Substrate for electrical stimulation device produced with electrospun recycled PET ultrathin fibers

M.C. Barbosa[#1], C.A. Razzino[1], A.F.C. Ribeiro[1], F.R. Marciano[1,2,3], A.O. Lobo[1,2,3*]

[1] Laboratory of Biomedical Nanotechnology, Universidade do Vale do Paraíba (UNIVAP), Av. Shishima Hifumi, 2911, São Jose dos Campos, 12.224-000, SP, Brazil
[2] Biomaterials Innovation Research Center, Department of Medicine, Brigham and Women's Hospital, Harvard Medical School, Cambridge, MA 02139, USA
[3] Department of Chemical Engineering, Northeastern University, Boston, MA 02115, USA

[#]Corresponding author: aolobo@mit.edu

Annually, about nine billion PET bottles are produced in Brazil and 47% of these materials are properly recycled. Many of these materials are disposed inappropriately, causing severe damage to the environment due to its slow degradation. To date, PET is one of the most important thermoplastics in use, due to its excellent mechanical properties, transparency, solvent resistance and recyclability. Thus, new applications of this post-consumer material are studied and recycled PET (PETr) have been used for many applications, such as: filtrations [1,2], production of carbon fibers [3], capacitors [4] and substrate to electrical conduction [5]. Herein, we are proposing the development of a substrate for electrical stimulation device based on electrospun PETr ultrathin fibers. For this, firstly, pieces of PETr were added at trifluoroacetic acid/dichloromethane solution (80:20 w/w) and maintained under magnetic stir for 24 hours. Then, the solution was electrospun and optimal electrospinning conditions were found as follows: 15 kV as positive voltage, a needle-collector distance of 10 cm and 0.5 mL h^{-1} as solution flow rate. Environmental conditions were carefully controlled as follows: humidity (~ 40-45%) and temperature (~ 25 ºC). The electrospun ultrathin fibers obtained were characterized by scanning electron microscopy (SEM) and differential scanning calorimetry (DSC). Morphological details obtained by SEM show a mean fiber diameter of 391 ± 28 nm, smooth and without beads. A TG around of 70.1 °C with 18.1% of crystallinity was observed by DSC. To these electrospun ultrathin fibers will be incorporated carbon nanomaterials (carbon nanotubes and graphene) in order to improve crystallinity, mechanical, electrical and thermal properties, besides adding conductivity. The conductivity of these fibers and your applicability as substrate for the production of device for electrical stimulation will be evaluated by cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) techniques.

[1] I.N. Strain et al, Journal of Materials Chemistry A. **3**, (2015) 1632.
[2] N.E. Zander, M. Gillan, and D. Sweetser. Materials. **4,** (2016) 1.
[3] E. Svinterikos, I. Zuburtikudis, Journal of Applied Polymer Science. **37**, (2016) 1.
[4] H.H. Shi, H.E. Naguib, Nanotechnology. **27**, (2016) 325.
[5] B. Indumathi et al. Polymer Science Series A. **5**, (2016) 793.