Effects of Algae (*Isochrysis galbana*) and Humic Acids on Copper Toxicity to Polychaete (*Hydroides elegans*) Larvae

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Philosophy

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October 2005
Abstract

Copper is an essential trace metal for the proper functioning of many enzymes. However, elevated copper concentrations in aquatic systems often cause deleterious effects on aquatic organisms. Copper toxicity to aquatic organisms is determined by its availability. In this study, I examined how copper availability was affected by algae and humic acids. Copper toxicity was expressed using the early developmental stages of Hydroides elegans, a marine polychaete common in tropical and subtropical waters. The results showed that the reduction in labile copper concentration was dependent on the algal concentration. At a minimum concentration of Isochrysis galbana that can support the larval development (10⁴ cells/mL), the reduction in labile copper concentration was minimal. The reduction in copper concentration increased as the algae concentration increased. Without adding algae into the exposure medium, larval survivorship could be modeled as a logistic function of copper concentration, with a 48-h LC₅₀ of 59 µg Cu/L. The toxicity curve was displaced to higher total copper concentration with increasing algal concentration, with 48-h LC₅₀ values of 64 µg Cu/L at 10⁴ cells/mL, 98 µg Cu/L at 10⁵ cells/mL, and 123 µg Cu/L at 10⁶ cells/mL. A logistic model fitted the larval survival well using residual copper concentration.

Humic acids (HA), when used at concentrations that can be expected in coastal
waters (<16 mg/L), greatly affected the labile copper concentration. The binding between copper and humic acids was strong, with a conditional stability constant of 6.50 and a complexing capacity of 14.43 µg Cu per mg HA. Without adding HA into the exposure medium, larval survivorship could be modeled as a logistic function of copper concentration, with a 48-h LC<sub>50</sub> of 64.8 µg Cu/L. The toxicity curve was displaced to higher total copper concentration with increasing humic acids concentration. At 16 mg/L of humic acids, the toxicity of copper to <i>H. elegans</i> larvae was significantly reduced, with a 48-h LC<sub>50</sub> of 106.8 µg Cu/L.

This study highlights the dependency of metal toxicity on algal and humic acids concentration and the importance of considering algal sorption and organic binding in larval toxicological tests.
Mr. X. Tang and Mr. C.B. Zheng.

Finally, my deepest appreciation is extended to my family including my parents and my sister Angel, also my boyfriend Alex for their continuous love, support and encouragement.
Table of Contents

Declaration ---------------------------------- i

Abstract ---------------------------------- ii

Acknowledgments ---------------------------------- iv

Table of Contents ---------------------------------- vi

List of Tables ---------------------------------- ix

List of Figures ---------------------------------- x

Chapter 1. General Introduction 1

1.1 Research Background ---------------------------------- 1

1.1.1 Copper ---------------------------------- 2

1.1.2 Factors Affecting Copper Toxicity ---------------------------------- 8

1.1.3 Isochrysis galbana as Food for H. elegans ---------------------------------- 11

1.1.4 Hydroides elegans (Haswell) ---------------------------------- 13

1.1.5 Algal Sorption of Metals ---------------------------------- 20

1.1.6 Humic Acids ---------------------------------- 22

1.2 Aim of this Study ---------------------------------- 31
Chapter 2. Effect of Algal Sorption on Toxicity of Copper to Hydroides elegans Trochophores

2.1 Abstract

2.2 Introduction

2.3 Materials

2.4 Methods

2.5 Results

2.6 Discussion

2.7 Conclusion

2.8 Literature Cited

Chapter 3. Effects of Humic Acids on Toxicity of Copper to Hydroides elegans Trochophores

3.1 Abstract

3.2 Introduction

3.3 Materials
3.4 Methods ........................................................................................................ 112
3.5 Results .......................................................................................................... 117
3.6 Discussion ..................................................................................................... 140
3.7 Conclusion .................................................................................................... 151
3.8 Literature Cited .......................................................................................... 152

Chapter 4. General Discussion and Future Studies ........................................... 161

4.1 General Discussion ...................................................................................... 161
4.2 Conclusion and Future Studies .................................................................... 163
4.3 Literature Cited .......................................................................................... 164

Curriculum Vitae .................................................................................................. 165