Tailoring Wettability and Surface Energy of Textiles by DCSBD Plasma for Design-Oriented Applications

D. Ondrušová[1], R. Janík[1], S. Ďurišová[1], S. Šťastná Zajacová[1], N. Oslejová[1]

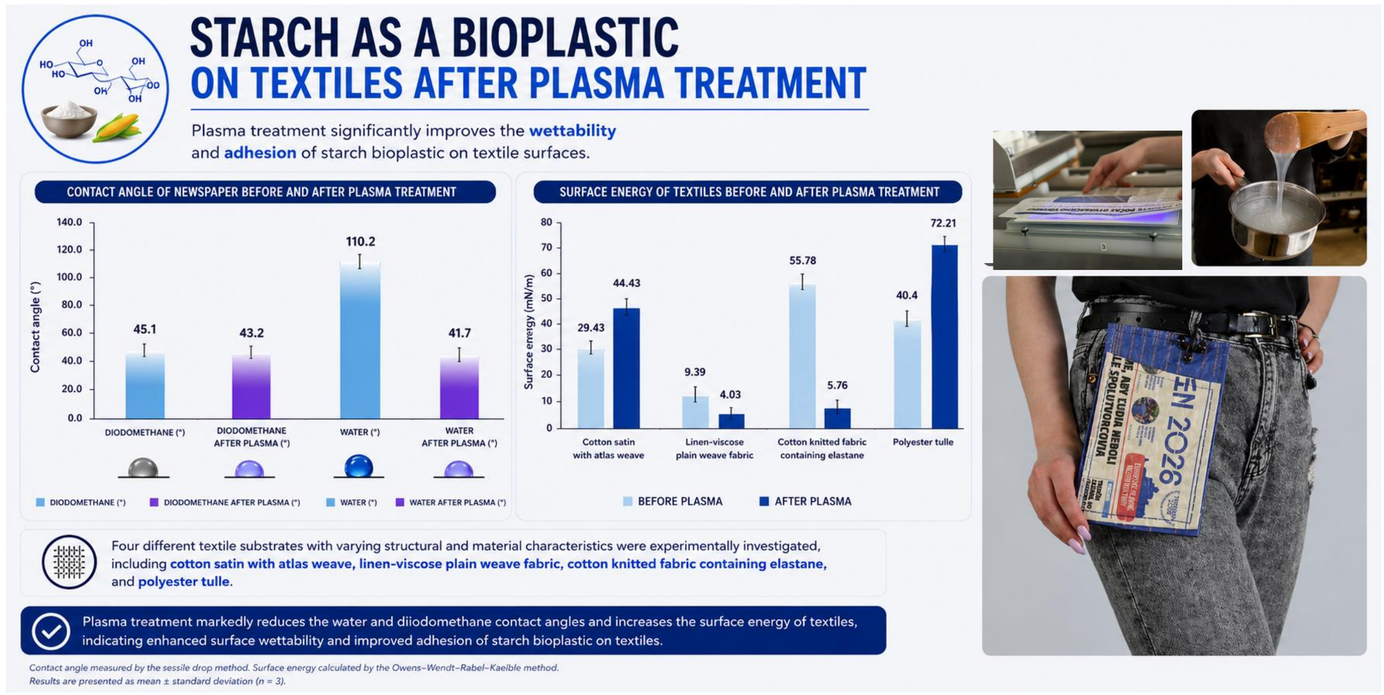
➢ INTRODUCION

Sustainable textile design can be enhanced by combining biodegradable starch-based composites with environmentally friendly DCSBD plasma surface activation. This research demonstrates the potential of plasma-treated textiles and natural polymer systems for advanced material-design applications with improved surface interaction and adhesion behaviour.

➢ METHODS

Four textile substrates with different structural and material characteristics were experimentally investigated, including cotton satin, linen-viscose woven fabric, cotton knitted fabric containing elastane, and polyester tulle. The textiles were surface-treated using DCSBD plasma technology under atmospheric-pressure conditions to modify their surface activity and improve interaction with starch-based composite layers. A starch-based biodegradable composite was prepared using starch, water, and glycerol as a plasticizing component. The prepared composite system was subsequently applied onto selected textile substrates to evaluate adhesion behaviour and surface compatibility. Plasma treatment was performed using a DCSBD reactor operating at an input power of 375 W with controlled exposure times. Surface wettability and surface free energy were evaluated by contact angle measurements using a Drop Shape Analyzer DSA100 system. FTIR spectral analysis was performed using a Nicolet ATR-FTIR spectrometer equipped with a diamond crystal to evaluate plasma-induced chemical changes on the textile surfaces. Morphological and interfacial changes between the composite layer and textile structure were analysed using confocal microscopy. The experimental workflow additionally included optical image analysis and photographic documentation of the prepared textile-composite systems. The obtained results demonstrated that plasma activation significantly influenced surface interaction, wettability behaviour, and adhesion potential of biodegradable starch-based coatings on textile substrates.

➢ THE RESULTS



The research demonstrates the potential of atmospheric DCSBD plasma for environmentally friendly surface modification of textile materials intended for biodegradable composite applications. The combination of renewable raw materials, atmospheric plasma treatment, and experimentally prepared composite structures represents a promising approach for the development of sustainable material systems with functional and visually distinctive characteristics.

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[1]Faculty of Industrial Technologies in Púchov, Ivana Krasku 1809/34, 020 01 Púchov, Alexander Dubček University of Trenčín, Slovakia

✉ Correspondig author: robert.janik@tnuni.sk

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