

EFFECTS OF WATER SOLUBLE FRACTION OF CRUDE OIL ON CRUSTACEANS

A.T. Law, Ambok Bolong Abol-Munafi and
Noor A.M. Shazili

Faculty of Applied Science and Technology
Universiti Putra Malaysia Terengganu, Mengabang Telipot,
21030 Kuala Terengganu, Malaysia

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Introduction

Aquatic organisms are highly sensitive to crude oil toxicity especially their early life stages. Water soluble fraction (WSF) of crude oil ranging from 1 to 20 mg/L can have lethal effects to the organisms (Law, 1997; Law and Noor, 1994; Lai and Kessler, 1992). These studies revealed that the WSF of crude oil containing mainly of the aromatic hydrocarbons have some severe effects on the embryonic development and the early life stage of the organisms. This will have a great effect of the aquaculture of these commercial important species in Malaysia. Therefore this study was undertaken for assessing the toxicity of the WSF of a Malaysian crude oil and some selected aromatic hydrocarbons such as xylenes, toluene, naphthalene, and phenanthrene on the egg hatchability, larvae and post larvae of *M. rosenbergii* and *P. monodon*.

Materials and Methods

The flow-through bioassay technique described previously (Law, 1995) was used for the study of the toxicity of WSF crude oil on egg hatchability of *M. rosenbergii*. The toxicity of WSF crude oil to larvae and post-larvae were conducted by using the compartmentalized tank technique developed by Law and Yeo (1997). WSF crude oil content in the test solution was prepared and determined by the fluorescence method as described previously (Law and Noor, 1994). The contents of xylenes, toluene, naphthalene and phenanthrene were determined by the UV techniques developed in our laboratory.

Results and Discussion

Under conditions of good water quality, the hatching rate of *M. rosenbergii* in the controls ranged between 95% and 100%. In this study, the results showed that eggs hatchability rate in the controls was $97.41 \pm 3.38\%$ while 0% hatchability of eggs was observed when the concentration of WSF was higher than 30 mg/L. By using the probit analysis, the EC_{50} value of WSF crude oil was estimated as 16.67 ± 0.42 mg/L oil with a slope function of 1.9 and 95% CL between 14.25 and 19.23 mg/L. The toxicity of WSF oil depends on the

aromatic hydrocarbon contents in the crude oil. Therefore, similar toxicity studies of the effect of toluene, xylenes, naphthalene and phenanthrene on the hatching rates of the eggs were conducted. The EC_{50} values were 62.04 mg/L, 28.20 mg/L, 8.75 mg/L and 8.64 mg/L respectively. The results indicated that the Malaysian crude oil is more toxic than toluene and xylenes, but less toxic than naphthalene and phenanthrene on *M. rosenbergii*. The results also exhibited that the higher number of the benzene ring in the aromatic hydrocarbons the higher the toxicity to the prawns. For the toxicity study on larvae, a $48hLC_{50}$ value of 3.59 ± 0.50 mg/L oil was found. The results indicated that *M. rosenbergii* larvae are more sensitive than the eggs to the WSF of the Malaysian oil. The non-effect level of WSF oil for *M. rosenbergii* is about 36 ug/L in the estuarine waters of 12 ppt salinity. The $96hLC_{50}$ value of WSF oil for *P. monodon* post-larvae obtained in this study is 13.97 ± 1.04 mg/L. The residual oxygen bioassay of the shrimp exposed to different levels of WSF oil suggested that a threshold oil level of 3.02 mg/L is a non-effect level of WSF oil level recommended for the aquaculture of *P. monodon* is 130 ug/L.

Conclusions

The water-soluble fraction of the Malaysian crude oil is highly toxic to marine and fresh water crustaceans. The $48hLC_{50}$ WSF oil for *M. rosenbergii* larvae is 3.02 mg/L and the $96hLC_{50}$ WSF oil for post-larvae of *P. monodon* is 13.97 mg/L. The non-effect levels of WSF oil for aquaculture of *P. monodon* and *M. rosenbergii* recommended are 130 ug/L and 36 ug/L respectively.

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