

Sustainable Synthesis of Cellulose Acetate from Cotton Waste

W.D.Y. Kantha, S.D.C. Madusanka, A.M.P.B. Samarasekara*, D.A.S. Amarasinghe

Department of Materials Science and Engineering, University of Moratuwa, Sri Lanka.

**Email: bandu@uom.lk*

This research presents an innovative approach to the synthesis of cellulose acetate from cotton waste, contributing to sustainable materials development. Cotton waste, a byproduct of textile processing, is an abundant and underutilized resource. The study focuses on extracting cellulose, a natural polymer found in cotton fibers, as a precursor for cellulose acetate production. In this study, cellulose was extracted from cotton wool using a simple, cost-effective method. The extraction process involved the alkaline peroxide pretreatment of cotton wool with a mixture of sodium hydroxide and hydrogen peroxide at 95 °C for 1 hour. The extracted cellulose was then characterized using Fourier transform infrared spectroscopy (FTIR) to confirm the removal of lignin and hemicellulose. The FTIR analysis indicated the presence of cellulose and removal of functional groups of lignin and hemicellulose. The extracted cellulose was then chemically modified using acetic anhydride and acetic acid under different reaction conditions by going through the processes of activation, acetylation, and hydrolysis respectively. The resultant cellulose acetate sample was centrifuged to sediment at 1500 rpm for 15 minutes. This cellulose acetate finds applications in textiles, packaging, and biomedical fields due to its exceptional properties, including biodegradability, film-forming capability, and compatibility with various industries. The results of this research contribute to the growing field of environmentally friendly material synthesis, providing a practical and sustainable method for synthesizing cellulose acetate.

Keywords: Cellulose, Cellulose acetate, Cotton, FTIR analysis, Hydrolysis.