STABLE FREE RADICAL ASSISTED MECHANICAL DEVULCANISATION: DEVULCANISATION OF NR/BR BLENDS

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This paper investigates the effect of polybutadiene rubber content on the efficiency of stable free radical (4-hydroxy tempo, 4HT) assisted mechanical devulcanisation of NR/BR blends. Further, the effectiveness of this novel process in the real world is tested by the devulcanisation of commercial NR/BR blends like buffing dust obtained from pre-cured tyre tread and ground tyre rubber (GTR). Based on the minimum torque (M_L) values recorded for devulcanised samples, which is indirectly related to the viscosity of the sample, it was observed that comparable level of devulcanisation can be achieved for NR/BR blends upon mechanical devulcanisation (control process) irrespective of the BR content in the blend. In 4HT assisted mechanically devulcanised samples, a higher per cent devulcanisation was indicated by further reduction in M_L values. The revulcanisate tensile properties of the 4HT assisted devulcanised blends were significantly higher than the corresponding mechanically devulcanised samples whereas the positive influence of 4HT upon the tear strength of revulcanised samples significantly reduced with increase in BR content of the blend. The 4HT assisted devulcanisation of buffing dust and used rubber samples like GTR proposed the feasibility of stable free radical as an effective devulcanisation aid. The revulcanisate properties of the buffing dust and GTR devulcanised with the assistance of 4HT were higher than that obtained for the corresponding mechanically devulcanised sample. The revulcanisate properties of GTR were lower than that of buffing dust indicating the role BR content and the quality of sample (effect of ageing) used for devulcanisation upon the revulcanisate properties.

Keywords: Mechanical devulcanisation, Mechano-chemical devulcanisation, Revulcanisate properties, Stable free radical

INTRODUCTION

Recycling is the process of converting waste or end of life products to re-usable materials. It is an alternative to "conventional" waste disposal that can prevent the waste of potentially useful materials and can reduce the consumption of fresh raw materials, air pollution (from incineration), and water pollution (from landfilling). Recycling of used rubber products, mostly tyres, is a global concern due to their highly stable crosslinked structure created through the process of vulcanisation. In the literal sense, recycling of a material would produce a fresh supply of the same material which is often difficult or too expensive to achieve. Hence, recycling of tyres suggest their reuse via converting it to different materials/products for many applications (Joseph *et al*., 2016; a

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