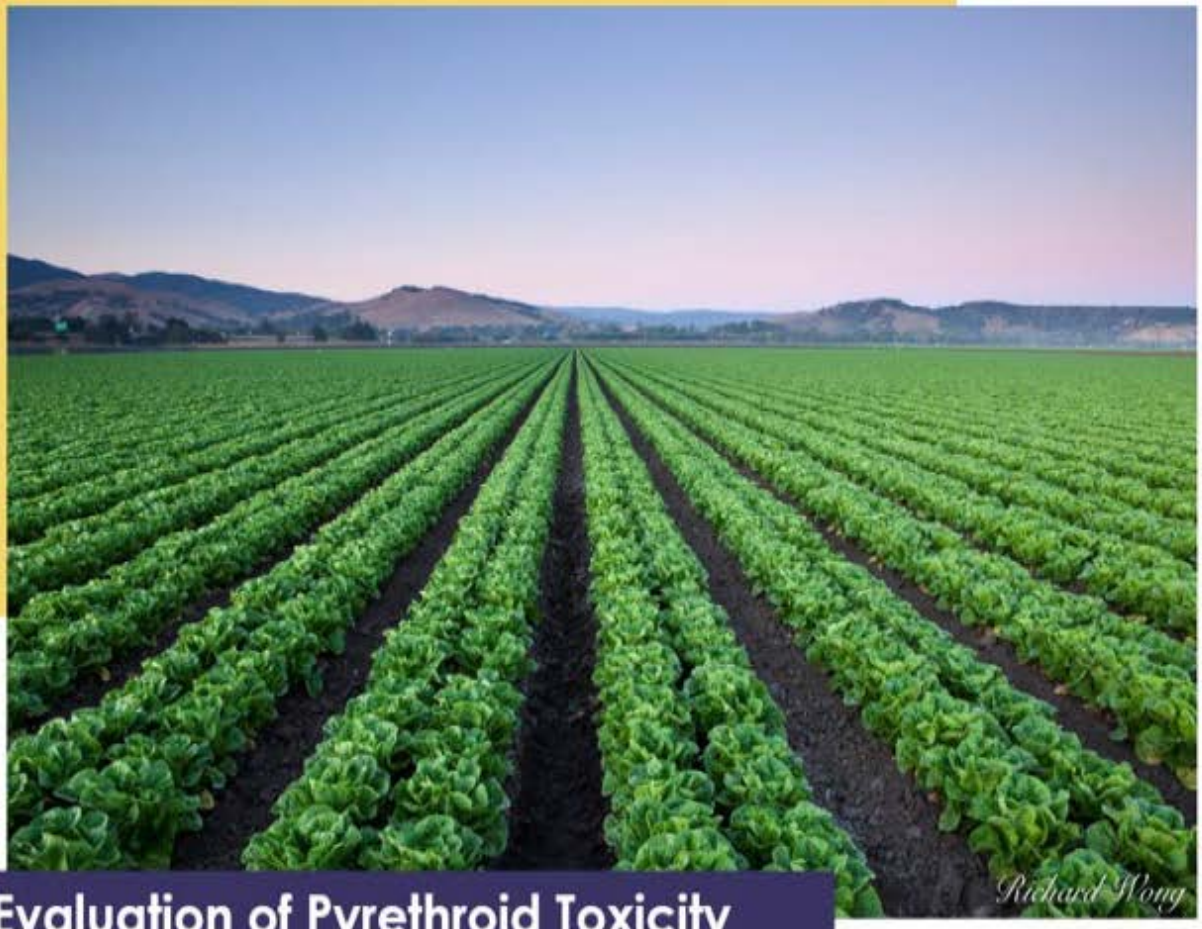

Evaluation of Pyrethroid Toxicity Removal in Agricultural Detention Basins using *Hyalella azteca*

DRAFT FINAL PROJECT REPORT

UC Davis Aquatic Health Program Laboratory

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List of Acronyms

AHPL	Aquatic Health Program Laboratory
ANOVA	Analysis of Variance
C_{DOC}	Colloid-bound particles <0.7 µm
C_{FREE}	Freely-dissolved
CS	Clarified Supernatant
C_{TSS}	Sediment-bound particles >0.7 µm
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DOM	Dissolved Organic Material
H. azteca	Hyalella azteca
Hrs	Hours
In	Inches
K_{oc}	Organic carbon adsorption coefficient
K_{ow}	Octanal-water partition coefficient
LC50	Lethal Concentration at 50%
L	Liter
LOEC	Lowest Effect Concentration
mL	Milliliter
ng/L	Nanogram per Liter
NOEC	No Effect Concentration
QAPrP	Quality Assurance Project Plan
ROEPAMHR	Reverse Osmosis EPA Moderately Hard synthetic water

SC	Specific Conductance
SOP	Standard Operating Procedure
SWAMP	Surface Water Ambient Monitoring Program
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TU	Toxic Unit
UCD	University of California at Davis
USEPA	United States Environmental Protection Agency
YCT	A mixture of yeast, alfalfa, trout chow as food for Hyalella
µm	Micrometer

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EXECUTIVE SUMMARY

Introduction

Settling basins are a prevalent and effective best management practice in reducing the occurrence of pesticide release into receiving waters from agricultural fields. To date, there has been significant research on the efficacy of settling basins and other constructed water treatment mechanisms in reducing pesticide runoff. However, there is evidence that while settling basins are effective in trapping the heavier sediment particles, they are less so at trapping finer, lighter sediments and colloids, to which pyrethroids can bind. Thus, aquatic organisms may still be exposed to toxic levels of pyrethroid pesticides, even after remediation.

Materials and Methods

Whole water and clarified supernatant water samples were collected from three sites in Salinas, California, for acute *Hyalella azteca* toxicity testing to determine the magnitude of toxicity of the pyrethroids present in these samples. Determining the toxicity of the whole water and clarified supernatant samples provided baseline information regarding the types and amounts of pyrethroids that would be found in a real-world agricultural setting, and whether these concentrations would be toxic to aquatic organisms.

Then, settling column tests were evaluated to determine the amount of settling time needed to reduce pyrethroid concentrations to biologically non-toxic levels, and where the toxicity of various fractions of pyrethroids were evaluated: freely dissolved (C_{free}), colloid-bound (C_{DOC}; particles <0.7 µm), and sediment-bound (C_{TSS}; particles >0.7 µm). These tests consisted of three "methods" designed to mimic real-world field conditions, or to isolate a particular fraction: Method 3.1 (typical toxicity testing method), Method 3.2 (mimic high-flow conditions during irrigation season), and Method 3.3 (water-phase). Determining the toxicity of the settling column samples at various time points (0-hrs, 6-hrs, and 24-hrs) provided information regarding the effects of settling time on the removal of sediment and sediment-bound pyrethroids.

Results and Conclusions

Our results, coupled with analytical chemistry, indicate that pyrethroids were in agricultural runoff at toxic concentrations that can negatively impact *H. azteca*. Concentrations of pyrethroids exceeded USEPA Aquatic Life Benchmarks for acute and chronic exposure of

pyrethroids to aquatic invertebrates for all sites and whole water samples collected, including one sample taken at Sal_Chualar22 with 22 toxic units and resulting in a 96-hr LC50 of 4.5%. The results of the settling column tests indicate that in most cases, 6 hours of settling time is sufficient for reducing TSS and pyrethroid concentrations to non-toxic levels for *H. azteca*, but maximum efficacy was reached within 24 hours. While the results of our study, as well as those in the literature, demonstrate that settling basins are generally successful in reducing sediment and sediment-bound pyrethroid concentrations, caution should be applied when considering that lighter colloidal particles will settle more slowly than heavier sediment particles, and may be responsible for toxicity to aquatic organisms after remediation.