CHAPTER I
INTRODUCTION

Allergy is one of prevalent diseases caused by over sensitization in immune process which still needs an effective treatment. Although avoidance of the allergen exposure is the most important matter, several treatments such as drug therapy and allergen immunotherapy are the known clinical cure (Rolland *et al.*, 2009). Recently, allergen delivery system has received much attention since it is a fundamental approach which concerns the addition of a series of allergen combined with adjuvants to increase allergen immune response by balancing T-helper cells 1 and 2 (Huggin *et al.*, 2004).

Chitosan is an aminopolysaccharide, known for the bioactivity, biocompatibility, and biodegradability. Up to present, there are many reports related to the possibility to use chitosan in biomedical and pharmaceutical areas. For allergen delivery system, chitosan was reported as an adjuvant (Scholl *et al.*, 2005) to enhance the immune response to the cells. The fact that chitosan can be modified into various derivatives, the development of chemical structure of chitosan to incorporate allergen into chitosan is a good strategy to achieve chitosan allergen delivery system.

Recently, the progress in analytical instruments has led us to get more understanding of the polymer structures, their consequent morphologies, and properties and/or performances at nanometer level. This also brings us to establish the relationship between the primary chemical structures and the induced nanometer scaled morphologies. There are many reports related to the challenges in unique molecular designs which proved to us the nanoparticles formation with the specific morphologies in terms of nanorods (Cao *et al.*, 2008), nanospheres (Kataoka *et al.*, 2006), micelles (Gaucher *et al.*, 2005), and vesicles (Wiesman *et al.*, 2007), etc. Those nano-sized materials are known as potential materials for drug carriers, gene deliveries, and molecular biology related therapies (Davda *et al.*, 2001).

In the case of nanospheres, several reports showed how various materials were potential for drug delivery and targeting. In terms of allergen delivery system, nanospheres can be expected to provide a sustained release of the allergen with effectiveness and efficacy at cell level.

On this viewpoint, currently, we succeed in preparing chitosan nanoparticles by simply introducing hydrophobic and hydrophilic groups onto the chains (Yoksan *et al.*, 2003). In separate work, we have also found that chitosan forms a complex with hydroxybenzotriazole (CS-HOBt) which allows water solubilization (Fangkangwanwong *et al.*, 2006). The CS-HOBt allows us to carry out the conjugating reaction via the homogeneous system in aqueous with the use of water-soluble conjugated agent.

The present work is another step to extend the nanospherical chitosan development for a concrete and practical application for allergen delivery system. Therefore, an important point is how to functionalize chitosan with biomolecules to achieve biocompatible nanoparticles with structures and/or morphologies of which allergen incorporation is possible. Herein, we propose a model nanoparticulate chitosan based on the conjugation of amino acid molecules and polyethylene glycol via a simple conjugation reactions including the preliminary dust mite allergen incorporation and the fundamental qualitative and quantitative analysis.