

INVESTIGATION OF THE IMPACT OF CRYSTALLINITY AND SURFACE MORPHOLOGY ON THE MECHANICAL PROPERTIES OF *Artocarpus heterophyllus* LATEX AND POLY(ETHYLENE OXIDE) STRETCH FILMS

N.V.P.K. Gamage¹, W.S.S. Gunathilake², H.C.S. Perera³, B.S. Dassanayake¹ and C.P. Jayalath^{1*}

¹*Department of Physics, Faculty of Science, University of Peradeniya, Sri Lanka*

²*Department of Chemistry, Faculty of Science, University of Peradeniya, Sri Lanka*

³*Khalifa University, Abu Dhabi, UAE*

**jayalathcp@sci.pdn.ac.lk*

Most researchers focus on developing new stretch films due to their advantages as packaging materials. However, the materials used to produce these films are often costly and less environmentally friendly. To address these issues, a novel material was synthesised by blending poly(ethylene oxide) (PEO) and *Artocarpus heterophyllus* latex (AHL). AHL, commonly known as jackfruit latex, is a waste material with a composition similar to natural rubber. This study aimed to investigate the impact of crystallinity and surface morphology on the mechanical properties of the novel polymer blend material. The polymer blend was prepared by mixing PEO and AHL using toluene as the solvent. The optimized sample for a stretch film was identified as a PEO:AHL ratio of 1:1, determined by comparing tensile measurements and surface photographs taken with a macro camera for different ratios. This study utilised X-ray diffraction (XRD), FEI Quanta 3D FEG dual beam scanning electron microscopy (SEM) [SEM 1], ZEISS EVO LS15 high-performance variable pressure environmental SEM [SEM 2], and polarization optical microscopy. XRD analysis revealed that both pure PEO (control) and the PEO-AHL 1:1 polymer blend exhibit semi-crystalline properties. SEM 1 and polarized optical microscopy images confirmed that incorporating AHL into the PEO matrix markedly reduces its semi-crystalline nature. This reduction was analysed by comparing the size and the distribution of spherulites, a characteristic feature of crystalline materials. SEM 2 further examined surface morphology variations due to AHL addition, revealing a ruffled surface structure in the polymer blend compared to the control sample. These findings demonstrate that adding AHL to PEO increases the material's effective surface area by changing its surface morphology from uniform to ruffled. Additionally, it significantly lowers the crystallinity of pure PEO, enhancing its stretchability and making it a viable alternative to existing stretch film materials.

Keywords: *Artocarpus heterophyllus* latex, Crystallinity, Poly(ethylene oxide), Polymer blend, Surface morphology