

## DICHLOROCARBENE MODIFIED NATURAL RUBBER

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Submitted: 14 June 2004 Accepted: 30 December 2005

Elizabeth, K.I., Alex, R., Kuriakose, B. and Peethambaran, N.R. (2005). Dichlorocarbene modified natural rubber. *Natural Rubber Research*, 18 (2): 120-129.

Dichlorocarbene modification of natural rubber (NR) was carried out by alkaline hydrolysis of chloroform in presence of cetyl trimethyl ammonium bromide as phase transfer catalyst. Modified NR was characterized chemically by chlorine estimation, FTIR, DSC and thermal studies. Extent of modification depended on the time and temperature of reaction. FTIR studies revealed the introduction of chlorine through a cyclopropyl ring to the main chain of NR. Chemical modification considerably increased the Tg of NR as observed from the DSC thermograms. Thermogravimetric analysis showed that the degradation temperature shifted towards the higher side with increased level of chlorination. Modification was accompanied by a change in the physical nature of NR from a soft flexible state to a hard non-tacky form. Peroxide vulcanizates of modified NR showed higher tensile strength than that of pure NR. Solvent swelling studies indicated polar nature of the modified NR and it showed lower swelling in ASTM oils. Oil swelling nature of modified NR containing 15% and more chlorine content was closer to that of hydrogenated nitrile rubber (HNBR). Due to the polar nature, modified NR mixed well with the polar rubber HNBR and showed improved properties for peroxide vulcanizates.

Key words: Dichlorocarbene modification, Hydrogenated nitrile rubber, Natural rubber, Oil swelling.

### INTRODUCTION

For imparting special properties, general-purpose rubbers can be chemically modified by reaction involving their double bonds (Soutiff *et al.*, 1990; Schulz *et al.*, 1982; Marechal, 1983; Claramma *et al.*, 1989; Veeralakshmanan *et al.*, 1995; Barnad *et al.*, 1975). It was found that the reaction of double bonds with various reagents resulted in improving the flame retardation, oil resistance, air permeability and other properties (See Toh, 1978; Eskinia *et al.*, 1990; Gelling, 1985). The reaction of carbenes with olefins to form cyclopropyl derivatives has attracted much attention. Pinnazzi and Levesque (1969) found that carbene addition had a significant influence on the properties of polydienes. Dichlorocarbene modification on styrene

butadiene rubber (SBR) was reported to increase the solvent as well as flame resistance (Ramcsan *et al.*, 1998). The *cis*-1,4 polyisoprene, natural rubber (NR) is a versatile elastomer, which finds application in various products. However, it has very poor heat, flame and solvent resistance.

This article reports an attempt to improve the properties of NR by dichlorocarbene modification through the alkaline hydrolysis of chloroform using cetyl trimethyl ammonium bromide (CTAB) as a phase transfer agent. The modification was followed by measuring the percentage of chlorine in the modified sample and the product was characterized by FTIR, DSC and chemical analysis. The thermal stability of modified product was evaluated by thermogravimetry (TGA). The technologi-