

LIQUID NATURAL RUBBER AS A REACTIVE PLASTICISER FOR NITRILE RUBBER

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Application of liquid natural rubber (LNR) as a reactive plasticiser in nitrile rubber (NBR) was studied using compounds containing different loadings of dibutyl phthalate (DBP) and LNR. Cure characteristics, physical properties as well as ageing and ozone resistance were measured on compounds containing the plasticisers upto 15 phr. Changes in rheological behaviour, imparted by the plasticiser on NBR, were evaluated using four compounds containing 5, 10, 15 and 20 phr of plasticiser. The study showed that LNR can be used as a plasticiser in NBR without affecting its cure characteristics, storage life and most of the physical properties except brittle point. Improvement was observed in properties like green strength, mill shrinkage and compression set. Rheological studies showed that LNR system at high temperatures and shear rates have lower viscosity than the corresponding DBP systems which enables easier moulding. Die swell also decreased with the incorporation of LNR. The use of LNR as a reactive plasticiser was justified by the higher volume swell in oil indicative of its ability to compensate for the shrinkage resulting from leaching.

Key words—Liquid natural rubber, Dibutyl phthalate, Nitrile rubber, Reactive plasticiser, Rheology.

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INTRODUCTION

Plasticisers added in nitrile rubber (NBR) are mostly the ester type on account of their compatibility. In applications where the product is in constant contact with petroleum oils, the latter may carry away the plasticisers, resulting in shrinkage of the product. To compensate this, a small quantity of styrene-butadiene rubber (SBR) is usually added. An appropriate reactive type plasticiser could avoid the use of SBR together with a conventional plasticiser liable to leaching. In this context it was considered that depolymerised liquid natural rubber (LNR) may be a suitable substitute.

While considering LNR as an alternative plasticiser in NBR, several factors were taken into account. Being a reactive plasticiser, the very same sulphur cure system used for NBR may vulcanize the plasticiser also, so that leaching by oil can be minimised. Vulcanized LNR tends to swell in hydrocarbon oils and shrinkage, if at all any, may be compensated by the swelling. Liquid natural rubber may have a significant contribution in altering the flow properties of the rubber mix. Reduction in hardness due to plasticiser addition can be minimised as the LNR gets covulcanized with the base rubber.