CHAPTER VI
CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The porous hydroxyapatite particle as a controlled release carrier of proteins were successfully synthesized by co-precipitation technique. The precursors were obtained DCPD and $CaCO_3$. Incorporation of proteins was accomplished during the co-precipitation of the two reactants. Characteristics of the HAp particles were determined by XRD, EDS, FT-IR, TGA, ZP, SEM, TEM, and Autosorb-1. Proteins-loaded HAp were dissolution tested in prolonged PBS solution. Proteins release could be regulated using HAp particles resulting in prolonged release of proteins except gelatin type B. Mechanism of proteins-loaded HAp release was believed to be the combination of diffusion or degradation of the carrier. Many factors play roles and synergistically control on the release of proteins from the hydroxyapatite which were electrostatic interaction between protein and hydroxyapatite. Potential for using of proteins-loaded HAp-PCL scaffolds was assessed by mouse calvaria derived pre-osteoblastic cells, MC3T3-E1. The direct and indirect cytotoxicity evaluation of the proteins, HAp and protein-loaded HAp-PCL scaffold with MC3T3-E1 indicated that non-toxic. Potential for using of proteins-loaded HAp-PCL scaffolds was assessed in terms of cell attachment, cell proliferation, and ALP activity were no effect of proteins release from HAp. Alkaline phosphatate (ALP) activity at 7 days showed decreasing of the ALP activity due to cellular process switching to mineralization. According to mineralization or calcium deposition of cell for 21 days, the CBP/HAp-PCL scaffold was better than HAp/PCL, PCL, Gelatin/HAp-PCL, OVA/HAp-PCL, BSA/HAp-PCL, TCPS respectively.

6.2 Recommendations

1. Efficiency of the protein release could be improved by synthesis hydroxyapatite with small particle size and low crystallinity.

2. Hydroxyapatite is difficult to degrade, so protein can still inside the HAp. Material could be improved by using easily degradable polymer.

3. PCL scaffold could be improved the porosity by mixing with small particles.

4. Crude bone protein extracted from pork bone is a good protein for Bone tissue Engineering.