

EFFECT OF FIBER SIZE ON PROPERTIES OF OIL PALM FIBER WASTE FILLED NATURAL RUBBER COMPOSITES

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By

T.G.K.H. Madushika

Export Agriculture Degree Programme
Faculty of Animal Science and Export Agriculture
Uva Wellassa University of Sri Lanka

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ABSTRACT

The twenty-first century has witnessed remarkable achievements in the rubber industry in regard to green technology through development of natural fiber based rubber composites. A wide variety of natural fibers extracted from coconut, palmyra and banana has been used as fillers in the development of natural rubber (NR) based green composites, most importantly to reduce environmental pollution caused by hazardous powdered fillers and to enhance reinforcement. Oil palm fiber (OPF) is hard, tough and has a potential to reinforce the rubber matrix. Mesocarp part of OPF, which generates as a waste material of palm oil processing mills was used as a filler in this study. The objective was to investigate the effect of size of OPF on cure, physico-mechanical, water absorption and ageing properties of NR composites. A chemical treatment was conducted to reduce fiber size and to improve physico-mechanical properties. Chemical processing with sodium hydroxide, bleaching with sodium chlorate and oxalic acid were conducted to remove residual oil and reduce fiber size. A series of NR composites was prepared with 2 phr OPF by varying its size from 250 μm to below 50 μm . The NR composite prepared without OPF, but with 2 phr of carbon black was considered as the control. Although an increase in properties was expected with the reduction of fiber size, no significant increase was observed. Nevertheless, results showed the highest values for the NR composite prepared with OPF in the size range 125-175 μm in regard to modulus at 300% elongation, tensile strength, hardness, resilience and an average value for water absorption. This revealed even dispersion of OPF in the rubber matrix of the above composite and the results were in agreement with crosslink density indicated by the delta cure value. There was no decrease in tensile modulus and strength after ageing, which indicates a high retention of these properties. Overall, results revealed that carbon black in NR composites could be replaced with OPF to manufacture rubber products requiring hardness ranging from 29-36 Shore A.

Keywords: Oil palm mesocarp fiber, natural fillers, natural rubber, cure characteristics, physico-mechanical properties