

CHEMISTRY OF THE DEVULCANIZATION PROCESS USING TME AS A MODEL COMPOUND

ANNEME BOYCE

Chemistry Department, Faculty of Science, Nelson Mandela Metropolitan University, P.O. Box 77000,
Port-Elizabeth 6031, South-Africa e-mail: s213426145@nmmu.ac.za

ABSTRACT

An improvement of the properties of recycled rubber by developing a more selective breakdown process is an important issue and a global challenge. Devulcanization is the most promising way to achieve this. It is a process which aims to totally or partially cleave monosulfidic (C-S-C), disulfidic(C-S-S-C) and polysulfidic (C-S_x-C) cross-links of vulcanized rubber.

In this study, the devulcanization of sulfur-vulcanized natural rubber with a variety of diphenyl disulfides has been studied using 2,3-dimethyl-2-butene (TME) as a low-molecular weight model compound. First TME was vulcanized with a mixture of sulfur and 2-bisbenzothiazole-2,2'-disulfide (MBTS) at 160°C, resulting in a mixture of addition products (C₆H₁₁-S_x-C₆H₁₁). The compounds were isolated and identified by High Performance Liquid Chromatography (HPLC) with respect to their various sulfur ranks. In the second stage, the vulcanized products were devulcanized using various diphenyl disulfides as devulcanization agents at 200°C. The chemistry of the breakdown of the sulfur-bridges was monitored and the findings are discussed in this paper.