Estefanía Martinez C et al., J Nanomed Nanotechnol 2017, 8:6(Suppl)
DOI: 10.4172/2157-7439-C1-059

Bacterial nanocellulose hemocompatibility assesment: Effect of drying and biomaterial microporosities on blood response

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Statement of the Problem: Bacterial nanocellulose (BNC) is a multifunctional nanomaterial with applications in diverse fields, including scaffolds for tissue engineering and cell regeneration. In these fields, there is a gap in the knowledge regarding its blood response. This work aimed at studying the influence of material drying method and its microporosities on the material hemocompatibility response.

Methodology & Theoretical Orientation: BNC was produced using *Komagataeibacter medellinensis*, following the protocols by Castro et al. (2013). For the evaluation of drying effect, the biomaterials were dried by freeze drying and oven, never-dried BNC was used to comparative propose. To determine the effect of three-dimensional microporosities, BNC was synthetized using porogens and never-dried. The biomaterials were characterized by Scanning Electron Microscopy (SEM) to observe the biomaterial interaction with blood cells and fibrin. Hemolysis and thrombogenicity tests to evaluate the response of red blood cells and clotting time, respectively. These studies were performed under ISO 10993 and ASTM F756, respectively.

Findings: BNC biomaterials are conformed by nanoribbons network and interconnected micropores. Regarding this, drying processes was found that freeze-drying biomaterials present hemolytic behavior (hemolysis percentage over 2%) and a clotting time under 5 minutes. This behavior is related to friction of red blood cells with BNC nanoribbons and a quick adsorption of fibrin, which trigger the clotting cascade. The best result was found with never-dried cellulose, related to its natural water content that reduce the friction of blood cells and adsorption of fibrin (Figure). Respecting the three-dimensional microporosities, there was no statistically difference in hemolytic and clotting time; however, according to SEM images, microporosities promotes the interaction of blood cells with the biomaterial.

Conclusion & Significance: Never-dried cellulose was found to perform an appropriate blood response compared with freeze and oven dried. Furthermore, never-dried BNC allows the conformation of hemocompatible three-dimensional biomaterials, which are useful for the development of cell interactive scaffolds. In prospective these biomaterials are appropriate for future development of new implantable biomedical devices based on BNC for blood contact, taking advantage of nanotechnology.

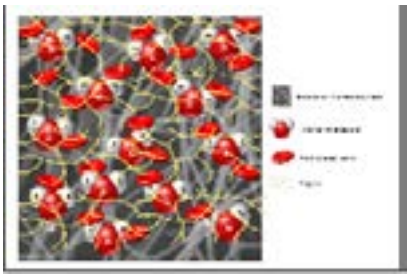

Figure 1: BNC water content reduce the friction of red blood cells and the adsorption of fibrin

Biography

Estefanía Martinez C is a Registered Nurse from the Universidad de Antioquia. At present, she is advancing in her undergraduate studies in Nanotechnology Engineering at the Universidad Pontificia Bolivariana, where she starts to work in the New Materials Research Group (GINUMA) in the evaluation of wound dressings and biomaterials based on bacterial nanocellulose in the biomedical field. Her interest is on the future applications of nanomaterials in tissue regeneration applying a multidisciplinary focus between engineering and nursing.

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