Abstract

Effect of epoxidized natural rubber (ENR) (ENR-12, ENR-27 and ENR-42) incorporated in polyvinyl alcohol (PVA) at various ratios (PVA/ENR = 100/0, 90/10, 80/20, 70/30, 60/40, 50/50 and 0/100) on adhesive and film properties of different PVA (BF-17, BP-17 and BF-26) was investigated. Incorporation of ENR at 10-30% could improve the film mechanical properties (i.e., increased tensile strength and elongation at break) and adhesion properties (i.e., increased adhesive shear strength and elongation) of the PVA. In particular, PVA/ENR blend prepared from PVA-BF26 and ENR-12 at PVA/ENR ratio of 80/20 exhibited the best adhesive properties (adhesive shear strength = 2.77± 0.15 N/mm^2 and breaking elongation = 2.45± 0.35 mm). This blend also showed the greatest improvement of mechanical properties of the resulting film (tensile strength = 105.45±1.45 MPa and elongation at break = 137.34 ± 1.84%), compared to the PVA without ENR incorporation.

The evolution of adhesive strength with applied time of selected PVA-BF26/ENR12 (80/20) blend was measured at different applied temperatures (room temperature (RT) and 50 °C). The maximum adhesive strength was developed within 24 and 12 hr at applied temperature of RT and 50 °C, respectively. Moreover, adhesive property of PVA-BF26/ENR12 (80/20) blend was also compared to that of different commercial glues. The PVA-BF26/ENR12 (80/20) blend showed similar adhesive strength to that of the commercial solvent-based rubber adhesive (Scotch®) but lower than that of the commercial latex adhesive (TOA®) and urea-formaldehyde adhesive. The properties of PVA-BF26/ENR12 (80/20) blend film and different commercial plastic films were comparatively investigated. Film from PVA-BF26/ENR12 (80/20) blend exhibited similar tensile strength compared to that of LDPE and PP films, but lower than that of Nylon/LLDPE and PET/LDPE laminated films. In addition, the PVA-BF26/ENR12 (80/20) blend film had higher water vapor barrier and polar-solvent resistance, compared to the PVA-BF26 without ENR incorporation, which resulted in increased the stability during storage and application at high relative humidity condition of the PVA/ENR blend film.

Therefore, incorporation of ENR with appropriate type and amount in PVA could improve the adhesive property and film properties as well as the stability of PVA. This was mostly contributable to good compatibility of PVA and ENR molecules, resulted from intermolecular interactions of both polymers.