Potential of Using Rice Husk Ash Silica as Filler in Acrylonitrile Butadiene Rubber Compounds

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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). Replacement of environmentally harmful carbon black (CB) using such a natural source is important. Therefore, this study was conducted to investigate the potential of using RHA silica (RHAS) as filler for Acrylonitrile butadiene rubber (NBR) compounds as partial replacement of CB. Commercial grade silica (CS) was used for the comparison of the performance of RHAS during the study. RHAS was derived by sol-gel technique and X-ray diffractogram proved the amorphous nature of RHAS and Fourier Transform Infrared Spectrophotometric analysis underlined that the chemical nature of RHAS is almost similar to that of CS. NBR compounds (Series 1) were prepared by 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) which contain CB and CS were prepared using the same ratios. Compound with 60 phr of CB was considered as the control. Both series of compounds have shown desirable highest torque, Delta cure, and lowest torque with better-crosslinking density and processability at all loading levels compared to control. Scorch time and Cure time showed extended times. Hardness, compression set, and tensile strength of both series showed acceptable values 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 to the control. Overall, there is a potential to use RHAS as a partial replacement of CB in NBR compounds and can be used to replace CS.

Keywords: Acrylonitrile butadiene rubber, Carbon black, Commercial silica, Rice husk ash silica