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EFFECT OF PROCESS AIDS ON ENGINEERING PROPERTIES OF NATURAL RUBBER

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Six different process aids — naphthenic oil, paraffinic oil, aromatic oil, pine tar, white factice and CI resin — in natural rubber were evaluated for their effect on physical properties of vulcanizates, with special reference to those relevant to engineering application. Creep, stress relaxaton, set, hysteresis, heat build-up and resilience were studied. It was found that naphthenic oil showed the optimum properties, where as CI resin gave the least desirable set of properties. These two process aids were further evaluated to study the effect of their concentrations on properties. It was found that the engineering properties were improved by the addition of naphthenic oil upto 10 phr. However, CI resin showed abnormal behaviour. A rating of process aids was made as far as general engineering properties were concerned.

Key words : Process aid, Creep, Stress relaxation, Hysteresis, Heat build-up, Set, Resilience.

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INTRODUCTION

Elastomers are being used in many engineering applications and the design parameters for such applications have been described by several authors (Freakley and Payne, 1978; Turner *et al*, 1979). Viscoelastic behaviour, stress-strain relations, creep, stress relaxation, set, dynamic-mechanical behaviour etc., are some of the properties of rubber vulcanizates which are of prime importance in engineering applications.

Much work has been done on the effect of environmental factors, compounding ingredients and type of crosslinks on creep and related properties (Thrion and Chasset, 1963; Puydak, 1970). The effects of carbon black and other fillers on the dynamic properties of natural rubber (NR) and other rubber vulcanizates have also been reported (Medalia, 1978; Isono and John, 1984). Similar studies have also been made to evaluate the effect of antioxidant on creep and stress relaxation (Scheele and Hillmer, 1969). The effect of curatives on these properties was studied by Tamura and Murakami (1973). Though the influence of process aids on physical properties of rubber vulcanizates has been studied (Zverev and Zubov, 1959; Rechuite and Dimellar, 1982), the effect of the same on creep and related properties has not been reported.

Natural rubber is one of the polymers used in many engineering applications. Since these products contain considerable amount of fillers, incorporation of process aids becomes essential. This study is inten-