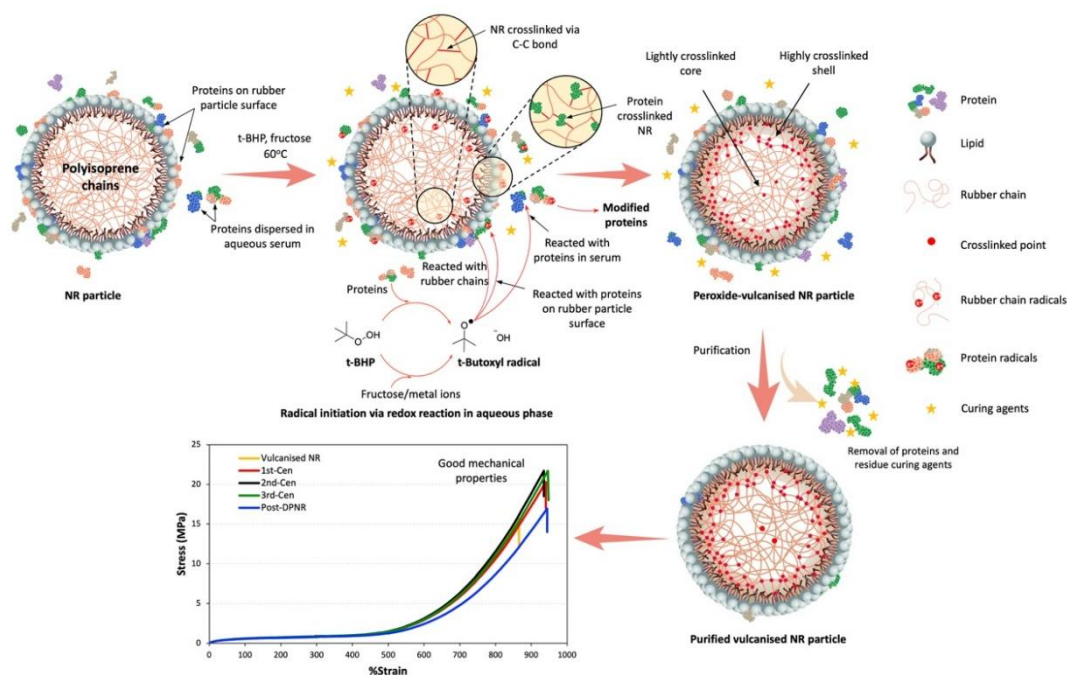


Purification of peroxide-prevulcanised natural rubber latex: Unveiling the mechanistic role of proteins and enhancing mechanical and dynamic performances



This study explored a safer and cleaner method for producing natural rubber (NR) latex by using a peroxide-based prevulcanization system instead of the conventional sulphur-based process. Natural rubber (NR) latices, both before and after enzymatic deproteinization (DPNR), were vulcanized using tert-butyl hydroperoxide (t-BHP) and fructose at 60°C to examine how purification affects vulcanization behaviour and material properties. The results showed that untreated NR latex exhibited high vulcanization efficiency, resulting in high mechanical properties (tensile strength of 15.90 MPa) and good dynamic performance. In contrast, DPNR latex showed very low vulcanization efficiency, with poor mechanical strength (1.67 MPa) and low dynamic properties. These findings suggest that proteins play a crucial role in facilitating redox-mediated vulcanization by acting as natural reducing agents that promote radical initiation of t-BHP. The proteins may also contribute to additional radical and crosslink formations through protein-derived radicals.

To obtain highly purified prevulcanized NR latex while maintaining good material performance, latex samples vulcanized at 60°C for 3 hours were purified using surfactant washing and enzymatic deproteinization. Multiple washing steps effectively removed allergenic and extractable proteins as well as



other impurities, with enzymatic treatment achieving even greater purification. The resulting NR films met nearly all requirements of the Japanese Pharmacopoeia and passed the in-vitro cytotoxicity test (ISO 10993-5:2009). Notably, the purified NR films retained excellent mechanical and dynamic properties, demonstrating the optimized purification strategies that can produce high purity prevulcanized NR latex suitable for medical applications.

The associated SDG goals are: Good health and well-being (3) and Responsible consumption and production (12)

For more information: Manus Sriring (manus.sri@mahidol.ac.th)

Reference:

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