Bacterial Cellulose: production and applications

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Bacterial Celulose (BC) is a remarkable material, produced by the strictly aerobic bacteria *Gluconoacetobacter xylinum*. It is highly crystalline and pure cellulose, with outstanding mechanical properties, which may be obtained in a pre-defined shape. It absorbs a large amount of water, thus behaving like a highly stable and resistant hydrogel. In our group, we aim at developing applications in various fields, namely the production of biomedical devices, coatings for food products and composites with new properties.

The development of bioreactors for the large-scale production is a central topic, aiming at the affordable production of BC, allowing its use as a bulk material. In parallel, bioreactor design has been centered on the development BC structures with enhanced piezoelectricity. Such novel electro-active material could be explored as artificial muscles or in the tissue engineering of nerves.

Conductive polymeric composites have been receiving considerable attention because of their potential applications in electrodes, biosensors, batteries, antistatic coatings, gas sensors, membranes, light emitting diodes and notability in neuronal tissue engineering, robotics and biomedical actuators. The rationale is based on the putative modulatory effect of the electrical stimulation on cell attachment, proliferation, migration and differentiation. As such, research has been focused on the surface modification of BC by the covalent attachment of conductive polymers.

Applications in the biomedical field, as a scaffold for tissue engineering, requires the fine tuning of porosity and surface properties, allowing the cell migration and proliferation within the material. The development of artificial vascular prosthesis is one among the currently ongoing projects.

1. "Bacterial Cellulose: properties, production and applications" in "Cellulose: Structure and Properties, Derivatives and Industrial Uses". Nova Science Publishers, Inc, New York.
2. Andrade, F.K., Moreira, S.M.G., Domingues, L., Gama, F.M. Improving the affinity of fibroblasts for bacterial cellulose using carbohydrate-binding modules fused to RGD. Journal of Biomedical Materials Research: Part A (accepted)