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Development of bio-based plywood adhesive utilizing protein recovered from hydrolyzed specified risk materials

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Currently, production of composite wood products relies almost exclusively on petrochemical-based resins, more specifically the formaldehyde-based resins, as adhesives. As petrochemicals are obtained from non-renewable resources and formaldehyde is a known carcinogen, this research was conducted with the aim to develop a formaldehyde-free plywood adhesive system utilizing waste protein as a renewable feedstock. The feedstock for this work was specified risk material (SRM), which constitutes the bovine tissues that are completely banned from any food, feed, and fertilizer applications, and are being disposed of either by incineration or landfilling with severe environmental and economic impacts. In this study, we developed a technology for utilization of SRM protein in value-added applications. In particular, the SRM was thermally hydrolyzed, protein fragments were recovered from the hydrolyzate, and the recovered protein fragments were chemically crosslinked with polyamidoamine-epichlorohydrin (PAE) resin to formulate an adhesive system for bonding of veneer sheets to make plywood specimens. The effects of crosslinking time, the ratio (wt/wt) of protein fragments and PAE resin in the formulation, and hot pressing temperature on the strength of resulting plywood specimens were investigated by lap shear strength testing method. Adhesive formulations consisting of as much as 78% (wt/wt) protein fragments met the minimum requirements of ASTM specifications for urea formaldehyde resin type of wood adhesives in dry as well as soaked conditions. Under optimal conditions of specimens preparation, some formulations yielded plywood specimens having shear strength comparable to that of commercial phenol formaldehyde resin in both dry and soaked conditions.

Biography

Birendra B Adhikari has completed his PhD in Chemistry from Saga University, Japan, and Post-doctoral studies in Chemistry from California State University Long Beach, CA, USA. Currently, he is pursuing another Post-doctoral studies in Bioresource Engineering at University of Alberta, AB, Canada. His reseaerch experiences lie in multidisciplinary areas combining organic and analytical chemistry as well as chemical and bioresource engineering. He has published 16 papers as the first author, and has shared authorship in 15 papers in reputed peer reviewed journals.

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