

Natural Rubber Serum Biorefinery: Transforming an Industrial Waste Stream into High-Value Bioactive Compounds

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Abstract

Natural rubber serum, accounting for 60–70% of natural latex, has long been treated as industrial waste despite its richness in proteins, enzymes, carbohydrates, and other non-rubber biomolecules. In Thailand, more than one billion liters are discarded annually, creating environmental and economic burdens. Here, we present a Bio-Circular-Green (BCG) biorefinery platform that redefines natural rubber serum as a scalable feedstock for producing bioactive compounds (Fig. 1).

Using serum-derived non-rubber components as biocatalytic resources, we developed industrially translatable processes for producing β -glucan oligosaccharides (BGOs; hydrolyzed yeast β -glucan, HBGs) [1,2] and achieved industrial-scale extraction of Hevea Latex Polysaccharides (HeLP) [3,4]. The process also yields co-products, including quebrachitol and protein fractions, the latter showing promise as plant-based protein ingredients.

HeLP and BGOs are under evaluation through Thailand FDA's Novel Food pathway. HeLP has recently been certified as safe for human consumption, whereas BGOs are being assessed in clinical studies. Functional studies indicate that HeLP, BGOs, and quebrachitol exhibit anti-wrinkle, wound-healing, anti-inflammatory, immunomodulatory, anticancer potential, gastroprotective, anti-diabetic, and prebiotic activities, supporting applications in cosmeceuticals, functional foods, dietary supplements, future foods, and pharmaceutical-related products. Several of these bioactives have already been incorporated into commercial cosmeceutical products.

To enable commercialization, CERB is partnering with Innozuz Co., Ltd. to establish the first GMP-certified natural rubber serum biorefinery at the Southern Industrial Estate, scheduled to begin operation in June 2026. This initiative establishes a new paradigm for valorizing rubber-processing by-products while reducing waste, strengthening Thailand's biorefinery sector, and advancing the BCG economy and the United Nations Sustainable Development Goals.

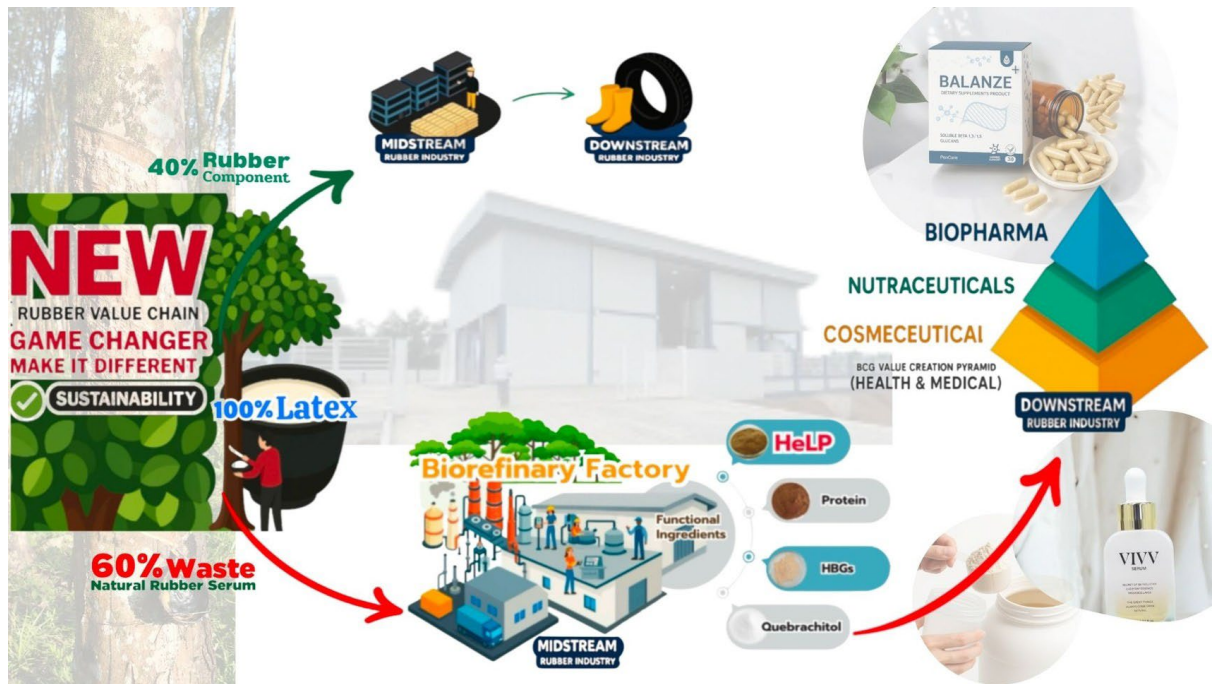


Fig. 1. New rubber value chain

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Biography (For Plenary, Keynote, and Invited Speakers)

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Personal History:

I am Assoc. Prof. Dr. Thanawat Pitakpornpreecha, a pharmacist and biochemist at the Faculty of Science, Prince of Songkla University, Thailand. I received my Bachelor of Pharmacy degree with Second Class Honors from Prince of Songkla University in 2005 and my Ph.D. in Biochemistry from the same university in 2010. I am currently the Director of the Center of Excellence in Natural Rubber Latex Biotechnology Research and Development (CERB).

My research focuses on natural products, molecular biology, biochemistry, and the biotechnology of *Hevea brasiliensis* latex, particularly natural rubber serum. I have led research and translational projects aimed at transforming natural rubber serum and related by-products into high-value bioactive compounds for applications in cosmetics, functional foods, nutraceuticals, and pharmaceuticals. My work also involves the development of GMP-standard biorefinery processes, novel food registration, clinical research, intellectual property, and commercialization in collaboration with government agencies and industrial partners.

I have published research in international journals, contributed to patents, and served as a speaker in academic and industry forums related to natural rubber biotechnology, bioactive compounds, and sustainable biorefinery innovation.

Research Keyword

Natural rubber serum, Bioactive compounds, Novel food, Biorefinery, Molecular biology & Biochemistry.