

MOLECULAR WEIGHT OF ANTIOZONANTS AND THEIR STABILISATION EFFECTIVENESS IN NATURAL RUBBER UNDER STATIC STRAIN

Earlier work had indicated that with substituted *p*-phenylenediamine, antiozonant activity decreases as the molecular weight of the alkyl group increases (Lewis, 1972). This work is an attempt to investigate the efficiency of representatives of two different classes of antiozonants of different molecular weight, in natural rubber (NR) under static strain conditions.

ISO 1658-1973 (E) test recipe was used. The following antiozonants were employed for the study:

- N-isopropyl-N-phenyl-*p*-phenylene-diamine
[M Wt 226; alkyl-aryl class]
- N-[1,3-dimethylbutyl]-N'-phenyl-*p*-phenylenediamine
[M Wt 268; alkyl-aryl class]
- N,N'-bis [1,4-dimethylpentyl]-*p*-phenylenediamine
[M Wt 304; dialkyl class]
- N,N'-bis [1-methylheptyl]-*p*-phenylenediamine
[M Wt 333; dialkyl class]

Mixing was carried out on standard laboratory mill, in accordance with ISO 1658-1973 (E). Tensile sheets (0.269-cm thickness) were compression moulded at 150°C, to cure times determined on Wallace Shawbury Curometer. Test pieces stamped out as in BS 903 Part A23 (1963) and conditioned in strained state, for 48 hours in the dark at ambient temperature were used. The edges and clamped areas of the samples were coated with collodion. Hampden Shawbury ozone tester conforming to ISO 1431, 1972 was used at 25 pphm ozone

concentration. Assessment was done according to BS 903 Part A23 (1963).

The results are presented in Table 1. A and B show the performance of the representatives of the alkyl-aryl class. It was observed that the critical threshold strain (CTS) was 5% for both; an improvement on the 3 per cent CTS for unstabilised NR reported in an earlier study (Ahabue, 1986). However, the period of exposure before the appearance of cracks was longer (48 hours) in the case of N-isopropyl-N'-phenyl-*p*-phenylenediamine (antiozonant A) with molecular weight 226, than that (24 hours) in the case of N-(1, 3 dimethyl butyl)-N'-phenyl-*p*-phenylenediamine (antiozonant B) with molecular weight 268. Also, at higher strains, greater exposure period was observed for antiozonant A than for antiozonant B.

C and D compare the performance of the representatives of the dialkyl class. At the strain levels studied, N, N'-bis (1, 4-dimethylpentyl)-*p*-phenylenediamine (antiozonant C), with molecular weight 304, and N,N'-bis (1-methylheptyl)-*p*-phenylenediamine (antiozonant D), with molecular weight 333, did not produce any visible crack. However, CTS was found to have increased to 100 per cent and 80 per cent for antiozonants C and D respectively. Cracks were observed after 48 hours exposure at CTS. It may be seen from the results, that within the alkyl-aryl class, effectiveness of antiozonant was more when the molecular weight was low. This is reflected in the slightly better performance of antiozonant A over antiozonant B.