NIIST

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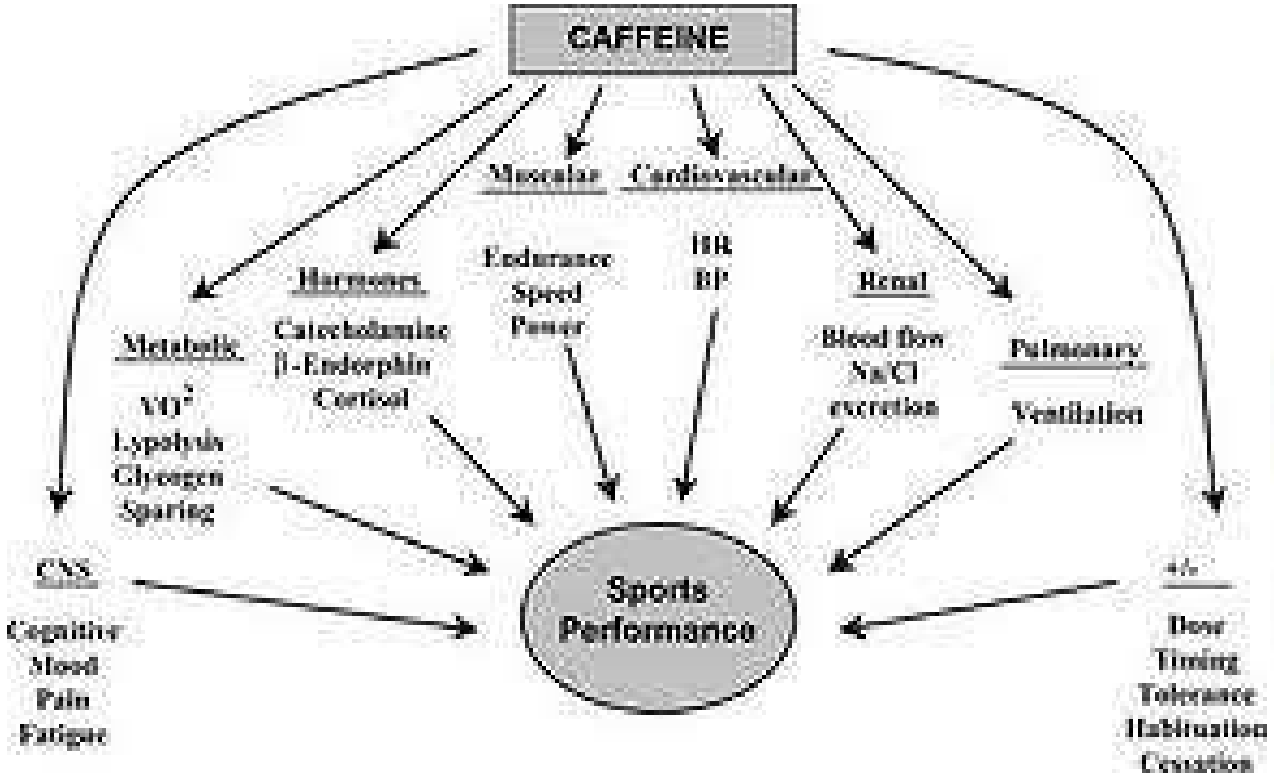
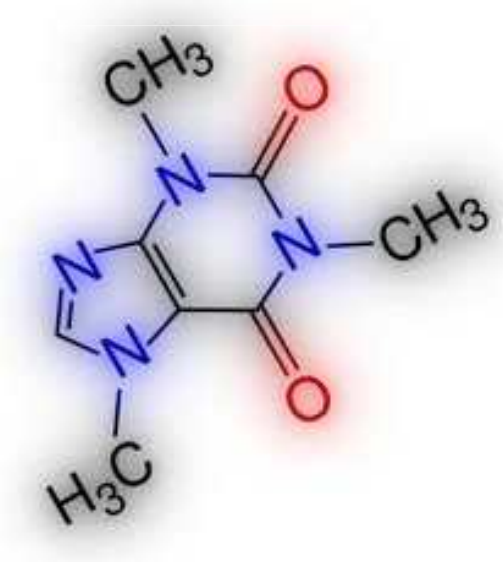
Organic Chemistry Projects for BSc. Chemistry (Core): Some Useful Tips

Natural Prodcuts:

Extraction from Plants

CAFFEINE


CAFFEINE
Muscular
Cardiovascular
Endurance
Speed
Power
HR
BP
Hormones
Catecholamine
β-Endorphin
Cortisol
Renal
Blood flow
Na/Cl
excretion
Metabolic
VO^2
Lypolysis
Glycogen
Sparing
Pulmonary
Ventilation
CNS
Cognitive
Mood
Pain
Fatigue
Sports
Performance
+/-
Dose
Timing
Tolerance
Habituation
Cessation


CH3
O
N
N
CH3
N
N
O
H3C

Extraction of Caffeine from Tea

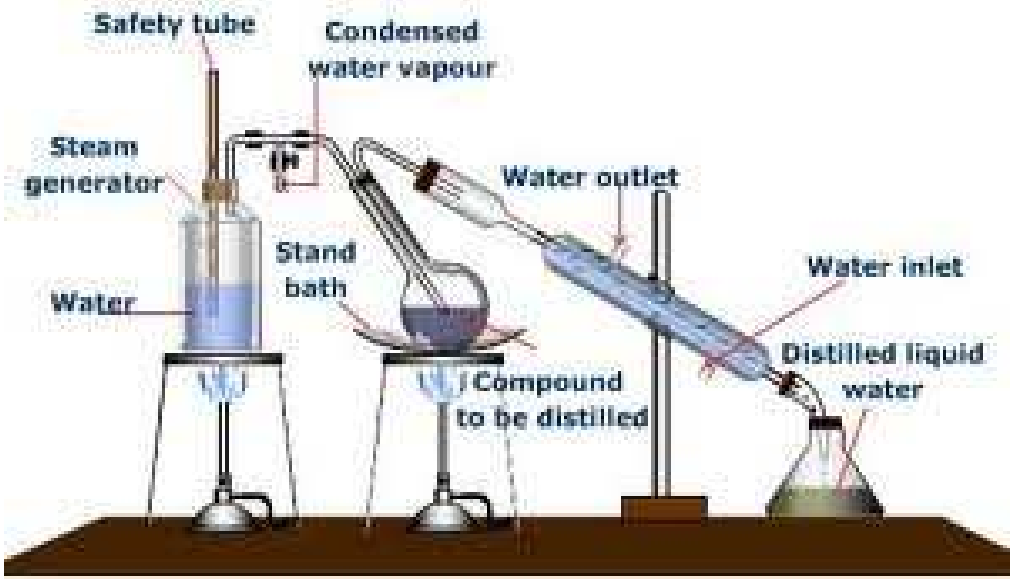
- Place 50 mL of the prepared tea solution in a 125 mL separatory funnel and add 20 mL of 5% aqueous HCl. (to help prevent emulsion formation)
- Extract this mixture 4 times with 10 mL portions of methylene chloride (dichloromethane).
- Do not shake the separatory funnel but vigorously SWIRL it (you may invert the separatory funnel to get better mixing during the swirling process) to help prevent the formation of an emulsion. Drain each of the above four methylene chloride extracts into a single 125 mL Erlenmeyer flask; make sure that there are not significant amounts of water drops in the methylene chloride extracts. If you see significant amounts of water in the combined methylene chloride extracts, place the combined extracts in a separatory funnel and drain off the methylene chloride (being careful to keep the water in the separatory funnel) layer into another dry 125 mL Erlenmeyer flask.

- Dry the combined methylene chloride extracts by adding 2-3 spatula scoops of anhydrous sodium sulfate and swirling the flask.
- To remove the sodium sulfate from the combined methylene chloride extracts, filter the resulting mixture through a fluted filter paper placed in a funnel which goes into a dry 125 Ml Erlenmeyer flask.
- Add 0.2 g of silica gel and 1 or 2 boiling stones to the methylene chloride filtrate in the Erlenmeyer flask and evaporate the solvent by heating gently in the hood on a steam bath (See how to set up and use a steam bath) to give a dry powder of your tea extract on silica gel. During the heating/evaporation process, constantly keep swirling the flask so that the solvent does not “bump” out of the flask.

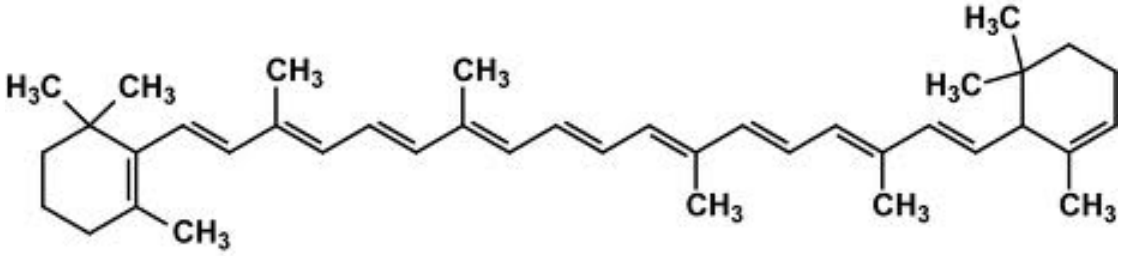
Basil oil

Steam distillation.

- Steam distillation was carried out by passing steam into a 3-liter round-bottomed flask containing the dried or fresh plant material for 90 min and collecting the condensate (water and oil) in a round-bottomed flask.
- The condensate was extracted three times with ethyl ether to completely extract the essential oil. Sodium Sulfate was added to the ethyl ether to remove moisture. Ethyl ether was then removed by rotary evaporation



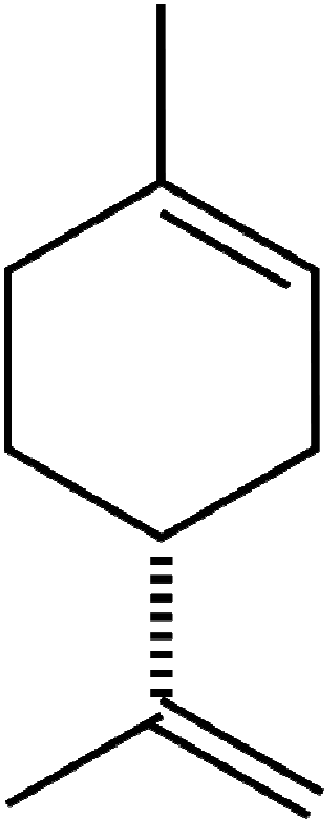
Extraction of beta-carotenes



Extraction conditions.

- Roots were cut to slices (width 2 mm, length 1 cm).
- The extraction yield of carotenes was observed at different temperatures (20°C, 40°C, and 60°C) using ethanol (96%, Reachem, Slovak Republic) and 2-propanol. Initially, 25 g of cut carrot samples were added to 100 g of 96% ethanol.
- Carrot slices were extracted in water bath (20°C, 40°C, 60°C), shaken after every 10 min, and after every hour of extraction 5 ml sample was taken and mixed with petroleum ether (20 ml).
- Water was added for the separation of phases, and extract with petroleum-ether

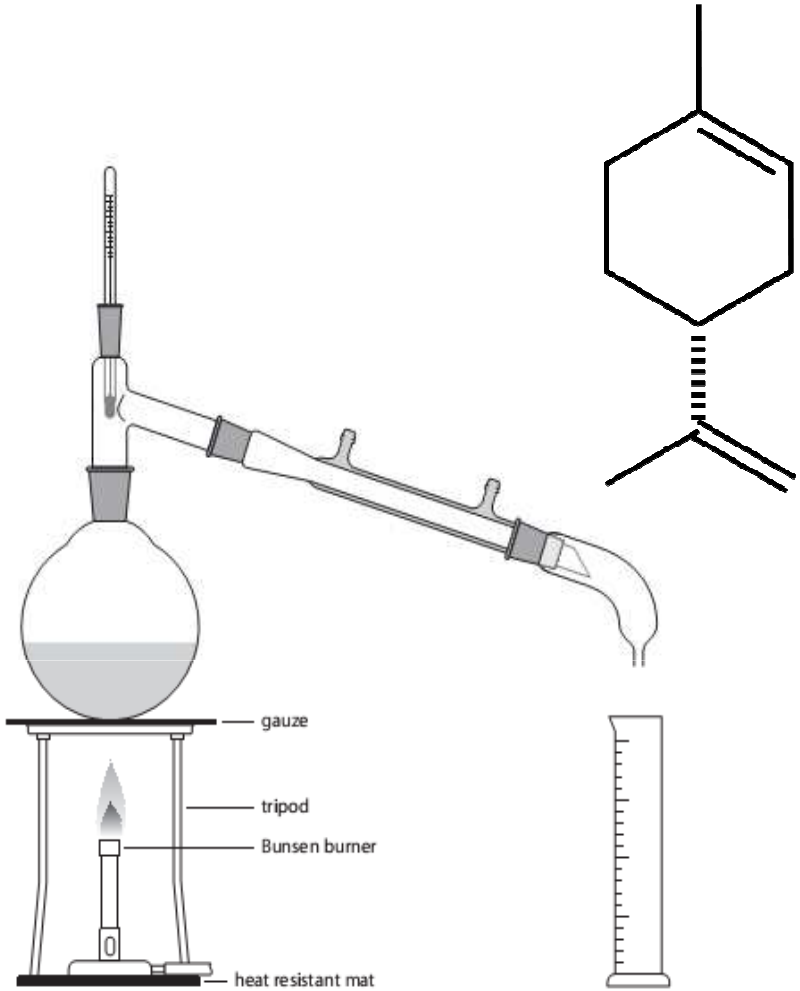
Limonene



- ❖ **Blocks the carcinogenic effect of some chemicals**
- ❖ **Clinical trial for breast cancer : Protective effects**
- ❖ **Oxidative stress in Lymphomas**

Stage 1

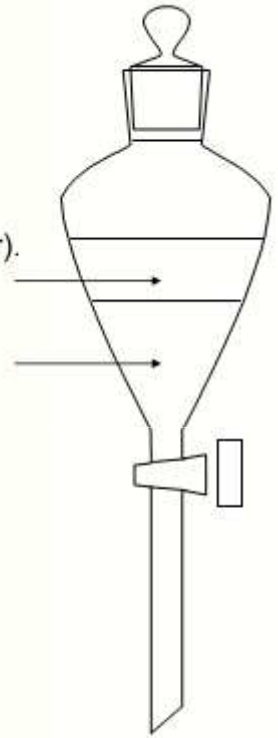
- Grate the outer orange coloured rind of two oranges and add to 100 cm3 of distilled water in the 250 cm3 round bottomed flask. Add anti-bumping granules to the round bottomed flask.
- Set up the distillation apparatus as shown in the apparatus section.
- Heat the flask so that distillation proceeds at a steady rate, approximately one drop per second of distillate. (Note: Take care not to let the liquid in the round bottomed flask boil too strongly).
- Collect approximately 50 cm3 of distillate in the measuring cylinder. The oil layer will be on the surface.
- Using a dropping pipette carefully remove the oil layer into a test tube for the next stage.



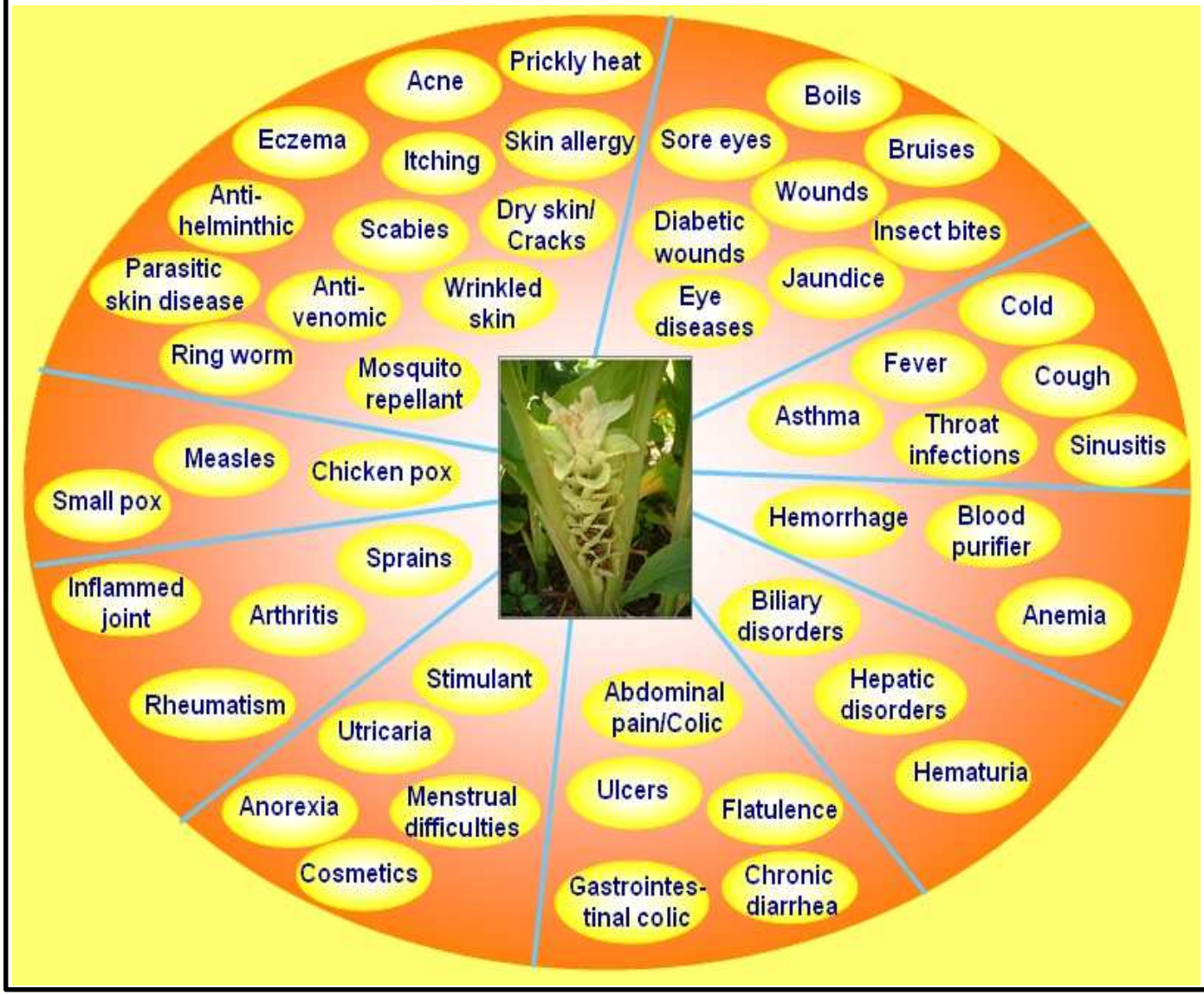
Extraction of Limonene from the Distillate

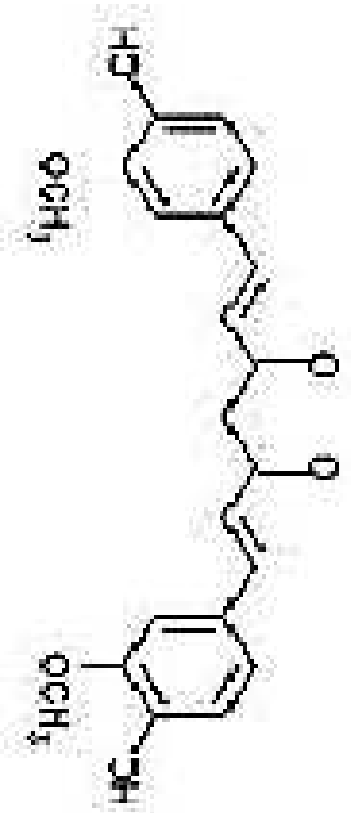
Limonene, an alkene, is extracted into a low density water immiscible solvent (ether).

The lower layer is the remaining aqueous distillate



Curcumine


Prickly heat
Acne
Boils
Eczema
Skin allergy
Sore eyes
Bruises
Itching
Wounds
Anti-helminthic
Dry skin/ Cracks
Scabies
Diabetic wounds
Insect bites
Parasitic skin disease
Anti-venomic
Wrinkled skin
Jaundice
Eye diseases
Cold
Ring worm
Mosquito repellant
Fever
Cough
Asthma
Throat infections
Sinusitis
Measles
Chicken pox
Small pox
Hemorrhage
Blood purifier
Sprains
Inflammed joint
Arthritis
Biliary disorders
Anemia
Stimulant
Abdominal pain/Colic
Hepatic disorders
Rheumatism
Utricaria
Hematuria
Ulcers
Anorexia
Menstrual difficulties
Flatulence
Cosmetics
Gastrointes-tinal colic
Chronic diarrhea



Extract curcumine from turmeric

- **Step 1**

Take 150 ml ethyl alcohol in a 250 ml Round-Bottom flask attached to a soxhlet extractor. Fill the soxhlet extractor with 50 gm of turmeric powder. Start extraction by maintaining the temperature at 50 to 60 degrees. Continue extraction for 3 to 4 hours until the solvent which fills the extraction unit is almost colorless.

- **Step 2**

Remove the soxhlet and concentrate the extract. Ensure that not all ethyl alcohol evaporated off the extract. Add 50 ml of hexane to the extract and stir the solution using a magnetic stirrer.

- **Step 3**

Add water slowly to the solution. You can now observe curcumin precipitating out. If you add more water, the resin may also precipitate out along with curcumin resulting in a black mass. In this case collect the black mass and repeat step 5 and 6.

- **Step 4**

Filter out curcumin using suction filtration and recrystallize from ethanol.

- **Extraction of turmeric using hot and cold method- quantify the amount of curcumin**
- **Volatile oils from turmeric from Fresh turmeric**
- **Curcumin from different curcuma species**

- **Similarly we can do the same for Ginger (volatile oils) and Oleoresins**

And related spices.

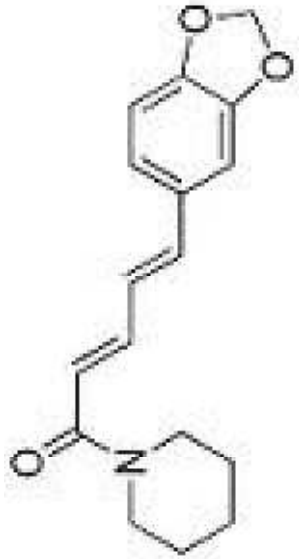
Extraction of volatile oils from different types of plants, flowers etc.

Collect data on different plants, different species and compare the amount of Volatile oils in different parts of the plant during different periods

Introduction of Steam Distillation and related set up

Piperine

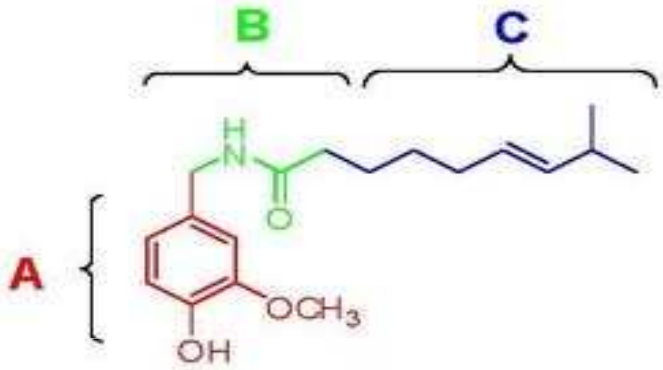
- Increases the body's uptake of nutrients
- Act as anti oxidant
- Has an antibacterial effects

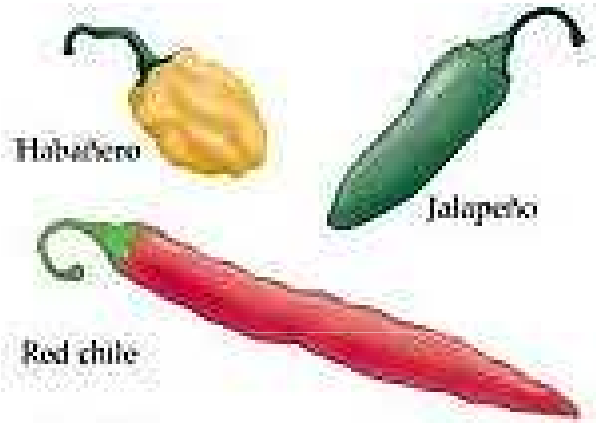


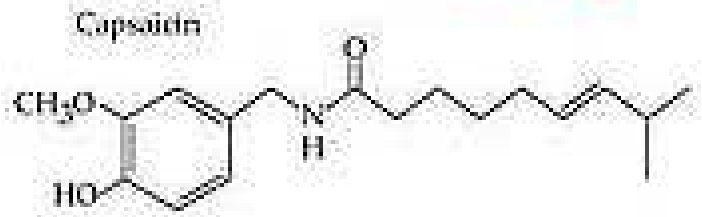
Isolation of piperine

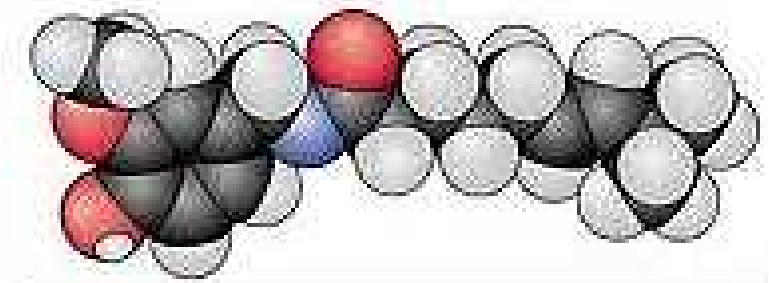
- Place 15g of ... ground black pepper in a 250mL round-bottomed flask, add 150mL of 95% ethanol and 5 boiling chips , and heat at reflux for 2h.
- Filter the mixture by suction filtration and then concentrate the filtrate to a volume of 10-15mL by simple distillation or by use of a rotary evaporator. to 10mL of a 10% solution of KOH in 95% ethanol contained ina 125mL erlenmeyer flask add the concentrated pepper extract.
- Heat the resulting solution and add water dropwise. a yellow precipitate forms.
- Add water until no more solid appears to form and then allow the mixture to stand at least overnight .
- Collect the solid by suction filtration and recrystallize it fromacetone .

Capsaicin


B
C
A
H
N
O
OCH3
OH


Habañero
Jalapeño
Red chile


Capsaicin
CH3O
HO
N
H
O



Extraction of Capsaicin from Chili Peppers

1. Get into a group of 5 an obtain the necessary materials. Each person in your group should obtain a different type of pepper.

2. Label the dram vials 1:10, 1: 100, 1: 1,000, 1: 10,000, 1:100,000.

3. Fill each dram vial with 4.5 mL of 5% sucrose solution. (If you are unsure about how to read the pipette, please ask.)

4.Place the weighing boat on the electroni cbalance .Zero the balance by pushingthe“zero”button.

5. Cut off a small piece of the pepper and place it in the weighing boat. You want a 5 grams sample of pepper. Cut off or add more pepper until the balance reads 5 grams

6. Place the pepper sample in the glass mortar and add 5mL of 95% ethanol. Use the pestle to grind up the pepper in the ethanol.

7. Use a clean pipette to transfer 0.5mL of the extract into the vial marked 1:10. Cap and shake the vial.

8. Use a clean pipette to transfer 0.5mL of the extract in the 1:10 vial into the vial marked 1:100. Cap and shake the vial.

9. Use a clean pipette to transfer 0.5mL of the extract in the 1:100 vial into the vial marked

1:1,000. Cap and shake the vial.

10. Use a clean pipette to transfer 0.5mL of the extract in the 1:1,000 vial into the vial marked 1:10,000. Cap and shake the vial.

11. Use a clean pipette to transfer 0.5mL of the extract in the 1:10,000 vial into the vial marked 1:100,000. Cap and shake the vial.

12. Place a clean pipette in the 1:100,000 vial.

13. Perform the taste test with the other four members of your group. Using the clean pipette in the 1:100,000 vial to place a drop of the solution on each person’scoffee stirrer. All members should place the drop on their tongues and determine if they can detect the capsaicin.

14. Move the same pipette (you do not need a new one for each vial) to the next vial (1:10,000) and repeat the taste test. Continue until at least three people in your group can detect the capsaicin in the solution, then mark the appropriate box in the data table.

15. Eat an unsalted cracker and drink some water.

16. Repeat steps 12-15 until all 5 peppers have been tested.

17. Record the Scoville units in the data table. Remember that if capsaicin is detected at the 1:10,000 dilution, then the Scoville unit for that pepper is 10,000.

18. Wash and dry all of the materials and place them back in the proper place. Your box of materials should have the mortar & pestle, 10 dram vials, and 15 pipettes in it before you leave the room.

Isolation and Characterization of Zerumbone From *Zingiber Zerumbet*

Introduction

- ***Zingiber Zerumbet Smith*** **is a tall upright ginger growing up to 3m tall with long narrow leaves. It has cone shaped bracts. After a few weeks, the first green cone turns red and then flowers appear in the cone.**

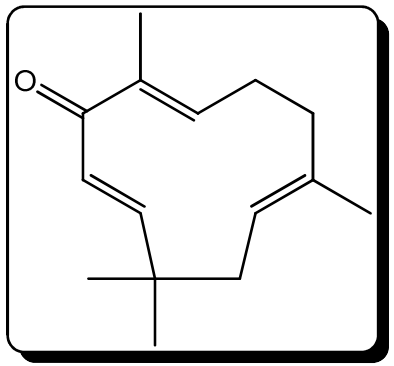
- ***Synonyms***: Wild Ginger, Shampoo Ginger, Pinecone Ginger etc. (In Malayalam "Kolinji")

- **Main components of Zerumbet oil are zerumbone, zerumbol, humulene, humulene oxide, caryophyllene, camphor and camphene.**

Zerumbone

- ***It is crystalline monocyclic sesquiterpene phytochemical with potential biological activities like Anti-HIV, Anti-cancer, Anti-Inflammatory, Anti-Microbial etc.***

- ***It is the most abundant component present in the oil Zingiber Zerumbet. It constitute around 40-50% of the rhizome extract.***



Zerumbone

Extraction and Isolation of Zerumbone

Part-1 : Extraction

- ***Fresh and cleaned rhizomes (1kg) were sliced into small pieces and dried at 45^{o}C for three days in an air oven.***

- ***The dried rhizomes were powdered in a grinder and extracted three times with distilled acetone (500mlX 3).***

- ***The extract was filtered using Buckner funnel and concentrated in a rotary evaporator under reduced pressure at 45-50^{o}C .***

Isolation and Purification

- ***Zerumbone was isolated from the acetone extract by column chromatography.***

Procedure

- ***Column was packed in hexane using silica gel (100-200 mesh).***
- ***Extract (1g) was dissolved in minimum amount of toluene or in 50% EtOAc:Hexane solvent system and loaded.***
- ***The column was eluted with hexane and 2% EtOAc:Hexane solvent system to remove the less polar compounds.***
- ***Elution with 5% EtOAc:Hexane gave Zerumbone as viscous liquid. It was then crystallized from distilled hexane as white shining crystals.***

Extraction of casien, lactose and albumin

- Egg white is a fining agent that can be used in the clarification and stabilization of wine.

Homogenization of invertase, albumin and casein were achieved via grinding process, addition of 1M acetic acid and acidification by 0.1M hydrochloricacid correspondingly. Extraction of invertase and casein involved precipitation through the utilization of 95% ethanol

Isolation of Casein, Lactose, and Albumin from Milk

Isolation and Purification of Casein

- Make a dilute solution (approx. 10%) of acetic acid by adding 1 mL glacial (100%) acetic acid to 10 ml distilled water in 10-mL-Erlenmeyer flask. Mix thoroughly and set aside.. Place 4.0 g of powdered non fat milk and 10 mL of water into a 50- or 100-mL beaker. Heat on a sand bath to about 40°C (top of sand bath at about 50°C). Monitor the temperature of the milk solution with a thermometer.
- When the mixture has reached 40°C, add the dilute acetic acid drop wise to the warm milk. Do not add all of the dilute acetic acid at one time! Maintain the solution at about 40°C and after every 5 drops, stir the solution gently using a small spatula. Using the spatula, push the precipitated casein onto the side of the beaker so that most of the liquid drains from the solid .
- Then transfer the congealed casein to a 20-mL vial in small portions. The casein will stick together and be hard to transfer if you use large pieces. If any liquid separated from the casein in the vial, use a Pasteur pipet to transfer the liquid back into the beaker

- Slowly continue the drop wise addition of the 1 mL of dilute acetic acid solution to the beaker to complete the casein precipitation. Remove as much casein as possible from the beaker and transfer it to the vial.
- Avoid adding an excess of acetic acid to the milk solution, as this will cause the lactose in the milk to hydrolyze to glucose and galactose. When most of the casein has been removed from the milk solution, add 0.2 g of calcium carbonate to the milk in the beaker. Stir this mixture for a few minutes and save it for use in the isolation of lactose below.
- Transfer the casein from the 20 mL vial to a Hirsch suction filter funnel. Draw a vacuum on the casein for about 5 min to remove as much liquid as possible, pressing the casein with a spatula during this time. (The liquid contains the albumins and lactose--so a great loss of liquid at this point will result in decreased yields of these other two components.)

- Transfer the casein to a 7- to 10-cm piece of filter paper, fold this over onto the casein, and press gently to absorb any remaining liquid.
- Place the solid on a watch glass, let air dry until the next lab period, and weigh. Casein is used to make white glue, so it is important that you don’t leave it on the filter paper or it will become glued to it! Calculate the weight percent of casein isolated from the powdered milk.

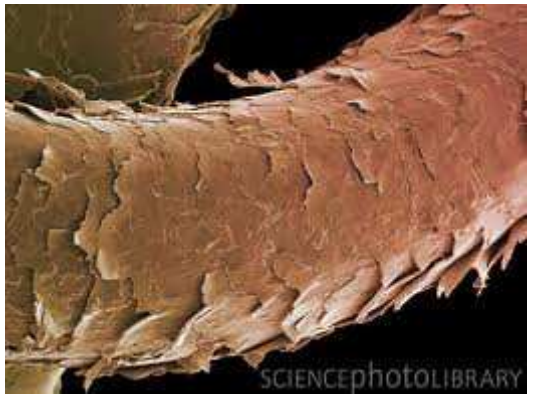
Isolation of the Sugar, Lactose, and Albumin Proteins from Milk

- After the isolation of casein, the milk mixture contains the sugar (lactose) and the protein (albumin). Heat the milk mixture to about 75°C for about 5 min. on a sand bath. Heating results in a nearly complete denaturation and precipitation of the albumins from the solution.
- Decant the liquid in the beaker away from the solid into a clean plastic 10-mL centrifuge tube. You may need to hold the solid with a spatula when transferring the liquid. Press the solid albumins with a spatula to remove as much liquid as possible and pour the liquid into the centrifuge tube. Save the albumins in the original beaker.
- You should now have about 7 mL of liquid. If you have less than 2 mL, you need to add an additional 1 mL to the albumin residue, heat to about 75°C, and decant, combining the two liquid portions. This procedure will minimize the loss of lactose that may have crystallized along with the albumin precipitate.

- When the liquid has cooled to about room temperature, place it in the centrifuge. Make sure the centrifuge is balanced by placing another plastic centrifuge tube filled with water to the same level as your lactose tube, at a position 180° opposite the lactose tube. Centrifuge for 5 min according to the instructions posted on the wall above the centrifuge.
- Following centrifugation, decant the liquid away from the solid into a 50- or 100-mL beaker. Add 15 mL of 95% ethanol to the beaker. Solids will precipitate. Heat this solution on a sand bath to about 60°C to dissolve some of the solid. Pour equal amounts of the hot solution into two 10-mL plastic centrifuge tubes (obtained from the rack next to the Beckman centrifuge in Room 215) and centrifuge this solution as soon as possible before it cools appreciably. Centrifuge for 2 min. It is important to centrifuge the solution while it is still warm to prevent premature crystallization of the lactose. A considerable quantity of solid material is deposited on the bottom of the centrifuge tubes.

- Remove the warm, supernatant liquid from the tube using a Pasteur pipet, and transfer the liquid to a 25- or 50-mL Erlenmeyer flask. (You can discard the solid remaining in the centrifuge tube.) Stopper the flask and allow the lactose to crystallize for at least two days. Granular crystals will form during this time. Collect the lactose by vacuum filtration on a Hirsch funnel. Use about 3 mL of 95% ethanol to aid the transfer and to wash the product. α-Lactose crystallizes with one molecule of water of hydration per molecule of lactose and therefore its formula is C12H22O11.H2O. Weigh the product after it is thoroughly dry.
- Calculate the weight percent of the α -Lactose isolated from the powdered milk. Measure the optical activity of α -lactose by weighing and dissolving all of your sample in 2 mL of distilled water and analyzing the solution by polarimetry. Try to obtain a reading as soon as the polarimeter readings stabilize to the nearest tenth of a degree (+0.1°C). Over a period of time, one can observe a gradual reduction in the specific rotation.

Extraction of keratin from hair



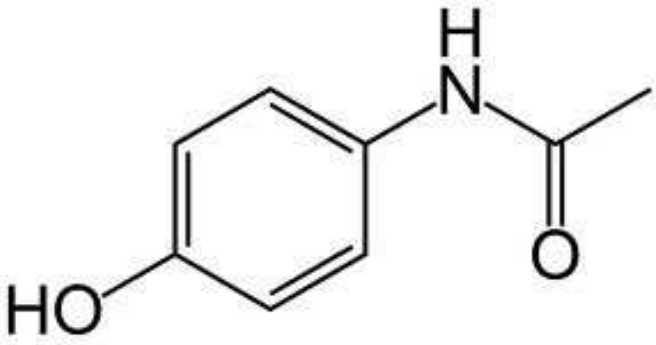
- Human hair was washed with ethanol; external lipids were removed using a mixture of chloroform/methanol (2 : 1, v/v) for 24 h.
- The delipidized hair (20 mg) was mixed with a solution (5 ml) containing 25 mM Tris–HCl, pH 8.5, 2.6M thiourea, 5M urea and 5% 2-mercaptoethanol (2-ME) (Shindai method) or 25 mM Tris–HCl, pH 9.5, 8M urea and 5% 2-ME (conventional method) at 50 °C for 1—3 d. The
- Mixture was filtered and centrifuged at 150003g for 20 min at room temperature. The obtained supernatant was used as a hair protein fraction. The pellet was recovered, washed with distilled water and used as an extracted hair sample

DRUGS

Paracetamol

Paracetamol is approved for reducing fever in people of all ages. The World Health Organization (WHO) recommends that paracetamol only be used to treat fever in children if their temperature is greater than 38.5 °C (101.3 °F). Paracetamol has a well-established role in pediatric medicine as an effective analgesic and antipyretic.

It has analgesic properties comparable to those of aspirin



Preparation of paracetamol

- 1.0 g of 4-aminophenol and 9 cm3 of distilled water was placed in a 50 cm 3 conical flask and stirred briskly at room temperature, in order to suspend the solid in the water.
- In a fume cupboard, 1.1 cm3(1.17 g) of ethanoic anhydride was added to the stirred suspension and gently shaken 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 under suction, washed with a littlecold water and dried (0.83g; 60%).
- The product was purified by crystallisation from distilled water, by dissolving the crude product in the minimum of distilled water at about 80 °C
- The clear solution was allowed to cool slowly to room temperature and the recrystallised product was collected by suction filtration.

Aspirin

- Aspirin is used in the treatment of a number of conditions, including fever, pain, rheumatic fever, and inflammatory diseases, such as rheumatoid arthritis, pericarditis, and Kawasaki disease.[15]
- Lower doses of aspirin have also shown to reduce the risk of death from a heart attack, or the risk of stroke in some circumstances.[16][17][18]
- Aspirin has also been suggested as useful in preventing pregnancy loss or colorectal cancer.

Aspirin

- Weigh 4.0 g (0.030 mole) of salicylic acid in a 125 mL Erlenmeyer flask. Using this quantity of salicylic acid to calculate the theoretical yield of aspirin. Record the weigh on the report sheet. Carefully add 6 mL (0.051 mole) of acetic anhydride to the flask.
- **Using extreme caution**, add 5 drops of concentrated sulfuric acid to the flask, swirl gently, and place the flask in a beaker of boiling water. Clamp the flask to a ring stand and heat for 20 minutes. Constantly stir with a glass rod; the entire solid must completely dissolve.
- Remove the flask from the boiling water bath and allow to cool to room temperature. Crystallization should occur during cooling. If crystals begin to grow, let the flask sit undisturbed until crystals stop growing then add the 40 mL of ice water. If crystals do not grow, slowly pour the solution into a 250-mL beaker containing 40 mL of ice water, mix thoroughly, and place the beaker in ice.

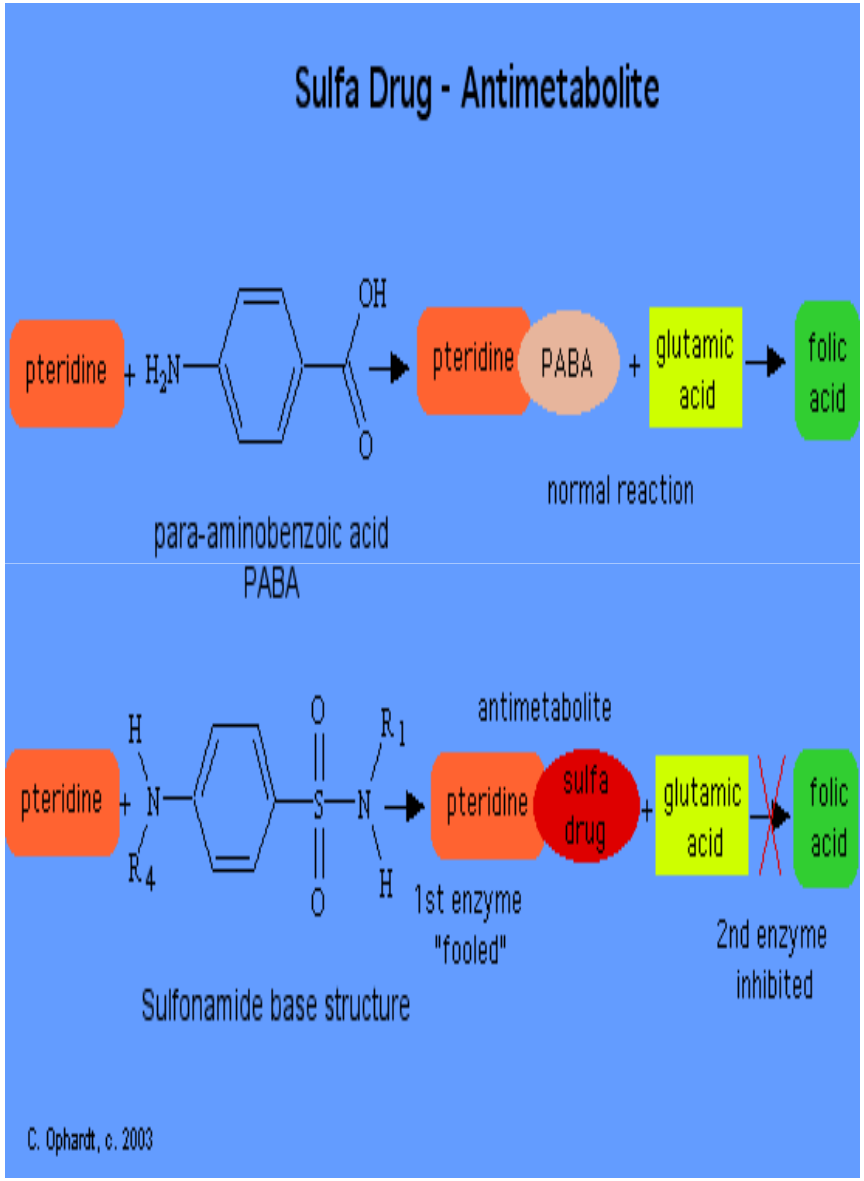
- Wash the crystals with two 10-mL portions of cold water followed by one 10-mL portion of cold ethanol. Allow the crude product to dry, then weigh it on the rough balance. Weigh a watch glass. Add the crystals and re-weigh. Calculate the weight of crude aspirin. Determine the percent yield. Test a small amount of this crude product for its melting point as described in Part II. Test the freshly made product for purity.
- Aspirin naturally decomposes into acetic acid over time so the purity test should be done the day the aspirin is prepared. Save some of your aspirin for testing.
- **Recrystallization**

Dissolve about 2-4 g of your crude product in about 20 mL ethyl alcohol in a 125 mL Erlenmeyer flask, warming the alcohol in a water bath to effect dissolution

Sulfa drug

synthetic antimicrobial agents that contain the sulfonamide group

The sulfonamide chemical moiety is also present in other medications that are not antimicrobials,including thiazide diuretics(including hydrochlorothiazide, metolazone , and indapamide, among others), Loopdiuretics(including furosemide, bumetanide,and torsemide), Sulfasalazine, in addition to its use as an antibiotic, is also used in the treatment of inflammatory bowel disease.



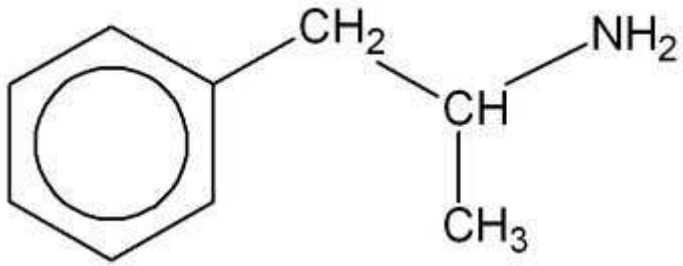
Preparation of sulfa drug

Step 1:A mixture of 20 mL of 1 M sodium hydroxide solution, 5 mL of methylene chloride, 0.5 g of the amine and 0.5 g of the sulfonyl chloride is shaken or stirred for about 20 min and then allowed to stand. The organic and aqueous layers are separated. To the aqueous layer, carefully acidify with 6 M HCl. Isolate any solid that precipitates from solution.

Step II:4-acetamidobenzenesulfonamide from the previous step is weighed and placed in a 50mL round-bottom flask equipped with a magnetic stir bar. Dilute hydrochloric acid (6 M)is added to the flask in an amount equal to twice the weight of the 4acetamidobenzenesulfonamide. The flask is fitted with a cold water condenser and heated at reflux with constant stirring for 45 minutes, after which it is allowed to cool to room temperature. If any solid appears upon cooling, the mixture is reheated at reflux for another 15 minutes. After cooling, the reaction mixture is neutralized by slow addition of a saturated Na2CO3 solution with stirring until it tests slightly alkaline to pH paper.

Amphetamine

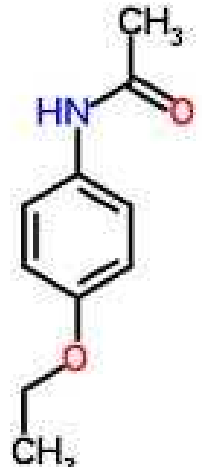
psychostimulant drug of the phenethylamine class that produces increased wakefulness and focus in association with decreased fatigue and appetite.



Procedure

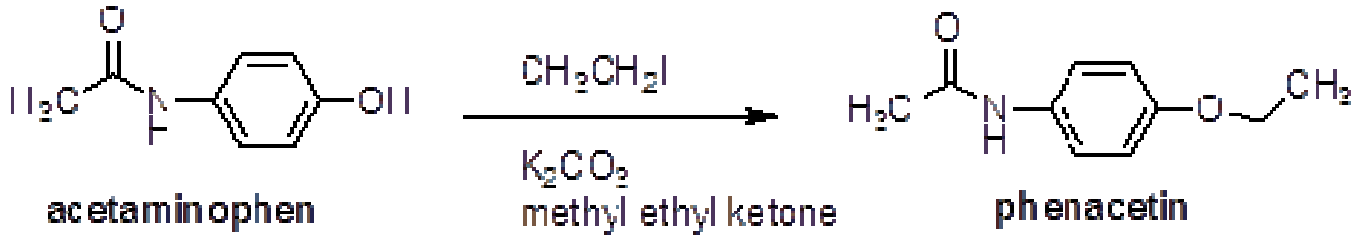
- A mixture of 40 g (0.3 mole) phenylacetone, 200 ml ethanol, 200 ml 25%ammonia,40g (1.5mole) Al-grit and 0.3 g (1 mmol) HgCl2 is warmed with vigorous stirring until reaction takes place, after which warming is stopped immediately.
- Cooling should be applied if the reaction becomes too violent. When the violence of the reaction has diminished, the mixture is refluxed with vigorous stirring for about 2 hr, concentrated in vacuo to 200 ml and poured into ice water, alkalinized with 120 g KOH, and extracted with ether.
- The extractions are treated with 20% HCl, the resulting water layer alkalinized and extracted with 150 ml ether. The organic layer is dried over Na2SO4, the ether evaporated, and the residue distilled in vacuo. Yield: 12.5 g (30%).Preparation of amphetamine sulfate yielded 96-98% product with a purity of 99.2-99.8% (USP grade).

Phenacetin



- **Phenacetin** is an analgesic Its analgesic effects are due to its actions on the sensory tracts of the spinal cord. In addition,
- phenacetin has a depressant action on the heart, where it acts as a negative inotrope.
- It is an antipyretic, acting on the brain to decrease the temperature set point.
- It is also used to treat rheumatoid arthritis (subacute type) and intercostal neuralgia.

Phenacetin



Phenacetin may be synthesized as an example of the Williamson ether synthesis: ethyl iodide, paracetamol, and anhydrous potassium carbonate are refluxed in 2butanone to give the crude product, which is recrystallized from water.

To a 100 ml round bottomed flask, weigh 100 mg of acetaminophen and 180 mg of powdered anhydrous potassium carbonate (K_2CO_3). (Potassium carbonate is at best sparingly soluble in the solvent used and increasing its surface area facilitates the deprotonation of acetaminophen). Using an automatic pipette, add first 1.0 mL of methyl ethyl ketone* (MEK, bp 80^{o}C) and then 80 µL of iodoethane* into it. (Iodoethane is corrosive and should be handled in the HOOD). Equip the RB with an air condenser and heat the stirred mixture to reflux for one hour.

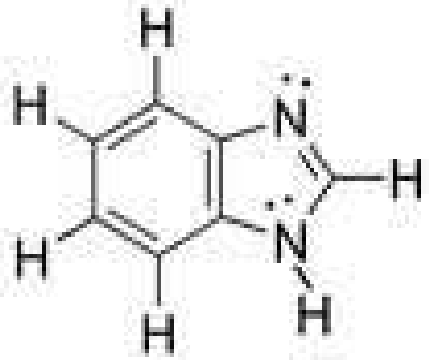
- At the end of the heating period, cool the RB in a water bath, and then transfer as much as possible of the reaction mixture liquid into a conical flask to remove any solids . With 1.0 mL of dicholomethane, carefully rinse the solids remaining in the reaction vessel, and filter the rinse.
- Carefully boil off the MEK and dichloromethane from the reaction products after having added a boiling stone (given the high boiling pt of MEK, insulating the conical flask with aluminum foil will greatly accelerate this step).
- This operation is necessary because MEK is significantly soluble in water, and vice versa, which complicates the following extraction.
- In the same conical flask, dissolve most of the remaining solids in 1.0 mL dichloromethane and extract with 1.0 mL 5% aqueous sodium hydroxide. Both the organic layers and aqueous layers should be clear after this operation

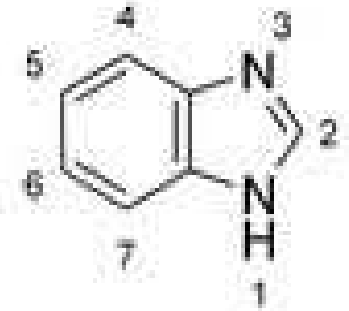
- This is to separate any unreacted acetaminophen from phenacetin exploiting the acid-base characteristics of the former (phenols pka ~10).
- Dilute solution by adding 20 mL of water, discard the upper aqueous layer, and keep the organic layer. Dry the organic layer with 50 mg anhydrous sodium sulfate. To ensure that the organic layer is dry, the sodium sulfate should be in contact with the aqueous layer for at least 5 minutes (agitate periodically).
- At the end of the drying period, transfer the dichloromethane solution to another dry conical flask (do not transfer sodium sulfate). Carefully rinse the sodium sulfate granules with 0.5 mL of dichloromethane and transfer the rinse to the previously dried dichloromethane solution.
- Boiling off the dichloromethane yields phenacetin. Weigh the phenacetin obtained,calculate the percent yield,

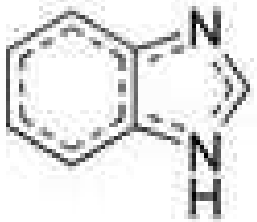
Introduction to Synthetic Organic chemsitry

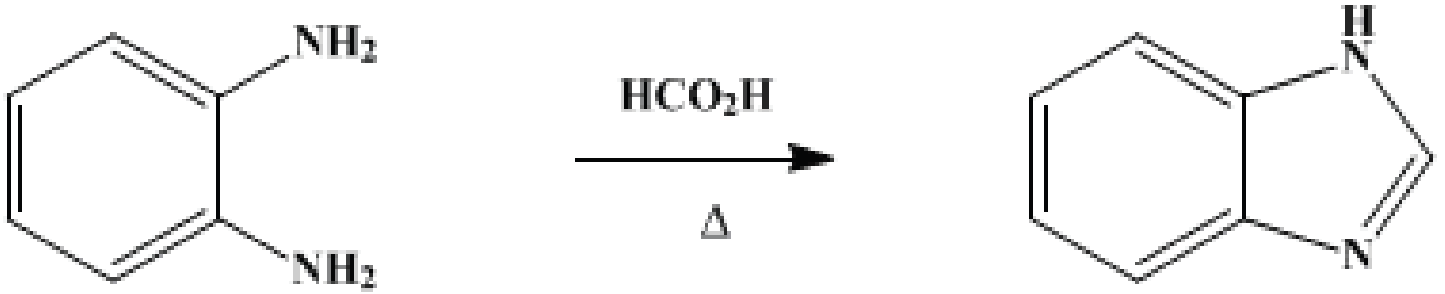
BENZIMIDAZOLE

- Benzimidazole derivatives play important role in medical field with so many Pharmacological activities such as antimicrobial, antiviral, antidiabetic and anticancer activity







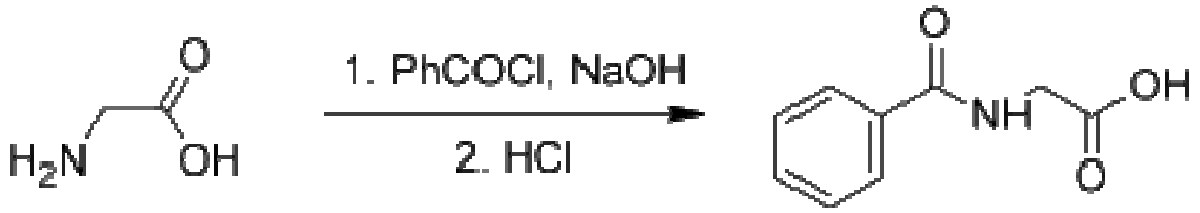


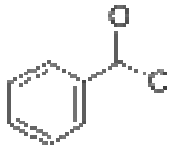
BENZIMIDAZOLE

In a 500-cc. round-bottomed flask 54 g. (0.5 mole) of *o*-phenylenediamine is treated with32 cc. (34.6 g.) of 90 per cent formic acid (0.75 mole) .The mixture is heated in a water bath at100° for two hours. After cooling, 10 per cent sodium hydroxide solution is added slowly, with thorough mixing by rotation of the flask, until the mixture is just alkaline to litmus. The crude benzimidazole is collected with suction in a 75-mm. Büchner funnel; ice-cold water is used to rinse all

solid out of the reaction flask. The crude product is pressed thoroughly on the filter, washed with about 50 cc. of cold water, and then purified without previous drying .The benzimidazole is dissolved in 750 cc. of boiling water in a 1.5-l. beaker. The solution is digested for fifteen minutes with about 2 g. of Norite and filtered rapidly through a well-heated filter .The filtrate is cooled to 10–15°, and the benzimidazole is filtered and washed with 50 cc. of cold water. The white product is dried at 100°. The melting point is 170–172°,

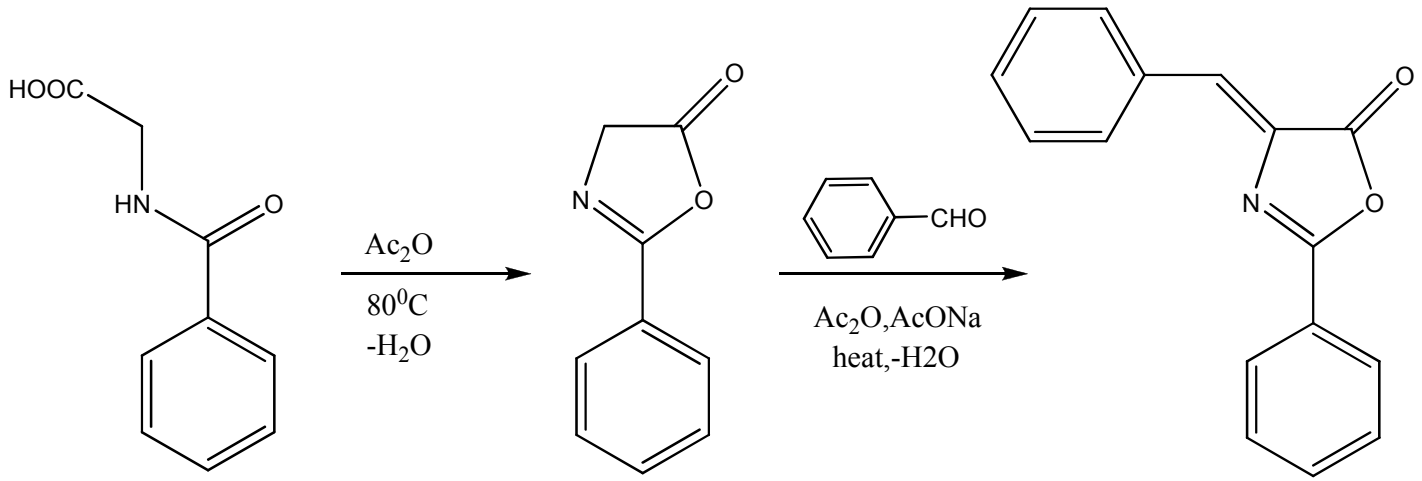
Hippuric acid



PhCOCl = 

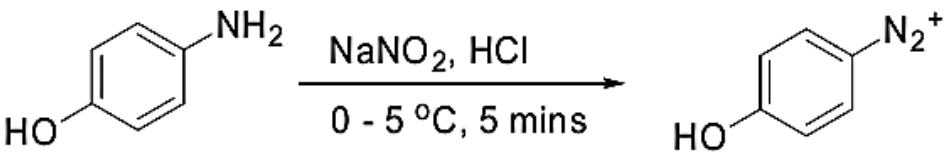
Glycine (12.5 g, 0.17 mol, 1 equiv.) was dissolved in $NaOH_{(aq)}$ (13.3 g in approx 130 mL water, 0.33 mol, 2 equiv.). The flask was placed in a room temperature water bath and benzoyl chloride (21 mL, 0.18 mol, 1.06 equiv.) was added portionwise keeping the temperature below 30 °C. Total addition time approx 60 mins. Stirred for a further hour then cooled in ice. Conc. HCl (approx 20 mL) was added and the mixture stirred for 30 mins. pH 3-4. Copious white precipitate.

Filtered and washed with water. The cake was transferred to a beaker and triturated with 100 mL hot DCM for 10 minutes. Filtered and washed with DCM (2 × 20 mL). After air drying (10 mins), dissolved in boiling water (approx 500 mL), hot filtered to remove some residual solid and allowed to crystallise slowly overnight. The crystals were filtered out (room temp.) and washed with water to obtain the product hippuric acid as white needles (22.4 g, 75%) after drying under a stream of nitrogen. Mpt. 189-190 °C (water), consistent with literature.



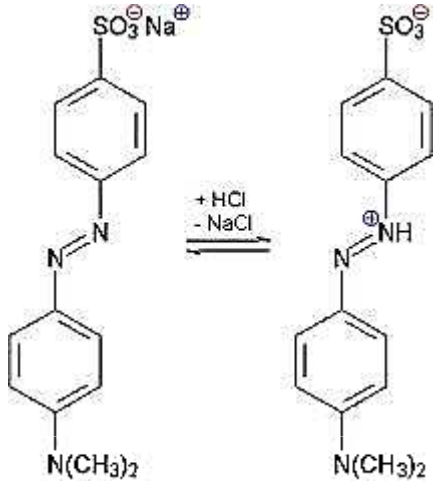
DYES

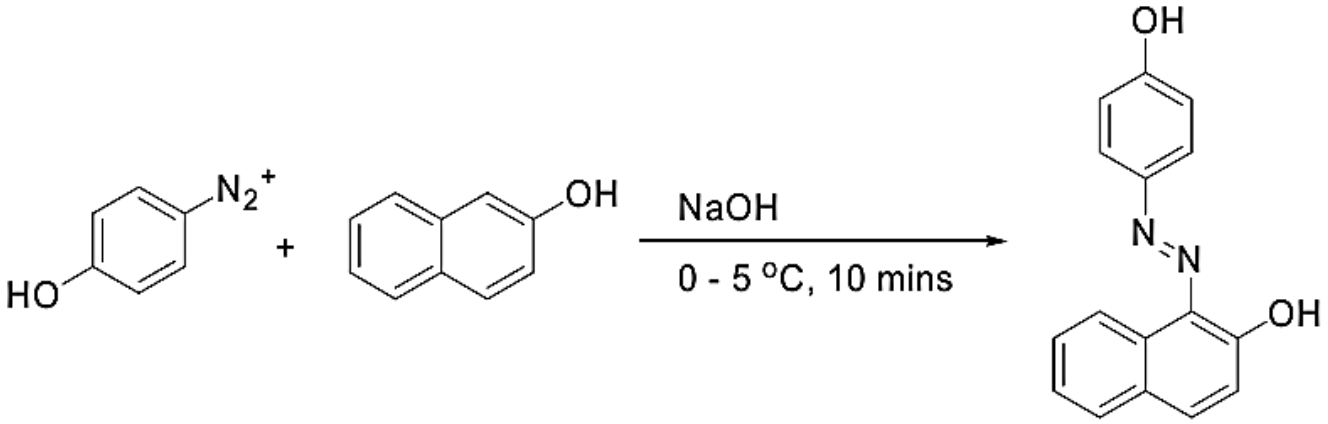
Synthesis of an Azo Dye - the Coupling Reaction of Benzenediazonium Ion with Naphthalen-2-ol



4-aminophenol

2-hydroxybenzenediazonium ion





naphthalen-2-ol

1-(4-hydroxyphenylazo)-2-naphthol

1. Prepare 30 cm 3 of ~10% aqueous sodium hydroxide solution by dissolving 3 g of sodium hydroxide in 27 cm 3 of water in an 150-cm 3conical flask.

2. Weigh 1.44 g of naphthalen-2-ol (0.01 mol) and dissolve it into the sodium hydroxide solution. Stir the mixture until complete dissolution. Cool the solution with an ice-water bath.

3. The benzene diazonium salt solution can be prepared as below:

(a) Dissolve 0.70 g of $NaNO_2$ (0.01 mol) in 5 cm3 of water.

(b) Put 1.20 g of 4-aminophenol (0.011 mol) into 45 cm3 of water in a 100-cm 3 conical flask. Add slowly 12 cm 3 of concentrated hydrochloric acid and stir the mixture until the 4-aminophenol is dissolved completely.

(c) Cool the 4-aminophenol solution in an ice-bath. Some 4-aminophenol may precipitate out upon cooling. While keeping the solution at 0 °C add the sodium nitrate(III) solution slowly with a dropper.

The mixture should be well-stirred during addition. When the addition is completed, stir the mixture for another 2 - 3 minutes. The slightly turbid pale grey solution is the benzenediazonium salt solution.

4. To the alkaline naphthalen-2-ol solution add the benzenediazonium salt solution slowly. A large amount of brick red precipitate forms during addition. The addition takes about 5 minutes. The reaction mixture should be stirred efficiently and cooled in an ice-water bath during the addition.

5. When the addition is completed, stir the mixture at 0 °C for 5 - 10 minutes. This is to ensure the reaction goes to completion.

6. Filter the mixture by suction filtration. Wash the solid product on the Büchner funnel with a small amount of cold water. Dry the product on the Büchner funnel with the suction turning on for a few minutes.

7. Transfer the product to a watch-glass. Allow the product to dry for 1 - 2 days. Weigh the product and determine the percentage yield for the reaction.


Thank you!