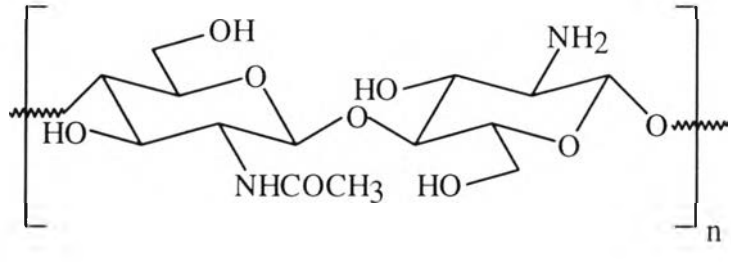
CHAPTER I
INTRODUCTION

Naturally, chitin-chitosan is a copolymer of the second most abundant polysaccharide next to cellulose. The unit of chitin and chitosan can be expressed as β-(1-4)-2-acetamido-2-deoxy-β-D-glucose and β-(1-4)-2-amino-2-deoxy-β-D-glucose, respectively (Scheme 1.1).

Scheme 1.1 Chemical structure of chitin-chitosan copolymer



Up to now, chitin-chitosan has received much interests as a biopolymer and been reported for its specific properties, i.e., the biocompatibility, biodegradability, bioactivity, and non-toxicity including the possibility for physical and chemical modifications. However, chitin-chitosan has the strong hydrogen bonding among the chain that limits itself to be able to dissolve in particular solvents. Most practical researches for chitin-chitosan utilizations, thus, are mainly reported on the physical modification such as powder blending (Sawayanagi *et al.*, 1982), fiber extrusion (Tokura *et al.*, 1979), film (Xu *et al.*, 1996) or membrane casting (Hirano *et al.*, 1978, Qurashi *et al.*, 1992, and Wang *et al.*, 1998). For the past two decades, many attempts have been paid on the chemical modification (Kurita *et al.*, 1992, Nishimura *et al.*, 1991, Moore *et al.*, 1982, and Horton *et al.*, 1973) for chitin-

chitosan to obtain derivatives with the properties that never achieved in the natural one. However, most chemical reaction processes have to be done in heterogeneous system or in some specific acid solutions, which obstructs the variety and the satisfactory on the reaction. To breakthrough this problem, an alternative way is to modify the chitin-chitosan in advance into the low molecular weight species or the oligomers, following by the chain modification step.

On this point of view, it is known that there are mainly three pathways, i.e., chemical treatment (Nishimura *et al.*, 1991, Allan *et al.*, 1997, Matsushima *et al.*, 1957, and Horowitz *et al.*, 1957), enzymatic degradation (Aiba, 1993, 1994), and photoirradiation (Ulanski *et al.*, 1992, Lim *et al.*, 1998, and Andrady *et al.*, 1996) to achieve the chain degradation of chitin-chitosan. Although the chemical treatment can be easily done, the chemical waste turns out to be the problems of the processes nowadays. Enzymatic degradation is an attractive way since it can be achieved in natural system with mild condition. However, it requires the multi-step processes in order to handle enzyme. Photoirradiation is an interesting method to propose the way to apply the high radiation energy, for the peaceful and useful utilization.

Recently, γ-irradiation for chitin-chitosan has received much attention (Lim *et al.*, 1998, and Ulanski *et al.*, 1992) and has been reported for the potential applications, such as biomedical applications that require the final products to be sterilized before use (Lim *et al.*, 1998, and Ulanski *et al.*, 1992). Although the chain degradation and the changing of chemical structure have been proposed (Wenwei *et al.*, 1993, and Ulanski *et al.*, 1992), the structural characterization has not been well defined while less studies are done on the chemical modification of the obtained chitin-chitosan.

The present research work is, thus, based on the utilization of γ-irradiation for chitin-chitosan degradation and focused on the structural analysis to clarify the structure of chitin-chitosan. The work also stands on

the point to study on the chemical modification of the irradiated chitosan to propose a unique precursors, which can be expected for the advance applications, especially the controlled release system of the drugs.