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OPTIMIZATION OF PROCESS PARAMETERS FOR STABLE ZnO DISPERSIONS

Anand K, Siby Varghese, Shera Mathew, Thomas Kurian*

Rubber Research Institute of India, Rubber Board, Kottayam - 686 009, India
*Cochin University of Science and Technology, Kochi 682 022, India

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As most of the nanomaterials are very expensive, the concept of stable ultrafine dispersions with uniform size distribution is gaining commercial importance. For optical applications including transparency and also for reducing the additive concentration, ultrafine particles should be uniformly dispersed in the polymer matrix. Dispersion of ZnO has been a consistent issue because of its strong tendency to form aggregates. Present research work focuses on combining ball milling and ultrasonication to produce stable aqueous dispersions of ZnO with consistent size distribution. Milling time and concentration of surface active agent (SA) were followed through, dynamic light scattering (DLS) and Zeta potential measurements. It was observed that 12h milling with 2-3 wt per cent SA was found to be the optimum conditions for the preparation of ZnO dispersion. Effect of ultrasonication on ball milled samples resulted in dispersions with reasonable stability.

Keywords: Ball milling, Dispersion, Ultrafine ZnO, Ultrasonication, Zeta potential

INTRODUCTION

Zinc oxide is an important raw material for a broad range of products. The tyre industry remains the largest single market for ZnO, consuming more than half of the total worldwide demand of 1,200,000 metric tons (Walter, 2009). Many industries such as paints, dyes, cosmetics, pharmaceuticals, ceramics, micro-electronics, etc. employ colloidal dispersions of ZnO in the fabrication of products. The demand of such industries for stable colloidal dispersions is huge as use of fine particles will improve the homogeneity, solubility, strength, reactivity *etc*. (Inam *et al*. 2011.)

Grinding using ball milling technique is of great interest mainly because of specifications imposed on size and size distributions of grounded materials (Murthy *et al*., 1995; Fadhel *et al*., 1999; Suryanarayana *et al*., 2001; Gupta *et al*., 2001). Grinding using ball mills is a process applied to reduce the size of the particles which may have different nature and a wide diversity of physical, mechanical and chemical characteristics. Besides particle size reduction, mixing, blending and material dispersion can be achieved by ball milling (Monov *et al*., 2012). Advantage of using dispersions with fine particle size is that sedimentation during storage can be minimized with good processing easiness.

Correspondence: Siby Varghese (Email: siby@rubberboard.org.in)