



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Alana R. Tessman	Project Number S1915
Project Title Testing Seed Viability after Imbibition of Produced Water Treated with Enzyme Additive to Bioremediate Residual Toxins	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To test a possible solution through bioremediation to the uptake of chemicals during seed imbibition of produced water intended for agriculture.</p> <p>Methods/Materials Sorted/weighed 400 Phaseolus lunatus (Lima Bean) and 200 Lactuca sativa (Lettuce) Soaked 50 seeds each (Lima) in 4/ 400ml glass beaker solutions of: Produced Water (PW), Enzyme Add.(EA), (PW+EA), H(2)O (Distilled) w/pH 4-8 (Control), in triplicate, repeat w/ 100 seeds (Lettuce) at 25°C, covered, zero light, 24 hrs. Reweighed imbibed seeds. Performed TZ (Triphenyl Tetrazolium Chloride) test on samples of 10 seeds each from 24 solutions. Extracted seeds, removed testa, opened seeds, evaluated viability. Deep red coloring identifies areas of respiration- 3 tiered Classification: High Viable / Low Viable / Non-viable . Conducted (EC) Electrical Conductivity test on Leak Water using a CAS TI-nSpire cx w/Vernier Conductivity Prob. Prepared 4 solutions in triplicate for each seed type totaling 24 test solutions/ 200 Lima- 400 Lettuce. Conductivity readings taken pre and post imbibition after 24hr. Fluorescence Testing of Leak Water and Seed Imbibed with the 4 solutions, kiln dried/1400°F, powderized and measured for residue oil on Hitachi Spectrophotometer & Fluorescence Photometer using surfactant heated to Cloud Point 30°C.</p> <p>Results TZ Imbibition tests showed Produced Water (PW) seeds rendered the most non-viable while both Enzyme Additive (EA) tests rendered the most viable. (Control) produced all viable seeds -1. Electrical Conductivity (EC) test results of Leak water showed decreased conductivity in all but Control w/(PW) showing the greatest loss of EC. Weight Measurement tests showed (PW) had lowest seed weights post-imbibition. Fluorescence testing indicated (PW) imbibition contained trace elements of oil while (PW)+(EA) indicated oil free results.</p> <p>Conclusions/Discussion Results of all four tests showed unique and possible supporting experimental responses to two of the standard vitality tests for seeds. Conclusive findings of both toxic chemical uptake during imbibition and remediation of these toxins when treated with an Enzyme Additive Bioremediation agent present possible answers/solutions to questions surrounding the use of produced water within the oil/ag commercial industries.</p>	
Summary Statement I positively identified uptake of chemicals from produced water during seed imbibition and the extraction of these chemicals through bioremediation.	
Help Received I researched and designed the fluorescence experiment on seed imbibition but carried it out with the help of the lab technician at Turner Labs in Fresno. I also visited the Ransom Seed Lab in Carpinteria to learn how to effectively perform the TZ test. My science teacher helped me acquire the chemicals for the TZ	