Nahom Efrem 16/06/2009

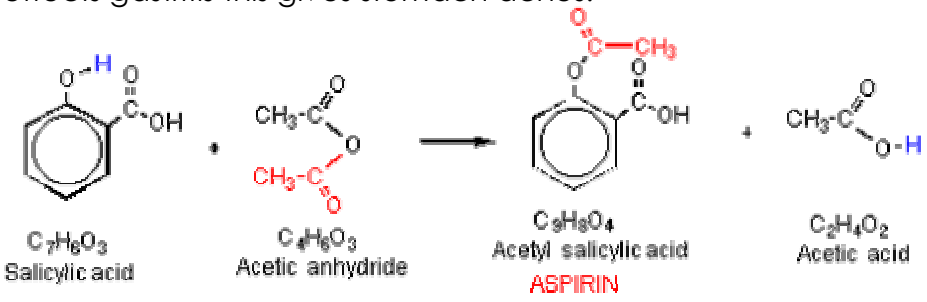
Synthesis of Aspirin

The aim of this practical is to carry out a chemical reaction between salicylic acid with anhydride. This will allow us to calculate the percentage yield. The chemical company for which you work has developed a new laboratory method for synthesising aspirin which produces a high yield of pure product. Before investing the large amount of money it would take to scale up the process for mass production of aspirin, the directors want to know if this new method is significantly better than existing methods, in terms of the percentage yield and purity of aspirin produced.

Theory

Aspirin, which is sometimes called acetylsalicylic acid, was first made in 1893 by a German chemist Felix Hofmann. Aspirin is classified as organic ester and organic acid. It is mostly used in medicine like pain killers and also they are used for reducing fever. Aspirin is made by reacting salicylic acid with acetic anhydride. The human generation already knew how useful salicylic acid for pain. It was until the 19th century when we learned how to make mass production of aspirin and how to cope with the toxic side effects.

Aspirin has many pharmaceutical uses; the most important is the cure for any kind of pain. It can also treat arthritis because it has an anti-inflammatory effect and also reduce fever. One of the majors side effects gastritis this gives stomach aches.



Synthesis of Aspirin

	Mass/g
Weighing boat + 3 salicylic acid	4
Weighing boat after transfer	1.06
2-hydroxybenzoic	3

	Thermometer Estimation (°C)	Electrical Measurement (°C)
Start collapsing	120	124
Melting Point	125	129

16.32

	Petri dish + Filter paper + Aspirin
- 15.25	Petri dish + Filter paper
= 1.07	Aspirin

Melting Point apparatus

Observations

- At the start of the practical we had to add 3 grams of salicylic acid to a weighing boat and then weight it. The salicylic acid is like a white powder.
- Once I measured the salicylic acid and the weighing boat after this I had to add it to 6ml of acetic anhydride once I add this no reaction took place but there was a colour change which changed from see through.
- Before the acetic anhydride was added and now it has turned cloudy once the acetic anhydride was added. The only observation I can pick out from acetic anhydride was the smell, it smelt like vinegar it might mean that this could be used in the process of alcohol.
- After the two has turned cloudy you will place them in a hot water bath then once in the hot water it will become see through and also the vinegar smell gets stronger.
- I started to add drops of water into the beaker nothing happened but when I added 20ml of cold water it had a quick reaction when I added it had a white emulsion for couple of seconds and then went away.
- Once I place the beaker in the cold water after about 10min it started to crystallize. Once crystallized I had to put it in this machine where it sucked out the excess water.

- When I left it over night it turned into crystals, to see if this was pure we had to do the Iron III chloride test. When I added 2-3 drops of this to my aspirin it turned purple this showed us that phenol derivative is present.

Aspirin Percentage Yield Calculation Sheet:

1) Write a balanced chemical equation for the synthesis of aspirin:

$C_7H_6O_3+C_4H_6O_3 \rightarrow C_9H_8O_4+C_2H_4O_2$

2) Calculate the molar mass (Mr) of 2-hydroxybenzoic acid ($C_7H_6O_3$)

Carbon	+	Hydrogen	+	Oxygen	=	138 g/mol
(12.01 x 7)		(1.0079 x 6)		(16 x 3)		
84.7		6.047		48		

3) Using the mass of 2-hydroxybenzoic acid you used in your experiment, calculate the number of moles of 2-hydroxybenzoic acid used in your experiment.

Moles of 2-hydroxybenzoic $\frac{3}{138}$ = 0.0217mol

4) Assuming that all of the 2-hydroxybenzoic acid is converted into aspirin, deduce the number of moles of aspirin produced in theory (Theoretical yield)

Salicylic acid (138 g/mol): limiting reactant: Acetic Anhydride
0.003kg = 3g
3g / (138 g/mol) = 0.0217 moles molar mass of aspirin x acetic anhydride moles =

Theoretical yield
180.157 x 0.0247 = 4.45g

Acetic Anhydride (102 g/mol):
6ml= 2.52g
2.52g / (102 g/mol) = 0.0247 moles

5) Calculate the molar mass (Mr) of aspirin ($C_9H_8O_4$)

Carbon	+	Hydrogen	+	Oxygen	=	180g/mol

Synthesis of Aspirin

(12.01 x 9) (1.0079 x 8) (16 x 4)
108 8.06 64

6) Using this and the mass of aspirin obtained in your experiment, calculate the number of moles of aspirin produced (Actual Yield).

Moles of aspirin = $\frac{1.07}{180}$ = 0.00594mol

7) Calculate the percentage yield of your preparation.

$\frac{1.07}{4.45} \times 100 = 24\%$