Tishk International University
Faculty of Pharmacy / 2nd Year
Practical Organic Chemistry II
Experiment 01

Preparation of Paracetamol

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- Paracetamol, also known as acetaminophen and APAP, is a medicine used to treat pain and fever.
- It is typically used for mild to moderate pain relief.
- First used clinically by **von Mering** in 1893
- Since the 1950's paracetamol is the most commonly used and readily available over the counter analgesic.

Physical properties

- IUPAC Name: **4-hydroxyacetanilide**
- Molecular Formula: **$C_8H_9NO_2$**
- Molecular Weight: **151.163** g/mol
- Melting Point: **169** °C
- Boiling Point: **420** °C
- Density: **1.263** g/cm^3

paracetamol

Solubility of Paracetamol

- The solubility of paracetamol in 26 solvents in the temperature range from (−5 to +30 °C) is reported.
- Paracetamol has a very low solubility in nonpolar and chlorinated hydrocarbons such as toluene and carbon tetrachloride.
- the solubility is very high in solvents of medium polarity such as *N*,*N*-dimethylformamide, dimethyl sulfoxide, and diethylamine.
- Paracetamol is soluble in alcohols, but the solubility decreases with an increase in the length of the carbon chain in the *n*-alcohol homologous series (methanol to 1-octanol).

- The solubility of paracetamol in water is much lower than in other polar solvents such as the alcohols.

Solubility in water	Temperature
7.21 g/kg	0 °C
8.21 g/kg	5°C
9.44 g/kg	10°C
10.97 g/kg	15°C
12.78 g/kg	20°C

Uses of Paracetamol

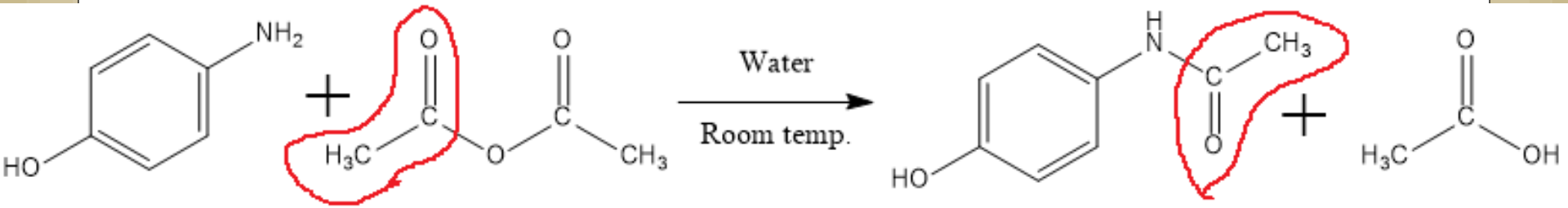
- Paracetamol is used to treat many conditions such as **headache**, muscle aches, arthritis, backache, toothaches, colds, and **fevers**. It relieves pain in mild arthritis but has no effect on the underlying inflammation and swelling of the joint.

For more information about uses, dosage, precautions and side effects follow the link below:

1. https://www.drugs.com/paracetamol.html
2. https://www.webmd.com/drugs/2/drug-57595/paracetamol-oral/details
3. https://www.practo.com/medicine-info/paracetamol-219-api
4. https://www.nps.org.au/news/safe-and-appropriate-use-of-paracetamol-closing-the-consumer-knowledge-gap

Preparation of paracetamol

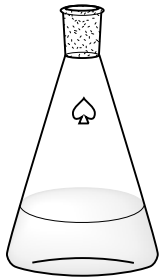
Synthesis of the amide essentially just requires running the reaction under certain temperature conditions.
Paracetamol is prepared by reaction of 4-aminophenol by acetylating it with acetic anhydride.



4-aminophenol acetic anhydride 4-hydroxyacetanilide acetic acid

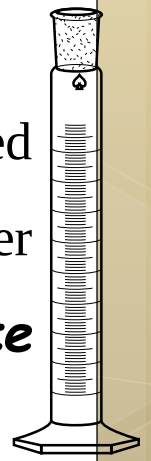
PARACETAMOL

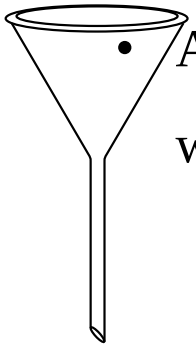
Procedure



- 1.0 g of 4-aminophenol and 9 ml of distilled water was placed in a conical flask and stirred gently at room temperature, in order to suspend the solid in the water.

  In a fume hood, add 1.1 ml of acetic anhydride to the stirred suspension and gently shake to mix. The solid got dissolved after about 30 seconds. ***Shaking was continued until a precipitate was formed.***





- After 10 minutes the solid was filtered off **<u>under suction</u>**, washed with a little cold water and dried.

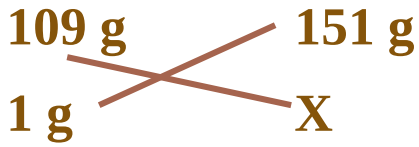
Calculation

Molecular Weight 4-nitrophenol (C_6H_7NO) = 109 g/mol

Molecular Weight Paracetamol ($C_8H_9NO_2$) = 151 g/mol

Theoretical yield:

109 g of 4-nitrophenol forms 151 g of paracetamol



$$\rightarrow X = \frac{151 * 1}{109} = 1.385 \text{ g}$$

Practical Yield: …… g

$$\text{Yield \%} = \frac{Practical\ Yield}{Theoretical\ Yield} \text{ x } 100$$

Yield % = %