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Microencapsulation of Ethion by Interfacial Polymerization Utilizing Potassium Phthalimide-*N-oxyl* (PPINO) as a Promoter

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Abstract

Polyurea microcapsules containing an active agent, i.e. ethion as pesticide, have been prepared by interfacial polymerization between 2, 4-toluene diisocyanate (TDI) and diethylenetriamine (DETA) in an oil-in-water (O/W) emulsion system. The effects of the nature of the emulsifier, the monomer weight ratio, and a novel promoter, i.e. potassium phthalimide-N-oxyl (PPINO), on the morphology, microstructure, and thermal stability of the microcapsules have been investigated. PPINO was used as a water-soluble promoter capable of dimerizing and trimerizing the isocyanate reactant in the interfacial polymerization. The transmission electron microscopy (TEM) micrographs showed that the addition of the promoter had no significant effect on the microcapsule shell thickness. Increasing the amount of PPINO caused the degree of crystallinity of the polymer shell to decrease considerably. In addition, increasing the amount of promoter up to 2 wt% caused the thermal stability of the microcapsules to decrease, while using promoter beyond this level resulted in higher thermal stability.

Keywords: *Microcapsule, Interfacial Polymerization, Potassium Phthalimide-N-oxyl (PPINO) Promoter, Morphology*

1. Introduction

Microencapsulation of active ingredients with a polymeric shell has been widely used in various applications for many years [1]. This trapping technology mainly controls the release rate of active agents, protects sensitive materials from undesirable environmental conditions, reduces mammalian toxicity, and sustains the performance of the active ingredients [2–7]. Encapsulation of active chemical agents such as pesticides and herbicides by polyurea coating materials has been extensively investigated through interfacial polycondensation reactions between a variety of diamines and diisocyanate monomers [6, 8–11]. The functional performances of such microcapsules are highly dependent on the particle morphology and microstructure characteristics of the polymeric shell, such as thickness, composition, crosslinking density, crystallinity, and porosity of the shell. These

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