

Effect of Mixing Method on Properties of Natural Rubber/Acrylonitrile Butadiene Rubber Blend Composites Reinforced with Silica Extracted from Rice Husk Ash

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Acrylonitrile butadiene rubber (NBR) is used where rubber products require swelling resistance. Natural rubber (NR) can be blended with NBR for synergism of properties using either phase mixing or pre-blending methods. According to literature, the mixing method may have a significant effect on properties of blends and it has not investigated for NR/NBR blends filled with silica extracted from rice husk ash (RHAS). RHAS is used as the filler, an alternative to carbon black which induces high heat built-up in products. The sol-gel method was used to extract RHAS, X-ray diffractogram and Fourier Transform Infrared Spectroscopy proved the amorphous nature and the chemical compatibility of RHAS with commercial silica. Blends filled with 25 parts per hundred parts RHAS were prepared to keep NR to NBR ratio at 0:100, 20:80, 40:60, 60:40, 80:20, and 100:0 using phase mixing and pre-blending methods referring to the control, American Standard Testing Method reference formulation for oil seals. Curing, physical and swelling properties of blends were evaluated. Results revealed that there was no significant difference between mixing methods on properties. Blends with high NBR amounts showed higher crosslinking density while all blends showed acceptable scorch and cure times. Tensile and tear strength showed comparatively lesser values in all blends than the control while elongation properties were compatible with control. The compression set varied from 1-6%, control had 4.3%. Hardness ranged from 45-60 IRHD, control had 73 IRHD. Equilibrium swelling (%) of control in toluene is 82%, but all blends showed values from 80-150%. Equilibrium swelling (%) of control in hydraulic and engine oil was below 2% while high NBR content showed lower swelling. Equilibrium Swelling (%) ranged from 1-16% in hydraulic oil and 1-12% in engine oil. Overall, these blends can be used in the preparation of non-marking stationary sealing articles and there is a potential to use RHAS in NR/NBR blends for reinforcement.

Keywords: Natural rubber, Acrylonitrile butadiene rubber, Pre-blending, Phase mixing, Rice husk ash silica