Sustainable future alternatives to petroleum-based polymeric conservation materials

The research described here is the first study on the use of sustainable, plant-based bioplastics as substitutes for petroleum-based plastic packaging, and in novel adhesive and coating formulations. Bio-polyethylenes, bio-polysters and bio-cellulose-based products were evaluated against petroleum-based materials. Bio- and petroleum-based polyethylenes shared optical, chemical and thermal properties. Bamboo and sugarcane fibre containers were also chemically stable. Polyester polyactic acid (PLA) bags and containers became brittle and opaque at a relative humidity (RH) above 65%. FTIR spectroscopy and thermogravimetric analysis suggested that PLA hydrolysed to produce acids. PLA/cornstarch bags fragmented on ageing and formed a gel at high RH levels. A 5 wt% solution of adhesive prepared from soya protein was an effective and reversible adhesive for wood, paper and glass, but adhered poorly to polyethylene and poly(methyl methacrylate). Humic acid-based solutions formed cohesive films which adhered well to glass, paper and soil.

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