

Lab 1...Part 2

Extraction and Isolation of Piperine

Isolating the primary alkaloid from *Piper nigrum* via Soxhlet extraction



ASSISST. LEC .
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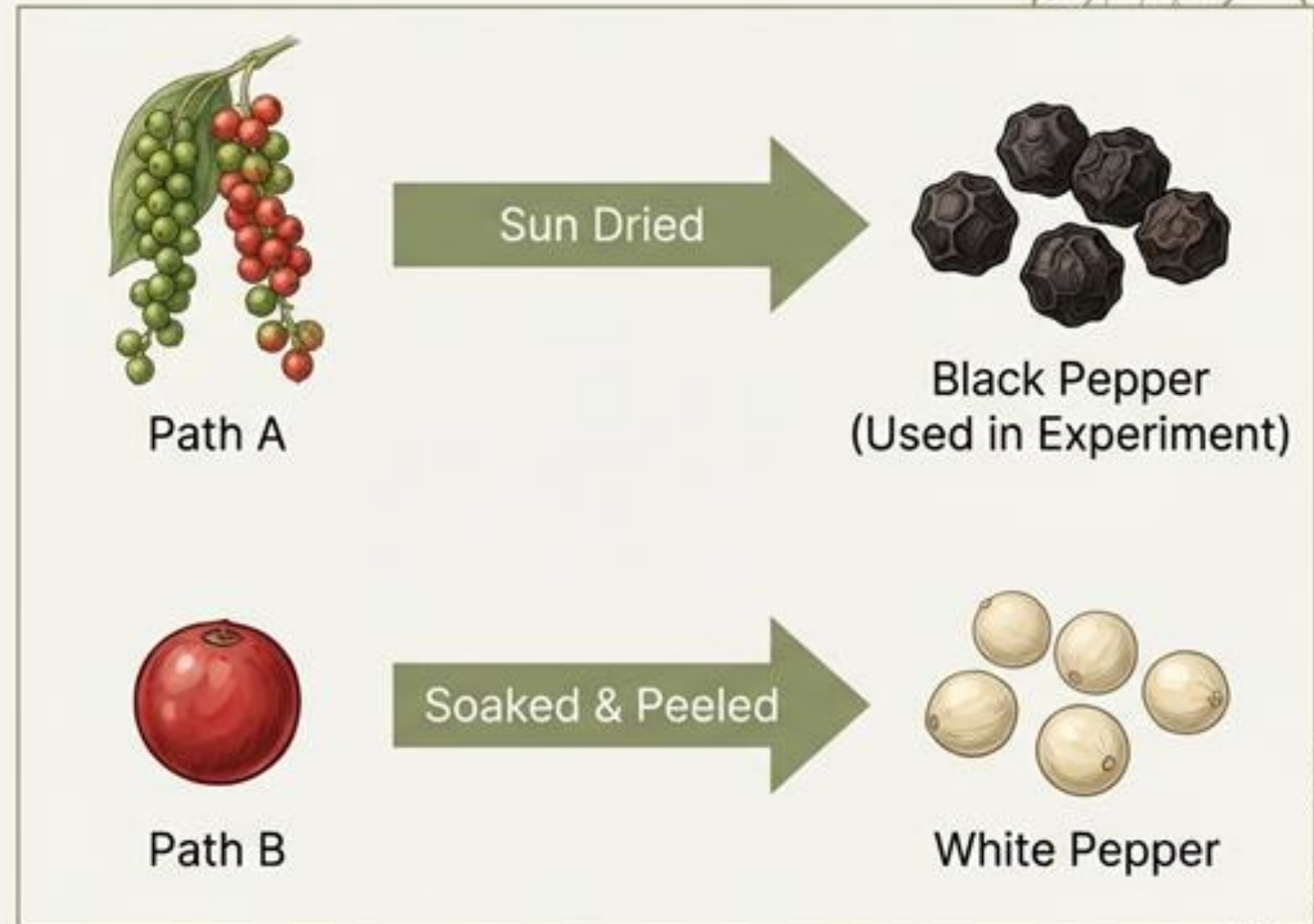
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PHARMACOGNOSY DEP. 2026

The Source: *Piper nigrum*

Family: Piperaceae

Piper nigrum is a perennial plant bearing aromatic, aromatic, **berry-like fruits**.

The fruit transitions from green (unripe) to red (mature) during its lifecycle. The distinction between Black and White pepper is a result of processing, not species differentiation.

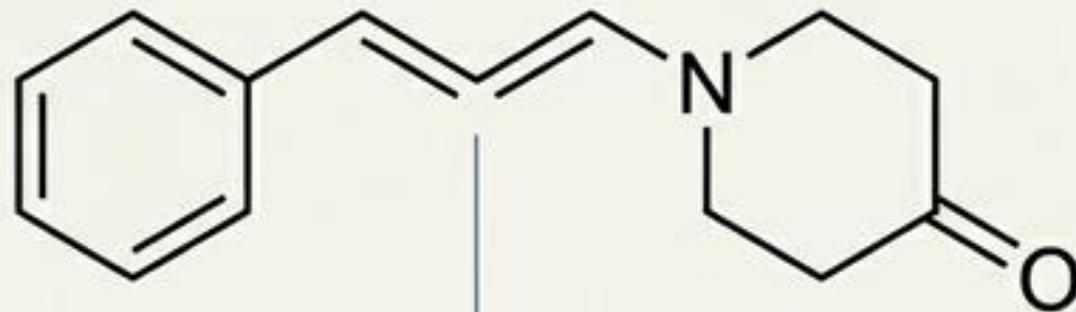


Target Material: Dried, sun-cured black berries.

Target Profile: *Piperine*

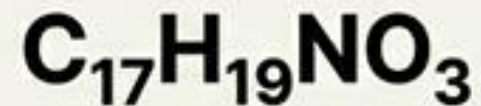
Classification:
Pyridine and
piperidine alkaloid
group.

Solubility: Insoluble
in water (Critical for
extraction).



State:
Solid substance.

Sensory: Weak base.
Tasteless initially,
distinct burning
aftertaste.



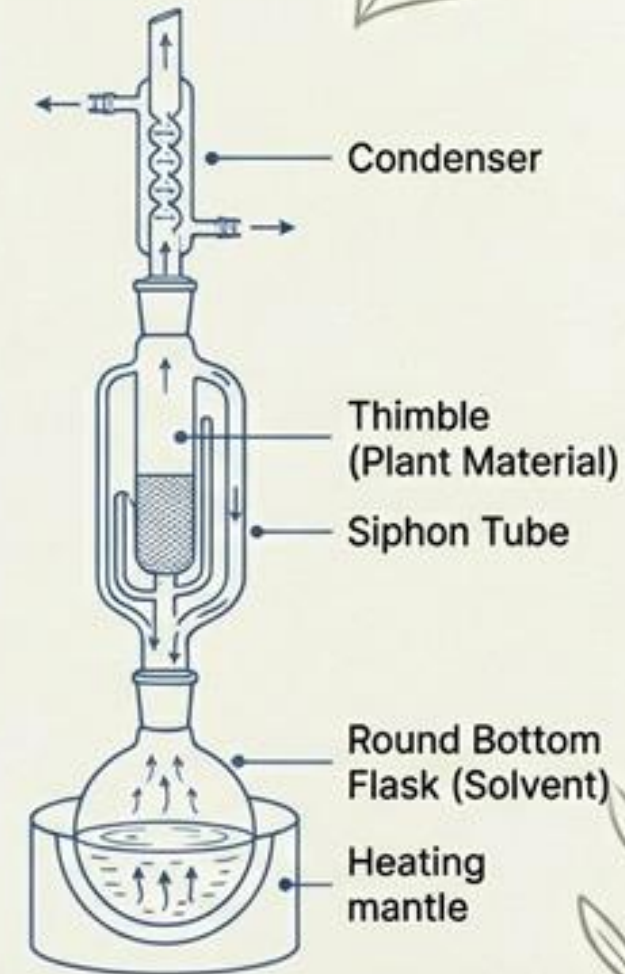
Most abundant alkaloid in black pepper.

Experimental Strategy: Continuous Hot Extraction

Objective: Isolate pure piperine alkaloid from *Piper nigrum* fruits.

Method: Continuous hot extraction.

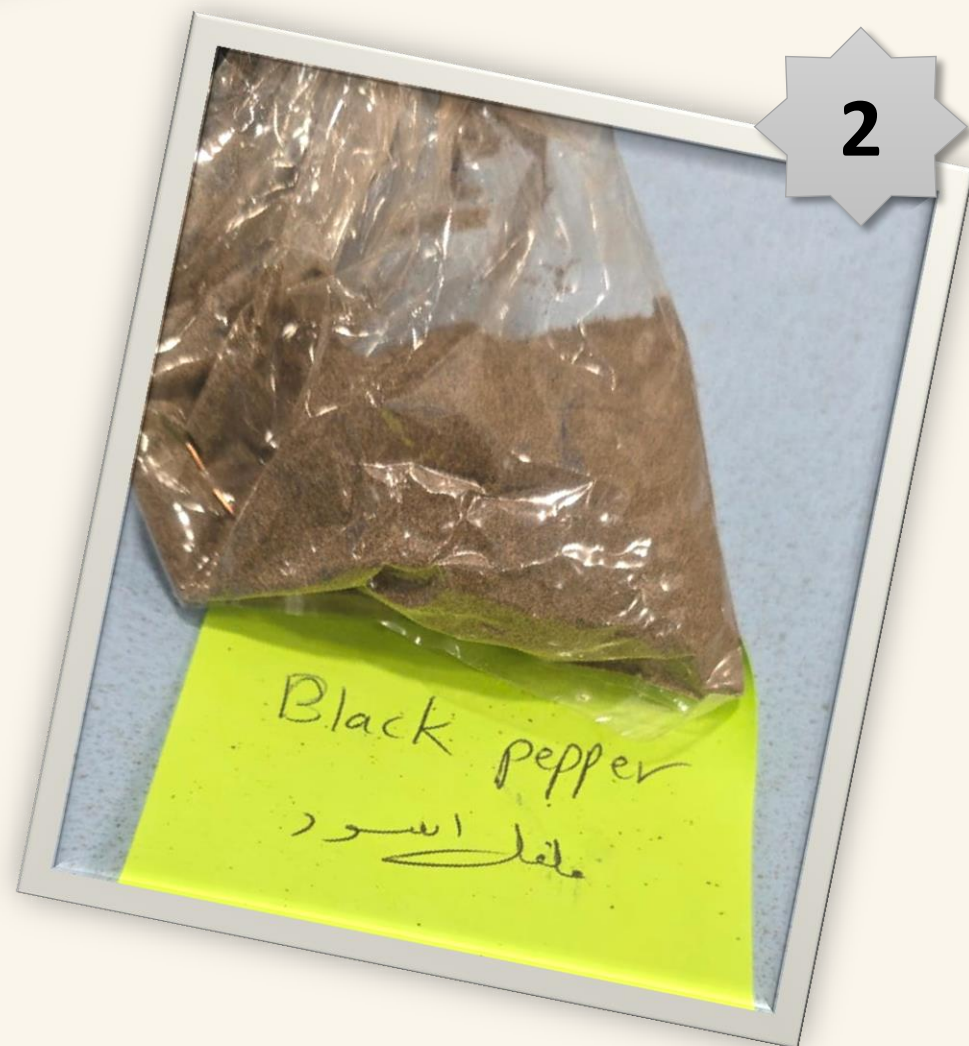
Rationale: Plant material is heat-sensitive. Direct boiling destroys the target compounds. The Soxhlet method allows efficient extraction with controlled heat exposure, recycling the solvent without overheating the solid bulk.



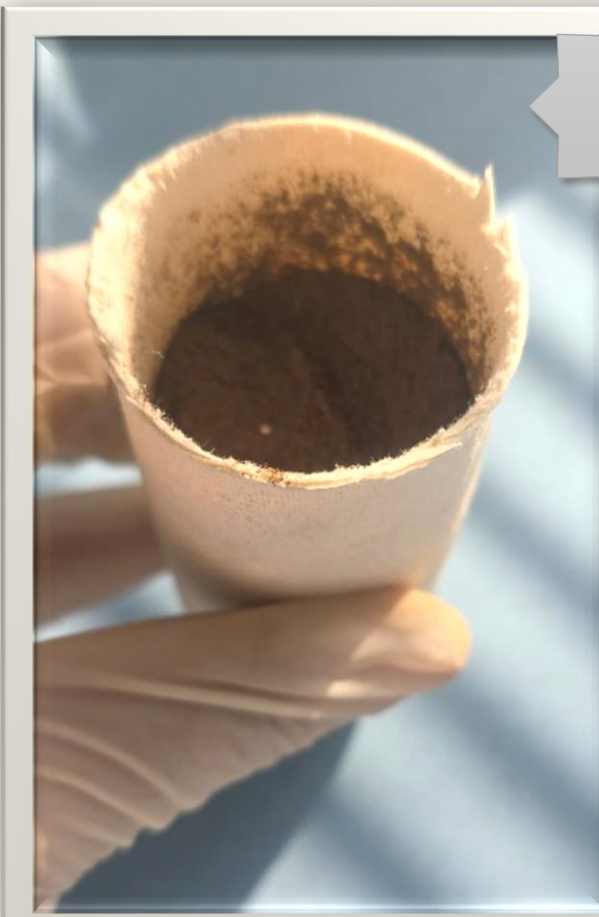
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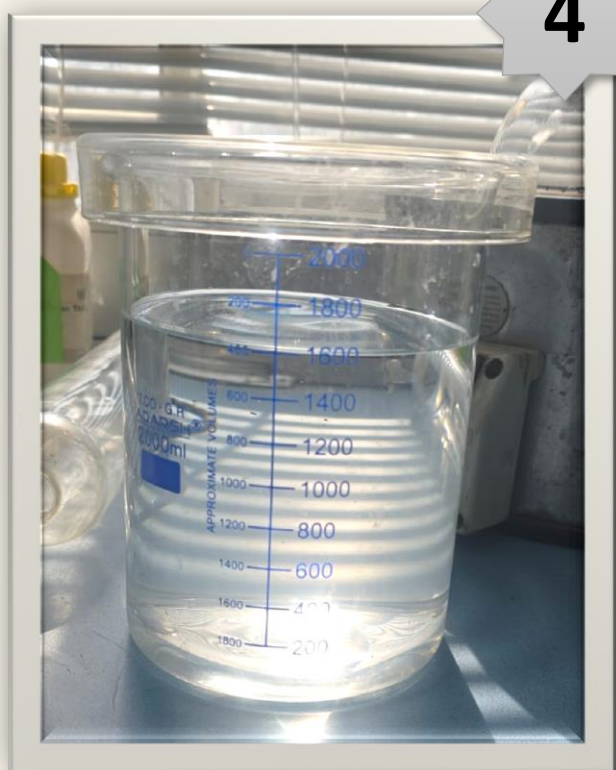
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Extraction solvent **90% Ethanol**

5



6



Heating
Mantle

Reagents & Solvents

Solvent: 90% Ethanol

Role: Extracts both the target alkaloid and alkaloidal salts present in the fruit matrix.



Precipitating Agent: 10% Alcoholic KOH

Role: Essential for the isolation phase to precipitate isomers and resins.



The Extraction Workflow



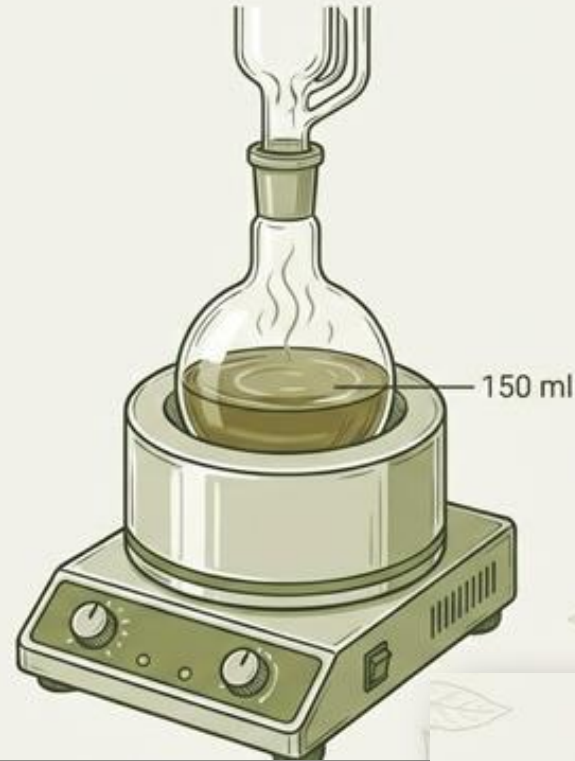
Step 1: Extraction

Input: 10 gm fine powdered Black Pepper.

Solvent: 150 ml of 90% Ethanol.

Duration: 2 Hours continuous reflux.

Action: Follow immediately with hot filtration to remove solid residue.



Step 2: Concentration

Apparatus: Water bath set to 60°C.

Procedure: Reduce volume via evaporation.

Initial Volume: 150 ml.

Target Volume: ~30 ml.

Constraint: Careful thermal control is required to prevent degradation of the alkaloids.



Step 3: Isolation & Precipitation



Reaction: Add 2 ml of 10% Alcoholic KOH to the 30 ml concentrate.

Condition: Leave mixture to stand overnight.

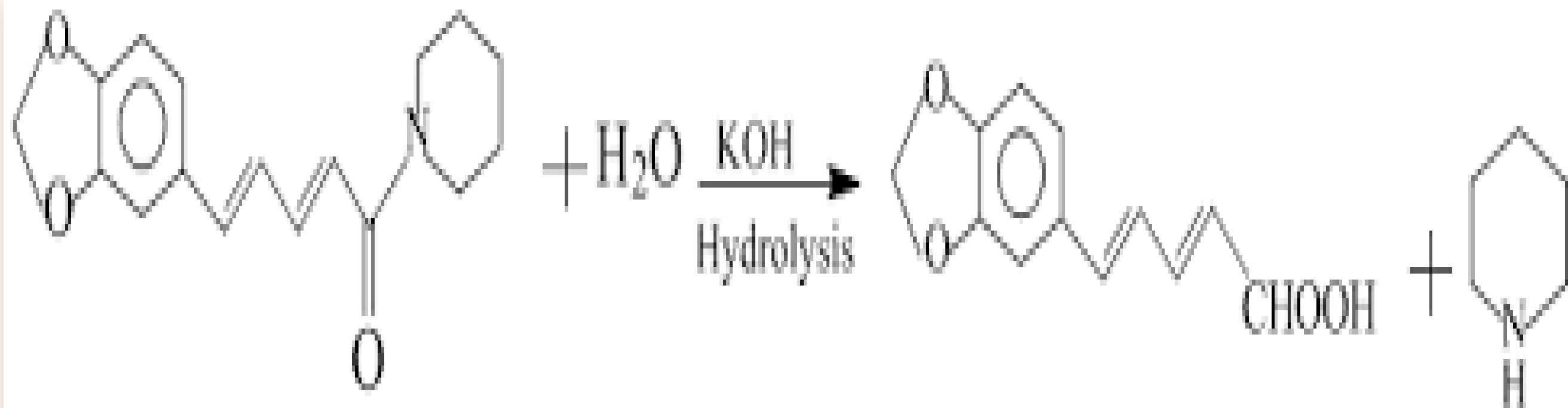
Result: Precipitation of impurities and crystallization of Piperine.

Critical Mechanism: The Risk of Hydrolysis

Why Alcoholic KOH instead of Aqueous KOH?



The presence of water causes the hydrolysis of the amide bond in Piperine, destroying the target molecule. Strictly anhydrous (alcoholic) conditions are required during the precipitation step to preserve the alkaloid structure.



Piperine (1)

Pipericacid

piperidine

Results & Identification

Final Yield: ~0.3 gm (from 10 gm source).

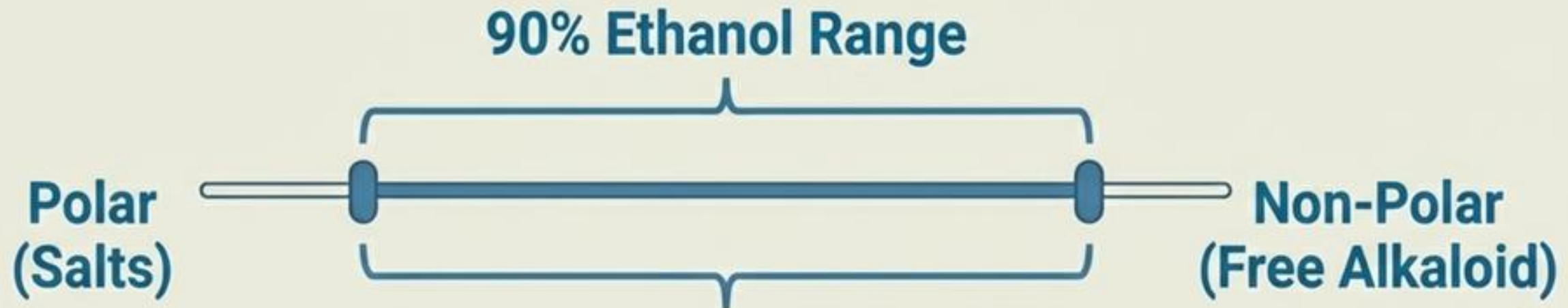
Melting Point: 125°C.



Fine Yellow Needles.

Discussion: Solvent Selectivity

Piperine is a solid weak base, essentially insoluble in water. The choice of 90% Ethanol acts as a 'bridge solvent'.



Ethanol extracts both alkaloidal salts and free alkaloids, optimizing yield before the specific precipitation step.

Discussion: Purification Logic

The addition of Alcoholic KOH is not merely for crystallization; it acts as a chemical filter.

Impurity Removal Profile



Isomers



Chuvacine & Isochuvacine (Precipitated)



Matrix



Acidic Resinous Material (Precipitated)



Target



Pure Piperine (Retained in crystal form)

Summary

- Source: *Piper nigrum* (Dried Black Pepper).
- Method: Soxhlet extraction with 90% Ethanol.
- Critical Control: Anhydrous conditions (Alcoholic KOH) to prevent hydrolysis.
- Identification: Yellow needle-like crystals with MP 125°C.
- Final Yield: 0.3g.



Active
Go to 5

End of Lab 1...Part 2

Thank you
for listening