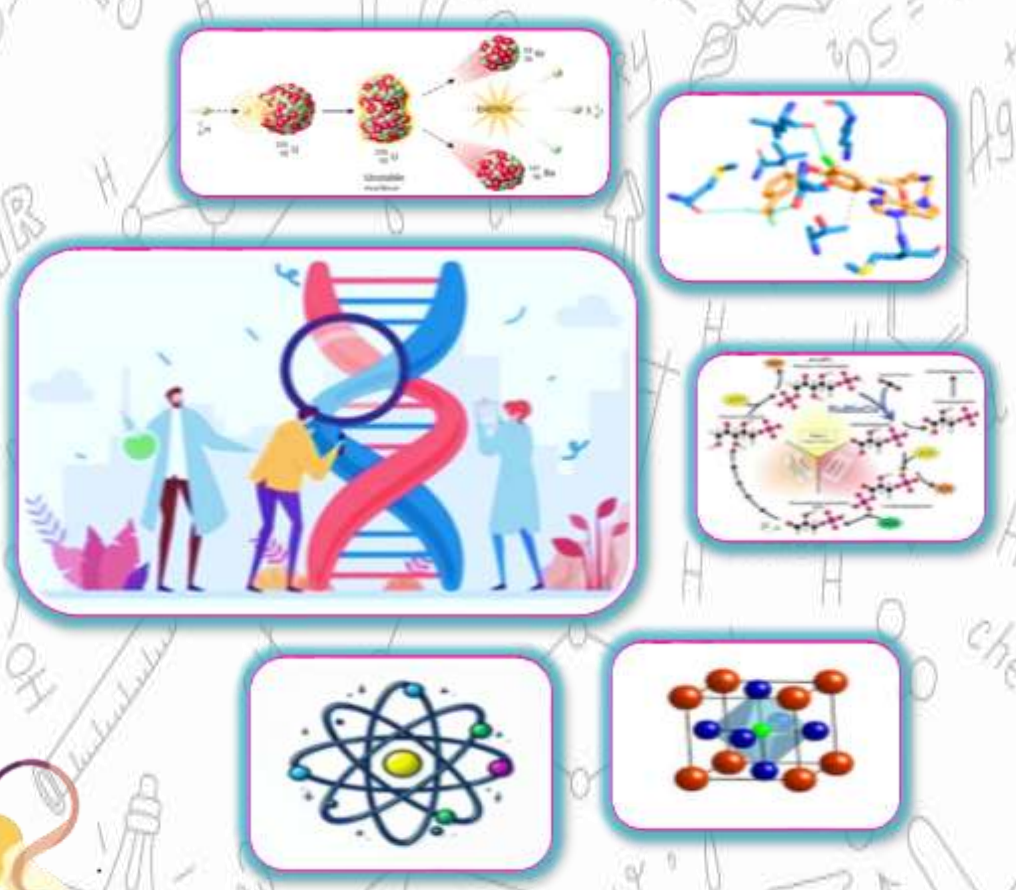
RAMAIAH
College of Arts, Science
& Commerce - Autonomous

Department of Chemistry & Biochemistry

LAB MANUAL

IV Semester BSc - Chemistry

Compulsory Chemistry Practical's



RAMAIAH College of Arts, Science & Commerce - Autonomous

DEPARTMENT OF CHEMISTRY/BIOCHEMISTRY

BSc-CHEMISTRY

COURSE CODE:24CHEE402

COMPULSORY CHEMISTRY PRACTICAL

LAB MANUAL

Program: BSc
IV Semester-Chemistry
Course: IV Semester Compulsory Chemistry Practical

Course Code: 24CHEE402: COMPULSARY CHEMISTRY PRACTICALS		
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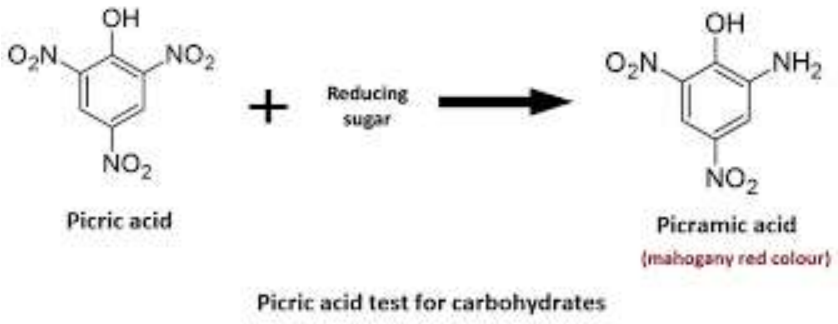
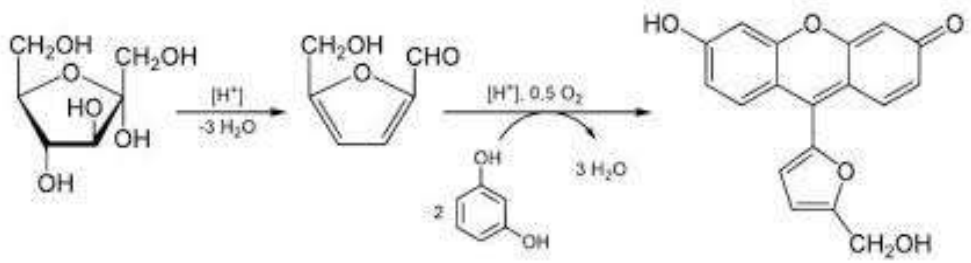
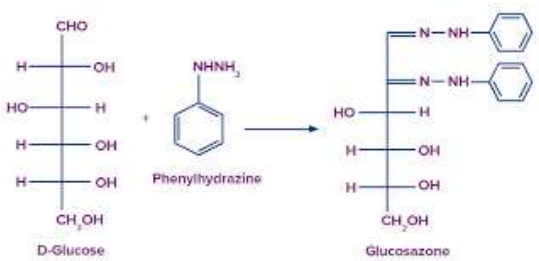
EXPERMENT-1

Qualitative Analysis of Carbohydrates:

Sl. No.	Experiment	Observation	Inference
1.	**Molisch's Test:** 1 cm^3 of test solution in a test tube + 2 drops of Molisch's reagent mixed well + 1 cm^3 of conc. H_2SO_4 slowly along the sides of the test tube.	a) Purple ring at the junction of two layers b) No violet or purple ring	a) Carbohydrates are present. b) Carbohydrates are absent.
	Reaction: Conc. H_2SO_4 (Carbohydrate → Furfural) + α-Naphthol → Coloured complex		
2.	**Benedict's Test:** 1 cm^3 of the test solution + 2 ml of Benedict's reagent, and heat the test tube in a boiling water bath for 3 min.	Green, Yellow, Brown or Red colour	Presence of reducing sugar.
	Reaction: Reducing sugar + $2Cu^{2+}$ → Oxidised sugar + Cu_2O (Yellow or brick red ppt)		
3.	**Picric Acid Test:** 1 cm^3 of the test solution + a few drops of saturated picric acid + 1 cm^3 of 10% Na_2CO_3 solution heated directly over flame.	a) Mahogany colour (reddish yellow) ppt b) No colour change	a) Reducing sugar b) Non-reducing sugar



Picric acid test for carbohydrates

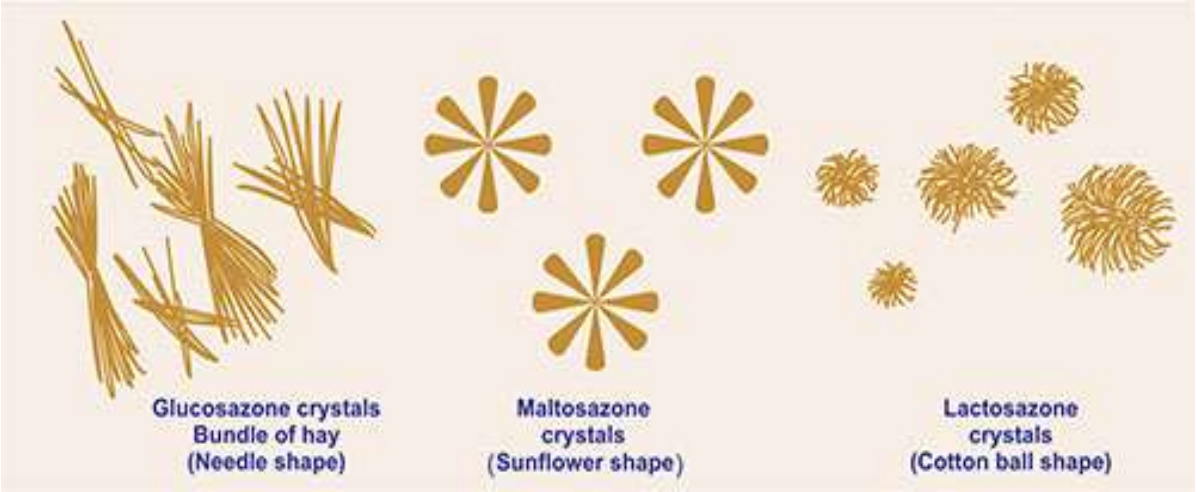
Sl.No	Experiment	Observation	Inference
4.	**Barfoed's test:** 1 cm³ of test solution + 2 cm³ of Barfoed's reagent, heat the test tube in a boiling water bath for about 4 minutes.	Formation of red colour (ppt).	Reducing Monosaccharides are present.
5.	**Seliwanoff's test:** 1 cm³ of test solution + 2 cm³ of Seliwanoff's reagent, keep the test tube in a boiling water bath for about one minute.	a) Red ppt within a few seconds. b) Red ppt after a few minutes.	a) Ketones (Fructose sugar) are present. b) May be glucose.
			
6.	**Bial's Test:** 1 cm³ of test solution + 3 cm³ of Bial's reagent, boil for 1 minute directly over flame.	a) Green colour b) No green colour	a) Pentose sugar present b) Hexose sugar present
7.	**Iodine Test**: 1 cm³ of test solution + a few drops of iodine solution.	a) Appearance of blue colour b) Appearance of reddish-brown colour	a) Starch is present b) Sucrose is present
8.	**Osazone Test:** 1 cm³ of test solution + a pinch of phenylhydrazine hydrochloride + a pinch of sodium acetate + 2 drops of glacial acetic acid heated.	a) Yellow or white ppt	Reducing sugar
			

9. Preparation of Solid Derivative of Monosaccharides: Osazone

Osazones are the **solid derivatives of sugars**. They are formed when **reducing carbohydrates** are treated with an excess of **phenylhydrazine**. The obtained osazones are crystallized into definite shapes.

Glucose, fructose, and mannose react with phenylhydrazine to yield only one type of osazone, called **glucosazone**. The crystals can be observed under a **light microscope**.

Sugar	Time Required	Shape of Crystals
Glucose / Fructose / Mannose	5/2/5 minutes	Needle-shaped crystals
Maltose	10 minutes	Sunflower-shaped crystals
Lactose	15 minutes	Puff-shaped crystals



Reagents for Carbohydrate Analysis: -

Molisch Test:

a. α-Naphthol reagent: α-naphthol (5%) in ethyl alcohol b. Concentrated sulphuric acid

Iodine Test:

Solution of potassium iodide (3%) in distilled water. Add a few crystals of iodine until the solution turns deep yellow.

Test for Reducing sugars:

Fehling's Test

Reagent A: Cupric sulphate (7%) in distilled water.

Reagent B: Dissolve 34.6 g of sodium potassium tartrate and 25 g of potassium hydroxide in 100 ml distilled water.

Benedict's Test:

Dissolve 17.3 g of sodium citrate and 10 g of sodium carbonate in 50 ml of distilled water, and warm the solution on a hot-water bath with constant stirring.

Separately, prepare cupric sulphate solution by dissolving 1.73 g of the salt in 20 ml of distilled water.

Mix the cupric sulphate solution with the sodium citrate–carbonate solution and make up the volume to 100 ml.

Barfoed's Test:

Dissolve 13.3 g of cupric acetate in 80 ml of distilled water. Add 2 ml of glacial acetic acid and make up the volume to 100 ml with distilled water.

Seliwanoff's Test:

Resorcinol (0.05%) in 4 N hydrochloric acid.

Bial's Test:

Prepare orcinol (0.35%) in concentrated hydrochloric acid and add 0.25 ml of ferric chloride (10%) solution.

Mucic Acid Test: concentrated nitric acid.

Test for Sucrose: a) Concentrated HCl b) Benedict's reagent c) Seliwanoff's reagent d) Sodium hydroxide (10N)

Osazone Test:

a) Phenylhydrazine reagent: 2 parts of phenylhydrazine hydrochloride and 3 parts of sodium acetate are mixed and ground in a porcelain mortar. **b)** Glacial acetic acid.

Experiment – 2

Qualitative Analysis of Proteins

Sl. No.	Experiment	Observation	Inference
1.	**Biuret Test:** (Test for the presence of a peptide bond) Cupric ion in an alkaline medium forms a violet-colored complex with peptides & proteins. The minimum requirement for a positive test is the presence of two peptide bonds in a molecule.		
	1 cm^3 of test solution + 1 cm^3 of 10% NaOH solution + 2 drops of $CuSO_4$ or Biuret reagent.	Violet colour	Proteins are present
2.	**Xanthoproteic Test:** Test for amino acids with aromatic side chains. The aromatic compound undergoes nitration to give yellow-colored nitro derivatives. The colour changes to orange in alkaline medium.		
	1 cm^3 of test solution + 5 cm^3 of conc. HNO_3. Place the tube in a boiling water bath for 5 min. Cool & add NaOH solution.	Yellow or Orange colour	Proteins are present
3	**Sulphosalicylic Acid Test:** 2 ml protein solution + add sulphosalicylic acid reagent dropwise with mixing.	White precipitate or turbidity	Proteins present
4	**Heat Coagulation Test:** 2 ml protein solution + add acetic acid reagent dropwise with mixing & heat for 2 min.	Precipitation	Proteins present
5.	**Ninhydrin Test:** 1 ml of the test solution + few drops of ninhydrin reagent and heat for 5 minutes.	Formation of purple colour	Proteins present

Reagents:-

Biuret Test:

a. Sodium hydroxide solution (10%) b. Cupric sulphate solution (0.15%)

c. Sodium potassium tartrate solution (0.6%) d. Copper reagent: Mix equal volumes of reagents b and c.

Sulphosalicylic Acid Test:

Sulphosalicylic acid reagent: Sulphosalicylic acid 5% in 20% sodium sulphate solution.

Heat Coagulation Test:

Acetic acid (1%).

Ninhydrin Test

Ninhydrin reagent: 2% (w/v) in acetone.

Xanthoproteic Test:

a. Sodium hydroxide (40% w/v) b. Concentrated nitric acid c. Hydrochloric acid (6N).

Protein Solution:

0.5% (w/v) solution of Bovine Serum Albumin (BSA).

Qualitative Analysis of Lipids:

l. No.	Experiment	Observation	Inference
1.	**Solubility Test:** a) 2 drops of liquid + water b) 2 drops of liquid + alcohol c) 2 drops of liquid + acetone	 Insoluble Soluble Soluble	 May be an oil or fat May be an oil or fat May be an oil or fat
2.	**Saponification Test:** 2 drops of liquid + 10 cm^3 of NaOH solution. It is refluxed for 10 min, saturated with NaCl, boiled, and cooled.	Precipitate (soap) is formed	An oil or fat is present
3.	**Acrolein Test:** A drop of liquid + $KHSO_4$ solution, heat.	Pungent smell of acrolein	An oil or fat is present
	Test for Steroids		
1.	**Salkowski Test:** 2 ml lipid + 2 ml conc. sulphuric acid. Vortex fluorescence.	The acid layer shows a yellow colour with green	Cholesterol is present
2.	**Liebermann–Burchard Test:** 2 ml lipid + 2 ml acetic anhydride + 2–3 drops of conc. Sulphuric acid. Mix.	Green color	Cholesterol is present

Reagents for Lipid Analysis:

Solubility Test: Chloroform, ether, benzene, CCl_4, and hexane

Saponification Test: Alcoholic KOH (2% KOH in ethyl alcohol)

Acrolein Test: Potassium bisulphate (solid)

Test for Steroids

Salkowski Test: Conc. sulphuric acid

Liebermann–Burchard Test: Acetic anhydride and conc. sulphuric acid.

STUDY OF ADULTRANTS IN FOOD-STUFFS

1. To detect the presence of adultrants in fat,oil and butter.

Requirements:
test-tube,conc.HCl,furfural,acetic anhydride,conc.H_2SO_4,acetic acid,conc.HNO_3.

Procedure:

Common adultrants present in ghee and oil are parrifin wax,hydrocarbons,dyes and argemone oil.These are detected as follows :

1. Adultration of vegetable ghee in desi ghee(Bandouin test)

Take small amount of desi ghee in a test tube and add to it 1ml of HCl and 2-3 drops of 2%alcoholic soln. of furfural.Shake the contents vigorously. .Appearance of red colour in the acid layer shows that vegetable ghee has been mixed as an adultrant to desi ghee.

2. Adultration of paraffin wax and hydrocarbon in vegetable ghee.

Heat small amount of vegetable ghee with acetic anhydride.Droplets of oil floats on the surface of unused acetic anhydride indicates the presence of wax or hydrocarbon.

3. Adultration of dyes in fats.

Heat 1ml of fat with 1ml of conc.sulphuric acid and 4ml of acetic acid.Appearance of pink or red colour indicates the presence of dye in fat.

4. Adultration of argemone oil in edible oils.

To small amount of oil in a test tube,add few drops of conc.HNO_3 and shake.Appearance of red colour in the acid layer indicates the presence of argemone oil.

Experiment 9

Green Synthesis of Aspirin

Aim

To synthesize aspirin (acetylsalicylic acid) using a green chemistry approach minimizing hazardous reagents and energy consumption.

Principle

Aspirin is synthesized by acetylation of salicylic acid using an acetylating agent such as acetic anhydride. In green synthesis, safer catalysts (like phosphoric acid or solid acid catalysts) are preferred instead of concentrated sulfuric acid, and reaction conditions are optimized to reduce waste and energy usage. The reaction follows nucleophilic acyl substitution where the hydroxyl group of salicylic acid reacts with acetic anhydride to form aspirin and acetic acid as a by-product.

Chemical Equation

$$C_7H_6O_3 + (CH_3CO)_2O \rightarrow C_9H_8O_4 + CH_3COOH$$

Salicylic acid reacts with acetic anhydride to form aspirin (acetylsalicylic acid) and acetic acid as a by-product.

Procedure

1. Take 2 g of salicylic acid in a dry conical flask.
2. Add 4–5 mL of acetic anhydride to the flask.
3. Add 2–3 drops of phosphoric acid (green catalyst).
4. Swirl the mixture gently and heat on a water bath (50–60°C) for about 10–15 minutes.
5. Allow the reaction mixture to cool to room temperature.
6. Add 20 mL of cold distilled water slowly to decompose excess acetic anhydride.
7. Place the flask in an ice bath to complete crystallization.
8. Filter the precipitated aspirin using vacuum filtration.
9. Wash the crystals with cold water and allow them to dry.
10. Recrystallize from ethanol (optional for purification).

Result

White crystalline aspirin is obtained. The product can be confirmed by its melting point (~135°C) and yield percentage.

Green Synthesis of Acetanilide

Aim

To prepare acetanilide from aniline using an eco-friendly acetylation method.

Principle

Acetanilide is prepared by acetylation of aniline using acetic anhydride or glacial acetic acid. In green synthesis, water is often used as a solvent to avoid harmful organic solvents. The amino group of aniline reacts with the acetyl group forming acetanilide via nucleophilic substitution, producing a less toxic amide.

Chemical Equation

$$C_6H_5NH_2 + (CH_3CO)_2O \rightarrow C_6H_5NHCOCH_3 + CH_3COOH$$

Aniline reacts with acetic anhydride to produce acetanilide and acetic acid.

Procedure

1. Take 5 mL of aniline in a conical flask.
2. Add 10 mL of water and stir well (green solvent system).
3. Slowly add 7 mL of acetic anhydride with constant stirring.
4. Warm the mixture gently on a water bath for 10 minutes.
5. Cool the reaction mixture; acetanilide crystals will begin to separate.
6. Pour the mixture into ice-cold water to enhance crystallization.
7. Filter the solid product using filtration.
8. Wash with cold water to remove impurities.
9. Dry the crystals and recrystallize using hot water if necessary.

Result

White crystalline acetanilide is obtained with a melting point around **114°C**, confirming purity.

Note (Green Chemistry Aspects)

- Use of safer catalysts (phosphoric acid instead of sulfuric acid)
- Reduced energy consumption (mild heating)
- Use of water as a solvent (in acetanilide synthesis)
- Minimization of toxic by-products

Experiment 7: Preparation of perfumes

Aim

To synthesize a fragrant ester (artificial perfume) by esterification of a carboxylic acid with an alcohol.

Principle

Synthetic perfumes are commonly prepared by esterification reactions, where a carboxylic acid reacts with an alcohol in the presence of a strong acid catalyst such as concentrated sulfuric acid to form an ester and water. These esters are responsible for pleasant fruity fragrances and are widely used in perfumes and flavoring agents. The reaction is reversible and follows equilibrium, so excess alcohol or removal of water helps drive the reaction towards ester formation. The resulting ester is then purified and used as a perfume.

Theory

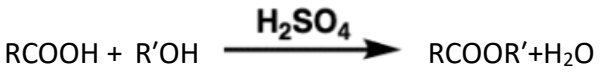
Esters are organic compounds characterized by the functional group –COOR and are known for their characteristic pleasant odors. They are formed by the reaction between carboxylic acids and alcohols via a nucleophilic substitution reaction called Fischer esterification. In this reaction, the hydroxyl group (–OH) of the acid is replaced by the alkoxy group (–OR) from the alcohol. Concentrated sulfuric acid acts both as a catalyst and a dehydrating agent, increasing the rate of reaction and shifting equilibrium towards ester formation. For example, isoamyl alcohol reacts with acetic acid to form isoamyl acetate, which has a banana-like smell. Similarly, different combinations produce different fragrances, making esterification a fundamental method in synthetic perfume preparation.

Composition of perfume:

A perfume mainly consists of three parts:

1. The odouriferous constituents (2-10%).
2. The fixatives (these make the perfume last longer by reducing its volatility.
3. The dilutant is invariably pure ethyl alcohol, which serves to dilute the blended perfume to the desired odour strength.

Chemical Reaction



1.

AIM: - To prepare Ethyl Salicylate

APPARATUS: - Boiling tube, water bath, beaker and separating funnel

PROCEDURE: -

- 1 gm. of salicyclate was taken in a boiling tube.
- 2 ml. of Ethyl Alcohol and 1-2 drops of concentrated sulphuric acid were added.
- Then the boiling tube was heated in a boiling water bath for about 20-25 minutes.
- The contents of the boiling tube were poured in a beaker containing cold water.
- The odour was noted.
- The ester, separating in the lower portion of the beaker, was obtained using a separating funnel.

RESULT: - The compound obtained smelled of wintergreen and thus was Ethyl Salicylate.

2.

AIM: - To prepare Methyl Salicylate

APPARATUS: - Boiling tube, water bath, beaker and separating funnel

PROCEDURE: -

- 1 gm. of Salicylic acid was taken in a boiling tube.
- 2 ml. of methyl alcohol and 2-3 drops of concentrated acid were added to it.
- The boiling tube was heated in a boiling water bath for about 20-25 minutes.
- The contents of the boiling tube were then poured in a beaker containing cold water.
- The odour was noted.
- The ester, separating in the lower portion of the beaker was obtained by using a separating funnel.

RESULT: - The compound obtained had a pungent and characteristic odour of wintergreen and thus was Methyl Salicylate.

3.

AIM: - To prepare Ethyl Benzoate

APPARATUS: - Boiling tube, water bath, beaker and separating funnel

PROCEDURE: -

- 1 gm. of Benzoic acid was taken in a boiling tube.
- 2 ml. of ethyl alcohol and 2-3 drops of concentrated acid were added to it.
- The boiling tube was heated in a boiling water bath for about 20-25 minutes.
- The contents of the boiling tube were then poured in a beaker containing cold water.
- The odour was noted.
- The ester, separating in the lower portion of the beaker was obtained by using a separating funnel.

RESULT: - The compound obtained had a pungent and fruity odour and thus was Ethyl Benzoate.

Experiment 8

PREPARATION OF TALCUM POWDER

Aim

To prepare the face powder in laboratory.

Ingredients

S.No.	Ingredients	Quantity in %
1.	Kaolin (Hydrated magnesium silicate)	8
2.	Calcium carbonate	15
3.	Zinc Oxide	5
4.	Zinc Stearate	5
5.	Magnesium Carbonate	5
6.	Talc (Hydrated Aluminium silicate)	60
7.	Perfume	Small quantity

Procedure

The Ingredients of kaolin, calcium carbonate, zinc oxide, zinc stearate and talc are taken in the given prepositions in the mortar and they are crushed into fine powder by using pestle. The perfume is added to magnesium carbonate in another mortar and mixed well. Finally the second mixture added to the first mixture well and transferred to the container for storage.

Result

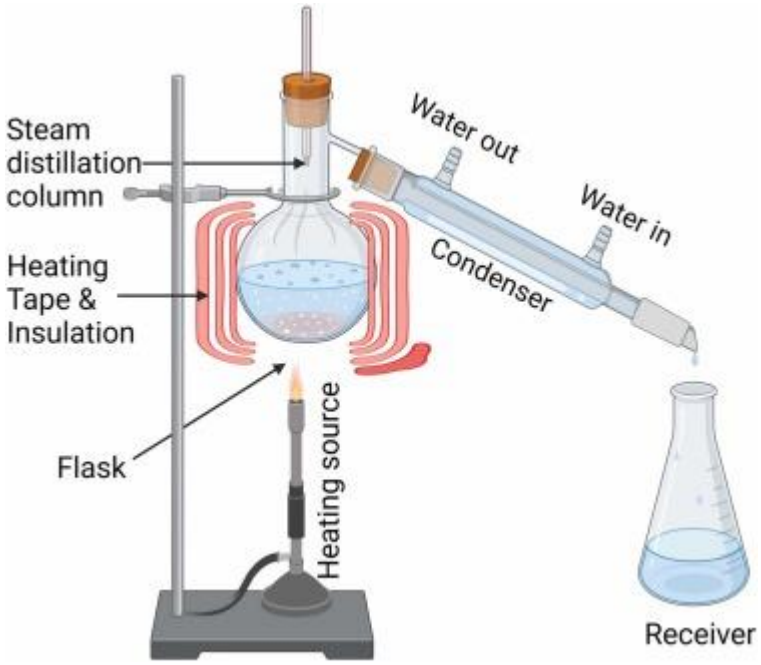
The amount of prepared face powder = ------- g

Experiment 6: Extraction of Essential Oil from Cinnamon Leaves by Steam Distillation

Aim

To extract essential oil from cinnamon leaves using the steam distillation method.

Principle



Steam distillation is a technique used to isolate **volatile, heat-sensitive compounds** such as essential oils from plant materials.

- When steam passes through cinnamon leaves, it **vaporizes the volatile oil components**.
- The mixture of steam and oil vapours condenses upon cooling in the condenser.
- Since essential oils are **immiscible with water**, they separate as a distinct layer.
- The oil is then collected using a **separating funnel**.

This method prevents decomposition of the oil as the boiling point is effectively lowered in the presence of steam.

Theory:

Steam distillation is a specialized separation technique used to extract **volatile and heat-sensitive essential oils** from plant materials such as cinnamon leaves. The essential oil present in cinnamon leaves mainly contains **eugenol**, along with other aromatic compounds.

The principle of this method is based on the **co-distillation of immiscible liquids** (water and essential oil). When two immiscible liquids are heated together, the total vapour pressure becomes equal to the sum of the individual vapour pressures. As a result, the mixture boils at

a temperature **lower than the boiling point of either component**. This allows the essential oil to vaporize without undergoing thermal decomposition.

During the process, **steam passes through the plant material**, rupturing the oil glands and releasing the volatile compounds. These vapours, consisting of steam and essential oil, travel into the condenser where they are cooled and converted back into liquid form.

The obtained distillate is a mixture of **water and essential oil**, which are **immiscible**. Due to differences in density, the essential oil either floats on or sinks below the water layer. This allows easy separation using a **separating funnel**.

Thus, steam distillation is an efficient and widely used method for isolating essential oils while preserving their **chemical composition, aroma, and therapeutic properties**.

Procedure

1. **Preparation of sample:**
    - Take fresh or dried cinnamon leaves and cut them into small pieces.
2. **Setting up apparatus:**
    - Assemble the steam distillation apparatus consisting of:
        - Round-bottom flask
        - Steam generator (or water flask)
        - Condenser
        - Receiver
3. **Distillation process:**
    - Add water to the distillation flask and place the cinnamon leaves inside.
    - Heat the flask to produce steam.
    - Steam carries the essential oil vapours through the condenser.
4. **Condensation:**
    - Pass cold water through the condenser to cool the vapours.
    - The vapours condense into a liquid mixture of oil and water.
5. **Collection of distillate:**
    - Collect the distillate in a receiver.
6. **Separation of oil:**
    - Transfer the distillate into a separating funnel.
    - Allow layers to settle and separate the essential oil from water.
7. **Drying of oil (optional):**
    - Dry the oil using anhydrous sodium sulfate to remove moisture.

Result

Essential oil is successfully extracted from cinnamon leaves by steam distillation.

Precautions

- Ensure all joints are airtight.
- Do not overheat; maintain steady steam generation.
- Use fresh plant material for better yield.
- Handle hot apparatus carefully to avoid burns.

Preparation of Hand wash and Hand sanitizer

Aim: Preparation of hand wash and hand sanitizer for common usage.

1. **Preparation of Hand Sanitizer.**

Requirements: Ethyl alcohol or Isopropyl alcohol (IPA), 3% Hydrogen peroxide solution, Glycerol, freshly prepared , cool distilled water.

Theory

Hand sanitizers are alcohol-based antiseptic solutions used to reduce or eliminate microorganisms present on the skin. The effectiveness of a hand sanitizer depends mainly on the concentration of alcohol and the presence of supportive ingredients that enhance stability and skin compatibility. Two commonly used alcohols in sanitizer formulations are ethyl alcohol (ethanol) and isopropyl alcohol (isopropanol). These alcohols exhibit strong antimicrobial activity by denaturing proteins and disrupting the cell membranes of bacteria, fungi, and many viruses. For maximum efficacy, the alcohol concentration is typically maintained between 60–80%, as lower concentrations are less effective and higher concentrations may evaporate too quickly without sufficient microbial action. Glycerol (glycerin) is added as a humectant, which helps retain moisture and prevents excessive drying of the skin caused by alcohol. Although it slightly reduces the antimicrobial activity, its inclusion is essential for skin protection during frequent use. Hydrogen peroxide (3%) is incorporated in small quantities not for antiseptic action on the skin, but to eliminate contaminating bacterial spores that may be present in the raw materials or containers, thereby ensuring the microbiological purity of the formulation. Distilled water is used to dilute the solution to the desired alcohol concentration and to ensure uniform mixing of all components. It also helps in achieving the correct volume and consistency of the sanitizer.

Procedure

1. Dilute 30% hydrogen peroxide to 3% solution. Take 100 ml volumetric flask and add 10 ml of 30% hydrogen peroxide solution and make up to the mark using distilled water and shake well.
2. Take 37.8 ml of isopropyl alcohol in a 50 ml volumetric flask and add 2.1 ml of hydrogen peroxide using measuring cylinder add 0.7 ml glycerol (glycerol is very viscous so wash the measuring cylinder by distilled water and rinse the funnel well) and make up to the mark using distilled water.
3. Finally transfer to appropriate bottle. Hand-rub sanitizer is ready for use. Use only for external purpose.

Result: The final composition of Hand sanitizer is 75% isopropyl alcohol, 1.5% glycerol and 0.1% hydrogen peroxide is prepared

2. **Preparation of Hand wash**

Requirements: Sodium lauryl sulfate (SLS) / Liquid soap base, Cocamidopropyl betaine (optional, for mildness), Glycerol, Sodium chloride (NaCl), Citric acid (optional, for pH adjustment), Distilled water, Fragrance (few drops), Food color (optional), Beakers, measuring cylinder, glass rod, pH paper/meter.

Theory:

Liquid hand wash is a cleansing formulation primarily based on surfactants, which are compounds that reduce surface tension and help remove dirt, oil, and microorganisms from the skin. The main ingredient, Sodium Lauryl Sulfate (SLS), acts as an anionic surfactant that produces foam and effectively cleans by emulsifying grease and dirt. A secondary surfactant like cocamidopropyl betaine may be added to enhance foaming and reduce skin irritation, making the formulation milder. Glycerol is included as a humectant to retain moisture and prevent dryness of the skin. Sodium chloride (NaCl) is used to adjust the viscosity (thickness) of the hand wash, while citric acid helps in maintaining the pH near neutral (around 6–7), which is suitable for skin. Fragrance and color are added for aesthetic appeal, and distilled water acts as the solvent to dissolve and uniformly distribute all components. Thus, the hand wash works by combining cleansing action, skin protection, and suitable physical properties to ensure effective and safe hand hygiene.

Procedure:

1. Preparation of Base Solution
   Take about 60–70 mL of distilled water in a clean beaker.
2. Addition of Surfactant
   Slowly add 10–15 g of Sodium Lauryl Sulfate (SLS) to the water with gentle stirring to avoid excessive foaming.
3. Addition of Secondary Surfactant (Optional)
   Add a small amount (5–10 mL) of cocamidopropyl betaine to make the hand wash milder and improve foaming.
4. Incorporation of Moisturizer
   Add 2–3 mL of glycerol and mix well. This helps in keeping the skin soft.
5. Thickness Adjustment
   Add a small quantity of sodium chloride (NaCl) gradually with stirring until the desired viscosity is obtained.
6. pH Adjustment
   Check the pH using pH paper. Adjust to pH 6–7 by adding a few drops of citric acid solution if required.
7. Addition of Fragrance and Color
   Add 1–2 drops of fragrance and a small amount of food color for appearance. Mix thoroughly.
8. Make up the Volume
   Add distilled water to make the final volume up to 100 mL.
9. Final Mixing and Storage
   Stir gently to obtain a uniform solution and transfer the prepared hand wash into a clean bottle.

Result

A clear, viscous, and pleasantly scented liquid hand wash is obtained.

Precautions

- Avoid vigorous stirring to minimize foam formation.
- Add NaCl slowly to prevent over-thickening.
- Maintain proper pH to avoid skin irritation.
- Use clean apparatus to avoid contamination.