

The Properties of NR Vulcanizate Filled with Silica-Gel Synthesized from Rice Husk Ash via Sol-Gel Process

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It was found elsewhere [1] that nanoparticles (OMMT) reinforced rubber would enhance both modulus and tensile properties without suffering the elongation at break of the NR vulcanizate. This research was therefore aimed to study nano-silica reinforcing natural rubber. The nano-silica was incorporated into NR via in-situ sol-gel process together with the gelation or solidification of NR latex. The research was started with the preparation of silicate solution extracted from 10 grams of rice husk ash in 300 ml of 1 M NaOH, for 17 hours. Silicate solution was then mixed with 30 % DRC NR latex, which was previously stabilized with nonionic emulsifier, with the ratio of 1:1 by volume. 5 % H₂SO₄ solution was added drop-wise to adjust pH of the mixture to 7, after 24 hours continuous stirring. The coagulated NR containing silica formed via in-situ sol-gel was washed with water while milling on a mini two roll mill to obtain white rubber sheet. Leached water was frequently tested with Ba(NO₃)₂ in order to check for the SO₄⁻². The sheet with no SO₄⁻² was then dried at 50 °C in a hot air oven for 24 hours or until dry. TGA analysis indicated that the silica content was found to be 15 phr with respect to NR. The dried NR sheet containing silica, formed in-situ, was compounded on a two roll mill with conventional vulcanization formulation and then characterized for its cure characteristic using Moving Die Rheometer (MDR) before compression molded to a rubber vulcanizate sheet at 160 °C with the cure time obtained from MDR. Neat NR and NR filled with precipitated silica, 15 phr, were also compounded and compression molded for comparison. It was elucidated from tensile and tear test results that the present of in-situ so-gel silica extracted from rice husk ash can reinforce NR better than precipitated silica due to the nano-scale silica particles present in NR matrix. SEM micrographs also show very well distribution of silica particles in NR matrix.

REFERENCE

- [1] C. Thongpin, N. Tangchantra, P. Kaewpetch, J. Dejkun and A. Chartsiriwattana, The Effect of Organic Modification Method onto Montmorillonite on Mechanical Properties of Natural Rubber, *Advanced Materials Research*, 2008, Vol. 55-57, pp. 341-344.

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ABSTRACTS



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