CHAPTER I
INTRODUCTION

Modern tissue engineering combines materials science with biotechnology and biology to repair and replace damaged. It has been shown that new tissues can be engineered from living cells and three-dimensional scaffolds. The success of these approaches is largely dependent on the scaffold properties. For instance, the scaffolds should provide sufficient mechanical strength, and have a high porosity, pore interconnection to ensure nutrient diffusion, cell ingrowth and elimination of waste. In addition, the scaffold should degrade into non-toxic products in a controlled fashion to prevent long-term physical hindrance and unwanted tissue reactions.

Hydroxyapatite (HAp) is a naturally occurring inorganic material that has been a mineralized tissue of bones and teeth in humans and vertebrates. It has been widely used as bone filler, spacer, and bone graft. HAp has been well-recognized as it is an excellent affinity to biological substances such as collagen, proteins, enzymes, cells, and viruses, biocompatible, osteoconductive and bioactive material (Liu Tse-Ying *et al.*, 2005). With the osteoconductive properties, HAp ceramic has been also investigated as scaffolds for cell delivery and tissue engineering. In addition, HAp can be used as protein delivery agent, drug delivery agent, catalyst, and absorbent (Li, Yanbao *et al.*, 2008). The apatite crystal often used to carry drugs or proteins has regularly a stoichiometric composition, i.e., Ca/P=1.67 (Liu Tse-Ying *et al.*, 2005). The adsorption of protein onto HAp is important to accelerate tissue healing when placed *in vivo* (Qing Yang *et al.*, 2006) in a variety of oral or osseous biological events. HAp has also adsorptive capabilities with respect to proteins and biologically active molecules, such as osteogenic agents and growth factors.

The main problem of bone tissue engineering are long time for bone regeneration and not prolong exposure of the proteins to stem cells.

The purpose of this study is to fabricate proteins-HAp powder embedded in porous PCL scaffold allowing to control the release rate behavior of different proteins. The relationship between characterization, cell culture and release rate behavior of different proteins.