# CHAPTER 6

# CONCLUSION

Polyhydroxyalkanoate is a versatile material having an enormous usage in the medical field. In fact, the first trial for the practical use of PHA was performed in the medical field. A study dated as early as in the 1960s had already reported the application of PLA materials for bone prosthesis material in oral surgery (Ueda and Tabata, 2003). The biodegradability, which is the main characteristic of PHA, becomes indispensable for newly developed medical technology, drug delivery and tissue engineering. Reflecting the current efforts to bring the fundamental research to the clinical application of these technologies, it is supposed that the market for PHA derivatives is still growing. From there, many studies have been implemented on this material due to its attractive properties in various fields.

In this study, the highlight was on the medium-chain-length PHA which was produced from SPKO. It was used to determine the biocompatibility and possible osteoconductive properties in bone. This was implemented by inserting the PHA which was in the form of a membrane (PHA film) in the defect created in a rabbit's mandible. A comparison was made between the defect inserted with PHA film and the negative control, where the defect created was left empty.

Histological analysis indicated that the percentages of average mean new bone volume of PHA groups were higher than the percentages of average mean new bone volume of negative controls. As expected, the variation between these two groups achieved a confidence level of $p < 0.05$, which were considered statistically significant. From these positive results, we can conclude that mcl-PHA indeed is not only biocompatible in bone but it has osteoconductive property which promotes bone regeneration.

It is suggested that studies on mcl-PHA films could be conducted on larger animals for a longer time duration. This could be implemented to further study the degradation pattern of the PHA *in vivo* as biodegradability is one of the most attractive properties in PHA.

The biodegradable materials, for example PHA, for curing damaged sites and drug delivery are currently being researched and developed extensively. Tissues have the ability to repair by themselves. It is considered that tissue repair would be promoted if there is a scaffold to assist the proliferation and differentiation of specific cells. For instance, in dentistry, the membrane for the space making has to function as a barrier and also as a permeable membrane, in order to shut out the inner growth of soft tissues but to promote new bone growth and to supply nutrients at the same time. These scaffolds will become redundant when the tissue are healed and should be removed from the sites in order to prevent the induction of foreign body reaction and inflammation (Ueda and Tabata, 2003). The ideal process of tissue repair with PHA as a biodegradable material is that the tissue will be able to regain its original shape and function

with the aid and guidance of PHA, which will eventually degrade completely according to the progress of the tissue repair.

Apart from that, further studies should also compare the different physical appearance of PHA which would be inserted into the animal. The PHA for example, could be; made into thinner films, cut into thin strips, in granules form or in rods. This could be done to understand more about the suitable physical attributes that act efficiently *in vivo* to promote higher percentage of new bone.

Finally, the PHA films which still present in the harvested defects could be collected and conserved for further analysis.