# CELLULOSE WHISKERS EXTRACTED FROM BANANA PSEUDO-STEM AS REINFORCING FILLER FOR NATURAL RUBBER TYRE TREADS USING LATEX INTERCALATION METHOD

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# ABSTRACT

Reinforcing the rubber compounds using cellulose fibre is an emerging trend in rubber industry because of unique physical properties of cellulose fibre. In this study cellulose fibres were extracted from pseudo-stem of banana using alkali treatments and converted into cellulose whiskers (CW) with high pressure defibrillation followed by acid treatment and bleaching. The CW was characterized using Fourier Transform Infrared Spectroscopy (FTIR), X-ray diffractometry (XRD) and Particle Size Analyzer. Both FTIR and XRD conforms the cellulose structure. XRD studies showed that the percent crystallinity of bleached fibres is about 69%. The particle size shows a bimodal distribution where approximately 21% of the sample has average size of 110 nm and the rest has the size of 795 nm. The purified CW was intercalated in diluted natural rubber (NR) centrifuged latex in order to prepare CW/NR composites and converted into rubber sheets. Mooney viscosity and stress relaxation coefficient of CW/NR composites were measured. The lowest Mooney viscosity and the highest stress relaxation coefficient were observed in CW/NR composites ensuring higher processability. The compounds were prepared in an internal mixture according to a tyre tread formulation keeping the sample without CW as the control. Cure characteristics were evaluated at 120°C and physical properties were evaluated on par with the ASTM standards. The highest cure rate and better scorch time were observed in CW/NR composite. The density, hardness, resilience, cut & chip and tensile strength of the composite were superior while tear strength and abrasion volume loss were inferior to the control. In overall, it reveals that cellulose whiskers have a great potential to use as reinforcing material for natural rubber tyre tread compounds.

*Keywords:* natural rubber, banana fibre, cellulose nano-whiskers, latex intercalation