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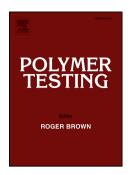
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#### ACCEPTED MANUSCRIPT

### Analysis Method

# NMR study of ring opening reaction of epoxidized natural rubber in presence of potassium hydroxide/isopropanol solution

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**Abstract:** The ring opening reaction of epoxidized natural rubber (ENR-50) in the presence of potassium hydroxide/isopropanol solution was studied using NMR, and it's thermal characteristic was investigated using TG/DTG and DSC.  $^1$ H-NMR showed that 16.9% of epoxide units was ring-opened in treated ENR-50, which was also supported by quantitative FTIR spectroscopy.  $^{13}$ C-NMR proved the location of alkyl group (isopropyl) in the polymer chain of treated ENR-50. The attachment location of isopropyl occurred at both most ( $\uparrow$ ) and least ( $\downarrow$ ) hindered carbons of the epoxide. 2D-NMR was used to identify and scrutinize the triad assignment of treated ENR-50. The TG/DTG results presented three decomposition steps at 190-331, 331-521 and 521-706  $^{\circ}$ C due to the existence of mixtures of polymer chains i.e. ring-opened and intact epoxide of ENR-50, which also led to increase in  $T_g$  of treated ENR-50 at 13.2 $^{\circ}$ C compared with purified ENR-50 at -17.7 $^{\circ}$ C.

**Keywords:** epoxidized natural rubber, ring opening reaction, epoxide, nuclear magnetic resonance, thermal characteristic.

### 1.Introduction

Nuclear magnetic resonance spectroscopy (NMR) techniques are extensively used for polymeric materials characterization either in solid or liquid phase. 1D NMR provides structural explanation on monomer units and reactive groups in the polymer chain. 2D NMR gives detail structural arrangements on the f monomer units in the polymer chain. The 1D NMR technique or both 1D NMR and 2D NMR techniques were

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