

Detention Basin Design and Performance for Pyrethroid Removal

Progress Report #2
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Task 1. Site Selection and Sample Collection. Four agricultural sites in the Central Coast region will be selected for sampling. A flow-through centrifuge will be used to separate and collect concentrated suspended solids and clarified supernatant. Samples will be collected, transported, and stored at 4°C in the laboratory until use.

Work accomplished this period: Whole-water, concentrated suspended solids, and clarified supernatant subsamples were collected for two sites in Salinas, California. (Site #3 – Sal Chualar and Site #4 – Sal Hartnell). Three whole-water samples, about 500 grams of concentrated suspended solids, and 120 liters of clarified supernatant were collected for each site.

Work planned for the upcoming period: None. All four project sampling sites have been selected and all samples have been collected.

Task 2. Characterize Pyrethroid Phase Distribution in Samples. The freely dissolved (C_{free}), colloiddally associated (C_{doc}), and suspended particle (C_{tss}) bound quantities of targeted pyrethroids; total organic carbon (TOC) and dissolved organic carbon (DOC); and sediment fraction of organic carbon (f_{OC}) will be measured for each site. Together the measurements will be used to calculate site- and compound- specific values of the organic carbon normalized distribution coefficients for suspended solids (K_{OC}) and colloidal organic matter (K_{DOC}).

Work accomplished this period: Site- and compound- specific values of the organic carbon normalized distribution coefficients for suspended solids (K_{OC}) and colloidal organic matter (K_{DOC}) have been calculated for Site #1 – Sal Hartnell and Site #2 – Sal Tembl. The freely dissolved (C_{free}), colloiddally associated (C_{doc}), and suspended particle (C_{tss}) bound quantities of targeted pyrethroids; total suspended solids (TSS); and dissolved organic carbon (DOC) for Site #3 – Sal Chualar and Site #4 – Sal Hartnell whole-water samples have been measured.

Work planned for the upcoming period: Sediment subsamples for Site #3 – Sal Chualar and Site #4 – Sal Hartnell will be sent to UC Davis Analytical Lab to be analyzed for sediment fraction of organic carbon (f_{OC}). Site- and compound- specific values of the organic carbon normalized distribution coefficients for suspended solids (K_{OC}) and colloidal organic matter (K_{DOC}) will be measured and calculated for Site #3 – Sal Chualar and Site #4 – Sal Hartnell.

Task 3. Perform Settling Column Tests to Assess Removal of Suspended Solids and Pyrethroid Compounds. Suspended solids and clarified supernatant will be recombined at varying ratios to represent different total suspended solid (TSS) concentrations. Small scale settling column tests will be conducted to determine distribution of particle settling velocities and effective removal of pyrethroids over time. Large scale settling column tests in collaboration with UC Davis Aquatic Health Program Lab (AHPL) will be conducted to determine pyrethroid removal and associated toxicity to *Hyalella Azteca*.

Work accomplished this period:

Small-Scale Settling Column Experiments:

Supernatant subsamples from Site #1 – Sal Hartnell and Site #2 – Sal Tembl were retrieved from UC Davis Aquatic Health Program Lab (AHPL) and combined in 55-gallon drums per site. Combined supernatant was analyzed for dissolved organic carbon (DOC) and separated sediment was analyzed for moisture content to determine sediment dry weight. Preliminary small-scale settling column experiments have been conducted to determine experimental TSS concentrations, sampling timepoints, and methods for measuring pyrethroid distribution.

Work planned for the upcoming period:

Small-Scale Settling Column Experiments:

Retrieve supernatant subsamples from Site #3 – Sal Chualar and Site #4 – Sal Hartnell from UC Davis Aquatic Health Program Lab (AHPL) and combine in 55-gallon drums per site. Conduct final small-scale column experiments for Sites #1 – #4 at high (2.5 g/L) and low (0.25 g/L) TSS concentrations throughout a 72-hour period to assess both TSS removal and pyrethroid removal over time. These results will be reported to examine whether adequate TSS and pyrethroid removal is achieved or additional system operations may need to be considered (e.g., use of coagulants or filtration).

Table 1. Whole-Water Total Suspended Solids (TSS) Concentrations

Site #	TSS (g/L)
1 – Sal Hartnell	2.09
2 – Sal Tembl	0.34
3 – Sal Chualar	7.18
4 – Sal Hartnell	0.15

AVERAGE TSS: 2.45 g/L

Large-Scale Settling Column Experiments:

Construct large-scale settling column experiments for Sites #1 – 4 at TSS level of 2.5 g/L proportional to small-scale design. Coordinate with UC Davis Aquatic Health Program Lab (AHPL) for settling column experiments timeline.

Task 4. Develop a Model that Effectively Describes Observed Solids and Pesticide Removals. Use partition coefficients and the data collected from settling column tests to develop a model to describe suspended solids and pyrethroid removal processes.

Work accomplished this period: None.

Work planned for the upcoming period: None.

Task 5. Apply Model to Field Scale Sites to Predict Design-Performance Relationships. Use the model developed in Task 4 to design and predict performance of hypothetical field-scale detention basins to be located at the sampling sites.

Work accomplished this period: None.

Work planned for the upcoming period: None.