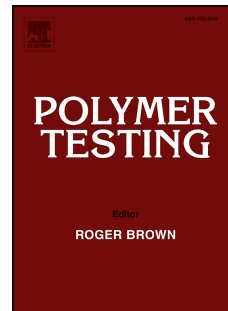


Accepted Manuscript

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PII: S0142-9418(16)30338-5

DOI: [10.1016/j.polymertesting.2016.07.014](https://doi.org/10.1016/j.polymertesting.2016.07.014)

Reference: POTE 4714

To appear in: *Polymer Testing*

Received Date: 13 April 2016

Revised Date: 21 June 2016

Accepted Date: 13 July 2016

Please cite this article as: P. Yu, H. He, Y. Jia, T. Shenghui, C. Jian, D. Jia, Y. Luo, A comprehensive study on lignin as a green alternative of silica in natural rubber composites, *Polymer Testing* (2016), doi: 10.1016/j.polymertesting.2016.07.014.

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A comprehensive study on lignin as a green alternative of silica in natural rubber composites

Peng Yu, Hui He*, Yunchao Jia, Tian shenghui, Chen Jian, Demin Jia, Yuanfang Luo
School of Materials Science and Engineering, South China University of Technology,
Guangzhou, 510641, People's Republic of China

* Corresponding author: Hui He, E-mail address: pshuihe@scut.edu.cn

Abstract

Using waste materials in polymeric products has drawn great attention over the recent years for economic and environmental concerns. Lignin, which is byproducts of paper-making industry, can be used as a valuable rubber filler. Silica is one of main fillers in rubber industry. Since using two different filler may exhibit some synergistic effects in polymers by making full use of each filler's advantage and character. In this research, we investigated the influence of lignin/silica hybrid filler towards natural rubber. The results revealed that the partial replacement of silica by lignin in the blends did not severely deteriorate mechanical properties of the composites. Besides, the inclusion of lignin into the rubber could not only weaken the Payne effect but also improve the processability, anti-aging resistance and anti-flex cracking of composites. The vulcanizate containing 20phr lignin and 30phr of silica in hybrid filler exhibited the optimal overall mechanical properties.

Keywords: lignin, rubber, silica, hybrid filler, composites

1. Introductions

Natural rubber is an important industrial raw material which is used extensively in many applications, although NR is known to exhibit numerous outstanding properties, reinforcing fillers are often required in this matrix to improve the modulus, hardness, wear resistance and reduce the material cost. Lignin, as the second most abundant renewable and biodegradable natural resource next to cellulose, is a complex macromolecule which is based on the repetition of three different phenylpropane units. In the past, lignin was mainly burned to produce energy[1], and this was a low-valued utilization. The research of high-value-added application of lignin has considerable significance for both utilization of renewable resources and

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