

Rubber bound phenolic antioxidant and its application in thermoplastic elastomer

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Abstract. Natural rubber bound phenolic antioxidant, 2,6-di-*tert*-butyl-4-vinylphenol (2,6-DBVP), was prepared from natural rubber and 2,6-DBVP in both solution and melt state. The 2,6-DBVP had been synthesized from 3,5-di-*tert*-butyl-4-hydroxybenzaldehyde and methyltriphenylphosphonium iodide (MePPh₃I) by Wittig reaction (0°C for 2 hrs, N₂ atmosphere). The conditions for preparation of natural rubber bound 2,6-DBVP (NR-DBVP) were optimized for both solution state (1 phr BPO and 8 phr 2,6-DBVP at 70°C for 2 hrs) and for melt state (1 phr BPO and 8 phr 2,6-DBVP at 70°C for 10 mins, with rotor speed of 60 rpm). A thermoplastic vulcanizate was obtained using a compatibilizer, polypropylene modified with phenolic resin (PhHRJ-PP), in a closed mixer (180°C for 3 mins, rotor speed 60 rpm). The antioxidant properties of vulcanized NR-DBVP, using phenolic as the vulcanization system, were similar to NR with the conventional antioxidant BHT. In addition, the antioxidant, water leaching property of the thermoplastic vulcanizate of NR-DBVP/PP were good in comparison to a NR blend with BHT; the morphologies of these thermoplastic vulcanizates were similar.

Keywords: natural rubber; phenolic antioxidant; 2, 6-di-*tert*-butyl-4-vinylphenol; compatibilizer; thermoplastic vulcanizate

1. Introduction

Rubber products undergo degradation which is mainly caused by oxygen, ozone, heat and dynamics stress. Consequently, there is an effort to improve rubber stability during processing, when exposed to the vulcanization thermal conditions and during the lifetime when exposed to the external environment. The thermal oxidation of rubber is an autocatalytic, free-radical chain reaction where the oxidative products are carboxylic acid, aldehyde, ketone, epoxide, etc. The rate of the oxidation process can be reduced using antioxidant (Cibulková *et al.* 2005). The

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