CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The incidence of toxic blue green alga, *Microcystis* bloom and the contamination of microcystins in giant freshwater prawn (*Macrobrachium rosenbergii*) and Nile tilapia (*Tilapia nilotica*) cultured in earthen ponds, the accumulation of microcystin in the fish and prawns including eradication of *Microcystis aeruginosa* and microcystins were investigated.

The survey was carried out in green water system of 4 prawn and 6 fish ponds during April 2006 – February 2007. Blue green algal species composition was identified by microscopic method and microcystins were analyzed by ELISA technique. Seven of blue green algal taxa which are known to be microcystin producing genera were found in this investigation Biovolume of microcystin producing blue green algae in the prawn ponds was higher than that in fish ponds. The toxic cyanobacterium which bloomed in prawn ponds was identified as *Microcystis aeruginosa*. Microcystins in the prawn (n.d.-3.20 µg/kg d.w.) was higher than those in the fish (n.d.-0.80 µg/kg d.w.). This result implied that aquaculture products especially giant freshwater prawns cultured in earthen ponds with green water system are likely to be contaminated with microcystins. This finding is useful for aquaculture in term of food safety in Thailand.

Then, study on accumulation of microcystins in giant freshwater prawn and Nile tilapia was carried out. Nile tilapia were cultured in three experiments; I. Green water system (Tr. 1), II. Green water system with *M. aeruginosa* ($20.9 \times 10^6 \pm 1.6 \times 10^6$ cells.L^{-1}) (Tr. 2) III. Green water system with *M. aeruginosa* ($28.7 \times 10^6 \pm 3.4 \times 10^6$ cells.L^{-1}) and feeding (Tr. 3). They were cultured in three experiments for one month during July – August 2008 and May – June 2009. Giant freshwater prawn was conducted in two experiments. They were grown in green water systems with and without toxic *Microcystis aeruginosa* Kützing ($16.4x10^6 \pm 1.6x10^6$ cells.L^{-1}) during September – November 2009.

Microcystin contents of 8.32 ± 0.76 and 9.35 ± 1.45 μg.kg^{-1} d.w. were found in fish Tr.2 and Tr. 3, respectively. Whereas microcystin contents were 14.42 ± 1.63 μg.kg^{-1} d.w. found in prawn samples. The elimination of microcystins by two formulas of Effective Microorganisms (EM) was also investigated. EM could not significantly reduce numbers of *M. aeruginosa* and microcystin content ($p>0.05$).

Blue green algal distributions and their changes in space and time depend on the morphological, hydrological, meteorological and geographic characteristics of a given water body. Local knowledge of bloom history and a good understanding of the local growth conditions for blue green algae will greatly enhance the capacity to predict bloom formation. As the knowledge and understanding of given water body accumulate, regular patterns of blue green algal growth may be noticed, so that in the long-run, monitoring may be focused upon critical periods and locations. Blue green algae should be reviewed regularly to provide the most cost effective use of resources and safety.

6.2 Recommendations

Due to the toxicity of blue green algal hepatotoxins to human beings and aquatic organisms, it seems probable that, the best response to safeguard the health and well being of humans and animals to avoid these toxins by all means. Therefore, constant monitoring for blue green algal toxins in aquaculture is very important. Moreover, health surveillance and evaluation need to be introduced by authorities everywhere, where exposure may be suspected.

Reduction of nutrient inputs and maintenance of flow regimes using watershed management tools are perhaps the best choices for long term success in preventing and controlling the development of blue green algal bloom. Tilapia and prawn aquaculture prefer nutrient-enriched water (green water), produced by the addition of animal manure or fertilizer, for supporting the growth of tilapia and prawn. Pond management is essential for a productive aquaculture farm. In this sense, adequate nutrient levels will allow the right biomass and structure of phytoplankton. An excessive supply of nutrients will result in an over-enrichment that eventually will promote algal blooms. Additionally, nutrients in excess will alter phytoplankton composition with a resulting change of dominant species; such changes imply the substitution of larger species for smaller ones, particularly blue green algae.

The use of algicides such as copper sulphate to control toxic blooms should be avoided, as it leads to cell lysis, hence releasing toxins into water. Removal of intact cells from water is the only recommended method which maybe safer. There is a possibility of exposure to hepatotoxins through consumption of contaminated food, it is important that such food should not be collected during the algal bloom season.

The study on biodegrading of microcystin should be carried on. It is one of the safe and mild treatments for removing blue green algal toxins from water.

It is interesting that the organism which can be control *Microcystis* or have MC degrading activity may associate with their mucilage. Tucker and Pollard (2005) identified two types of podovirus-like particles that inhibited growth of *M. aeruginosa* in natural lake samples collected during an *M. aeruginosa* bloom. Maruyama *et al*. (2003) reported that MC-degrading bacteria are present in the mucilage of *Microcystis*. Many research were successively isolated the bacteria from lakes, ponds, reservoirs and rivers, particularly those containing toxic blue green algal bloom.