

# Determination of Optimum Antioxidant Ratio for Effective Resistance on Aging of Natural Rubber based Solid Tire Tread Compound

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Antioxidants are highly effective ingredients and have a dramatic impact on the service life of the rubber product although being present at extremely low concentrations. Dosage of these chemicals depends upon the end application. The purpose of this research was to find out the optimum antioxidant ratio for effective resistance on thermo-oxidative aging of natural rubber based solid tire tread compound. Five tread compounds were prepared by varying the n-(1,3-dimethylbutyl)-n'-phenyl-p-phenylenediamine (6ppd) and 2,2,4-Trimethyl-1,2-dihydroquinoline (TMQ) antioxidant (AO) ratios (AO<sub>1</sub>-AO free, AO<sub>2</sub>- 2:1, AO<sub>3</sub>- 1.5:1.5, AO<sub>4</sub>-1:2, AO<sub>5</sub>-2:2). AO<sub>5</sub> was designed to test the effect of over dosage of antioxidants. Physio-mechanical properties such as tensile properties, tear strength, hardness, and abrasion resistance of five compounds were investigated before and after thermo-oxidative aging at temperature 70 °C for 72 hours according to the ASTM standards. Density and rebound resilience of five compounds were also investigated. According to the results obtained, percentage changing hardness, tensile strength, elongation at break and tear strength of AO<sub>1</sub>, AO<sub>2</sub>, AO<sub>3</sub>, AO<sub>4</sub> and AO<sub>5</sub> were (1%, 4.34%, 1.73%, 15.70%), (2%, 3.72%, 7.94%, -4.48%), (2%, 5.27%, 11.59%, 21.64%), (1%, 1.40%, 5.52%, 3.57%) and (2%, 3.99%, 1.60%, 14.19%) respectively after aging 72 hours. Hardness, modulus at 300% and abrasion resistance increases as the heat-aging time increases. The rate of decrease of tensile strength, tear strength and elongation at break was higher after aging. Result obtained for rebound was 44%, 46%, 47%, 46% and 48% respectively. Density of all five compounds were same. In conclusion as the percentage changing was minimum in AO<sub>4</sub> and it is the best among five ratios under 72 hours aging condition.

**Keywords:** Antioxidant, Hardness, Natural rubber, Tensile properties, Thermal-aging