Preparation and Properties of Frame Retardant Polyurea Particles Containing Phosphorous Compounds

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1. INTRODUCTION

Entrapment can control the release of active ingredients, permit liquids to be handled as solids, protect reactive components until time of use, allow the safe handling of toxic materials, extend the shelflife of delicate materials, and overcome product incompatibilities.

Polyurea microcapsules are completely insoluble in water and other common solvents and can incorporate both hydrophobic and hydrophilic active materials. We studied the microencapsulation of fragrant materials with various polymer matrices.

Frame retardants, as a core material, can be protected from the microcapsules by entrapping in the wall. The productive 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. Especially, the chemical structure of the monomer in the encapsulation by interfacial polycondensation is one of the important parameters determining the physical properties of the microcapsules.

In the present study, the physical properties of polyurea microcapsules was investigated by varying the type of monomeric diisocyanates.

2. EXPERIMENTAL

Polyuera microcapsules were formed by carrying out an interfacial polycondensation reaction in emulsion globules. An organic phase with the various diisocyanates as wall -forming material and various frame retardants as the core substance. The O/W emulsion was formed by adding the organic solution into the aqueous solution by stirring vigorously at ambient temperature. EDA solution was added into the O/W emulsion after stirring for 10 min to prevent an agglomeration among the resultant emulsion globules. Reaction for more than 120 min gave the formation of polyurea microcapsules.

The microcapsules were decanted, filtered out, washed and dried in a vacuum oven at 25℃for at least 48hr.

3. RESULT AND DISCUSSION

Fig. 1shows TG diagrams of polyuera microcapsules from the different diisocyanates. The first weight loss is seen above 300℃for all the samples, and the magnitude of the weight loss corresponds to the result of the DSC. The microcapsules from aromatic TDI have the highest thermal stability among all the samples, which seems to be related to the difference of reactivity with EDA, producing various wall properties. The weight loss of the microcapsules from H12MDI is greater due to many more methylene chains in it than IPDI.

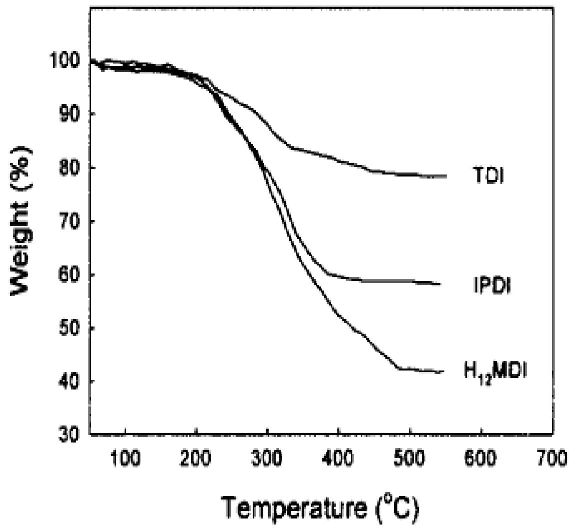
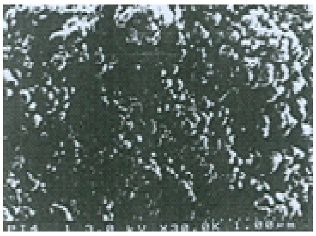


Fig. 1 TG diagrams of polyurea microcapsule containing triphenyl phosphate(TPP).

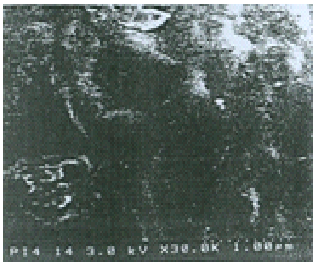
Surface morpologies of the microcapsule wall from the different diisocyanates are shown in Fig. 2.

In the case of TDI, it is confirmed that a rapid random reaction occurred between TDI in the organic phase and EDA in the water-soluble phase on the emulsion globules, producing a very rough wall membrane. The different of diisocyanates reactivity induced from the chemical structure brings about the various membrane mopologies, which can signify cantly determine the permeability, crystallinity, and thickness of the resultant microcapsules.

(a)



(b)



(c)

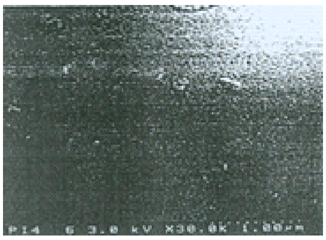


Fig. 2 SEM photograph of polyurea microcapsule from different diisocyanate : (a) TDI; (b) IPDI; (c) H12MDI

Polyester sheets were dyed and finished with various flame retardant compounds. (commercial A,B and M/C)

The durable flame retardancy was obtained when the phosphorous content in PET fabrics was about more than 4.0%. The impartment of flame retardancy (SE grade and LOI 28 up) for polyester sheets was possible by treating them with mixed dispersions of M/C containing organic phosphorous compounds.

Table 1. Flame retardant properties of polyester sheets finished with the microcapsule containing phosphorous compounds.

Items	Length of burnt position (mm)	Burning time (s)	Burning rate (mm/min)	LOI
Control	70.0	49.0	85.7	19.0
F-A *1 F-B *2	35.0 10.0	32.0 8.0	65.6 SENBR	21.2 24.0
F-C *3 F-D *4	- -	- -	SE SE	28.1 29.2

Note *1 Dyed/finished with commercial A
*2 ″ ″ with ″ B
*3 Dyed/finished with TCP M/C
*4 ″ ″ with TPP M/C

4. REFERENCE

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