Effects of Protective Colloids on the Formation of Polyurea Microcapsules

폴리우레아 마이크로캡슐제조과정에 보호콜로이드의 효과

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1. Introduction

Generally, the final properties of microcapsules greatly depend on the stability of O/W emulsions to stand mechanical agitation, the membrane of the droplets breaking up, and aggregations taking place between the membranes of the respective droplets. In this research, we focused on the microencapsulation of pesticide oils and cypermethrin. The interfacial reaction based on the polymerization of aromatic 2,4-toluene diisocyanate(TDI) and ethylene diamine(EDA) was also investigated to evaluate the influences of the protective colloids on microencapsulation.

2. Experimental

2.1 Preparation of the microcapsules

Polyurea microcapsules were formed by an interfacial polymerization in an O/W emulsion between TDI dissolved in cyclohexane and EDA dissolved in water. Polyvinylalcohol(PVA) and gelatin were used as the protective colloid. The O/W emulsion was formed by adding the organic solution to aqueous solution containing protective colloid, and then the mixture was stirred for three minutes. The EDA solution was then added the O/W emulsion after stirring for fifteen minutes to prevent agglomeration between the microcapsules. The temperature was increased to 70℃.

2.2 Characterization of the Microcapsule

The infrared spectra of the core material and microcapsules was observed using a computerized Nicolet Impact 400D Fourier transform infrared(FTIR) spectrophotometer. A

thermogravimetric analysis(TGA) was carried out on a DSC Mettler TA-3000(Thermal Science PL-STA). The shape and morphology of the microcapsules were examined using a scanning electron microscope(SEM, Hitachi S-4200, Japan). Finally the release behavior of the microcapsules was observed with a UV-Vis spectrophotometer(UV-1601, Japan).

3. Results and Discussion

Cypermethrin-containing polyurea microcapsules were prepared by interfacial polymerization using aromatic TDI and EDA as wall forming materials. The effects of the protective colloids of PVA and gelatin were investigated through experimentation. The mean size of the polyurea microcapsules was smaller and the surface morphology of the PVA was much smoother than gelatin(Fig. 1). In addition the release behavior was much more controlled and better sustained. As the concentration of protective colloid increased, the wall membrane of the polyurea microcapsules became more stable, the thermal stability of the wall membrane increased, the mean particle size became smaller, and the particle distribution was more uniform. The release behavior of the core material changed according to the concentration. As the gelatin concentration was increased, a more controlled and sustained release behavior was observed. However, in the case of PVA, the increase of PVA concentration lead to a more rapid release rate.

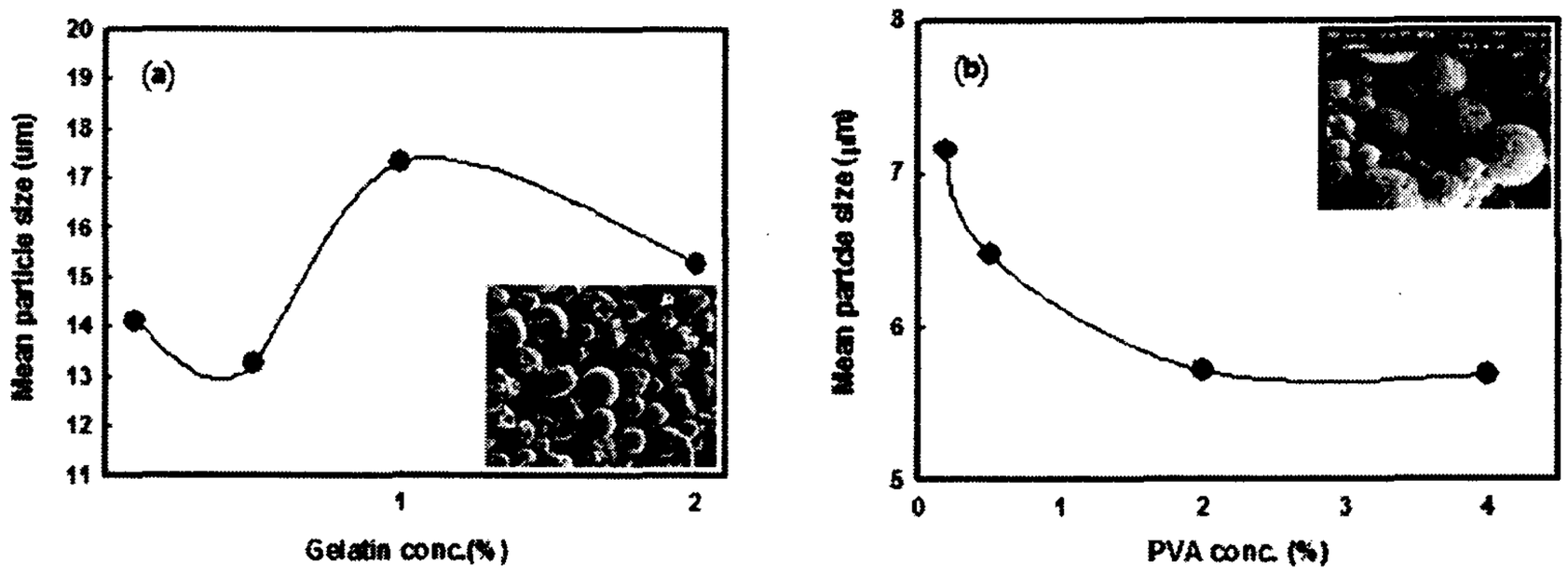

Fig. 1. Mean particles size and surface morphology of polyurea microcapsules prepared with different protective colloids (gelatine(a) and PVA(b)).

Reference

1. Peihong Ni, Mingzu, Nianxi Yan, *Journal of Membrane Science*, **103**, 51-55(1995)