CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

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Project Number

31724

Project Title

The Effect of Size and Structure of Various Chlorine Compounds on Their Ability to Adsorb to Sand

Abstract

Objectives/Goals

The objective of this experiment was to analyze the effects of the size and structure of various chlorine compounds on their ability to adsorb to sand.

Methods/Materials

The following materials were used in this experiment: NaOCl, LiOCl, Ca(OCl)2, C3N3O3Cl3, and C5H6O2N2Cl2 - the disinfectants. Also electric balance, graduated cylinders with sizes 10 mL and 25 mL, squirt bottle, test tubes, centrifuge, small jars, chlorine paper, and LaMotte Chlorine titration kit. First, 10 mL of a 1250 ppm chlorine compound solution was mixed with 5 g sand and separated. The chlorine concentration was measured, and 8 mL of water was mixed with the sand to remove the chlorine and then was separated. At the end of each rinse, the chlorine concentration was taken, and rinses continued until the reading became 0. Six trials were conducted for each compound; for five of the six trials, chlorine paper was used to measure the concentration of the effluent solution of each rinse. The concentration of chlorine in the solutions in the sixth trials were measured using titration.

Results

For this experiment, 5 trials were conducted for each of the 5 chemicals. It took NaOCl 5 rinses, LiOCl 7 rinses, Ca(OCl)2 6 rinses, C3N3O3Cl3 4 rinses, and C5H6O2N2Cl2 5 rinses to reach 0 ppm. Each solution began in the low to low-mid 1000s and continued until the values reached 0. Standard deviation was also calculated, and low values indicated the values were consistent.

Conclusions/Discussion

Based on the data gathered, the hypothesis was supported connecting the size and structure of the chlorine donors on their ability to adsorb to sand. The first part of the hypothesis addressed the relationship between ionic and molecular compounds, predicting that ionic compounds would take longer to come out of solution than molecular compounds. The second part of the hypothesis addressed the trend within the ionic compounds, theorizing that the smaller the compound, the longer it would adsorb to the sand due to increased electronegativity of the cation and greater attraction to its anion. The third part of the hypothesis brought forth the relationship between the two molecular compounds, with the prediction that the compound with more nonpolar behavior would adsorb better to the sand. This part of the hypothesis was also supported. Soil reclamation and mine acid neutralization are examples of applications of this experiment.

Summary Statement

This project studies how chlorinated compounds adsorb onto sand, the results of which can help reduce water pollution, clean up mines, and reclaim soil.

Help Received

Borrowed centrifuge and its test tubes from Mr. Antrim and borrowed other glassware from Father.