

**Crumb-Rubber and Silica Nano-Particle Derived
Rubber Composites: A Partial Solution for Waste
Management**

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Abstract

Currently, crumb rubber derived flooring is a small, but growing sector in the world floor coverings market. However it is not widely spread in Sri Lanka. Such flooring includes mats, rolls, sheets, and indoor and outdoor tiles. Among the materials for flooring, natural rubber blended with artificial rubber is one of the lower-priced and commonly used ingredients. However, the pristine rubber blends show retarded mechanical properties. Thus, reinforcement with additives and vulcanization is commonly practiced technique. In this research the blend of natural and artificial rubber is reinforced with crumb rubber and silica Nano particles. Both of these additives were prepared from the waste materials. Thus, this research is focused to introduce a partial solution for waste management. The idea is analogues to making large particle reinforced composites such as concretes in which two different sizes of particles (coarse gravel and sand) are densely packed with an adhesive (cement). The rubber crumbs are in micro-to-millimeter length scale while silica is in nanometer length scale. Rubber crumbs act as a good additive while silica particles act as space filler. In this study, crumb rubber with different sizes was prepared by mechanically crushing the waste tyres. The silica was extracted from rice husk by a facile heat treatment process and converted into Nano particles by a precipitation method. The properties of silica Nano particles were further characterized. The composite materials were prepared with different ratios of rubber: silica Nano particles: crumb rubber. The samples with same compositions but different rubber crumb sizes were also prepared. All the composites were further reinforced by vulcanization. Microstructure was evaluated using Scanning Electron Microscope images and the optimum composition was determined by evaluating their mechanical properties. We found that the tensile strength and tear strength increased and compression percentage decreased with increasing until 125 ppr (parts per rubber) crumb rubber added RSS and silica Nano particle composites.