Effects of several sterilization methods on the physico-chemical and bioresponsive properties of plasma treated PCL films.

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The objective of this research is to select the most appropriate sterilization method of plasma treated polycaprolactone (PCL) films by studying the effects of UV irradiation, H_2O_2 plasma and ethylene oxide sterilizations on the physico-chemical and bioresponsive properties of the films, and to investigate the potential of the plasma treatment itself to sterilize PCL films. After a comparison between the different performed sterilization methods, primary results showed that ethylene oxide sterilization did not significantly interfere with the physico-chemical properties of the plasma treated films. Moreover, plasma treatment followed by ethylene oxide gave a higher cell proliferation rate and improved cell adhesion properties compared to the untreated samples, which makes it a promising sterilization method for PCL. The choice of PCL in this study stems from the fact that it is a biocompatible and biodegradable polymer that has been extensively used in biomedical applications such as nerve regeneration.[1] Despite its excellent bulk characteristics, PCL surface properties such as low wettability need to be altered to enhance cell-material interactions.[2] This was performed via surface plasma treatment using a dielectric barrier discharge plasma reactor, operating in air and argon at medium pressure. Chemical and physical surface changes were examined using different techniques such as: water contact angle measurements (WCA), X-ray photoelectron spectroscopy (XPS) and atomic force microscopy (AFM). Results showed that, argon and air plasma treatments decreased the WCA from 73˚ to 54˚ by introducing polar groups onto the surface. PCL sterilization, which is a crucial step mostly overlooked in the literature, was studied because it can change the structure and surface of the treated polymer and thus alter the desirable effects produced by the plasma treatment. To study the plasma sterilization, plasma process parameters such as power and treatment time were varied and the treated films were tested for their sterility.

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[2] T. Jacobs, N. De Geyter, R. Morent, T. Desmet, P. Dubruel and C. Leys (2011). Plasma treatment of polycaprolactone at medium pressure, *Surface and coatings technology*, 205 543-547.