

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Residues of 7 groups of organochlorine pesticides (Σ HCH, Σ heptachlor, aldrin & dieldrin, Σ endrin, Σ endosulfan, Σ DDT and methoxychlor) were detected in sediment and 3 species of freshwater mussels: *Uniandra contradens ascia*, *Pilsbryconcha exilis exilis* and *Hyriopsis (Limnoscapha) desowitzi* collected from Khlong 7 canal, Rangsit agricultural area, Pathum Thani Province, Thailand. The predominant groups of OCPs found in both sediment and freshwater mussels were Σ HCH, Σ Heptachlor, Σ DDT, and Σ Endosulfan. There were significant seasonal differences in OCP concentration with the highest levels of OCP residues in sediment and mussels found around the rainy season of Thailand (June to November).

Comparison on the levels of OCP residue in sediment and mussels showed that concentration of OCPs were much higher in freshwater mussels compared to the levels found in the surrounding sediment. The result indicates the evidence of bioconcentration in the aquatic organism. Due to high lipid composition in aquatic organism, the non-polar OCPs were retained in organism tissue at much higher degree than those in the sediment.

Levels of OCP residues in sediment showed significant positive correlation among these 7 groups of OCPs. This possibly indicates pattern of pesticides used in the study area. Further analysis on association between OCP residues in sediment and OCP residues in freshwater mussels also showed significant correlation between these values. In some case (e.g. Σ DDT), the positive correlation between residue in sediment and mussel body indicates that freshwater mussels can effectively accumulate the contaminants.

Two candidate biological molecules (i.e. protein) were selected as the potential biomarkers for environmental impacts of OCP contamination in 3 species of freshwater mussels: *Uniandra contradens ascia*, *Pilsbryoconcha exilis exilis* and *Hyriopsis (Limnoscapha) desowitzi*. Specific activity of glutathione S-transferase, a biotransformation enzyme, in hepatopancreas of mussels showed significant seasonal difference. The elevated level of GST, an indicative of organic pollutant exposure, occurred significantly in accordance with high levels of OCP residues in sediment and mussel tissue. This suggests the potential use of GST in these freshwater mussels as biomarker of exposure to OCPs.

Vitellogenin, a yolk protein precursor, was measured from mussel gonad extract. Levels of vitellogenin in these 3 mussel species showed significant seasonal variation. Due to the facts that vitellogenin plays important role in egg production of the mussel, and freshwater mussels are known to be seasonal breeder, the fluctuating level of vitellogenin in different season is not unexpected. However, the elevated levels of gonad vitellogenin also showed significant correlation with certain OCP residues in sediment and mussel tissue. Since many OCPs can act as hormonally active agents (NRC, 1999), the elevated levels of vitellogenin during some period of the year may be the direct response to the increased amount of OCPs rather than normal seasonal fluctuation. This suggests the potential use of vitellogenin in these freshwater mussels as biomarker of exposure as well as biomarker of effects to OCP contamination.

Recommendations

Although most OCPs had been banned in Thailand for many years, their residues are still detectable in environment. Apart from the fact that OCPs are persistent, the issue that should be concerned is that some OCPs have been illegally used in this area. The use of banned pesticides should be more restricted. The local administration sectors should give the people awareness and education of the correct pesticide practices. Group communication between local people and the popular practice such as biological control e.g. using duck to get rid of apple snail instead of chemical pesticides especially endosulfan, should be performed. In the case of by-product from industry such as heptachlor epoxide, and some persistent metabolite of pesticides such as DDT and derivatives, HCH and derivative, the government should be routinely monitoring.