

**EFFECT OF FILLER RATIOS ON PROPERTIES OF NBR
COMPOUNDS REINFORCED WITH SILICA
EXTRACTED FROM RICE HUSK ASH, COMMERCIAL
SILICA AND CARBON BLACK**

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ABSTRACT

Rice husk is a most available and reliable natural source which contains more than 90% of silica (SiO_2) in its ash. Silica in its amorphous or crystalline forms can easily be derived from rice husk ash (RHA) using both simple and advanced chemical methods. Replacement of environmentally harmful carbon black (CB) using such natural source (RHAS) is important. Therefore, this study was conducted to investigate the potential of using RHA silica as filler for Acrylonitrile butadiene rubber (NBR) compounds as partial replacement of CB. Commercial grade silica (CS) was used for the comparison of performance of RHA silica during the study. RHA silica from Sri Lankan rice varieties was successfully derived using the sol-gel technique and X-ray diffractogram proved the amorphous nature of RHA silica and Fourier Transform Infrared Spectrophotometric analysis underlined that the chemical nature of RHA silica is almost similar to that of CS. NBR compounds (Series 1) were prepared keeping CB: RHAS ratio as 55:5, 50:10, 45:15, 40:20, and 35:25 parts per hundred parts of rubber by weight (phr). The compounds (Series 2) prepared for the comparisons which contain CB and CS filler composition were prepared using the same ratios. Compounds made according to the ASTM formulation for oil seals which consists of 60 phr of CB was considered as the control. Both series of compounds have shown desirable highest torque (MH), delta cure (MH-ML) and lowest torque (ML) of the vulcanization properties with better crosslinking density and processability at all loading levels compared to control. Scorch time (T_{s2}) and Cure time (T_{90}) showed extended times compared to control. Since silica creates low heat build-up inside the system the curing time is somewhat longer than the control compound Mooney viscosity of the CS containing compounds has increased with the CS loading when RHAS containing compounds show a decreasing trend with its loading. Hardness, compression set, tensile strength and of both series showed acceptable values with the control even though elongation at break and tear strength showed somewhat inferior properties. Swelling resistance is very high in both series with no significant between the series and in comparison to the control. Overall, there is a potential to use RHAS as partial replacement of CB in NBR compounds and can be used to replace CS. Further, replacement can be extended from loading level of 5 to 25 phr in NBR compounds.