

A novel leucoaurin based trifunctional polybenzoxazines coated hydrophobic cellulose paper for packaging application

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Abstract

Conventional cellulosic packaging materials lack the ability to resist the penetration of water, mineral oil, and harmful chemicals. These poor barrier properties of the conventional cardboard packaging materials make them ineffectual in various industrial applications. Hence, the present work focuses on the development of hydrophobic polybenzoxazine coated cellulose paper with improved tensile strength for the replacement of existing cardboard packaging materials. The trifunctional polybenzoxazines have been synthesized and coated on cellulose paper for the hydrophobic packaging material application. A new type of series of tri-functional polybenzoxazines were synthesized using leucoaurin with paraformaldehyde and separately with five different aliphatic amines of varying chain length (i.e.) butylamine (ba), hexylamine (ha), ethylhexylamine (eha), dodecylamine (dda) and octadecylamine (oda) through Mannich condensation. In the present work, the influencing effect of aliphatic chain length present in the skeleton of polybenzoxazines has been studied and the hydrophobic behavior was exploited for water-proof packaging application by coating polybenzoxazines on normal cellulosic printable paper-75 GSM (CP) and Wattman paper (WP) through spray coatings. The hydrophobic behavior of leucoaurin based benzoxazines coated cellulose paper was tested using goniometer and the coated cellulosic paper possesses good hydrophobic behavior with value of water contact angle above 125° . Among the polybenzoxazines synthesized, the leucoaurin with octadecylamine benzoxazine coated on cellulosic WP paper shows better water repellent property (water contact angle $136 \pm 2^\circ$) than that of others. In addition to that, the value of tensile strength of leucoaurin based polybenzoxazines coated papers was tested using UTM and the results obtained were compared with that of non-coated papers. The tensile strength of the coated papers was found to be 2 to 3 times higher than that of non-coated paper with the value of 21 MPa and 18 MPa for LA-PBZ coated copier paper and Wattman paper respectively. The obtained results suggest that the leucoaurin based polybenzoxazines coated papers can be considered for effective utilization for water-proof packaging applications.