Crumb Rubber and Silica Reinforced Rubber Composites for Outdoor Flooring Applications

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Abstract: Flooring products with rubber matrices is a small, but growing sector in the world floor coverings market. Both plastic and rubber floor covering products are not widely used in Sri Lanka. Such flooring includes mats, rolls, sheets, and indoor and outdoor tiles. Among the materials for flooring, natural rubber blended with synthetic rubber is one of the cheapest ingredients especially for countries like Sri Lanka since the availability of natural rubber for considerably low cost. The pristine natural rubber and its blends with synthetic rubber normally show retarded mechanical properties. Thus, reinforcement with fillers and vulcanization is commonly practiced technique to enhance the mechanical characteristics. The aim of this work is to develop and evaluate the mechanical properties of rubber composites reinforced with tyre waste (crumb rubber) and amorphous silica extracted from rice husk. For this study, two different sizes of crumb rubber particles of average size less than 500 µm and 500 µm to 1 mm were selected. In contrast to the granular form of precipitated silica used in tyre manufacturing process here powder form of amorphous silica is used as reinforcement filler. Silica was extracted from rice husk using thermal degradation along with the precipitation method. Both of these additives were prepared from the waste materials. Thus, this research is focused to introduce a partial solution for waste management too. The composite materials were prepared with different ratios of rubber:silica:crumb rubber. The crumb rubber loading was varied from 0 to 300 phr. All the composites were further reinforced with vulcanization. Initially, the mechanical properties of natural rubber and crumb rubber composite were measured and analysed to find the best ratio of the ingredients. After identifying the best ratio of rubber:crumb-rubber, silica was incorporated in varying amounts to gain the samples with optimum mechanical properties. It was found that with increases with crumb rubber loading some of the mechanical properties like resilience, tear strength tensile strength and percent elongation at break decreases with increasing crumb rubber loading while properties like modulus at 100% elongation and retention percentage after aging increases with increasing crumb rubber loading. SEM micrographs show that the samples that show optimum mechanical properties have a continuum and interlocked structure compare to the mechanically retarded samples.

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