



Bacterial cellulose: production and applications

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Bacterial cellulose (BC), excreted by *Gluconacetobacter xylinus*, is a unique nanofibrillar biopolymer with a wide range of applications in human and veterinary medicine, odontology, pharmaceutical industry, biotechnological, food and paper industry.

The major research activities of our research group include the following headlines:

- Surface-modification of BC matrices and BC whiskers for the design of novel functional BC nanocomposite systems. This domain includes the surface-activation of BC with CBMs (Carbohydrate Binding Modules) conjugated with bioactive peptides for biomedical applications.[1] CEB-UM has already shown that the adsorption of CBM-RGD (the minimal essential cell adhesion recognition motifs) onto BC improves its ability to adsorb fibroblasts.[2] Also, research on the use of BC tubes as new guides for neuronal growth (CAPES, 3989/05-4) and, for the first time, on assessing the in vivo cytotoxicity of BC nanofibers (SFRH/BD/18418/2004), is on course.

- Design of novel BC structures with tailored microporosity, for biomedical applications (SFRH/BD/48759/2008).

- Engineering of electro-conductive and electro-active BC scaffolds with potential applications in neuronal growth. The embedded polymeric directionality of the BC nanofibers is expected to exhibit shear piezoelectricity which, coupled with a high in situ moldability, thrusts a promising future for novel BC-based materials such as lightweight, biodegradable electro-actives, biosensors and flexible electric displays, with a tailored oriented stiffness and strength.

- Exploring the large-scale fermentation of BC. A novel bioreactor, based on a surface-culture method was designed. A simple and low-cost piece of equipment is capable of direct nebulization of a high volume of dispersed and microparticulated substrate over the growing bacteria. The developed system may reveal to be an interesting economic solution for the large-scale production of BC.

[1] Guerreiro, C.I.P.D.; Fontes, C.M.G.A.; Gama, M.; Domingues, L. 2008. *Protein Expression and Purification*. 59:161–168.

[2] Andrade, F.K., Moreira, S.M.G., Domingues, L., Gama, F.M. 2009. *Journal of Biomedical Materials Research: Part A (accepted)*.