

Novel Approach in Developing a Photodegradable Tyre

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Abstract: This research highlights the development of a photodegradable non-marking tyre by introducing a photosensitizer as a trigger to initiate photo degradation of the inner layers of the tyre. Reduction of tyre waste, which heavily contribute to environmental pollution, is the main expectation of the development.

Benzaldehyde has been identified as the photosensitizer. Effect of the sensitizer on the general compounding formula have been studied by morphology, rheology, melting properties, Mooney viscosity analysis, specific gravity analysis, and analysis of physical properties such as tensile strength and hardness. UV-Vis absorbance range of the sensitizer was observed at 200 nm to 290 nm. Sensitizers' thermal stability at the tyre processing conditions was confirmed by FTIR spectroscopy before and after keeping the sensitizer at the processing temperatures for a prolonged time period. No significant differences on physical and mechanical properties have been observed and thus it is concluded that the sensitizer has no effect on the compounding formula as well as tyre processing conditions.

Photodegradation studies were conducted following three different approaches and degradation was inspected by weathering and accelerate testing. First approach is to introduce the sensitizer to the general compounding formula, second approach is to introduce the sensitizer to the general compounding formula with the exception of antioxidant and the third approach is to introduce the sensitizer onto the surface of the sample specimen.

Tests conducted on samples prepared through approach one and two, have not shown any considerable changes on physical and mechanical properties during the time period of three months. Nevertheless, samples that were prepared following approach three have shown positive results of photo-degradation even in such a short period of time. Tensile strength, elongation at break and tear strength decreased while hardness and 300% modulus are increased during weathering and accelerated aging tests.

Results obtained so far have given a positive indicator for using the sensitizer as a novel degradable approach. However, time period reported is not sufficient to derive into a solid conclusion. This research is an ongoing research.

Keywords: photo-degradation, sensitizer, non-marking tyre, sulfur vulcanization, mechanical properties

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