Sustainability and Adhesive Performance of Plant Oil-Based Latexes

Iryna Bon[1], Vasylyna Kirianchuk[2], Zoriana Demchuk[3], Julianna Nichols[4], Ghasideh Pourhashem[1], Andriy Voronov[1]

[1] Department of Coatings and Polymeric Materials, North Dakota State University, Fargo, ND
[2] Department of Organic Chemistry, Lviv Polytechnic National University, Lviv, Ukraine
[3] Chemical Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN
[4] Department of Biochemistry, Seton Hill University, Greensburg, PA

Sustainability of the adhesives prepared from fossil-based materials has become a growing concern. Thus, replacement of petroleum-based materials by ones derived from renewable resources is pursued as a sustainable strategy for reducing their carbon footprint. Biobased latexes can be widely used as waterborne adhesives if their performance and properties are competitive to those currently available in the market. This work aims to evaluate the performance of latex adhesives with higher biobased content recently developed in our group. For this purpose, plant oil-based vinyl monomers HOSBM and CMM (derived from high oleic soybean oil and camelina oil, respectively) in combination with methyl methacrylate (MMA) and butyl acrylate (BA) were copolymerized using miniemulsion to yield latexes to be tested as adhesives. The MMA ("rigid" fragment) content was kept at 55 wt%, while BA (within remaining 45 wt% of the "soft" fragments) has been gradually replaced by either CMM or HOSBM.

The effect of partial substitution of the BA by CMM or HOSBM on adhesive properties was assessed using peel testing (ASTM D 1876-08) on the multiple substrates. Presence of plant oil-based fragments in latex copolymers improves adhesives peel strength on most substrates. Plant oil-based latexes with the maximum content of CMM or HOSBM (up to 45wt %) and their optimal adhesive performance were determined on various carpet and paperboard substrates.

Additionally, Life Cycle Assessment (LCA) method was used as a tool to evaluate the environmental performance of the synthesized latex adhesives as well as identify the hotspots in the synthesis of these plant-derived adhesives in their early design stages. LCA of plant oil-based monomers can explain to which extent the sustainability of the biobased latex adhesives can be improved.

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