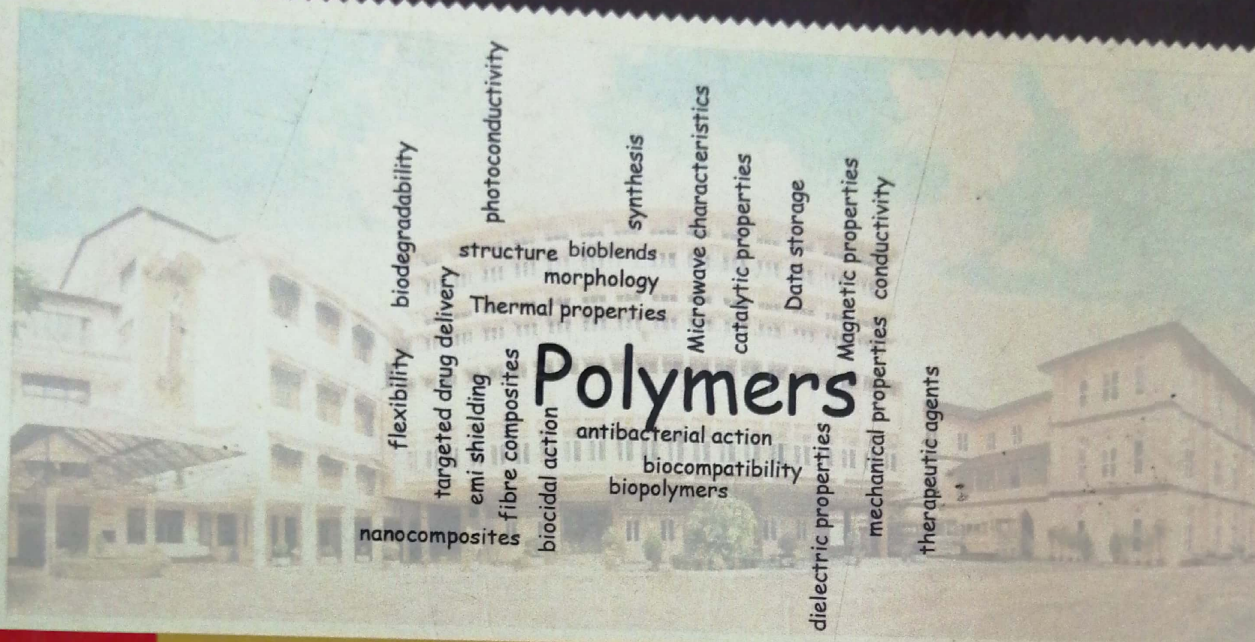




Post Graduate Department of Chemistry
St. Teresa's College (Autonomous)
Ernakulam, Kerala, India



Proceedings

UGC sponsored National seminar on

Advancements in Polymer Science and Technology

24, 25 JANUARY 2017

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Advancements in Polymer Science and Technology**

Proceedings (English)

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Post Graduate Department of Chemistry, St. Teresa's College, Ernakulam- 682011
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Editor:

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St. Teresa's College, Ernakulam- 682 011

Typesetting:

Dr. Saritha Chandran A.

Cover Page Design Conceived by:

Dr. Saritha Chandran A.

Printed at:

Indu Photos, Kalamassery

14 January 2017

ISBN: 978-81-7255-079-0

ISBN 978-81-7255-079-0



Distributor:

Sooryagatha (Publishers), T.D. Road, Kochi, Kerala-682035

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Replacing rubber grade zinc oxide with nano zinc oxide in natural rubber vulcanization: a green approach

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Abstract

Green synthesis of nano particles is attracting great interest nowadays. In the present study, we focus on the synthesis of nano ZnO by a simple precipitation method using *Averrhoa bilimbi* fruit extract. The synthesized nano ZnO was characterized using FTIR, XRD, XRF, SEM, FESEM, TEM, BET surface area etc. The particle size and BET surface area of synthesized nano ZnO were found to be 40-70nm and 8 m²/g respectively. Using XRD analysis the crystalline size of nano ZnO was found to be 23 nm. Different vulcanizates were prepared by incorporating nano ZnO in natural rubber. The cure time was found to be less for nano ZnO filled vulcanizates compared to rubber grade ZnO (RGZnO). Nano ZnO was able to give better scorch safety and cure rate index to vulcanizates compared to RGZnO. The mechanical properties like tensile strength, tear strength and modulus show remarkable improvement by using 3 phr nano ZnO. The abrasion resistance and hardness of nano ZnO filled vulcanizates were found to be superior to RGZnO filled vulcanizate. Thus nano ZnO can act as a good activator and reinforcing filler in natural rubber. The amount of RGZnO in vulcanization of natural rubber can be significantly reduced by using nano ZnO even at low phr.

Keywords: Abrasion resistance, Cure time, Green synthesis, Scorch safety.

1. Introduction

Metal oxide nano particles have attracted wide attention in recent years because of their unique properties and functionalities. Among these nano ZnO plays a pivotal role because of its size, morphology, band gap energy, large specific surface area, pore volume and dimensional stability. Nano ZnO has wide range of applications in various fields like rubber industry [1-2], bio imaging and drug delivery [3-5], antimicrobial composites [6-7], cosmetics [8-9], gas sensor [10-14], photocatalyst [15-16], fluorescent material [17-18], anti corrosive agent [19-20], solar cell [21-22], opto