



CALIFORNIA STATE SCIENCE FAIR

2013 PROJECT SUMMARY

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Project Title Metal Chelation Using Natural Compounds and Its Effect on Catalase Activity: Implications in Neurodegenerative Diseases	
Objectives/Goals Because metal dysregulation has been linked to the development of neurodegenerative diseases, the objective of this project was to determine: (1) Which metal ion, copper, iron or zinc, inhibits catalase the most? And (2) Which natural chelator, green tea, curcumin or garlic, is the most effective in diminishing the inhibitory effect of metal ions on catalase?	Abstract A gas-collecting apparatus was set up using a stoppered flask, tubing, and an inverted graduated cylinder filled with water. Catalase was injected into the flask with H ₂ O ₂ and the volume of oxygen released was measured after 1 minute. For Phase 1, to determine which metal inhibited catalase the most, we tested catalase alone for control, catalase + copper, catalase + iron, and catalase + zinc, doing 10 replicates for each. For Phase 2, the metal as determined in Phase 1 was mixed with catalase, then either green tea, curcumin or garlic was added to allow chelation. The catalase-metal ion-natural chelator mixture was then injected into the flask with H ₂ O ₂ . Volume of oxygen released was again measured after 1 minute.
Methods/Materials For Phase 1, the average volume of oxygen released for control, copper, iron, and zinc was 84ml, 70ml, 76ml, and 79ml respectively. Copper inhibited catalase the most with a 16.7% decrease in O ₂ released compared to control, followed by iron at 9.5%, and zinc at 6.0%. For Phase 2, when the natural compounds were added to the copper-catalase mixture, the average volume of O ₂ released were as follows: 83ml for green tea, 81ml for garlic, and 73ml for curcumin. With the addition of green tea to the copper-catalase mixture, volume of O ₂ released (83ml) almost equaled the volume of O ₂ released for catalase alone (84ml) with a minimal 1.2% difference. This showed that green tea practically negated the inhibitory effect of copper on catalase. Garlic performed almost as well as green tea with a 3.6% difference from control. Curcumin had the least effect with a 13.1% difference probably because it had low solubility in water.	Results The metal ion that inhibited catalase activity the most was copper, followed by iron, then zinc. Among the natural chelators, green tea diminished the inhibitory effect of copper on catalase the most, followed by garlic, then curcumin. These results can have significant implications in the prevention and treatment of neurodegenerative diseases.
Conclusions/Discussion This project is about determining which metal ion inhibits catalase the most and which natural chelator is the most effective in diminishing the inhibitory effects of metals on catalase.	
Summary Statement This project is about determining which metal ion inhibits catalase the most and which natural chelator is the most effective in diminishing the inhibitory effects of metals on catalase.	
Help Received Mrs. Reed, our Chemistry teacher, helped supply materials.	