Application of Dielectric Barrier Discharge (DBD) atmospheric pressure plasma for pretreatment of medical textiles

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Abstract:
Conventional pretreatment by wet chemistry and/or low-pressure plasma have several drawbacks [1]. Atmospheric plasma is an alternative and cost-competitive method to low-pressure plasma and wet chemical pretreatments, allowing continuous and uniform processing of fibers, substrates and films surfaces, improving its functionalization performance [2]. This technology has been studied in the field of the R&D project - PLASMAMED. The main objective of this project is to produce a new generation of coatings containing nanoparticles (NPs) and enzybiotics, with controllable antibacterial activity, on medical textiles, with special emphasis in antimicrobial dressing for pressure injury and hernia meshes. To achieve this goal, a dielectric barrier discharge (DBD) atmospheric pressure plasma was used as a pretreatment sustainable alternative.
In this sense, medical-grade 100% polyester (PES) fabrics were pretreated by atmospheric plasma technology, where various processing conditions were tested. Different treatment speeds and discharges powers were tested, as well as the application of various gases (such as helium, oxygen and nitrogen) and a corona treatment (air), with a carrier gas (argon). The characterization of these pretreated textiles was carried out by contact angle (CA), through the sessile drop technique, with 3 µL water droplets on the surface of the textile. In general, contact angles exhibit a significant decrease (between 40º and 60º for all studied gases), when compared with the standard values for substrate without treatment (around 120º). Therefore, plasma pretreatment significantly improved the hydrophilicity of these fabrics (Figure 1), which reveals to be an advantage for the further functionalization steps.
Keywords: textile pretreatment, atmospheric plasma, hydrophilicity, nanotechnology, medical textiles.

Figure 1: Contact angle results. Effect of plasma pretreatment on the hydrophilicity of medical-grade 100% PES fabric: before (on the left) and after plasma pretreatment with oxygen (on the right).

References:

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