Semester-III

18CHU314A PHARMACEUTICAL CHEMISTRY - PRACTICAL 3H 1C

Instruction Hours/week:L:0 T:0 P:03 Marks: Internal:40 External: 60 Total:100

End Semester Exam: 3hrs.

Course Objective

The course enables the student to

1. Understand the synthesis and characterisation of pharmaceutical drugs like aspirin and magnesium bisilicate.

Course Outcome

1. The students understood the synthesis and characterization of aspirin and magnesium bisilicate.

Methodology

Practicals

1. Preparation of Aspirin and its analysis.
2. Preparation of magnesium bisilicate (Antacid).

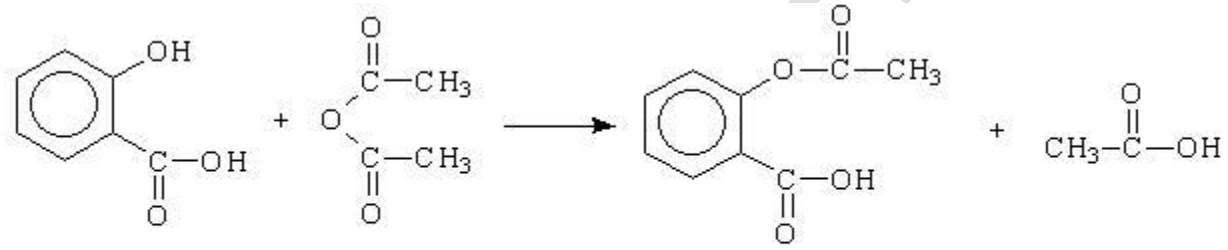
Suggested Readings

1. Patrick G.L. (1995): Introduction to *Medicinal Chemistry.* UK:Oxford UniversityPress.
2. Hakishan, V.K. Kapoor, (1996)*Medicinal and Pharmaceutical Chemistry*.New Delhi: VallabhPrakashan. Pitampura.
3. William O. Foye, Thomas L., Lemke ,& David A. William.(2008).*Principles of MedicinalChemistry*. New Delhi: B.I. Waverly Pvt. Ltd.

1. PREPARATION OF ASPIRIN

Principle:

To prepare aspirin, salicylic acid is reacted with an excess of acetic anhydride.A small amount of a strong acid is used as a catalyst which speeds up the reaction. The synthesis reaction of aspirin is shown below:



Salicylic acid ($C_7H_6O_3$) + Acetic anhydride ($C_4H_6O_3$) → Acetylsalicylic acid ($C_9H_8O_4$) + Acetic Acid ($C_2H_4O_2$)

Requirements

(i) Salicylic acid : 3 g

(ii) Acetic anhydride : 6 ml

(ii) Phosphoric acid 85% : 5-8 drops

Procedure:

Accurately weigh 3.00 grams of salicylic acid and transfer to a dry Erlenmeyer flask. Add 6 mL of acetic anhydride and 5-8 drops of 85% phosphoric acid to the flask. Gently swirl the flask to mix the solution. Place the flask in a beaker of warm water for 15 minutes. Add 20 drops of cold water drop wise to the warm solution to destroy the excess acetic anhydride. Add 20 mL of water to the flask. Set the flask in an ice bath to cool the mixture and speed crystallization. When the crystallization process appears complete, pour the mixture through a Buckner funnel. Apply suction filtration through the funnel and wash the crystals with a few milliliters of ice cold water. Be sure the water is near freezing to minimize loss of product. Perform a recrystallization to purify the product. Transfer the crystals to a beaker. Add 10 mL of ethanol. Stir and warm the beaker to dissolve the crystals. After the crystals have dissolved, add 25 mL of warm water to the alcohol solution. Cover the beaker. Crystals will reform as the solution cools. Once crystallization has started, set the beaker in an ice bath to complete the recrystallization.

Pour the contents of the beaker into a Buckner funnel and apply suction filtration. Remove the crystals to dry paper to remove excess water.

Result

Yield of aspirin…….g

2. MELTING POINT ANALYSIS OF ASPIRIN

Principle

Melting point (mp) is the temperature at which a solid becomes a liquid at standard atmospheric pressure; at this point, solid and its liquid are in equilibrium at a certain pressure. Melting point is one of physical properties of a compound by which it is identified.

Measuring the melting point of a substance is a good way to test for purity. A pure substance usually has a sharp melting point – *ie*a narrow temperature range during which it changes from a solid to a liquid. A substance which contains impurities often melts over a range of several degrees. Any impurities in the substance cause a lowering and broadening of this characteristic temperature.The melting point range of pure aspirin and the salicylic acid are

Substance	Melting point
2-Hydroxybenzoic acid	158–160 °C
Aspirin	138–140 ° C

Requirements

(i) Melting point tubes

(ii) Watch glass

(iii) Melting point apparatus

(iv) 0-360 °C thermometer

Procedure

Weigh the dry product to obtain the yield of the reaction. Pack a few crystals of aspirin product in a melting point capillary tube. The melting point tube is attached to the thermometer and place tube in the melting point apparatus.Allow the temperature of the melting point apparatus to increase 1 °C per minute starting from 120 °C. If impurities are present in crude sample, the melting point range will be lower than the range of pure aspirin. Record the melting point ranges of the pureaspirin.

Result

Melting point of aspirin experimentally found to be……..

3. TITRATION ANALYSIS OF ASPIRIN

Principle

Titratethe sample of aspirin (acetylsalicylic acid) with the standardized NaOH to determine the moles of acid in a given weight of aspirin product. This will allow assessing its purity.

$$\frac{\text{actual moles of aspirin}}{\text{theoritical moles of aspirin}} \times 100\% = \%\ \text{purity}$$

The Net Ionic Equation for the titration in this experiment:

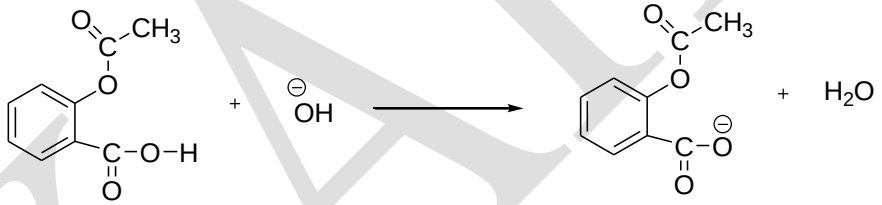
Requirements

(i) Conical flask 125 ml

(ii) Burette

(iii) Phenolphthalein indicator

(iv) Ethanol



Procedure

Accurately weigh between 0.10-0.15 g of the aspirin product into a 125 mL conical flask. Add 15 mL of 95 % ethanol and swirl to dissolve. Add 2 drops of phenolphthalein indicator to the flask. Record the exact concentration of the standard 0.1 M NaOH solution. Fill a buret with the standard NaOH solution and record the initial volume. Titrate the sample until a faint pink end point is reached. The pink color should last for at least 30 seconds after swirling. Repeat the titration with 0.10-0.15 g of a crushed aspirin tablet. Record the initial and final buret readings and determine the moles of aspirin from the titration and calculate the percent purity of the crude aspirin product from the titration analysis.

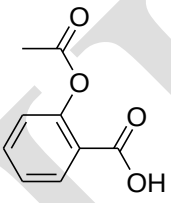
Result

Purity of aspirin experimentally found to be……..%

4. SPECTROSCOPY ANALYSIS OF ASPIRIN

Principle

Infrared spectroscopy (IR) is a characterization tool chemists use to help determine the molecular structure. IR capitalizes on the concept that functional groups absorb specific frequencies of energy based on their structure. Aspirin, or acetylsalicylic acid, has three functional groups. A benzene ring (aromatic group), A carboxylic acid (COOH) group An ester (R-C=O--O-R) group.



aspirin

Requirements

(i) IR instrument

(ii) KBr

(iii) Mortar and pestle

Procedure

In this technique a small amount of finely ground solid sample of aspirin is intimately mixed with about 100 times its weight of powdered potassium bromide, in a vibrating ball mill. This finely ground mixture is then under very high pressure in evacuable die or minipress to form a small pellet (about 1-2 mm thick and 1 cm diameter). A good KBr pellet is thin and transparent. Opaque pellets give poor spectra, because little infrared beam passes through them. White spots in a pellet indicate that the powder is not ground well enough, or is not dispersed properly in the pellets. The resulting pellet is transferred in to IR radiation and run. Predict the important functional groups of aspirin.

Result

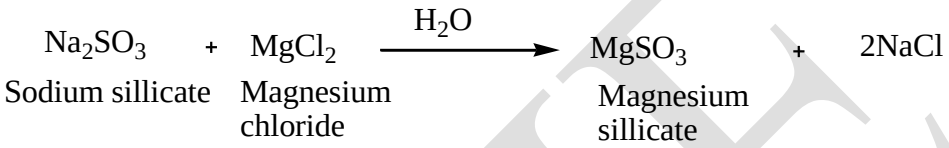
The O-H stretch for a carboxylic acid is found in the range …… cm^{-1}

The Carbonyl (C=O) group stretch found in the range…… cm^{-1}

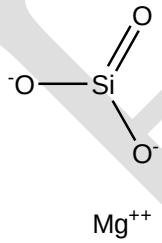
5. PREPARATION OF MAGNESIUM BISSILICATE

Principle

The most common route for the synthesis of magnesium silicate is via aprecipitation reaction between a soluble metal silicate (e.g., sodium orthosilicate, sodium metasilicate, or potassium silicate) and a soluble magnesium salt (e.g., magnesium sulfate, nitrate, or chloride).



Magnesium silicate occurs as a fine, white, odorless, tasteless powder, free from grittiness.



A schematic of the structure of magnesium silicate

Requirements

(i) Sodium silicate

(ii) Magnesium chloride

(iii) Conical flask 250 ml

(iv) Measuring cylinder

Procedure

Accurately weigh 1.2 grams of sodium silicate and transfer to a dry Erlenmeyer flask containing 20 ml of distilled water. Add 0.96 g of magnesium chloride to the flask. Gently swirl the flask to mix the solution. Immediately, white odorless magnesium silicate is precipitated. The precipitate is further stirred continuously for 5 minutes.The precipitated magnesium silicate is filtered, washed with excess amount of water and dried. The yield is noted.

Result

Amount of the magnesium silicate obtained……g

6. MELTING POINT ANALYSIS OF MAGNESIUM SILICATE

Principle

Melting point is the temperature at which a solid becomes a liquid at standard atmospheric pressure; at this point, solid and its liquid are in equilibrium at a certain pressure. Melting point is one of physical properties of a compound by which it is identified.

Measuring the melting point of a substance is a good way to test for purity. A pure substance usually has a sharp melting point – *ie*a narrow temperature range during which it changes from a solid to a liquid. A substance which contains impurities often melts over a range of several degrees. Any impurities in the substance cause a lowering and broadening of this characteristic temperature. The melting point range of sodium silicateand the magnesium chloride are

Substance	Melting point
Sodium silicate	1088 °C
Magnesium chloride	714 °C

Requirements

(i) Melting point tubes

(ii) Mortar and pestle

(iii) Melting point apparatus

(iv) 0-360 °C thermometer

Procedure

Weigh the dry product to obtain the yield of the reaction. Pack a grinded powder of magnesium silicate product in a melting point capillary tube. The melting point tube is attached to the thermometer and place tube in the melting point apparatus. Allow the temperature of the melting point apparatus to increase 1 °C per minute starting from 120 °C. If impurities are present in the crude sample, the melting point range will be lower than the range of pure magnesium silicate. Record the melting point ranges of the pure magnesium silicate.

Result

Melting point of magnesium silicateexperimentally found to be……..