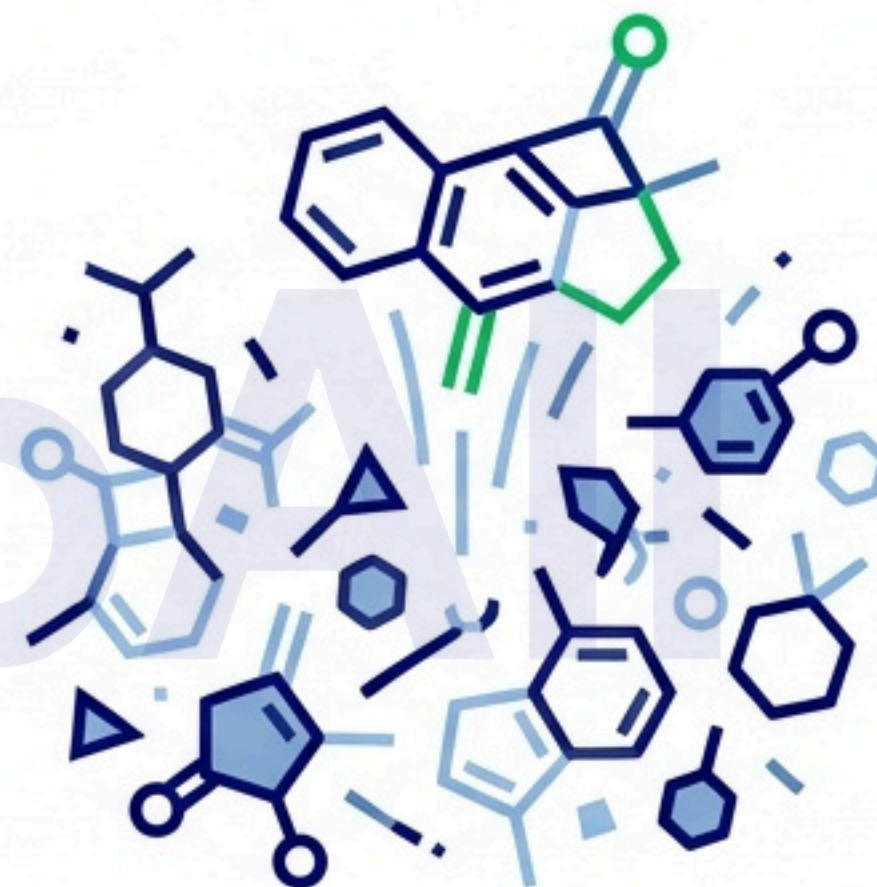


 Section 8.8

ORGANIC CHEMISTRY DASHBOARD

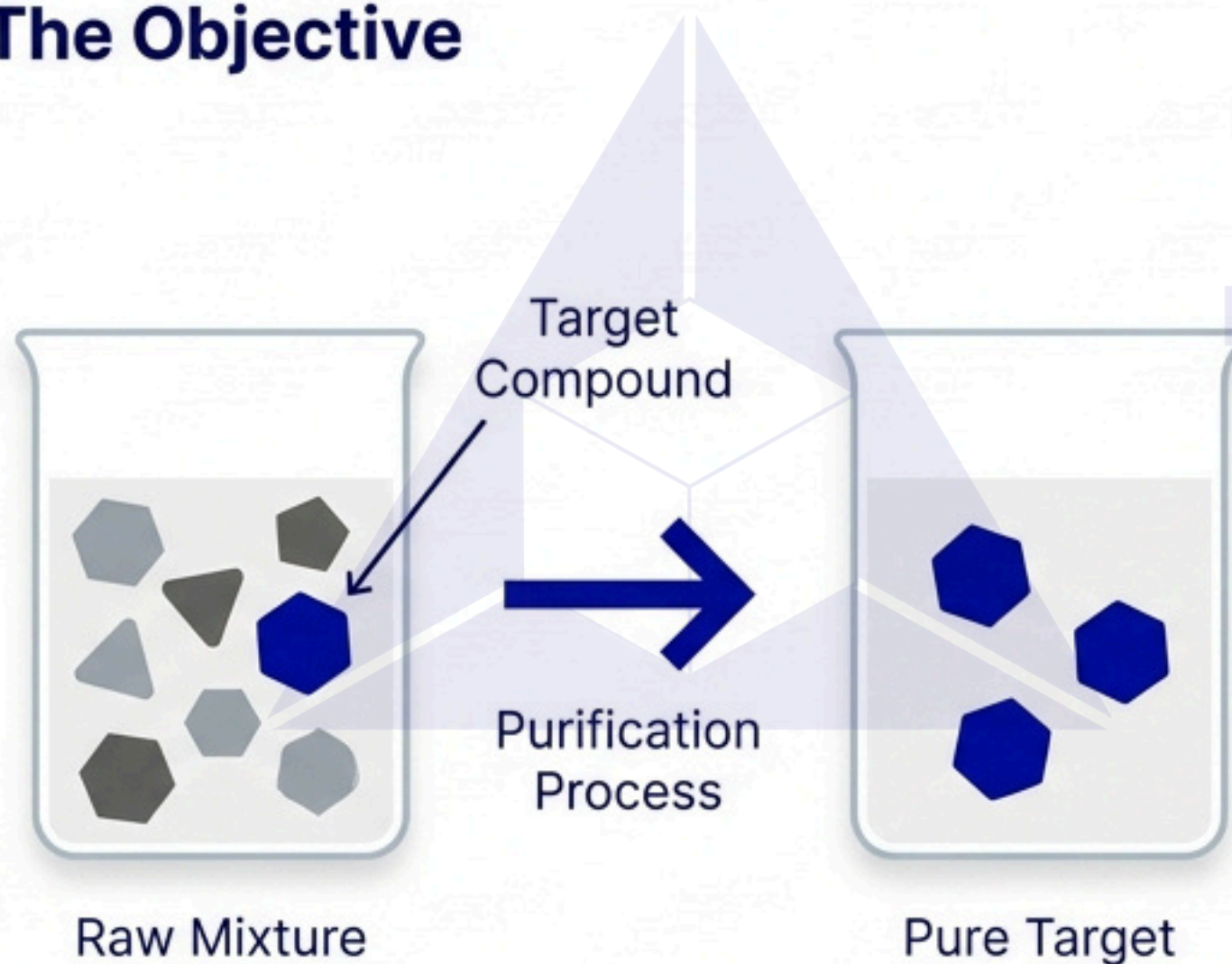
Isolating the Target

Core Principles and Techniques for the Purification of Organic Compounds

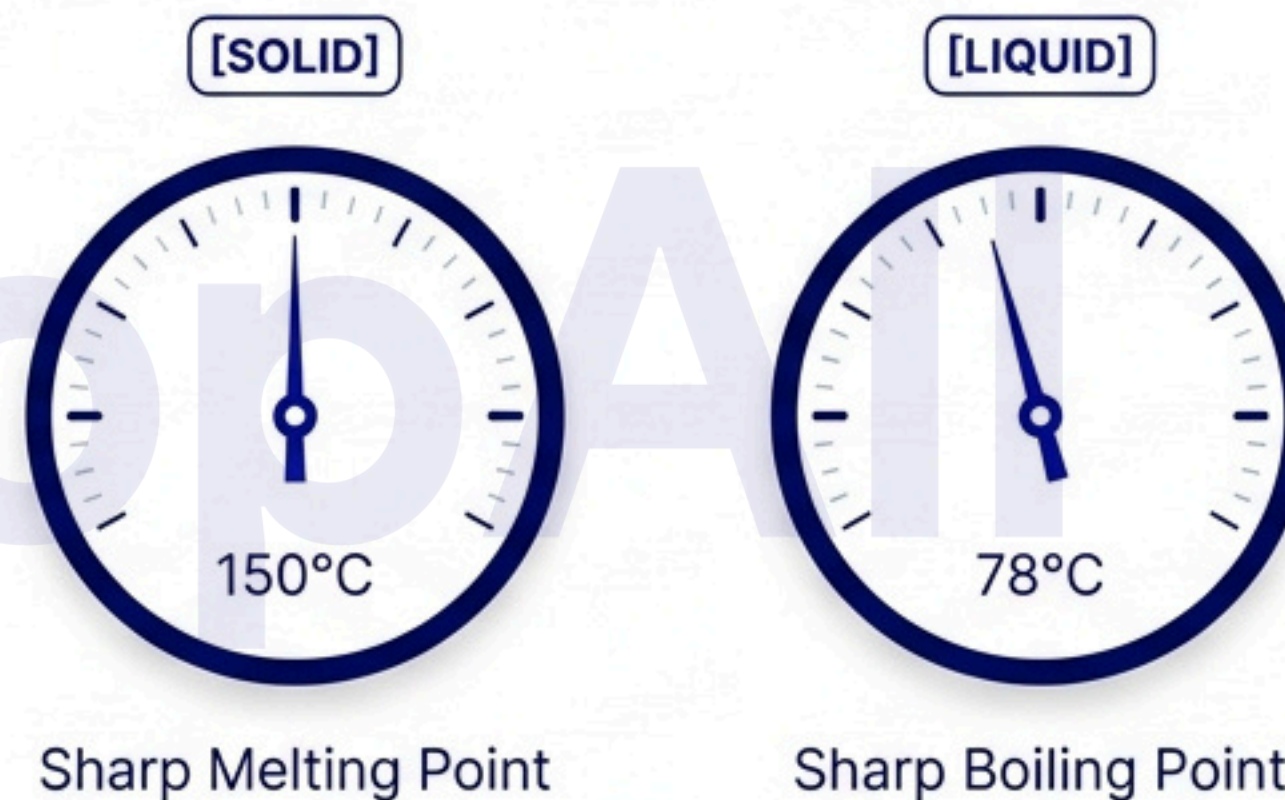


The Purity Diagnostic

The Objective



The Verification



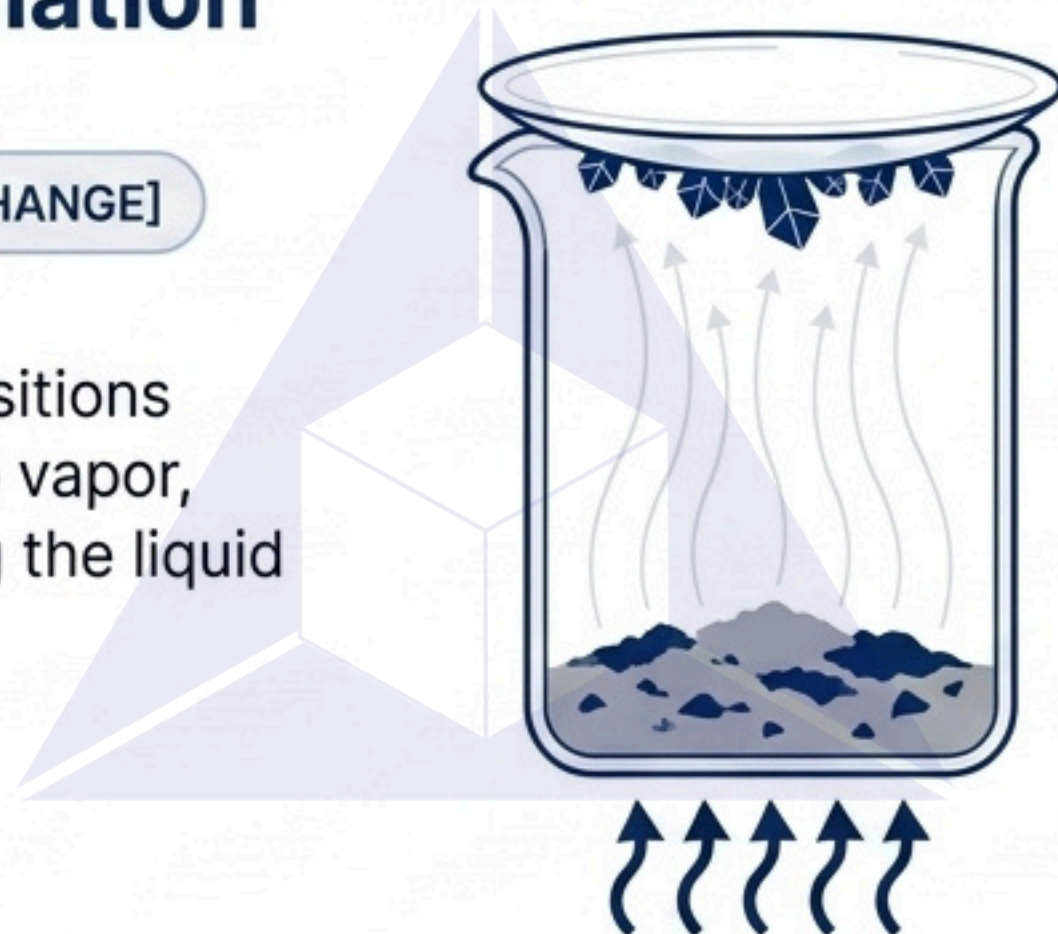
Pure compounds exhibit sudden, precise phase changes. A broadened melting or boiling range indicates remaining impurities.

Isolating Solids

Sublimation

[PHASE CHANGE]

Solid transitions directly to vapor, bypassing the liquid phase.

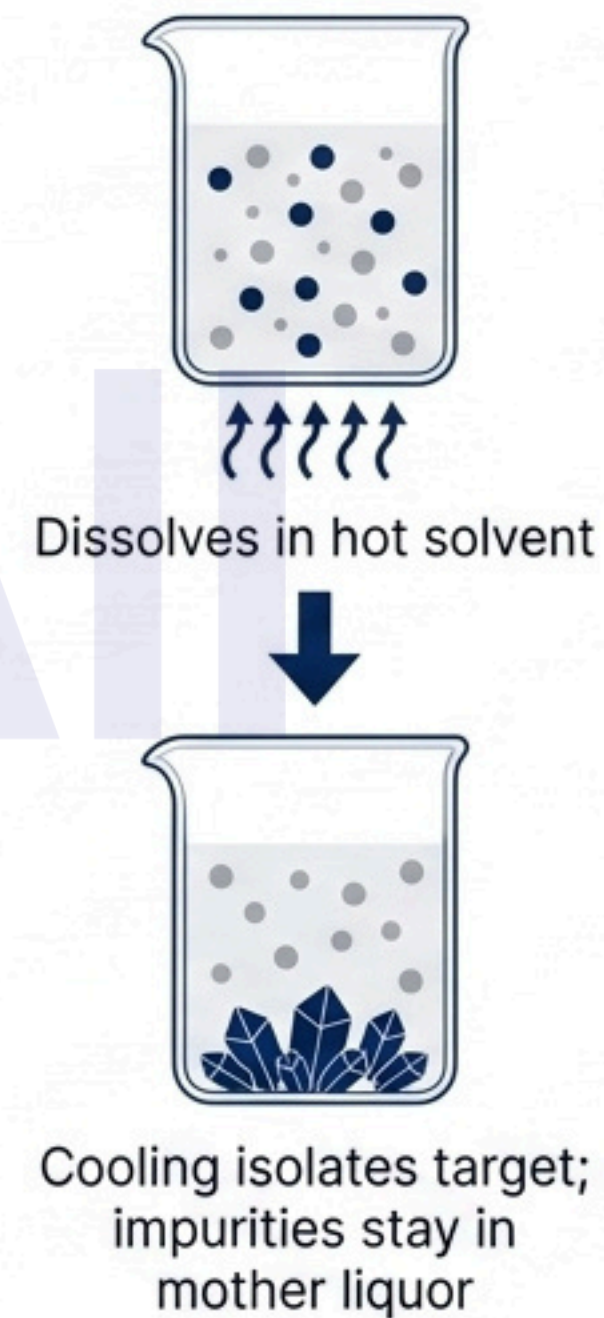


Use Case: Separating sublimable compounds from non-sublimable impurities.

Crystallisation

[DIFFERENTIAL SOLUBILITY]

Exploits solubility differences in a solvent at different temperatures.





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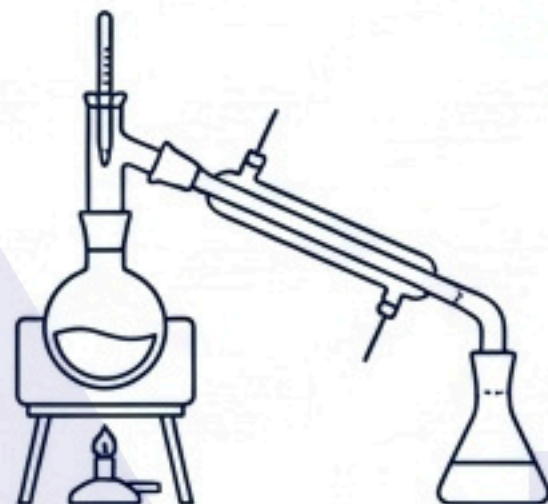


The Distillation Decision Matrix

Simple Distillation

Condition: Do the liquids have significantly different boiling points?

Vaporize the more volatile liquid, route through a condenser, collect pure liquid.

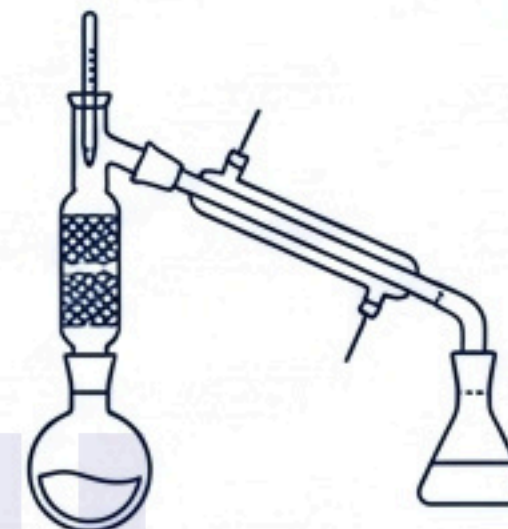


Fractional Distillation

Condition: Are the boiling points very close?

Interpose a fractionating column to provide theoretical plates for repeated condensation/vaporization.

Example: Crude oil refining

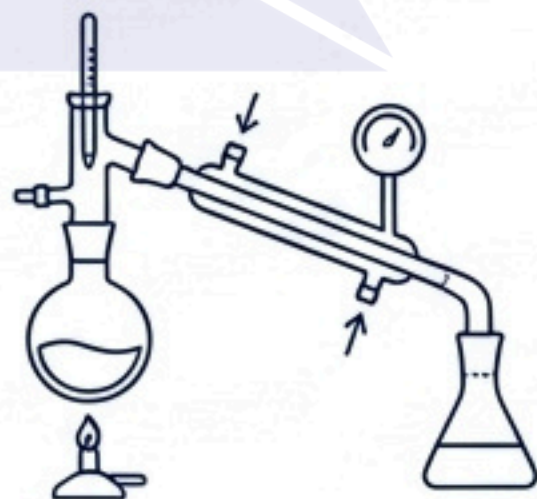


Reduced Pressure

Condition: Does the liquid decompose at or below its standard boiling point?

Lower the surface pressure to artificially lower the boiling point.

Example: Recovering glycerol from spent-lye

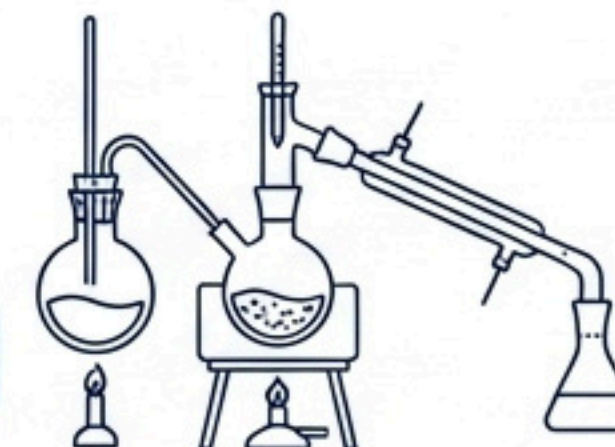


Steam Distillation

Condition: Is the substance steam volatile but immiscible with water?

Pass steam through mixture. Boils when $p_1 + p_2 = p_{\text{atm}}$.

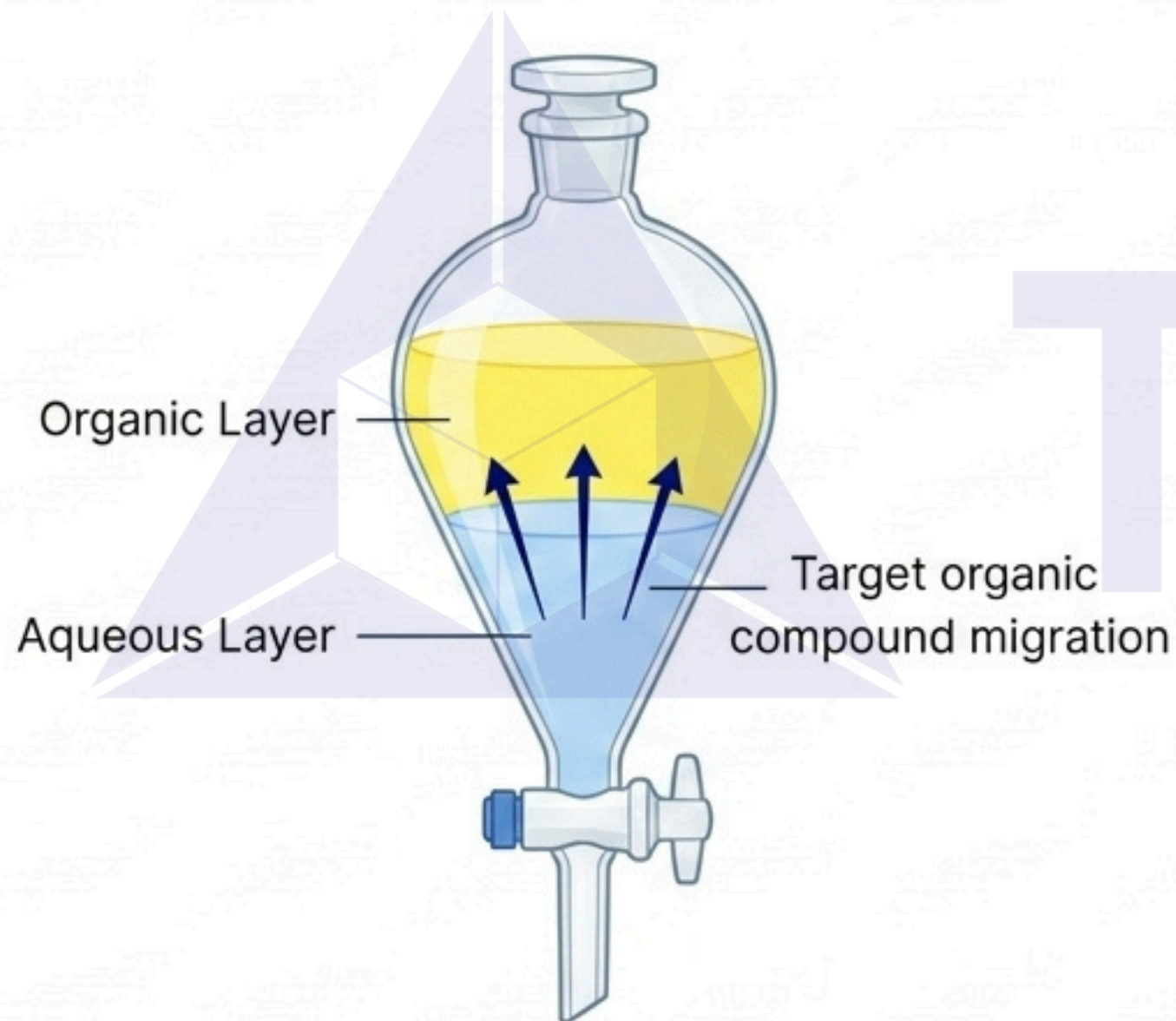
Example: Separating aniline from water



Solvent-Driven Extraction

[IMMISCIBLE LIQUIDS]

[PREFERENTIAL SOLUBILITY]

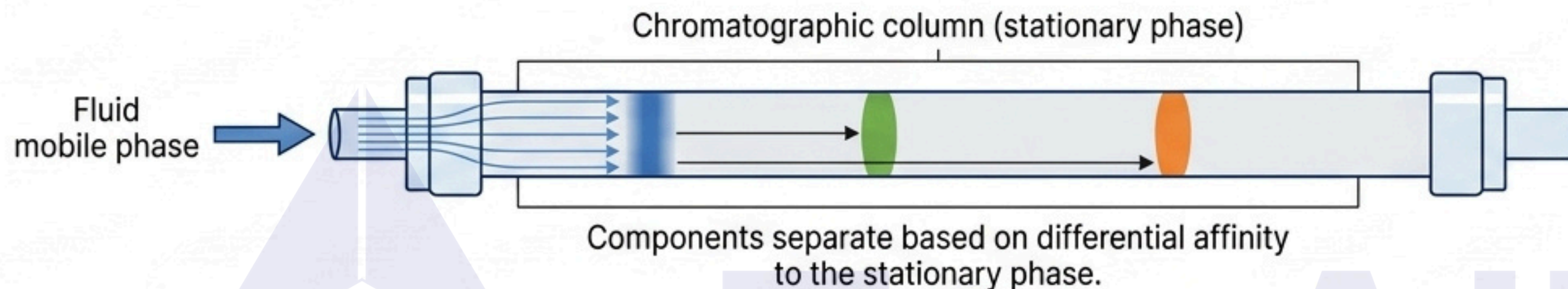


The organic compound is extracted because it possesses a higher solubility in the organic solvent than in the aqueous solution.



- Multiple continuous extractions yield higher purity than a single wash.

Chromatographic Profiling



The Matrix

Adsorption

Differential binding to solid stationary phase (e.g., Silica gel).

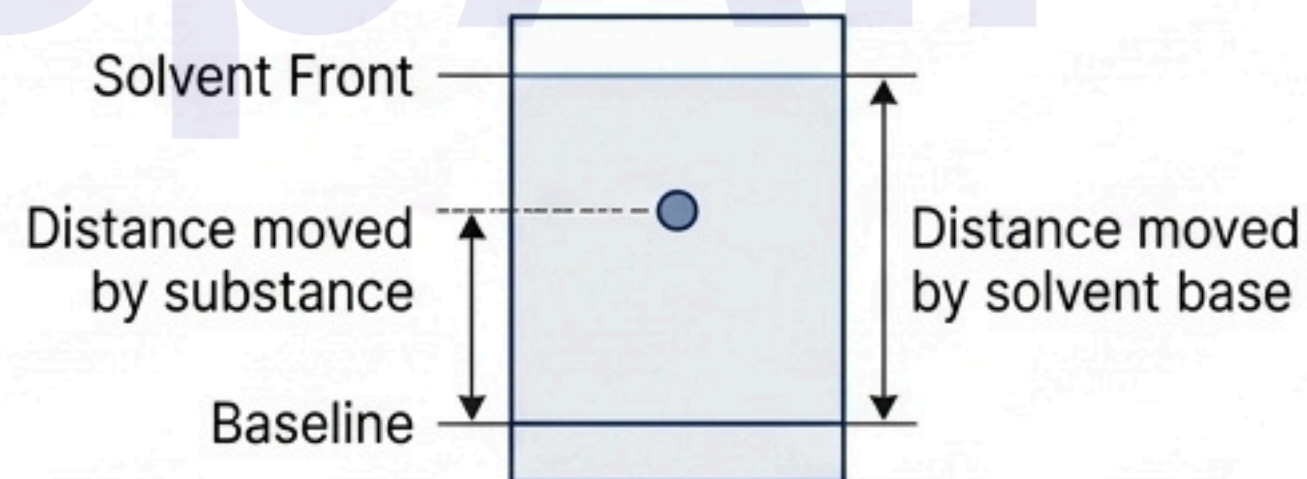
Forms: Column, Thin Layer (TLC).

Partition

Continuous differential partitioning between phases.

Form: Paper Chromatography.

The R_f Metric



$$R_f = \frac{\text{Distance moved by substance}}{\text{Distance moved by solvent base}}$$

The Master Separation Key

Method	Target State	Exploited Property	Key Identifier / Example
Sublimation	[SOLID]	Phase Change	Bypasses liquid state entirely
Crystallisation	[SOLID]	Temperature-Solubility	Hot solvent dissolves target; cooling isolates it
Simple Distillation	[LIQUID]	Boiling Point gap	Wide BP differences
Fractional Distillation	[LIQUID]	Boiling Point gap	Close BPs (Crude Oil)
Reduced Pressure	[LIQUID]	BP vs Decomposition	Decomposes at normal BP (Glycerol)
Differential Extraction	[LIQUID]	Preferential Solubility	Immiscible layers (Organic vs Aqueous)
Chromatography	[COMPLEX]	Differential Affinity	Adsorption/Partitioning (R_f value)



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