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The effect of cross-linking and anti-microbial agent on the performance of poly(vinyl alcohol) and cellulose acetate based membranes designed for wound dressings

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In recent years, research focusing on developing biomedical products from various polymeric membranes has witnessed a tremendous expansion attributed to their unique properties. Flexible thin polymeric membranes prepared from bioresorbable and biocompatible polymers, having a cross-linked network, are known to absorb and maintain their physical structure and integrity at the site of implantation. This generates the release of various biologically active components thus helping to restore the structure of injured and diseased tissues. The present work focuses on evaluating polyvinyl alcohol (PVA) and cellulose acetate (CA) based membranes cross-linked with tetraethylorthosilicate (TEOS) for wound dressing applications. These membranes contain varying percentages of alumina (Al_2O_3) and chitosan to provide them with antimicrobial properties. Previously, these membranes were developed for filtration and desalination, and we plan to use them as occlusive wound dressings, where the exudate absorption, water vapor transmission and ion exchange will be crucial performance properties. Following synthesis, this project is currently in its characterization phase, which is critical to wound dressings development. The thermal, chemical and surface characterization of the PVA and CA based membranes is being executed using TGA, FTIR, SEM, optical microscopy, TOF-SIMS and XPS. The samples were observed to have cross-links by identifying the presence of certain peaks throughout the FTIR fingerprint region. Additionally, through SEM we could witness a smooth continuous surface and layered cross-section lacking porosity both on the surface and through the cross-section for the samples. Further, TGA data confirmed that the elevated temperature for processing and sterilization will not contribute to premature degradation since the degradation peak was above 250°C for all samples. Characterization of these membranes to analyze their surface and antimicrobial properties is still ongoing.

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