

Siriluck Liengprayoon 2008: Characterization of Lipid Composition of Sheet Rubber from *Hevea brasiliensis* and Relations With Its Structure and Properties. Doctor of Philosophy (Biotechnology), Major Field: Biotechnology, Department of Biotechnology. Thesis Advisors: Associate Professor Klanarong Sriroth, D.E. and Professor Eric Dubreucq, Ph.D. 212 pages.

Natural rubber produced from *Hevea brasiliensis* latex possesses superior mechanical properties over its synthetic counterpart but lacks consistency in its quality due to its natural origin. This variation has been partly ascribed to non-isoprene components, especially lipids which are the main non-isoprene compounds retained in dry rubber. The aim of this work was to characterize the lipid composition of *H. brasiliensis* latex and derived dry rubber and to study its relationships with natural rubber structure and properties. The study was conducted with four *Hevea* clones: RRIM600, GT1, PB235 and BPM24. Beside latex, unsmoked sheet rubber (USS) prepared using a controlled and repeatable process was chosen as dry rubber sample. Lipid extraction was performed with an optimized method developed for both fresh latex and dry rubber. Lipid content of both sample types was found to be clonal dependent. Samples from PB235, BPM24 and RRIM600 (young) clones contained more lipids (3.4-3.7% w/w dry rubber for latex vs. 2.3-3.3% for USS) than GT1 and RRIM600 (old) clones (2.5-2.8% and 2.0-2.2% for latex and USS, respectively). Polar lipids, namely glycolipids and phospholipids, were found in lower amounts in sheet rubber than in the latex used for its preparation. Lipid composition was further analyzed with various chromatographic techniques. High amounts of a furan fatty acid were found in lipids from PB235 clone while linoleic acid was the main fatty acid in samples from the other clones. Gas chromatography coupled with mass spectrometry permitted to identify the unsaponifiable composition of the samples. The fatty acid compositions of glycolipids as well as phospholipids were elucidated through HPLC-ESI/MS analysis.

In parallel, USS rubber samples were studied for their structure and properties. The studied parameters were mesostructure (gel and molar mass distribution), macrostructure (measured with standardized specification methods), breakdown behavior and vulcanization behavior. Statistical analysis (PCA) of all data showed that samples from PB235 were clearly distinguished from those from the three other clones. A predominant plasticizing effect of esterified fatty acids and especially of furan fatty acids was observed in RRIM600, GT1 and BPM24. Nevertheless, PB235 rubber, that contained high amounts of furan fatty acid, did not exhibit such a behavior as it showed the highest initial plasticity and Mooney viscosity value. Unsaponifiable components seemed to exhibit an antioxidant activity that resulted in a higher plasticity retention index. Vulcanization characteristics of rubber from each clone were found to relate to the properties of rubber in its unvulcanized state. Lipids, especially free fatty acids, act as activators as observed from the shorter scorch time (t_{s2}) of rubber from RRIM600, GT1 and BPM24. The present study permitted a characterization of lipids composition, structure and properties of fully identified natural rubber samples from various *Hevea* clones, collected in a database. This allowed, through statistical analysis, to provide an overview of the relationships between lipid composition and rubber properties.

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