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Surface alteration of PVA/Coffee nanofibers using oxygen dielectric barrier discharge plasma for the investigation of physical and chemical characteristics

Abstract

Recently, atmospheric dielectric barrier discharge (A-DBD) has gained recognition as a practical technique for modifying the surface properties of polymers. It has the ability to alter the chemical and physical properties of material surfaces at room temperature without any change to their bulk properties. For this study, A-DBD plasma treatment has been carried out on electrospun PVA/Coffee nanofiber mats. These mats are prepared with PVA and Coffee solutions combined in a ratio of 2:3. These as-fabricated nanofiber mats are subjected to DBD plasma treatment in oxygen (O₂) gas at atmospheric pressure. The morphology of the prepared nanofiber mat is studied with scanning electron microscope (SEM). Other physical and chemical properties like crystallinity, functionality of the nanofiber mat (before and after plasma treatment) are studied with Powder X-ray Diffraction (P-XRD) technique and ATR-FTIR analysis. Surface characteristics of the mat before and after the plasma treatment are analyzed by Differential Scanning Calorimeter (DSC) and water contact angle measurement. The results indicate that plasma treatment of PVA/Coffee nanofiber mats causes certain enhancement of the produced nanofiber mats' physical and chemical characteristics in comparison to untreated ones. This study may help to understand the effect of A-DBD plasma processing on material surface modification.

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