

PHARMACOGNOSY & PHYTOCHEMISTRY LABORATORY

Experiment 7 Examination: Extraction & Identification of Volatile Oils by TLC

Student

Name:

Student

ID:

Date:

Section /

Mark:

Instructions: Answer all 15 multiple-choice questions. Select the single best answer for each question and mark your choice clearly. Time allowed: 30 minutes. Total Marks: 15.

1. Essential oils (volatile oils) are primarily composed of which chemical class and their oxygenated derivatives?

- A) Glyceryl esters of fatty acids
- B) Terpenes and terpenoids
- C) Polycyclic aromatic hydrocarbons
- D) Amino acid derivatives

2. Terpene derivatives present in volatile oils are biosynthesized via which metabolic pathway?

- A) Shikimic acid phenylpropanoid route
- B) Acetate-mevalonic acid pathway
- C) Glycolytic pathway
- D) Citric acid cycle

3. Which characteristic property distinguishes volatile oils from fixed oils regarding paper testing?

- A) Volatile oils leave a permanent grease spot on paper
- B) Volatile oils do not leave a permanent grease spot on paper
- C) Fixed oils evaporate completely without leaving a trace
- D) Both volatile and fixed oils leave permanent translucent spots

4. Unlike fixed oils, volatile oils cannot undergo saponification with alkalies because they:

- A) Do not consist of glyceryl esters of fatty acids
- B) Are water-soluble liquid compounds
- C) Contain long-chain saturated aliphatic hydrocarbons
- D) Have an extremely basic pH level

5. Upon prolonged exposure to light and air, volatile oils undergo which chemical transformation instead of rancidity?

- A) Saponification and crystallization
- B) Oxidation and resinification
- C) Hydrolysis into glycerol and fatty acids
- D) Fermentation into alcohols

6. Why is steam distillation specifically preferred over simple/normal distillation for extracting essential oils?

- A) Steam raises the boiling point to increase extraction speed
- B) Essential oil compounds are heat-sensitive and thermally decompose at high temperatures
- C) Simple distillation requires non-polar organic solvents
- D) Steam distillation converts fixed oils directly into essential oils

7. In steam distillation, introducing water/steam affects the boiling points of the plant constituents by:

- A)** Depressing the boiling points, allowing evaporation below thermal decomposition temperature
- B)** Increasing the atmospheric pressure inside the apparatus
- C)** Raising the boiling points to ensure complete vaporization
- D)** Preventing the volatile compounds from evaporating

8. What is the fundamental physical principle behind chromatographic separations?

- A)** Difference in molecular weight only
- B)** Distribution / partition coefficient between two immiscible phases
- C)** Gravitational settling rate of particles
- D)** Chemical oxidation rates of the solute

9. In Thin Layer Chromatography (TLC) using silica gel plates, what are the characteristics of the stationary and mobile phases?

- A)** Non-polar stationary phase, highly polar mobile phase
- B)** Polar solid stationary phase (silica gel), liquid mobile phase (solvent)
- C)** Gaseous stationary phase, liquid mobile phase
- D)** Liquid stationary phase, solid mobile phase

10. On a silica gel TLC plate, how does the polarity of a compound affect its movement up the plate?

- A)** More polar compounds have higher affinity for silica gel, moving slower and staying lower
- B)** More polar compounds move faster and reach the top first
- C)** Polarity has no influence on the speed or distance traveled
- D)** Non-polar compounds bind strongly to silica gel and do not move at all

11. How is the Retention Factor (R_f) defined in TLC analysis?

- A)** Distance traveled by solvent front $\div$ Distance traveled by spot
- B)** Distance traveled by compound spot $\div$ Distance traveled by solvent front
- C)** Total mass of sample applied $\div$ Mass of silica adsorbent
- D)** Concentration of reference sample $\div$ Concentration of test sample

12. Which reference standard is correctly matched with its plant source according to the laboratory protocol?

- A)** Anise fruit — Eugenol
- B)** Clove flower — Anethole
- C)** Thyme leaves — Thymol
- D)** Coriander — Eugenol

13. What solvent system ratio and composition are specified for running the TLC plate in Experiment 7?

- A)** Hexane : Ethanol (50 : 50)
- B)** Toluene : Ethyl acetate (93 : 7)
- C)** Chloroform : Methanol (80 : 20)
- D)** Water : Acetone (90 : 10)

14. What visualization spraying reagent is utilized to detect the volatile oil spots on the TLC plate?

- A)** Ninhydrin reagent
- B)** Vanillin / Sulfuric acid reagent
- C)** Iodine vapor solution
- D)** Potassium permanganate

15. If a sample applied on a TLC plate is too concentrated and produces "streaking" spots, what corrective action must be taken?

- A)** Increase the temperature of the developing chamber
- B)** Re-run the plate with a more dilute sample
- C)** Spray more vanillin/sulfuric acid before running
- D)** Use a non-polar solvent system with higher ethyl acetate

ANSWER KEY & EXPLANATIONS

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Q#	CORRECT ANSWER	TOPIC / EXPLANATION
1	B	Most essential oils are primarily composed of terpenes and their oxygenated derivatives (terpenoids).
2	B	Chemical constituents of volatile oils are divided into terpene derivatives (acetate-mevalonic acid pathway) and aromatic compounds (shikimic acid route).
3	B	Volatile oils evaporate rapidly and do not leave a permanent grease spot on paper, unlike fixed oils.
4	A	Volatile oils do not consist of glyceryl esters of fatty acids; hence, they cannot be saponified with alkalies.
5	B	Volatile oils do not become rancid like fixed oils; instead, exposure to light and air causes them to oxidize and resinify.
6	B	Steam distillation is used for heat-sensitive organic compounds that tend to decompose at high sustained temperatures.
7	A	Adding water/steam depresses the boiling points of the compounds, enabling distillation below thermal deterioration temperatures.
8	B	Chromatography relies on the distribution/partition coefficient of a compound equilibrium between two immiscible phases.
9	B	TLC is an adsorption technique using a solid polar stationary phase (silica gel or alumina) and a liquid mobile phase (solvent).
10	A	More polar molecules have a stronger affinity for the polar silica gel, spending less time in the mobile phase and moving more slowly.
11	B	$R_f = \frac{\text{Distance traveled by solute spot}}{\text{Distance traveled by solvent front}}$.
12	C	Thyme leaves correspond to Thymol. (Clove = Eugenol, Anise = Anethole, Coriander = Linalool).
13	B	The solvent system specified in the protocol is Toluene : Ethyl acetate in a ratio of (93 : 7).
14	B	The visualization spraying reagent used for TLC in this experiment is Vanillin / Sulfuric acid.
15	B	Overly concentrated samples cause spot streaking; the standard protocol requires diluting the sample and re-running the TLC plate.