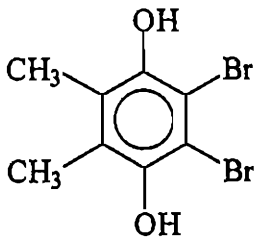
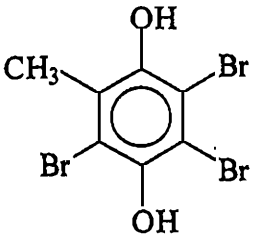
CHAPTER IV
CONCLUSION

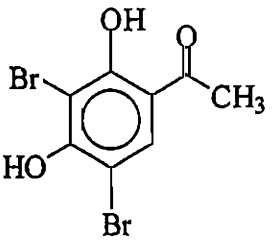
During the course of this research, the synthesis of four benzoquinones, eleven halobenzoquinones, four halohydroquinones, six alkyl-halobenzoquinones and related compounds were carried out with the aim to comprehend the structure activity relationship (SAR) of these compounds and their biological activity against brine shrimp *Artemia salina* Leach. lethality (BSL). The synthesis of halobenzoquinones gave high yield (75-95%) *via* the oxidation of bromophenols with chromic trioxide, except for Compounds **2b** and **4b** which were obtained in moderate yield. The synthesis of benzoquinones employing the oxidation of hydroquinones with chromic acid gave moderate yield (35-60%), except for the synthesis of Compounds **11**, **14b** and **15b** that provided high yield (82-97%). Alkyl-halobenzoquinones were derived from the methodology utilizing the addition of various fatty acids with silver nitrate in ammonium thiosulfate, acetonitrile and water. All synthesized compounds were well confirmed their identities by their physical properties and spectroscopic evidences such as IR, ^{1}H-NMR and ^{13}C-NMR and in some cases the elemental analysis (EA) were also performed. There are five compounds that have not been reported in chemical literatures before. These five new compounds are **5a**, **14a**, **15a**, **15b** and **16**. The structures are shown below.



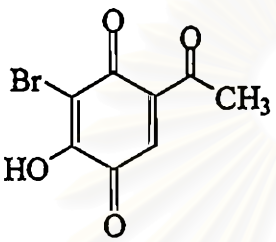
(5a)



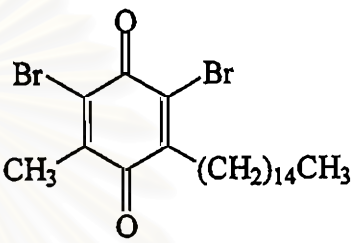
(14a)



(15a)



(15b)



(16)

Quinones and hydroquinones have been well known to possess vast biological activities such as antimicrobial activity, *etc.*[13, 14,16] The structure-activity relationship (SAR) study of these compounds however have not been widely reported. This is the first report to demonstrate the structure activity relationship of halobenzoquinones and halohydroquinones, and related compounds with the brine shrimp *Artemia salina* Leach. lethality test.

Bromobenzoquinone derivatives with one Br atom and a methyl group at C-2 displayed a high lethality activity. In the case of alkyl-halobenzoquinones, the high activity was observed when the halobenzoquinones have long side chain at C-2, while bromohydroquinone derivatives also exhibited high activity when there are three bromine groups and a methyl group attached to the parent compound. In contrast to benzoquinones, the high reactivity was detected when the substituent was H or short carbon chain. Hydroquinones with a methyl group at C-2 position also revealed high activity.

Comparing the outcome of structures and biological activity, it was found that the solubility of compounds indeed affected to activity. It was observed that compounds which were well soluble, they generally exhibited low activity. For example, hydroquinones were more soluble than quinones, thence hydroquinones displayed activity less than quinones.

Proposal for the Future Work

The outcome from this research work is an obvious example to demonstrate and to comprehend the role of structures that affect the activity. The results provided many opportunities for future studies. For instance, other types of quinones such as naphthoquinones, anthraquinones, *o*-benzoquinones and phenanthraquinones should be evaluated for their structures and activity relationship. The reported compounds derived from various sources including natural sources and chemical synthesis should be gathered and investigated for their activities. The accumulated results will be useful source like a library. In addition, as stated earlier that BSLT was the preliminary test, therefore, other activites such as anticancer, antitumor, antimicrobial, *etc* should be examined. In any case that there was a relationship between BSLT and others, it would clearly prove that BSLT could be utilized as a preliminary tool for further investigation of searching for bioactive compounds.