biomaterials based on polymers and fillers from natural sources

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Preparation and characterization of polymer-based biomaterials is one of the important research lines of "Materials + Technologies" Group. Composite materials based on biopolymers or polymers from natural sources and natural fillers are synthetized and characterized.
Polymeric matrices based on renewable materials such as lignin, tannins, chitosan or other proteins have been prepared in order to modify them for having competitive properties with respect to those obtained from oil.

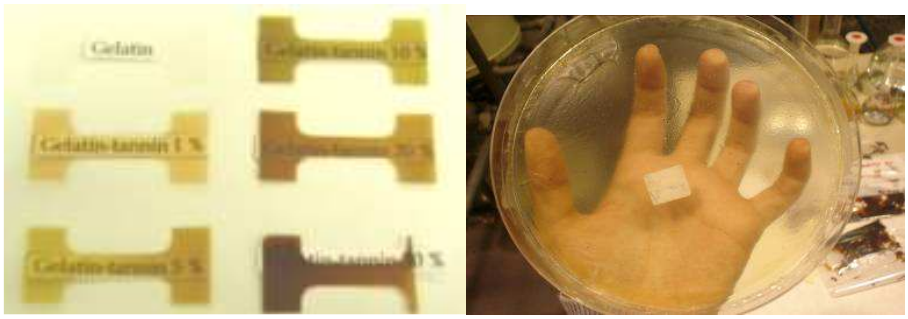

Figure 1. Gelatin/tannin and hemicelullose-based polymeric materials

Biopolymers such as poly (lactid acid) (PLA), poly(glycolide) (PGA) and copolymers have been synthetized, and characterized in order to prepare bio(nano)composite with them and fillers from natural sources. Those biocompatible polymers have potential applications in oftalmology, surgery, implants and biomedicine in general.

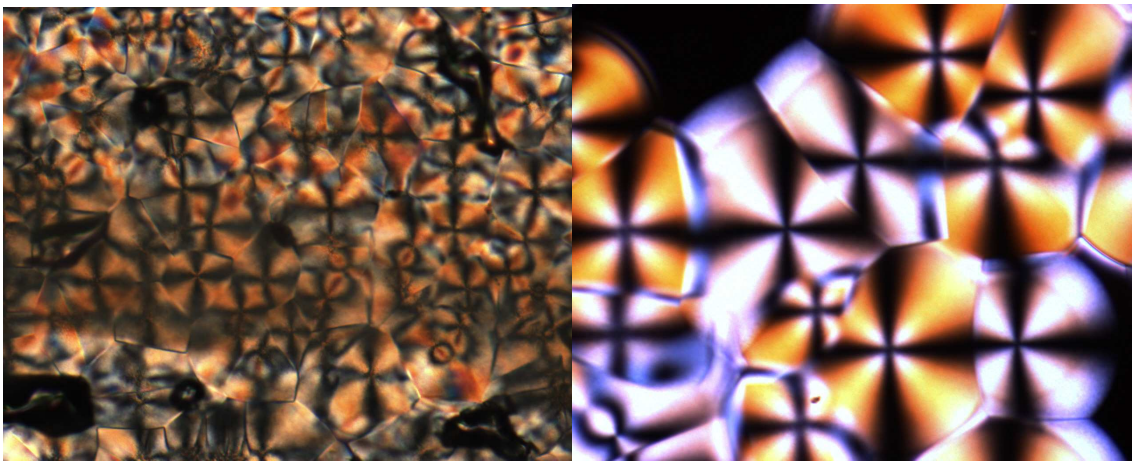

Figure 2. Spherulite formation during the crystallization of PGA (polyglycolide) and PLA (polylactid acid) biopolymers

With those biopolymers or polymers from renewable resources, biocomposites or bio(nano)composites have been prepared with natural fibers (sisal, flax, etc) or cellulose nanofibers, nanocrystals or nanowishkers as fillers. For cellulose, two types of processes have been carried out. First one, known as *top down* process, consits on the obtention of cellulose from agro industrial residues. The second one, known as *bottom up* process consists on the synthesis of bacterial cellulose, from *Gluconoacetobacter xylinum* in optimum conditions.

Figure 3. Sisal and flax plants, source of natural fibers

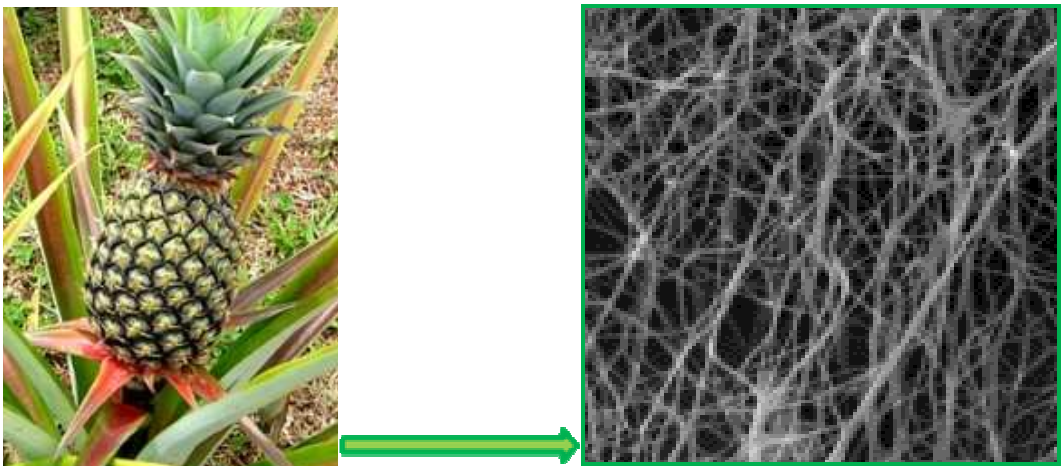

Figure 4. Synthesis of bacterial cellulose from pinneaple with *Gluconoacetobacter xylinum.* 20-70 nm-wide nanofibers are obtained

The group is working in the preparation of hybrid materials based on matrices and fillers cited above, trying to optimize obtention and composite preparation methods to obtain materials with comparable materials to those from non renewable resources.

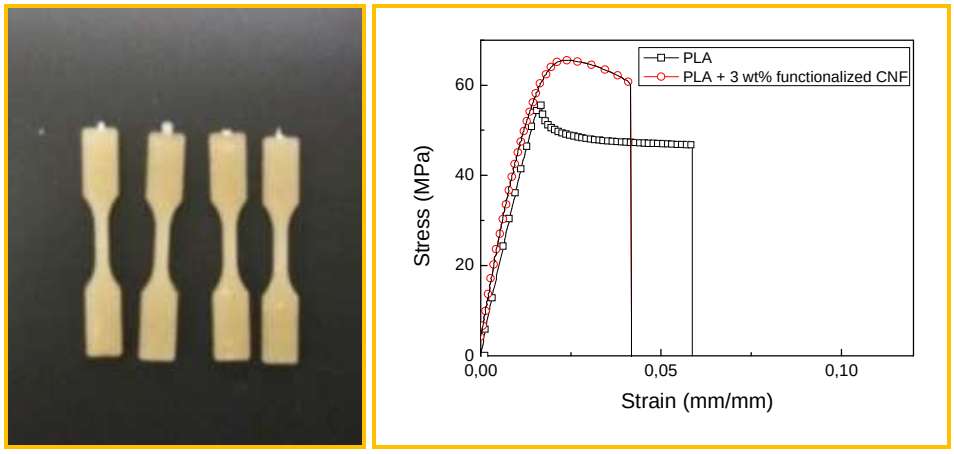

Figure 5. PLA/bacterial cellulose composite-made samples for tensile testing and obtained preliminary results