CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
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Project Number
J0605

Project Title
How pH Affects Steel

Abstract

Objectives/Goals
The objective of my science project is to determine the effects, if any, of higher and lower levels of pH on mild steel.

Methods/Materials
7 clean plastic containers with lids, 21 clean steel nails, 7 cups of pure water, 6 tbsp of Sodium Bisulfate (acid), 6 tbsp of Sodium Carbonate (base), Gram Scale, 8 labeled plastic bags, Safety goggles, rubber gloves.
1)Record the weight of one clean nail, 2) pour 1 cup of pure water into each container, 3) Add 1 of the following to 6 of the containers: Sodium Bisulfate: 1 tbsp, 2 tbsp, 3 tbsp. Sodium Carbonate: 1 tbsp, 2 tbsp, 3 tbsp (leave the 7th container with just water) 4) Place 3 clean nails into each container. Record the time and date when you put the nails into the solution. 5) Snap on the lids and leave the containers to set for 48 hours. 6) After 48 hrs., open the lid to a container and (wearing gloves) removed all 3 nails; rinse them to neutralize the pH. Record observations of the solution and the nail. 7) After rinsing, put all 3 nails from 1 container into a plastic sealable bag and label. Repeat until all nails are in bags. 8) Record the weight of 1 empty bag, then record the weight of each bag of nails. Subtract the weight of the empty bag from the weight of a full bag and divide by 3 to get the approx. weight of each nail in that bag. Repeat this step for each bag. 9) Put the nails back into their containers and record the time when all are in. 10) Repeat this procedure every 48 hours.

Results
I learned that the lower pH levels are, the more the steel will dissolve and oxidize. the pure water mainly just oxidized the steel while the Sodium Bisulfate (acid) dissolved the steel-to almost nothing in the higher amounts. The Sodium Carbonate (base), however, only corroded very slightly. The Oxygen in the water formed a layer of oxide on the nails, but not much of the nail itself was actually dissolved away like in the acid.

Conclusions/Discussion
Based on the results of this experiment, I conclude that the lower the levels of pH there are around mild steel, the faster it will corrode/dissolve. I do know that my results are not completely accurate. If I had left the nails in the solutions for longer, the reaction would have gradually ended because all of the molecules in the solution would have reacted until there was nothing left to react. This would have caused my graph to curve into a straight line of no corrosion after a longer period of time.

Summary Statement
I determined the effects of pH on mild steel versus oxidation.

Help Received
Father helped set up chemicals correctly and provided gram scale.