



CALIFORNIA STATE SCIENCE FAIR 2013 PROJECT SUMMARY

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Project Title Predicting Acid Rain Initiated Corrosion Resistance of Zinc-Plated and Stainless Steel Screws in Variant Environments	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this experiment was to compare the acid rain corrosion resistance of zinc-plated and stainless steel "wood" screws in manipulated temperature and humidity.</p> <p>Methods/Materials Materials used were stainless steel wood screws, zinc-plated wood screws, swimming pool acid, analytical balance, cupcake holders, 180 mL jars with caps, weighing dish, and water. Zinc-plated and stainless steel screws were dipped in a pH 4 sulfuric acid solution for 5 minutes, then rinsed in water for 5 minutes, and allowed to dry. To simulate environments, some screws were dried at an ambient temperature of 17-30°C and no humidity, while others were dried in a closed container at 93°C and 100% humidity. After drying for one week the screws were removed and their masses recorded. The screws were again dipped in the acid solution, rinsed and placed in their environments for another week, for a total of 5 weeks. During weeks 3-5, the screws were massed before and after wiping them with a paper towel.</p> <p>Results The data showed that zinc-plated screws corroded and lost mass significantly more than stainless steel ones. For example, in the environment where the most corrosion occurred, the zinc-plated screws lost about 3.16% mass, while the stainless steel ones lost about 0.03% mass. The results showed that corrosion was highest and mass loss the most when the drying environment was high in temperature and humidity. The exposed zinc-plated screws dried at 17-30°C showed a loss of about 0.68%, while those in high temperature and humidity showed loss of about 3.16%. It was observed that as corrosion started in the zinc-plated screws, the mass increased slightly, but later the screw lost more mass.</p> <p>Conclusions/Discussion The purpose of this experiment was to evaluate the effect of acid rain on zinc-plated and stainless steel screws in manipulated temperature and humidity. It was hypothesized that zinc-plated screws in high temperature and a moisture environment would be most affected by the acid rain simulation solution, and the data from this experiment supported the hypothesis. Through this experiment it was also found that acid rain in the environment would first attack the coating on a screw, in this case the zinc plating, and cause it to corrode first. These data can be used by architects and engineers when designing houses or buildings as another step in assuring the safety and durability of infrastructures.</p>	
Summary Statement This project analyzed the effect of acid rain on zinc-plated and stainless steel screws in manipulated temperature and humidity.	
Help Received Both Mr. Antrim and Father provided materials for the project.	