TITLE CHARACTERIZATION AND REINFORCEMENT OF SILICA-FILLED NATURAL RUBBER AND NATURAL RUBBER/STYRENE-BUTADIENE RUBBER BLENDS PREPARED FROM LATEX SYSTEM

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ABSTRACT This research has been made to elucidate the properties of natural rubber (NR) and natural rubber/styrene-butadiene rubber (NR/SBR) blends, with and without silica, prepared from latex system. The studies were focused on factors affecting silica dispersion i.e., type of devices, mixing methods and mixing sequences. The results showed that 10% w/w well-dispersed fumed silica (FSi) suspension can be prepared by either using the ultrasonic bath or agitator bead mill, while only the agitator bead mill can give well-dispersed precipitated silica (PSi) suspension. Scanning electron micrographs reveal that de-agglomerated silica distributes and disperses well after being processed for preparing the silica/NR and silica/NR/SBR masterbatches containing 10-30 parts per hundred parts of rubber (phr). Raman spectroscopy results also confirm that ratios of NR/SBR blends, with and without silica, prepared via latex system are as expected. It was found that cure retardation, as seen in conventional PSi-filled NR compounds, was not observed for the compounds prepared from masterbatch method. The masterbatch composites had silica less than 30 phr, without silane (Si-69), exhibited comparable abrasion resistance, rolling resistance and heat build-up to those of conventional composites containing Si-69. In the presence of Si-69, dynamic properties of both conventional and masterbatch composites are comparable at all silica loadings. Compared to the PSi, FSi having higher surface area imparts the NR samples with higher tear strength and thermal ageing resistance but, adversely, higher compound viscosity, Payne effect and heat build-up. When SBR content in unfilled NR/SBR blends is increased, scorch and optimum cure times, stiffness and heat build-up progressively increase, while resilience, tensile and tear strengths decrease. Besides, cure retardation behavior is not observed when adding silica in the blends with high NR content. Furthermore, the reinforcing efficiency of silica is more pronounced in SBR rich blends. Compared to the conventional blends, the masterbatch blends give lower cure retardation and hysteresis loss, higher strength, abrasion resistance, particularly for NR rich blends, because of their higher crosslink

density, better phase compatibility and dispersion of silica. Among different mixing sequences, use of silica/NR/SBR masterbatch gives the best mechanical and dynamic properties of 50/50 NR/SBR blend containing silica 30 phr. Dynamic mechanical results also reveal that the amount of silica in SBR phase is higher than that in NR phase of the blends for all mixing sequences.