

POSTER PRESENTATION

Open Access

Bacterial cellulose membranes and spheres composite with poly (L-lactic acid) through *in situ* polymerization

Erica Cirigo y Pérez*, Guilherme Colla, Luismar Marques Porto

From 5th Congress of the Brazilian Biotechnology Society (SBBIOTEC)
Florianópolis, Brazil. 10-14 November 2013

Background

Since poly(L-lactic acid) (PLLA) shows great biocompatibility as well as biodegradability [1] and bacterial cellulose (BC) is a high purity biomaterial with unique structural and mechanical properties, composed of cellulose and water [2,3], both are biopolymers with great potential for biomedical applications. This work had the purpose of producing biocomposites with properties that bring together the interesting BC and PLLA attributes. With these in mind, an *in situ* polymerization in BC membranes and spheres was made by L-lactic acid polycondensation. The presence of toxic residues in the composite was avoided by not using a catalyst [4] since it was possible to solubilize lactic acid in the BC hydrogel allowing to take advantage of the auto-polymerization property of this acid [1,4]. The characterization of the composite was made by Scanning Electron Microscopy (SEM) and cell viability was evaluated by MTS [2,5].

Methods

BC membranes and spheres were produced by culturing *Gluconacetobacter hansenii* ATCC 23769. For polymerization, commercial L-lactic acid was dehydrated at 105 °C under vacuum, followed by a three hours pre-polymerization step at 150 °C, also under vacuum [4]. When temperature decreased to 75 °C, BC membranes and BC spheres were added. Polymerization took place under vacuum, at 90 °C and agitated at 300 rpm for 48 hours. Samples were taken each 24 hours, submerged in methanol, washed in distilled water at 30 °C and 120 rpm for 24 hours and then dried at 45 °C. Microstructure was analyzed by SEM. To evaluate the cell viability,

cultures of mouse fibroblasts L929 were grown in Dulbecco's Modified Eagle Medium (DMEM) in a humidified atmosphere, at 37 °C with 5 % CO₂. Cell viability was determined using the colorimetric assay MTS [3-(4,5-dimethylthiazol-2-yl)-5-(3-carboxymethoxyphenyl)-2-(4-sulfophenyl)-2H-tetrazolium]. Cells were seeded in a concentration of 10⁵ cell/membrane and analyzed after 24 hours. Absorbance at 490 nm was quantified in a microplate reader [2].

Results and conclusions

Macroscopically, several properties of the composite biomaterial were observed. Compared with BC control all samples seemed more rigid, showed a white color when hydrated and a slight brightness when dried. Those properties were more evident within the 48 hours treatment. The SEM images showed evidences of integration between the BC and PLLA. MTS assays showed that there was cell adhesion on the 48 hours samples, but it also showed that there was a significant decrease of cell viability compared with the BC control, what suggests that cells do not have the same affinity for the biocomposite compared with the pure BC. Besides, shape of the samples was also an important factor since the difference in cell viability was significant between the spheres and the membranes.

Acknowledgements

To CNPq, CAPES, FAPESC, FINEP, LCME/UFSC.

Published: 1 October 2014

References

1. Madhavan Nampoothiri K, Nair NR, John RP: **An overview of the recent developments in polylactide (PLA) research.** *Bioresource Technol* 2010, **101**(22):8493-8501.

Department of Chemical Engineering Graduate Program, Federal University of Santa Catarina, Florianópolis, Santa Catarina, 88040-900, Brazil

2. Stumpf TR, Pértile RAN, Rambo CR, Porto LM: **Enriched glucose and dextrin mannitol-based media modulates fibroblast behavior on bacterial cellulose membranes.** *Materials Science and Engineering: C* 2013, **33**(18):4739-4745.
3. Shah N, Ul-Islam M, Khattak WA, Park JK: **Overview of bacterial cellulose composites: A multipurpose advanced material.** *Carbohydr Polym* 2013, **98**(2):1585-1598.
4. Achmad F, Yamane K, Quan S, Kokugan T: **Synthesis of polylactic acid by direct polycondensation under vacuum without catalysts, solvents and initiators.** *Chem Eng J* 2009, **151**(1-3):342-350.
5. Souza DJ, Sayumi M, Pértile RAN, Porto LM, Pezzin APT: **Estudo de biocompósitos de poli(L-ácido láctico) (PLLA) com celulose bacteriana (CB) visando aplicação como membranas biomédicas.** *XII Congresso Brasileiro de Polímeros - CBPOL 2013* Florianópolis; 2013.

doi:10.1186/1753-6561-8-S4-P56

Cite this article as: y Pérez *et al.*: Bacterial cellulose membranes and spheres composite with poly (l-lactic acid) through *in situ* polymerization. *BMC Proceedings* 2014 **8**(Suppl 4):P56.

**Submit your next manuscript to BioMed Central
and take full advantage of:**

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at
www.biomedcentral.com/submit

