The Chemistry Of Recycling Experiment

Introduction

Recycling aluminum is important in today's society because this can save other materials by making different items with the recycled material from for example, aluminum cans. In The Chemistry of Recycling experiment, Alum was created from the recycled material from an aluminum can. This was to learn the concept of recycling aluminium and what can be made from a simple can of aluminum.

Experimental Procedure

Performing The Chemistry of Recycling experiment, a tared weigh boat and an analytical balance were used to weigh pieces from 0.9 to 1.2 grams from an aluminum can and placing them into a 250 mL beaker to add 50 mL of KOH solution. While setting up an aspirator, the beaker was placed onto a hot plate to speed up the reaction and the vacuum filtration was used to remove gas. A büchner funnel was used to filter the aluminum pieces from the mixture. The beaker was cleaned with 5mL of distilled water, the filtration and cleaning was repeated until it was fully filtered. The filtration was moved to a dry and clean 250 mL beaker to mix 20 mL of 6.0 M sulfuric acid slowly and then filtered. The reaction was placed into an ice bath to form crystals. By scratching the side of the beaker with a stirring rod, it helped induce the crystals. The crystals were moved onto filter paper to rinse the beaker twice with 10 mL of 50% ethanol to gather as much crystals as possible. A filter apparatus was used to dry the alum crystals. A watch glass was weighed by itself then with the alum crystals. The chemical waste was poured into the correct containers and the equipment was cleaned and returned back to the appropriate spot.

Data

At the start of the experiment the mass of aluminum pieces were weighed to 1.0751 grams. At the end of the experiment the mass of the watch glass was weighed to 55.880 grams, and the mass of the alum crystals on the watch glass was 71.656 grams. To get the mass of the alum, the mass of the watch glass was subtracted from the mass of alum crystals on the watch glass that came out to be 15.778 grams. To calculate the molecular weight for aluminum the periodic table was used. The mass of aluminum reacted was converted into moles using dimensional analysis by dividing 1.0751 grams of weighed aluminium can by 26.98 molar mass of aluminium, which came to be 0.039848 mol. The theoretical yield alum came out to be 18.90 grams, by multiplying moles of aluminum and the molar mass of alum. The percent yield came to 83.48%, by dividing the actual yield (15.778 grams) by the theoretical yield (18.90 grams) and multiplying by 100 to get 83.48%.

Table 1: Masses for each product weighed

Product

Masses in grams (g)

Aluminum Pieces

1.0751 g

Watch glass

55.880 g

Alum crystals on watch glass

71.656 g

Alum Crystals

15.778

Table 2: Masses for yields

Yield

Masses in grams (g)

Actual Yield

15.778 g

Theoretical Yield

18.90 g

Observations

Using the recycled aluminium can pieces it created alum. The results from the experiment were alum crystals, different reactions were formed along with cooling it in an ice bath to create the alum crystals. Aluminium being recycled can be created to form many different items. An experimental error would be to leave the reaction on the hot plate longer than 30 minutes because the reaction was still producing gas after the 30 minutes it was supposed to stay on there. An error made by the experimenters was not turning the faucet on all the way in the beginning, which could have led to the reaction taking longer than 30 minutes. Another error was not filtering out all the aluminium can pieces out of the reaction.

The balanced equation for aluminum with base to form potassium aluminum hydroxide salt and hydrogen gas is 2Al(s)+2KOH(aq)+6H2O(l)?2KAl(OH)4(aq)+H2(g), the net ionic equation was 2Al(OH)3(s)+6H+(aq)?2Al3+ +6H2O(l), the reaction was acid-base and single displacement, this reaction was white and cloudy. The balanced equation for sulfuric acid added to form aluminum hydroxide, potassium sulfate and water was

2Al(OH)4(aq)+H2SO4(aq)?2Al(OH)3(s)+K2SO4(aq)+2H2O(l), the net ionic equation is Al(OH)4-(aq) + H+(aq) ? Al(OH)3(s) + H2O(l), the reaction is acid-base, and the reaction turned into a light pink to brown color. The third reaction's (aluminium hydroxide to aluminum sulfate and water) balanced equation was 2Al(OH)3(s)+3H2SO4(aq)?Al2(SO4)3(aq)+6H2O(l), the net ionic equation was 2Al(OH)3(s)+6H+(aq)?2Al3+(aq)+6H2O(l), the reaction was acid-base and double displacement and the reaction turned into a dark-grey color. The balanced equation for the final reaction with aluminium sulfate with potassium sulfate to form alum was Al2(SO4)3(aq)+K2SO4(aq)+24H2O(l)?2KAl(SO4)2?12H2O(s), the net ionic equation was K+(aq)+Al3+(aq)+2SO42-(aq)+12H2O(l)?KAl(SO4)2?12H2O(s), the reaction is synthesis and the reaction is clear. Finally, with all the reactions combined the balanced reaction was 2Al(s)+2KOH(aq)+4H2SO4(aq)+22H2O(l)?2KAl(SO4)2?12H2O(s)+3H2(g), the net ionic equation was Al3+(s) +KOH(aq)+H2O(l)?KAl(SO4)2?H2O(s)+H2O(g). The theoretical yield is 18.90 grams of Alum, the actual yield is 15.7782 grams and the per cent yield is 83.48%.

Conclusion

The purpose of this experiment was to make alum out of recycled aluminium cans. The experiment was successful by making different reactions to form the alum. The outcome of this experiment taught a better understanding of how materials can be recycled.