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CURING AND MECHANICAL PROPERTIES OF THE ACTIVATED PALM KERNEL SHELL (APKS) FILLED CARBOXYLATED NITRILE BUTADIENE RUBBER (XNBR)

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ABSTRACT

In this study utilization of APKS as biofiller in XNBR was conducted. In part A, APKS was prepared by the Malaysian Palm Oil Board (MPOB) in large size before being reduced to micro size by crushing, pulverizing, and sieving at 240 mesh. The characterization of micro APKS as a biofiller regarding morphology, chemical, and physical properties is performed through Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM) and energy dispersive X-ray (EDX), particle size, and Brunauer-Emmett-Teller (BET) analyses were carried out. In Part B, APKS was incorporated into XNBR at different loading ranging from 5 phr to 50 phr. The evaluation of APKS as a potential biofiller was investigated via cure characteristic measurement, FTIR, determination of bound rubber content, morphology analysis, tensile test, abrasion resistance, compression set, and hardness. In Part A, it can conclude that the presence of hydroxyl groups (-OH) in APKS could assign that APKS is a polar material. APKS has porous surface and an irregular shape of APKS and contains of 84.12% carbon content and 15.88% of oxygen content. The particle size of APKS ranges from 1.217 to 31.944 μm approximately. The particle size distribution of APKS is a bimodal distribution. The average surface area of the APKS sample is 491.7 m2/g, the pore volume is 2.323±0.197 m3/g and the pore radius is 513.9±330.1 nm approximately. In Part B, it was found that the presence of APKS in XNBR extended the optimum cure time (t_{90}) which reduced the curing rate index (CRI). Based on the overall results, 40 phr is the optimum APKS loading. Incorporating APKS into XNBR increased the crosslink density, BRC, tensile strength, modulus 300, abrasion resistance, compression set and hardness due to mechanical interlocking. In conclusion, APKS has a potential to be used as a semi-reinforcing filler in rubber matrix which enhancing the performance of vulcanizates while maximizing the utilization of palm oil waste into the rubber industry. The approach of utilizing the eco-friendly APKS as a sustainable biofiller can reduce the unutilized palm oil waste.

Keywords: Activated palm kernel shell, carboxylated nitrile butadiene rubber, biofiller, curing and mechanical properties

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