

Reinventing Natural Rubber: Engineering Allergy-Free Latex for Global Health, Industry, and Sustainability

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Natural rubber (NR) is a critical biomaterial for healthcare and industrial applications, valued for its superior elasticity, strength, and renewability. However, intrinsic allergenic proteins in natural rubber latex (NRL) remain a major concern, particularly in medical and occupational settings where type I hypersensitivity reactions can pose serious health risks. As a leading global producer, Thailand plays a key role in advancing safer and higher-value NR technologies.

This plenary presentation introduces an integrated and scalable approach to engineering allergy-free NRL through deproteinization and saponification processes, yielding highly purified latexes—deproteinized natural rubber (DPNR) and saponified natural rubber (SPNR). These materials exhibit significantly reduced extractable protein content and effective removal of major allergens (Hev b1, b3, b5, and b6.02), as confirmed by ELISA and SDS-PAGE analyses.

Importantly, allergen reduction is achieved without compromising performance. Vulcanized products derived from purified latexes demonstrate enhanced barrier properties against chemical and microbial penetration, improved elasticity and tensile strength exceeding ASTM standards, reduced discoloration, and superior comfort. These results challenge the traditional trade-off between safety and functionality in latex products.

From a global health perspective, while latex allergy prevalence has declined with the adoption of low-protein, powder-free gloves, economic constraints limit the widespread use of synthetic alternatives in many regions. The technologies presented here offer a practical and cost-effective pathway to reduce allergenic risks while preserving the intrinsic advantages of NR, supporting large-scale industrial implementation.

By bridging molecular-level material design with industrial scalability, occupational health, and sustainability, this work redefines the future of natural rubber as a safe, high-performance, and environmentally responsible material platform for next-generation personal protective equipment.

Keywords: Natural Rubber Latex; Allergy-Free Materials; Deproteinization; Saponification; Sustainable PPE; Latex Allergy Prevention