



# CALIFORNIA STATE SCIENCE FAIR 2012 PROJECT SUMMARY

Name(s) <b>Easun Arunachalam</b>	Project Number <b>S0502</b>
<b>Project Title</b> <b>A Novel Method of Increasing Phytoremediation of Heavy Metals in Wastewater through the Fenton Reaction</b>	
<b>Objectives/Goals</b> The research goals of my experiment were to determine if soybean ( <i>Glycine max</i> ) plants would absorb a greater amount of iron when the iron was at a higher oxidation state and to determine the pH at which the phytoremediation of iron is most effective. Iron was used as a model in this study due to its relatively low toxicity as compared to that of other heavy metals.	<b>Abstract</b> It was hypothesized that phytoremediation of Fe <sup>(3+)</sup> would be more effective than that of Fe <sup>(2+)</sup> , and a pH of 5 would be most conducive to iron absorption.
<b>Methods/Materials</b> G. max seeds were grown in water for two weeks, and were placed in jars containing Iron(II) sulfate heptahydrate [FeSO <sub>4</sub> · 7H <sub>2</sub> O] solution. Hydrogen peroxide solution was added to change the oxidation state of the free iron (II) ions, as described by the following reaction: $\text{Fe}^{(2+)} + \text{H}_2\text{O}_2 \rightarrow \text{Fe}^{(3+)} + \cdot\text{OH} + \text{OH}^-$	The pH of the solutions containing H <sub>2</sub> O <sub>2</sub> was adjusted to 5, 6, 7, or 8. The control samples contained G. max seedlings in iron (II) sulfate solution without hydrogen peroxide. Test strips were used to determine the concentration of iron present in solution two days and four days after the beginning of the phytoremediation. Thirty-two trials were conducted with a sample size of 1600 seeds.
<b>Results</b> G. max absorbed a greater amount of iron at a higher oxidation state, and the least amount of dissolved iron was detected in solutions of pH 8.	
<b>Conclusions/Discussion</b> It appeared that phytoremediation in samples containing iron in a higher oxidation state was more effective, and that a pH of 8 is most conducive to iron absorption. The reactions occurring within the solutions of pH 8 were further investigated with a view to determining if the iron (III) hydroxide precipitate formation resulted in the unexpectedly low dissolved iron levels. The results of this follow-up experiment indicate that the greatest amount of iron was actually removed in solutions of pH 5, substantiating my hypotheses.	
<b>Summary Statement</b> This study investigates whether a higher oxidation state and altered pH level will improve the efficacy of heavy metal removal by hyperaccumulating plant species.	
<b>Help Received</b> Mother helped obtain materials and assemble poster board.	