LATEX SERUM COATED SILICA FILLED NATURAL RUBBER COMPOSITES

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In this study, an attempt was made to reduce the incompatibility between silica and natural rubber by coating the silica particles with the non-rubber constituents present in natural rubber latex serum. The presence of various non rubber constituents like proteins, carbohydrates and lipids on silica surface were confirmed from TGA, UV and FTIR spectroscopy. RPA studies showed improved processability and cure characteristics for composite prepared from coated silica compared to the unmodified silica. The Payne effect studies of uncured compound showed that the filler-filler interaction (ΔG') decreased by 70 per cent than the control at 2 per cent serum coating on silica. The better processability of the modified rubber-silica compound is further evident from the lowering of the elastic torque and minimum rheometric torque (M_L) of the respective vulcanizates. The serum modification on silica reduced the viscous shear modulus (G") and loss factor (tan δ) by 36 and 33 per cent respectively, compared to the control. The physical properties of the coated system were comparable with that of the control compound.

Keywords: Latex, Natural rubber, Payne effect, Processability, Silica

INTRODUCTION

The combination of silica as the major filler with synthetic polymers for making radial tyres is well established due to its technological advantages and the green tyre concept (Rauline, 1992). The incorporation of silica to natural rubber is really challenging due to the incompatibility and other processing problems. The poor adhesion between the polar silica surface functionality and the nonpolar polyisoprene molecules, leads to reduced filler–polymer interactions. The surface silanol groups of silica particles results in strong filler–filler hydrogen bonding interactions, which results in aggregation of silica and reduces the dispersion of silica within the rubber matrix. Modification of natural rubber polymer backbone through epoxidation (Varkey *et al.*, 1998; Manna *et al.*, 1999; Cataldo, 2002; Kaewsakul *et al.*, 2012; 2014) and silica surface modification (Meng-Jiao *et al.*, 1991; Meng-Jiao and Siegfried, 1992; Meng-Jiao, 1998; Chonkaew *et al.*, 2014) to improve the compatibility between the polar filler and the non polar polymer are the two approaches attempted as solutions for the above problems. Several studies of surface modifications of silica with both covalent modifications of silanol groups by silane coupling agents (Meng-Jiao and Siegfried, 1992; Udo *et al.*, 1997; Sarkawi *et al.*, 2014a) surface grafting with vinyl, acrylic

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