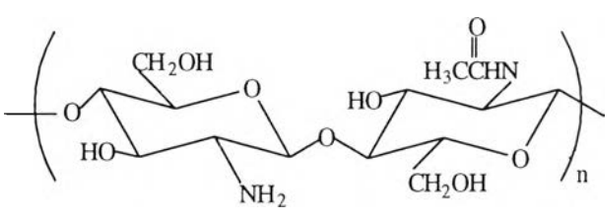
CHAPTER I
INTRODUCTION

Chitin, (1→4)-linked-2-acetamido-2-deoxy-β-D-glucose, is the second most abundant biopolymer after cellulose. It is found in the shells of crustaceans and insects as well as mushrooms and yeast. In nature, chitin appears as a copolymer chain with chitosan unit, (1→4)-linked-2-amino-2-deoxy-β-D-glucose (Scheme 1.1).

Scheme 1.1 Chemical structure of chitin-chitosan



The research works for several decades have proven chitin-chitosan as a non-toxic (Chandy *et al.*, 1992), bioactive (Kurita *et al.*, 1997), biodegradable (Mark *et al.*, 1985) and biocompatible (Singh *et al.*, 1994) polymer. Many practical applications of chitin-chitosan have been proposed via physical modification, i.e., film and gel crosslinking (Wang *et al.*, 1997, and Chen *et al.*, 1997), fiber extrusion (Tokura *et al.*, 1979, and Rathke *et al.*, 1994), membrane casting (Kanke *et al.*, 1989, and Bonvin *et al.*, 1994). Moreover, chitin-chitosan has more potential reactive group for chemical modification than that of cellulose (Nishimura *et al.*, 1991, and Kurita *et al.*, 1992). The applications of chitosan derivatives can be raised as, N-nonanoylchitosan for adsorption of copper (II) ion (Kurita *et al.*, 1988), N-carboxybutylchitosan for wound healing or dressing (Biagini *et al.*, 1992),

carboxymethylchitin for waste water treatment or calcium ions binder (Tokura *et al.*, 1983, and Deans *et al.*, 1992), and so on.

Recently, the derivatives of chitin-chitosan have received much interest and have been proposed as a potential material for drug carrier in medical field (Desbrieres *et al.*, 1997).

The preparation of chitosan derivatives always face the problem of high molecular weight and strong inter- and/or intra-molecular hydrogen bonding between chitosan main chain. Conversion of high molecular weight chitosan into smaller oligomers is one of the methods to overcome this problem. This can be achieved by methods such as chemical treatment by acid or base (Defaye *et al.*, 1989 and Allan *et al.*, 1997), photoirradiation (Ulanski *et al.*, 1992, and Andrady *et al.*, 1996) and enzymatic hydrolysis (Hirano *et al.* 1989, and Aiba *et al.*, 1994). Concerning on the obtained product, it can be expected that the enzymatic system is the most interesting pathway to provide the well-defined oligomer of chitosan under the mild condition and environmental friendly. Although many types of enzyme have been reported for chitin-chitosan degradation such as lysozyme, chitinase (*Streptomyces griseus*, *Bacillus sp.*, *Bacillus sp.* PI-7S, *Serratia marcescens* QMB 1466, *Aeromonas hydrophila*), chitosanase (*Bacillus sp.* No. 7-M, *Streptomyces griseus* HUT 6037), the novel chitinase and/or chitosanase still received much interest.

The present work is, thus, based on the enzymatic degradation of chitin-chitosan by using chitinase produced from bacteria strains isolated from soil in Thailand, *Staphylococcus species* strain TU005 (E). The work also extends to study on the effective chemical reaction to obtain chitosan oligomer derivatives and propose chitosan precursors to be a practical pathway for conjugation with a model drug.