

**GENOTOXICITY AND OXIDATIVE STRESS BIOMARKER RESPONSES  
OF JAPANESE MEDAKA (*Oryzias latipes* Temminck and Schlegel, 1846)  
EXPOSED TO PROFENOFOS**

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A Thesis  
Presented to the Department of Chemistry  
University of San Carlos  
Cebu City, Philippines

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In partial fulfillment of the requirements for the degree of  
Master of Science in Chemistry

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BY  
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OCTOBER 2015

## APPROVAL SHEET

This thesis entitled “**Genotoxicity and Oxidative Stress Biomarker Responses of Japanese Medaka (*Oryzias latipes* Temminck and Schlegel, 1846) Exposed to Profenofos**” prepared and submitted by **ROSALYN P. ALBURO** in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE IN CHEMISTRY** has been examined and is recommended for acceptance and approval for **ORAL EXAMINATION**.

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## ABSTRACT

Assessment of toxicity risks posed by pesticides to aquatic organisms may be a prerequisite to adverse effects on the ecosystem. Effects of the organophosphate pesticide (OP) profenofos to the different biomarkers namely thiobarbituric acid reactive substances (TBARS), acetylcholinesterase enzyme (AChE) activity inhibition and genotoxicity in terms of micronuclei (MN) and nuclear abnormalities (NA) were investigated. Biological samples of liver, brain and blood from Japanese medaka (*Oryzias latipes*) were used.

Profenofos caused significant oxidative stress in terms of TBARS to *O. latipes* on Day 2 of exposure for all profenofos concentrations of 0.04 ppm, 0.20 ppm and 1.00 ppm, but was significantly reduced the longer the exposure period owing to the capability of fishes to metabolize OPs. For AChE activity inhibition and genotoxicity, response to profenofos showed a positive dose-dependent and exposure-time dependent relationship. On Day 2, the highest concentration (1.00 ppm) was already causing significant AChE activity inhibition. Day 5, all exposure concentrations were already significantly different from Control. The highest recorded MN and NA frequencies per 1000 erythrocytes at Day 10 were 3 ( $\pm 0.27$ ) and 11.67 ( $\pm 2.16$ ); and 43.11 ( $\pm 0.63$ ) and 58.22 ( $\pm 4.49$ ), for low and high concentrations respectively, with control registering only 1.33 ( $\pm 0.27$ ) and 20.89 ( $\pm 2.78$ ) per 1000 erythrocytes, respectively. Concentration lower than what was observed in the field caused significant effect to the three biomarkers implying that the aquatic organisms present in Dalaguete River are subjected to possible toxicity risk. Evaluating the three biomarkers, TBARS cannot be a reliable measure for

toxicity to fishes since fishes can metabolize OPs over time. AChE activity inhibition test and genotoxicity can be good indicators of possible risk of pesticides to the aquatic biota. Pairing the two biomarkers can further provide ample information on the toxicity risk and lethality of profenofos.

It is recommended that further studies using other aquatic organisms be also conducted. Long-term sampling considering wet and dry seasons, bioaccumulation, and degradation and studies on fate and transport of profenofos and possible other pesticides in Dalaguete river are also recommended.

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