

EFFECTS OF PHENANTHRENE ON *Isochrystis galbana*

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First of all, I would like to extend my greatest appreciation to Prof. Dr. Law Ab-Thomas, chairman of the supervisory committee for his invaluable guidance, patience, generosity and time. Truly without his supervision and encouragement, this project might not have been completed successfully.

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by

HING LEE SIANG

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Chairman: Professor Dr. Law Ah Thean

Faculty : Applied Science and Technology

The effects of phenanthrene on *Isochrysis galbana* were carried out using batch culture and continuous culture techniques. The growth tests were conducted in enriched sea water at 28.0 ± 1.0 °C, pH of 8.1 ± 0.5 , salinity 30 ± 2 ppt and under continuous light illumination of $45 \mu\text{mol quanta/m}^2/\text{s}$. For batch culture, growth was estimated by increase in cell number with time. Extent of growth inhibition was influenced by concentration of phenanthrene and duration of exposure. Phenanthrene concentration of 5 mg/l and 7 mg/l temporarily inhibited the growth of cells and lethal effect was observed for concentrations higher than 7 mg/l. The IC_{50} value (the concentration of phenanthrene that causes 50% inhibition in growth of *Isochrysis galbana* relative to control) determined by batch culture technique was 1.58 mg/l.

Abstract of thesis presented to the senate of Universiti Putra Malaysia in fulfillment of the requirements for the degree of Master Science.

EFFECTS OF PHENANTHRENE ON *Isochrysis galbana* GROWTH

By

HING LEE SIANG

November 1999

Chairman: Professor Dr. Law Ah Theem

Faculty : Applied Science and Technology

The effects of phenanthrene on *Isochrysis galbana* were carried out using batch culture and continuous culture techniques. The growth tests were conducted in enriched sea water at 28.0 ± 1.0 °C, pH of 8.1 ± 0.5 , salinity 30 ± 2 ppt and under continuous light illumination of $45 \mu\text{mol quanta/m}^2/\text{s}$. For batch culture, growth was estimated by increase in cell number with time. Extent of growth inhibition was influenced by concentration of phenanthrene and duration of exposure. Phenanthrene concentration of 5 mg/l and 7 mg/l temporarily inhibited the growth of cells and lethal effect was observed for concentrations higher than 7 mg/l. The IC_{50} value (the concentration of phenanthrene that causes 50% inhibition in growth of *Isochrysis galbana* relative to control) determined by batch culture technique was 3.58 mg/l.

pH was also observed to influence the toxicity of phenanthrene. At pH 7.5, the lag period was shortened and at pH 8.5 the lag period was prolonged compared to *Isochrysis galbana* exposed to pH 8.1. The productivity of *Isochrysis galbana* decreased with increment of phenanthrene concentrations. At concentration of 1 mg/l, the photosynthetic rate of *Isochrysis galbana* was not significantly affected compared to 5 mg/l and 7 mg/l phenanthrene where the photosynthetic rate was greatly reduced compared to control.

The spiking continuous culture technique was used to estimate the NOEC (No Observed Effect Concentration) and LOEC (Lowest Observed Effect Concentration) values of phenanthrene on the inhibition of *Isochrysis galbana* growth. This method is based on the assumption that the culture at steady state (dilution rate equal to the growth rate) is relatively fragile and more responsive to mild perturbations and subtle influences. In this study, the NOEC value i.e., the concentrations of phenanthrene which had no effect on the steady state was 2.65 mg/l and the LOEC value which is the lowest concentrations of phenanthrene observed to have influenced the steady state was 2.70 mg/l phenanthrene. As such, the recommended safety level of phenanthrene for protecting *Isochrysis galbana* in marine environment is 26.5 µg/l.