Silica from Rice Husk as an Alternative to Commercially Available Silica Fillers in Tyre Compounding

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Rice husk is one of the major agricultural wastes. It is currently dumped into landfills in its raw form or is used as an alternative energy source. When burnt for energy it results in rice husk ash (R1-1A) which is disposed without use. RHA has very high economical value since approximately 90% RHA is silica. Thus, a proper management of such solid wastes can add value to rice industry. This work presents the extraction of silica from RHA using precipitation method, characterization and utilization of such silica as an alternative to commercially available silica in rubber compounding. The extracted silica was characterized using Fourier transform infrared spectroscopy, X- ray diffractometry, X-ray fluorescence spectrometry and scanning electron microscopy (SEM). The results were benchmarked against commercially used silica. The extracted silica has comparable chemical and amorphous properties as commercially used silica in rubber compounding. The SEM study confirmed, the extracted silica is in sub-micrometre length scale in size. Tyre compounds were made using extracted silica and commercially available silica by keeping other ingredients and conditions same. Mechanical properties of both compounds were evaluated. Silica from RHA added composite showed boost in resilience and drastic decrement in tensile and tear strength, elongation at break, abrasion resistance and hardness compared to the composite made using commercially existing silica. Both composites showed moderately similar value of 100% and 200% modulus. With the extracted silica, the fly off while mixing was less. Then, it needs higher mixing time. Compound viscosity drastically reduced and became soft after mixing. These preliminary works confirm that extracted silica cannot be used, as it is to get the comparable properties in rubber compounding as commercially available silica does. Thus, further improvements in extracted silica are being carried out to make it compatible with rubber.

Keywords: Rice husk ash, Silica, Rubber compounding