ABSTRACT

Anterior cruciate ligament (ACL) injury is one of the most common knee joint injuries, with a global prevalence of 30-78 per 100,000 individuals, particularly among physically active people. The limited regenerative capacity of natural ligament tissue and the risk of complications associated with conventional reconstruction methods have driven the development of artificial ligaments based on biomaterials. Bacterial Cellulose–Polyvinyl Alcohol (BC–PVA) composite has emerged as a promising candidate due to its favorable biocompatibility and mechanical properties that closely resemble native ligament tissue. This study aims to analyze the effect of oven-drying and freeze-drying methods on the chemical, mechanical, and structural stability of BC–PVA as a potential artificial ligament. Characterization was carried out using Fourier Transform Infrared Spectroscopy (FTIR), tensile testing, and swelling analysis. Results showed that the oven-drying method produced composites with the highest tensile strength (17.53 MPa), elongation at break of 149.17%, and stable swelling capacity (336.16% at 60 minutes). FTIR spectra indicated the formation of strong hydrogen bonds between BC and PVA without the appearance of new functional groups, suggesting stable chemical integration. Based on these results, the oven-drying method is considered the most optimal for producing BC–PVA material with superior mechanical performance and structural stability, thereby demonstrating strong potential as a candidate for artificial ligaments in regenerative medicine applications.

Keywords: *BC-PVA, ligament, oven-drying, regenerative biomaterial.*