

POLYUREA MICROCAPSULES WITH ENCAPSULATED DIISOCYANATES: PREPARATION AND INVESTIGATION

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Diisocyanates are widely used in self-healing materials due to their reactivity with water or air moisture. Their reactivity depends on the amount of isocyanate groups in molecule's structure. The aim of this work was to synthesize polyurea shell microcapsules with encapsulated different isocyanates cores.

For this study isophorone diisocyanate and its mixtures with hexamethylene diisocyanate, toluene diisocyanate and hexamethylene isocyanurate were encapsulated into polyurea shell using interfacial polymerization method. Taguchi L16 and L9 orthogonal arrays were implemented to determine influence of experimental parameters on microcapsule's size distribution and core content for isophorone diisocyanate loaded microcapsules. Various analysis methods (FT-IR analysis, optical microscopy, scanning electron microscopy, thermogravimetric analysis) were employed to investigate the effects of different parameters on properties of microcapsules. Taguchi larger the better method used to identify the best parameters for core content in microcapsules. It was determined that conditions to prepare microcapsules with the highest core content are requiring core-to-shell ratio – 4:1, 3000 RPM agitation rate, 1 hour of reaction time and the use of Gum Arabic emulsifier at concentration of 7 %. Taguchi nominal the better method used to identify the best conditions for microcapsule diameter of 50 micrometers. It was determined that conditions to prepare such microcapsules are requiring core-to-shell ratio – 5:1, 5000 RPM agitation rate, 1 hour of reaction time and the use of two emulsifiers poly(vinyl alcohol) and Gum Arabic at concentrations of 1% and 1.5 %, respectively. IPDI mixtures with other isocyanates were successfully encapsulated. The core content in microcapsules was about 70 % in most cases, while maximum core content was 86.7 %.