Bacterial Nanocellulose-Polypyrrole (BC-Ppy) composites as scaffolds for cardiac resynchronization

Srinivasan S.Y. [1], Hernández M. M. [2], Zapata O. [1], Campoy M.[1], Pérez-Amodio S. [2], Laromaine A.[1]

[1]. Institut de Ciència de Materials de Barcelona, Universitat de Autonoma de Barcelona, Bellaterra, Spain.
[2]. Instituto de Bioingeniería de Cataluña, Universitat de Barcelona, Barcelona, Spain
ssumithra@icmab.es

Introduction

Myocardial infarction leads to improper electrical impulse propagation across cardiac cells [1]. Therefore, electrically conducting polymers such as Polypyrrole are promising for cardiac tissue engineering, owing to its easy synthesis, aqueous stability & biocompatibility [2]. Whereas, Cellulose with ECM mimicking fibrous morphology, high flexibility & mechanical strength is ideal as cardiac scaffolds [3]. Here, we designed & evaluated BC-Ppy composites as potential scaffolds for cardiac tissue engineering.

Experimental Methods

BNCs were produced from the bacterial strain Komagataeibacter xylinus (K. xylinus) [4] and BC-Ppy via in-situ oxidative polymerization. The scaffolds were characterized by FT-IR, SEM, TEM, TGA and 4-probe keithly instrument to study their size, structure, morphology and conductive properties. Scaffolds are being tested in-vitro using cardiac fibroblasts and cardiomyocytes.

Results

BNC-Ppy scaffolds were synthesized and found to be ≈ 70 nm BC fiber diameter and that of Ppy NPs ≈ 85 nm. The conductivity of BC-Ppy films were found to be proportional to the concentration of initial monomer added, and was ≈ 10-3 S/cm. In-vitro cell culture experiments with BNC-Ppy scaffolds are at the initial stage studying the viability, cell attachment, morphology etc.

Conclusion

Only a handful studies have shown the efficacy of composites with Ppy as cardiac tissue engineering scaffolds and BNC has not been explored as an effective composite material for this purpose till date. In this work, the intrinsic electrical conductivity, along with excellent biological and mechanical properties of the material is studied for their favorable environment for cardiac cell culture. To the best of our knowledge, this will be a first of its kind study the use of BNC-Ppy as a scaffold for cardiac cells.

References

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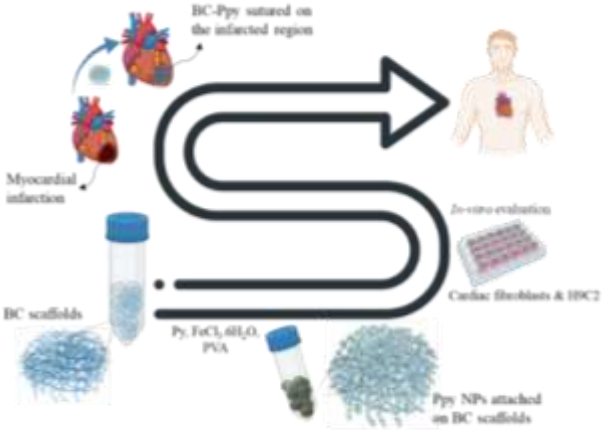
Figures


BC-Ppy sutured on
the infarcted region
Myocardial
infarction
In-vitro evaluation
Cardiac fibroblasts & HSC2
BC scaffolds
Py, $FeCl_3.6H_2O$,
PVA
Ppy NPs attached
on BC scaffolds