

Effects of surface-modified ultrafine fully vulcanized powdered natural rubber on the mechanical and thermal properties of polylactic acid composites

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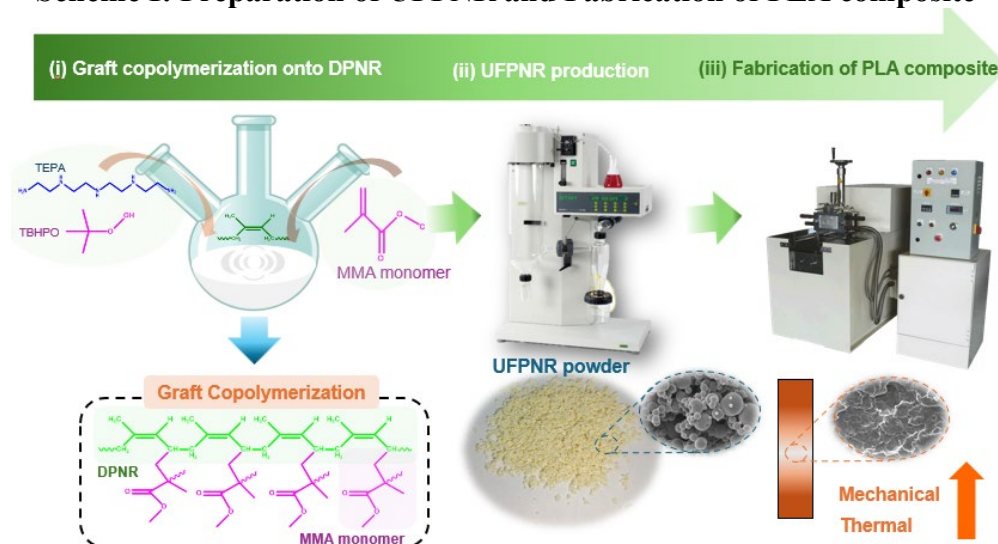
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Abstract


Utilization of biodegradable thermoplastic polylactic acid (PLA) has restricted its widespread application because of the cost and brittle nature of materials. Therefore, this study focused on providing solutions to the brittle nature of PLA using a cost-effective and highly efficient filler material that could be assessed in abundance from agricultural industry. Firstly, different monomers were produced based on ultrafine fully vulcanized powdered natural rubber grafted methyl methacrylate monomer (UFPNR-g-PMMA) at various proportion. Secondly, the optimized UFPNR-g-PMMA powder was used as a toughening filler in the PLA matrix to produce the composite. Furthermore, flexural and impact strength tests were used to examine the toughening effects of the UFPNR-g-PMMA filler. The results recorded suggests that the aim of the study has been achieved considering that 3-4 and 2-3 folds improvements achieved with flexural strain and impact strength with the UFPNR-g-PMMA filler at 5-20 wt/wt%, respectively. Thermal stability of the PLA/UFPNR-g-PMMA composites has also improved drastically. The toughening performance exhibited by the UFPNR filler in the PLA matrix suggests its potential as an alternative material for 3D printing and packaging.

Scheme I: Preparation of UFPNR and Fabrication of PLA composite



Reference 1) R. Panyawutthi, et al., *J. Thermoplast. Compos. Mater.*, 39, 763-788 (2026).

Biography

<p>Name: ...Sarawut Rimdusit...</p> <p>Title: ...Professor Dr.</p> <p>Affiliation: ...Center of Excellence in Polymeric Materials for Medical Practice Devices, Department of Chemical Engineering, Faculty of Engineering, Chulalongkorn University...</p> <p>Country: ...Thailand...</p> <p>Phone...02-218-7915...</p> <p>E-mail: ...Sarawut.r@chula.ac.th...</p>	 A portrait photograph of Professor Dr. Sarawut Rimdusit. He is a middle-aged man with short dark hair and glasses, wearing a dark suit, a white shirt, and a blue and white striped tie. He has a pink and white floral corsage pinned to his left lapel. The background is a solid light blue color.
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Personal History:

... Dr. Sarawut Rimdusit is a full professor and Head of Center of Excellence in Polymeric Materials for Medical Practice Devices, Department of Chemical Engineering, Faculty of Engineering, Chulalongkorn University, Bangkok, Thailand. He received his master and doctoral degrees from the Department of Macromolecular Science and Engineering, Case Western Reserve University, Cleveland, Ohio, USA in 1997 and 2000, respectively. He worked as a post-doctoral fellow under a Hitachi research fellowships in 2005 and 2008 at Toyohashi University and Technology and Monbusho research fellowship in 2003 at the Japan Aerospace Exploration Agency (JAXA, formerly ISAS). His research is concentrated on multicomponent polymeric systems based on polybenzoxazines and some network forming polymers. His recent research focuses on the use of polybenzoxazine alloys as functional materials including shape memory materials, self healing polymers and thermoreversible light scattering polymers. He has published 1 book on polybenzoxazine alloys and composites (Springer), 10 book chapters in English, 4 book chapters in Japanese and about 140 international papers related to the alloys and composites of polybenzoxazines with the current h-index of 37.

Research Keywords:

Shape Memory Polymers, Polybenzoxazine, Polymer Alloys and Composites, 4D Printing