Laboratory report 2 – Oxygen absorber

Name: XXX
Name of partner: XXX
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Title of the experiment: Oxygen absorber
Aims: To analyse qualitative an oxygen absorber sample taken from moon cake package.

Introduction

In a moon cake package, there is often a packet of oxygen absorber provided with each moon cake. Before the experiment, we have accessed to the Internet to search for the information about the chemical principles of oxygen absorber. We found that iron powder, sodium chloride and sodium carbonate are the components of the oxygen absorber. In this experiment, an investigation is planed and carried out to find out these chemical natures of the oxygen absorber.

Procedure

A) Test for iron

1. A magnet was put 1 cm above the packet. The observation was observed.
2. 1M HCl (aq) was added to the sample and 0.001M $K_2Cr_2O_7$ (aq) was then be added drop by drop. Any changes were observed.
3. 1M H_2SO_4 (aq) was added to the sample. A wooden splint was put near the mouth of the test tube to test for the gas

B) Test for Fe^{2+} and Fe^{3+} oxides

1. The oxygen absorber was dissolved into a test tube with $5cm^3$ 1M HCL(aq).

2a. 0.4M NaOH(aq) was added into the test tube until precipitate had formed. The colour of precipitate was observed and recorded.

b. After precipitates had formed, more 0.4M NaOH(aq) was added into the test tube. The precipitate whether would be redissolved was observed.

3a. Another test tube was prepared and step 1was repeated.

b. A few drops of 0.001M potassium hexacyanoferrate (Ⅲ), $K_3Fe(CN)_6$ (aq) were added The colour of solution was observed and recorded.

4a. Another test tube was prepared and step 1was repeated.

b. A few drops of potassium thiocyanate were added. The observation was recorded.

C) Test for Fe (Ⅱ) carbonate

1. The oxygen absorber was dissolved in a test tube with $5cm^3$ 1M HCl(aq).
2. The tube was stopped with dropper including a delivery tube which had connected to another test tube containing limewater.
3. The end of the test tube was heated by Bunsen burner to have a faster evolution of gas.
4. Any observation was recorded.

D) Test for Na^+

Flame test

1. A Bunsen burner was lighted. The air hole of the burner was slightly opened.
2. The end of a nichrome wire was cleaned by dipping it into concentrated HCl(aq) and then heated in the Bunsen flame.
   Heated until the flame is no longer coloured.
3. A spatula of the solid sample was put onto a watch glass.
4. The nichrome wire was dipped into the concentrated HCl(aq) and then the solid sample.
5. The end of the wire was put in the Bunsen flame again.
6. The colour of the flame was recorded.

Safety precautions:

1 Conc. HCl(aq) is highly corrosive. Handle with great care.

2 Wear safety glasses and protective gloves when handling conc.HCl(aq) and heating in the Bunsen flame.

3 If we spill any acid on our skin or clothes, wash it off immediately with plenty of water and then report to your teacher.

4 Wash containers of conc.HCl(aq) with great care. Do not add water to the acid directly.

E) Test for Cl^-

1. 0.05M $AgNO_3$ (aq) was added to the test tube which contained the solid sample. The change was observed.
2. 0.1M HNO_3 (aq) was added to the solution. Any observation was marked.
3. 0.5M NH_3 (aq) was added to the solution. Any changes were recorded

Observations and discussion

A)Test for iron:

Action of sample	Observation and explanation
1. Sample + magnet	The sample was attracted.
2. Sample + 1M HCl (aq) + 0.001M $K_2Cr_2O_7$ (aq)	Solution turns from colourless to pale green. Because iron react with hydrochloric acid to form iron (II) ions. $Fe(s) + 2HCl(aq) \rightarrow FeCl_2(aq) + H_2(g)$ Solution turns to greenish brown. Fe^{2+} ions are oxidized by $Cr_2O_7^{2-}$ ions to form Fe^{3+} ions that are brown. Orange $Cr_2O_7^{2-}$ ions are reduced to Cr^{3+} ions that are green. $6Fe^{2+}(aq) + Cr_2O_7^{2-}(aq) + 14H^+(aq) \rightarrow 6Fe^{3+}(aq) + 2Cr^{3+}(aq) + 7H_2O(l)$
3. Sample + 1M H_2SO_4 (aq)	Colorless gas bubbles were given out. $Fe(s) + H_2SO_4(aq) \rightarrow FeSO_4(aq) + H_2(g)$ No 'pop' sound with burning splint. Because the hydrogen gas given out is not enough to give a 'pop' sound.

B)Test for Fe^{2+} and Fe^{3+} oxides

Action of sample	Observation and explanation
1. Sample +1M HCl(aq)	Solution turned green. $2HCl(aq) + FeO(aq) \rightarrow H_2O(l) + FeCl_2(aq)$
2a. Solution from 1 +0.4M NaOH(aq)	Dirty green precipitate and reddish brown precipitate were formed. Because neutralization occurs and the test tube became warm. $FeCl_2(aq) + NaOH(aq) \rightarrow Fe(OH)_2(s) + NaCl(aq)$ $FeCl_3(aq) + NaOH(aq) \rightarrow Fe(OH)_3(s) + NaCl(aq)$

b. Resulting solution + excess NaOH(aq)	The precipitate didn't redissolve. Because complex ions formed and did not react with NaOH(aq).
3. Solution from 1 + $K_3Fe(CN)_6$ (aq)	Dark blue precipitate was formed. Because $Fe(CN)_6^{3-}$ react with Fe^{2+} to form deep blue complex precipitate. $3\ Fe^{2+}(aq) + 2Fe(CN)_6^{3-}(aq) \rightarrow Fe_3[Fe(CN)_6]_2(s)$
4. Solution from 1 +KCNS(aq)	Solution turns to blood red. Because CNS- react with Fe3+ to form blood red complex ion. $Fe^{3+}(aq) + CNS^-(aq) \rightarrow [Fe(CNS)]^{2+}(aq)$

C) Test for Fe (Ⅱ) Carbonate

Action of sample	Observation and explanation
1. Sample +1M HCl(aq)	Colourless gas bubbles were given out and the limewater turned milky slowly. It indicates that carbon dioxide was released. $2HCl(aq) + Na_2CO_3(s) \rightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$

D) Test for Na^+

Action of sample	Observation and explanation
1.Flame Test	Golden yellow flame is observed. It can be indicated that Na^+ is presented.

E) Test for Cl^-

Action of sample	Observation and explanation
1. Sample +0.05M $AgNO_3$ (aq)	White precipitate was formed. Because Ag^+ ions react with Cl^- ions to give AgCl(s) which is white in colour and insoluble in water. $Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$
2. Solution from 1 +0.1M HNO_3 (aq)	The precipitate did not redissolve. Because there is no reaction.
3. Solution from 2 +0.5M NH_3 (aq)	The precipitate was redissolved. $AgCl(s) + NH_4OH(aq) \rightarrow AgOH(aq) + NH_4Cl(aq)$

Conclusion

After carrying out this experiment, we found out that the oxygen absorber in moon cake paket consist of several chemical substance. They include iron powder, Fe^{2+} and Fe^{3+} oxides, Fe (Ⅱ) carbonate, Na^{+} ions and Cl^{-} ions. Therefore, it can act as a oxygen absorber when the iron powder react with the oxygen in the air to give Fe^{2+} and Fe^{3+} oxides.

$Fe(s)+O_2(g) \rightarrow FeO_x(s)$

During the process of absorbing oxygen, heat is usually let off by the rusting of iron. So, oxygen absorber can also act as a warm packet that can be used in winter to keep our hands warm.