

Preparation and Properties of Polyurea Microcapsules from Different Diisocyanates

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INTRODUCTION

Entrapment can control the release of active ingredients, sustain the effectiveness of such ingredients, permit liquids to be handled as solids, protect reactive components until time of use, allow the safe handling of toxic materials, extend the shelf life of delicate materials, and overcome product incompatibilities [1]. Release rate of the functional material from the microcapsules can be controlled by the chemical structure of the capsule wall, its thickness and the particle size of the microcapsules [2]. Especially, the chemical structure of monomer in the encapsulation by interfacial polycondensation is one of the important parameter determining the physical properties of the microcapsules. In the present study, the effect of chemical structure on the physical properties of polyurea microcapsules is investigated by varying the type of monomeric diisocyanates.

EXPERIMENTAL

Polyurea microcapsules were formed in the present study by carrying out an interfacial polycondensation reaction in emulsion globules between various diisocyanates, hydrogenated biphenyl methane diisocyanate ($H_{12}MDI$, $M_w=262.4$), Isophorone diisocyanate (IPDI, $M_w=224$) and toluene diisocyanate (TDI, $M_w=174$), and ethylene diamine(EDA).

RESULTS AND DISCUSSION

Fig. 1 shows FTIR spectra of polyurea microcapsules from various diisocyanates, $H_{12}MDI$, IPDI, and TDI. The microcapsules from aliphatic $H_{12}MDI$ would have much more C-H group than those from aliphatic IPDI with the difference of chemical structure. For samples from $H_{12}MDI$ and IPDI, the intensity of hydrogenated bonded N-H to free N-H is stronger than that from aromatic TDI, which is related with the difference of reactive activity. As it were, much reactive aromatic TDI could produce lots of hydrogen bonded N-H group than other aliphatic diisocyanates.

Fig. 2 shows TG diagrams of polyurea microcapsules from different diisocyanates. The first weight loss is seen above 300°C corresponding to the melting temperatures of all the samples. The release of core material in the microcapsule increases with the order of TDI, IPDI and H₁₂MDI, respectively. It is convinced that the microcapsules from aromatic TDI have the highest thermal stability among all the samples due to the difference of reactivity with EDA.

Fig. 3 shows the particle size distribution of the samples with various structures. Mean volume diameters of the microcapsules from TDI, IPDI and H₁₂MDI are 6.5, 5.6 and 4.6, respectively. It is convinced that both molecular weight and reactivity of diisocyanates determined the mean diameter and particle size distribution at the same time.

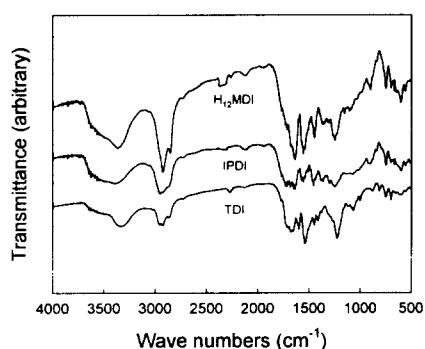


Fig. 1 IR spectra of polyurea microcapsules from different diisocyanates

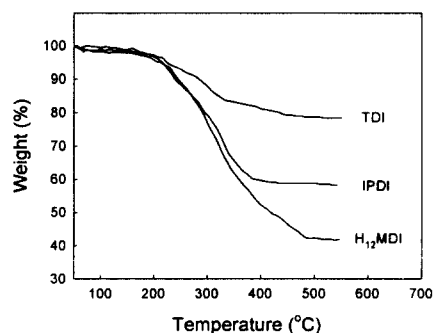


Fig. 2 TG diagrams of polyurea microcapsules from different diisocyanates

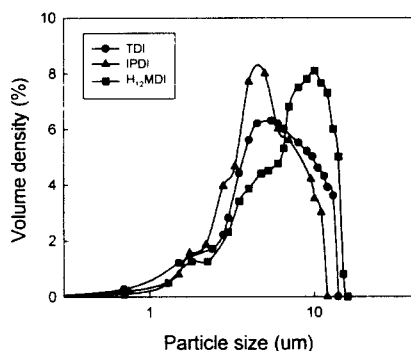


Fig. 3 Particle size distribution of polyurea microcapsules from different diisocyanates

References

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2. K. Hong and S. Park, Preparation of polyurethane microcapsules with different soft segments and their characteristics, *Reactive and Functional Polymers*, (1999) in press.