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EFFECT OF 1-SUBSTITUTED AND 1,5-DISUBSTITUTED 2,4-DITHIOBIURETS/N-CYCLOHEXYL BENZTHIAZYL SULPHENAMIDE/BINARY ACCELERATOR SYSTEMS IN THE VULCANIZATION OF NATURAL RUBBER

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1-phenyl 2,4-dithiobiuret (DTB-II) and 1,5-diphenyl 2,4-dithiobiuret (DTB-III) were studied as secondary accelerators along with N-cyclohexyl benzthiazyl sulphenamide (CBS) in the sulphur vulcanization of natural rubber. These binary systems were found to be very effective in reducing the optimum vulcanization time. Out of the two dithiobiurets DTB-II was found to be more active indicating a nucleophilic mechanism in the vulcanization reactions under review. In each case, the optimum dosage of the secondary accelerator required was arrived at. Tensile strength, modulus, elongation at break, hardness, compression set, heat build-up, resilience etc. of the vulcanizates, were studied. Vulcanizates given by the binary accelerator systems gave satisfactory balance of properties. Chemical characterization of the vulcanizates was also carried out to correlate the physical properties with the type of chemical crosslinks formed.

Key words: Natural rubber, Binary accelerator, Vulcanization, 1-phenyl 2,4-dithiobiuret, Nucleophilic reaction, Thiourea, Tensile strength, Chemical crosslink.

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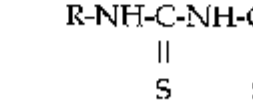
INTRODUCTION

In the sulphur vulcanization of rubber, use of a small amount of accelerator not only increases the rate of vulcanization but also effects better physical and chemical properties of the finished product. Selected binary accelerator systems are being widely used in industry now-a-days, as they produce vulcanizates with superior physical and mechanical properties compared to those achieved with single accelerator (Skinner and Watson, 1969; Dawson, 1940; Perminov, 1938).

Thiourea and its derivatives are known for their acceleration activity and they are finding much use in the mixed accelerator systems in rubber vulcanization (Das, *et al.*, 1983, Kucharik, 1982 and Dogadkin and Shershnev, 1962). Philpott (1962), showed very high reactivity of thiourea in the vulcanization of natural rubber latex when used with tetramethyl thiuram disulphide (TMTD) and CBS. A nucleophilic reaction mechanism was proposed. The present study was undertaken assuming that dithiobiuret derivatives of thiourea having the general formula



will show more nucleophilic activity than simple thiourea derivatives and hence will