Thesis Title	A Study of Structure - Properties of Purified Natural Rubber
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ABSTRACT

Sulphur vulcanisation of purified natural rubber (PNR), prepared by enzyme deproteinisation followed by centrifugation, were studied. The vulcanisation system, efficient (EV) and conventional (CV) vulcanisation systems, and the type of accelerator (TMTD, ZDMC, CBS, TBBS and MBT) were varied. The resulting network structures and properties of rubber vulcanisates were assessed.

The results obtained showed that, using the CV cure system, PNR cured at much slower rate and longer scorch time than its corresponding whole natural rubber (WNR), in which all non-rubber substances were present, for both vulcanisation systems and for all types of accelerators used. For a given amount of curing agents employed, PNR also cured to a lesser extent (lower degree of crosslinking) than did WNR. Thus, PNR generally gave softer vulcanisates or lower modulus than did WNR,

irrespective of the type vulcanisation system or the type of accelerator used. The tensile properties and abrasion resistance of PNR vulcanisates cured by the CV system were also generally poorer than those of WNR samples. The uses of ultrafast accelerator (TMTD, ZDMC) or their combinations with CBS or MBT gave PNR vulcanisates with better properties than the uses of fast (CBS, TBBS) or medium (MBT) accelerators alone. For EV vulcanisation system, PNR vulcanisates exhibited comparable tensile properties, hardness and abrasion resistance as those of WNR vulcanisates. Increasing the amount of stearic acid in the rubber formulation appeared to have a beneficial effect on the properties of PNR vulcanisates obtained. The generally poorer properties of PNR vulcanisates could be explained based on the effect of crosslink density.

However, heat build-up and flex-cracking properties of PNR vulcanisates showed improvement over those of WNR samples. This might be attributed to uniform distribution of mono-, di-, polysulphidic crosslinks in PNR vulcanisates compared with the WNR vulcanisates.

The study of the application of solid-state ^{13}C-NMR spectroscopy to characterise the network structure of NR vulcanisates vulcanised by sulphur showed limited applicability of this technique. Only samples that were cured by the CV system of sulphur vulcanisation could be analysed. No useful signal appeared for the vulcanisates that were cured by the EV vulcanisation system. Differentiation between monosulphidic and polysulphidic crosslinks were not possible due to overlapping of signals. Thus, only the total crosslink density could be estimated for the rubber vulcanisates studied.