CHAPTER V

CONCLUSIONS

The aim of this research was to synthesis the eugenol derivatives (**1-19**) for use in preliminary anesthetic test in aquatic animals such as *L. vannamei*, *L. calcarifer* and *C. macrocephalus*. The synthetic plan was divided into 7 groups. First, synthesis of eugenol with hydrogen substitutions on corresponding functional group (**1-2**), *via* alkylation, Grignard reaction and demethylation to give products in 96 and 70 %yield respectively. Second, the modification at hydroxyl group of eugenol with H-bond donor as amino group. Synthesis of 4-allyl-2-methoxybenzenamine (**4**) from eugenol was developed by using 2-methoxybenzenamine and NaOH in DMF *via* Smiles rearrangement provided **4** in good yield (89%). Third and fourth, the modification at hydroxyl and methoxy group of eugenol with H-bond acceptor such as methoxy and bromide. The 4-allyl-1,2-dimethylbenzene (**5**) was synthesized *via* *O*-alkylation of eugenol at hydroxyl group by methyl iodide with K_2CO_3 at reflux afforded in excellent yield (90%). Bromination of 4-allyl-1-bromo-2-methoxybenzene (**6**) and 4-allyl-2-bromoanisole (**15**) with pyridinium hydrobromide perbromide and acetic acid also give *ortho*-bromination of 3-allylanisole and 4-allylanisole in good yield (55% and 48% respectively). Fifth, the hydroxyl group of eugenol will be alkylated with various hydrocarbon chains such as ethyl, propyl, isopropyl, butyl, *sec*-butyl, pentyl, hexyl and heptyl groups, the *O*-alkylation of eugenol were achieved in up to 55-98% yield (**7-14**). Sixth, the modification of allyl group of eugenol (**17**) *via* hydrogenation by using trifluoroacetic acid and hydrogen over Pd/C as reducing agent provided in good yield (82%). And seventh, electrophilic aromatic substitution of eugenol *via* *ortho*-bromination (**18**) and *ortho*-nitration (**19**) by using *N*-Bromosuccinimide and urea nitrate were achieved up to 48% yield for bromine and nitro groups.

The eugenol derivatives (**1-19**) were used for preliminary anesthetic test in aquatic animals. It was found that the most synthetic derivatives can be anesthesia of *L. vannamei* post larvae and adult, *L. calcarifer* post larvae and *C. macrocephalus* post larvae and adult compared with eugenol (**20**). It was found that allyl group was an important part affect to the anesthesia and hydroxyl group was the interesting part that

can be developed. The modified hydroxyl group of eugenol with H-bond acceptor and alkylated with various hydrocarbon chains lead to comparable or better anesthesia property than eugenol. The chosen anesthesia candidates for *L. vannamei* PL were **6**, **8**, **15** and **17**; for *L. vannamei* adult were **1**, **6**, **8**, **9**, **10** and **13**; *L. calcarifer* PL were **1**, **2**, **5**, **8** and**16**; and for of *C. macrocephalus* post larvae and adult were **5**, **8**, **9** and **13**.

In summary, best anesthesia agent for aquatic animals (*L. vannamei* post larva and adult, *L. calcarifer* post larvae and *C. macrocephalus* post larvae and adult) was derivative **8** because of the short time of anesthetic, longer recovery period of time unconscious and high percent survival.