

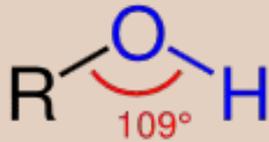
# Essential Oils: Storage Practices to Maintain Quality



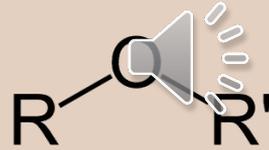
Jim Todd  
Industrial Crop Specialist

# Essential Oils

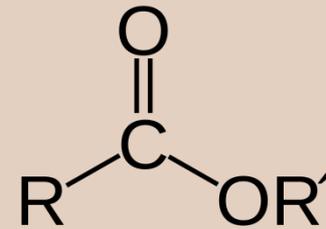
- Plant derived essential oils are complex mixtures of **volatile** aromatic compounds that impart the unique fragrance and flavour characteristics to the plant.
- Some of the main constituents found in essential oils:



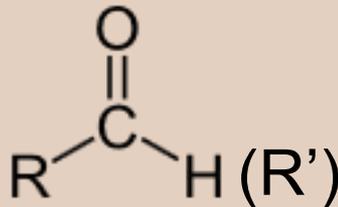
**Alcohols**



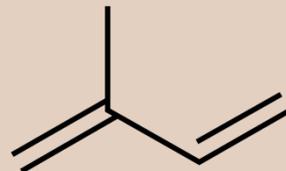
**Ethers**



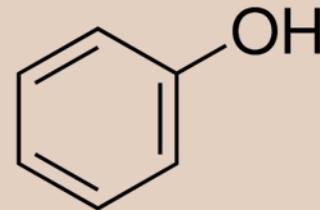
**Esters**



**Aldehydes &  
Ketones**



**Terpenes**



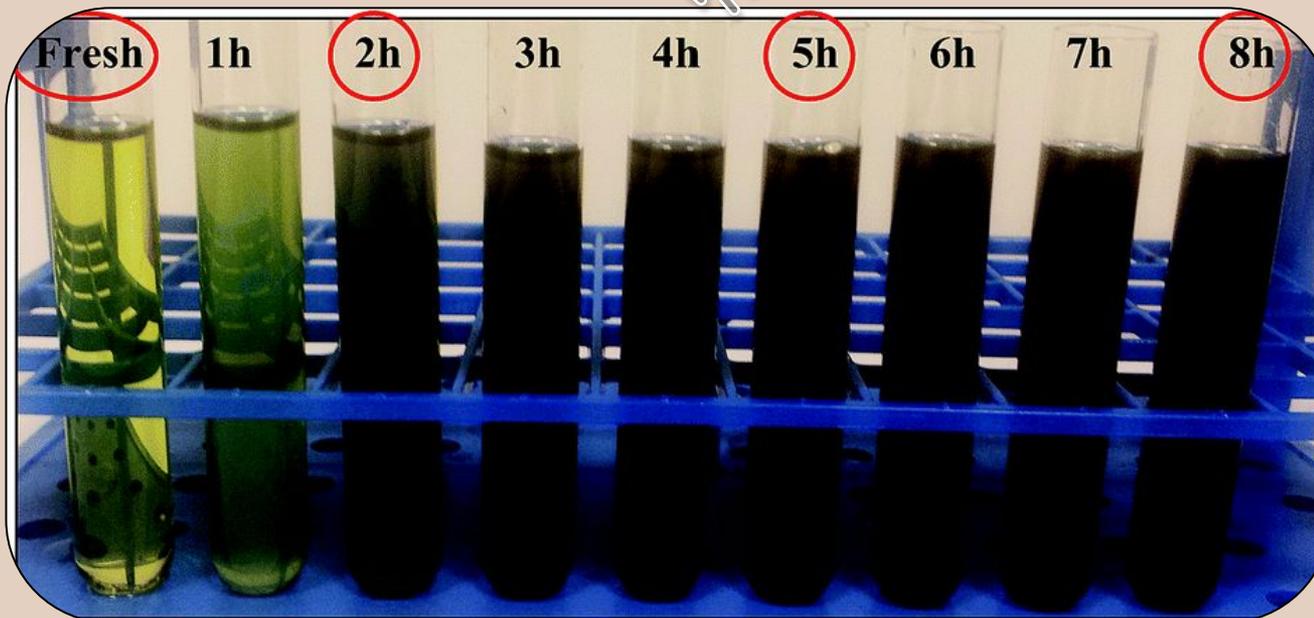
**Phenols**

# Hydrosol (hydro=water, sol=solution)

- Aqueous component of the distillation process
  - <1% essential oil (micro droplets) + other water soluble plant compounds
- Other names include:
  - Hydrolate (hydro=water, lait=milk)
  - Herbal water
  - Floral water (technically from the distillation of flowers)
  - Essential water

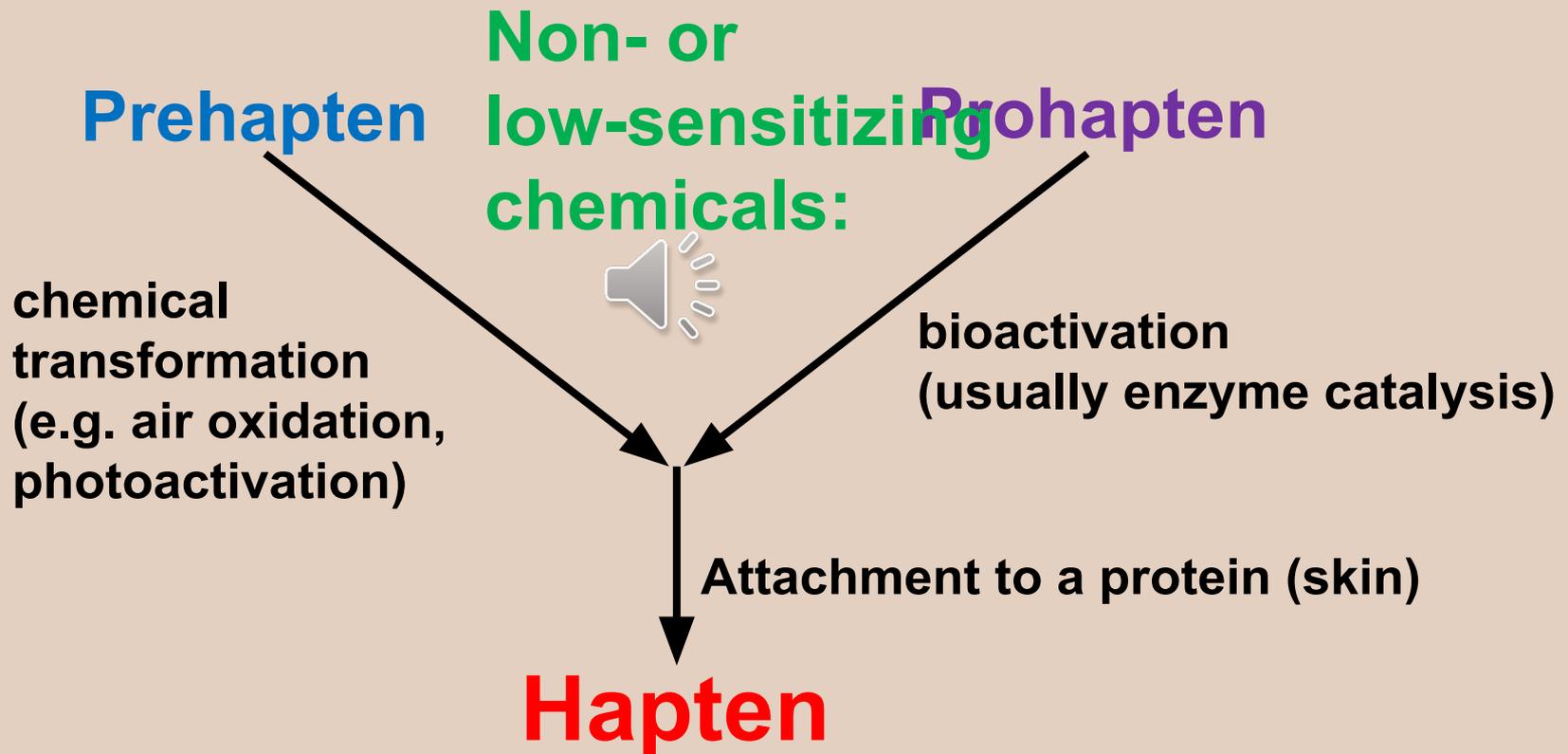
# Why is Essential Oil Stability Important

- Oil Degradation can result in:
  - Formation of unpleasant and/or pungent odours
  - Changes in oil colour
  - Changes in oil consistency
  - Formation of chemicals that may cause skin sensitivity

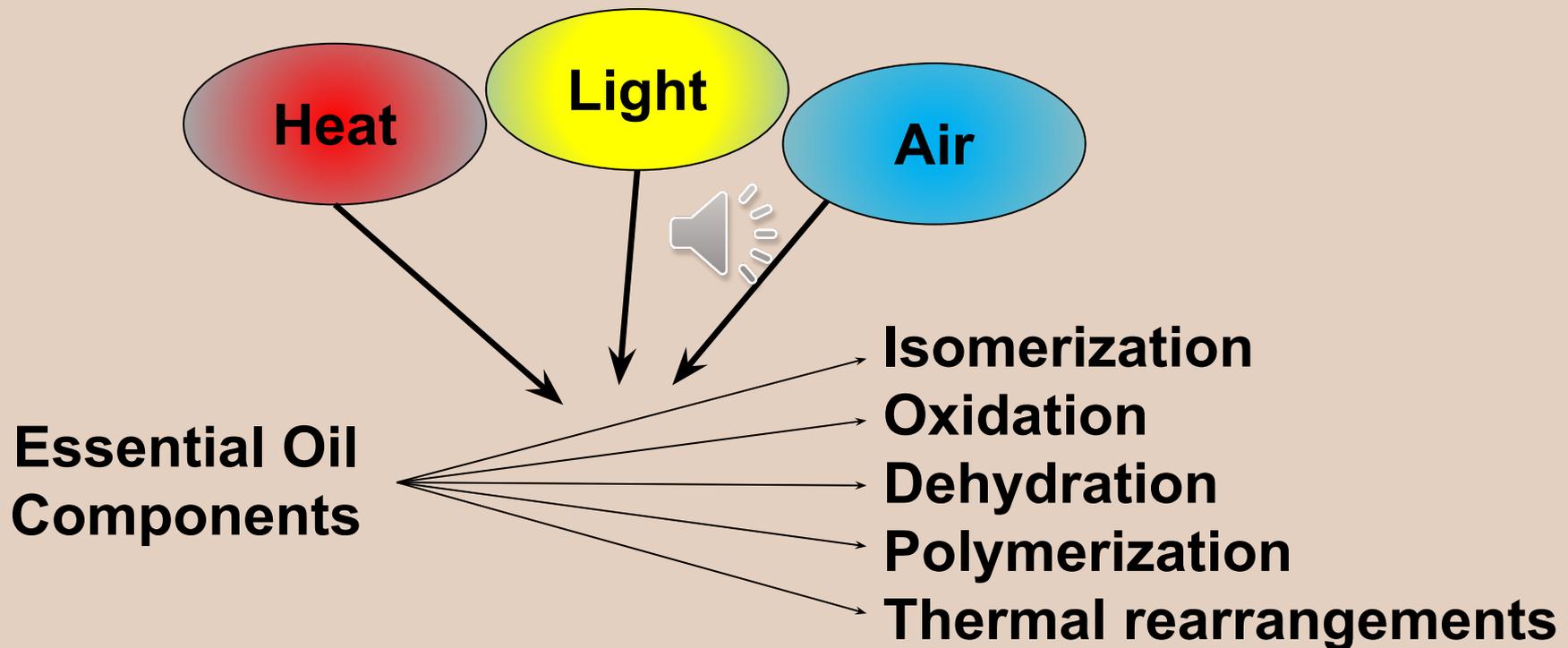


# Fragrance Allergens Act As Haptens

- Small chemicals that are immunogenic only when attached to a carrier protein.



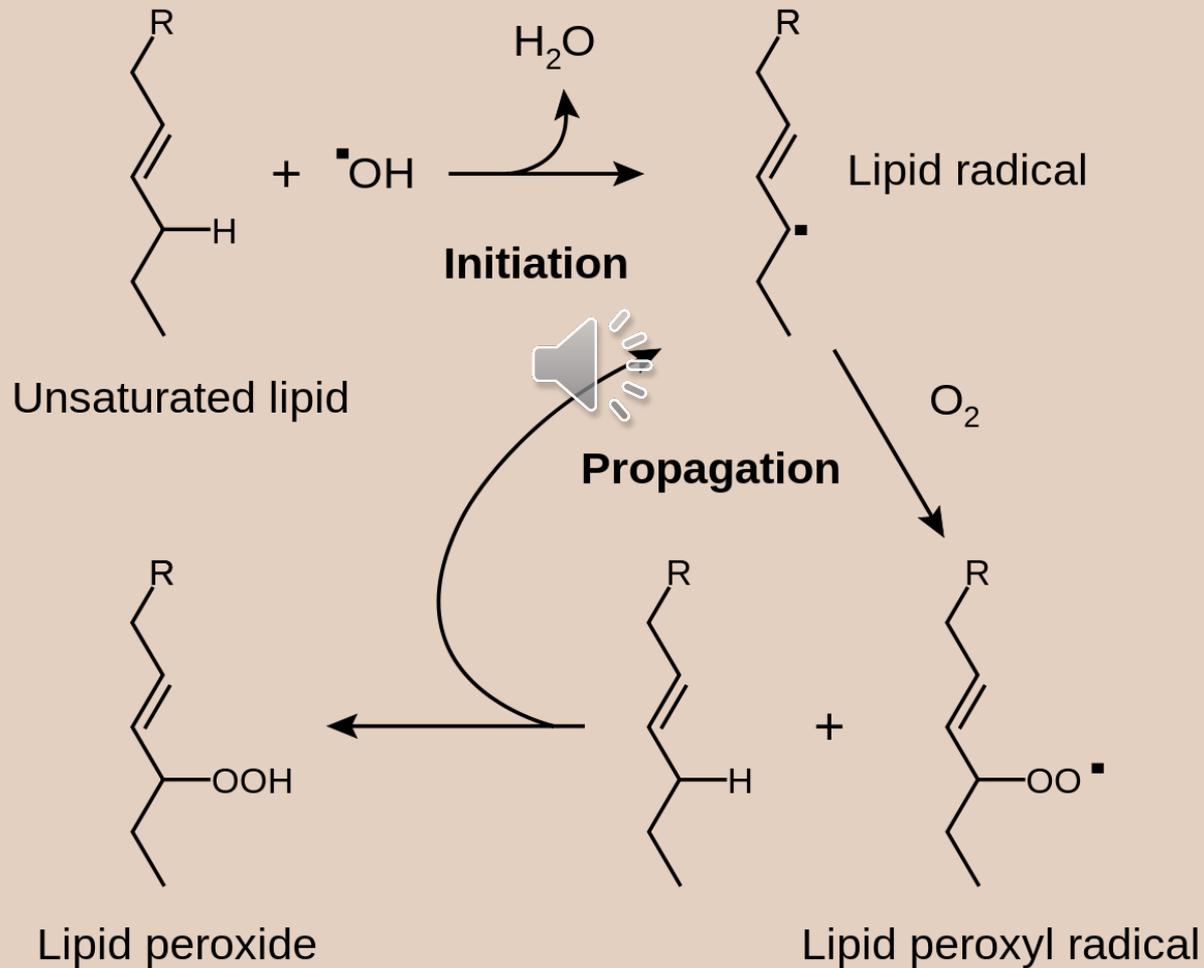
# Factors Influencing Essential Oil Stability



# What is Oil Oxidation?

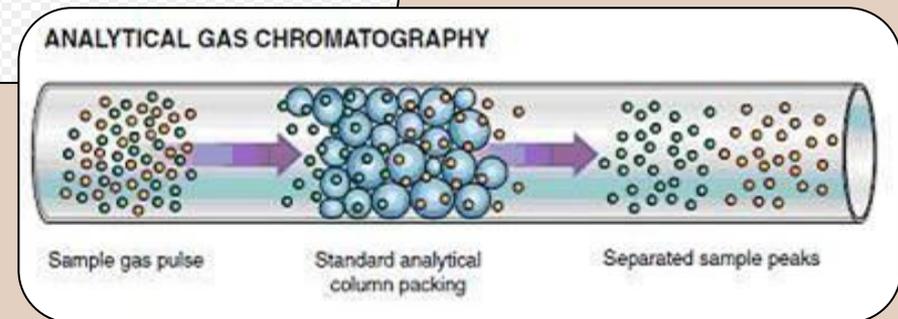
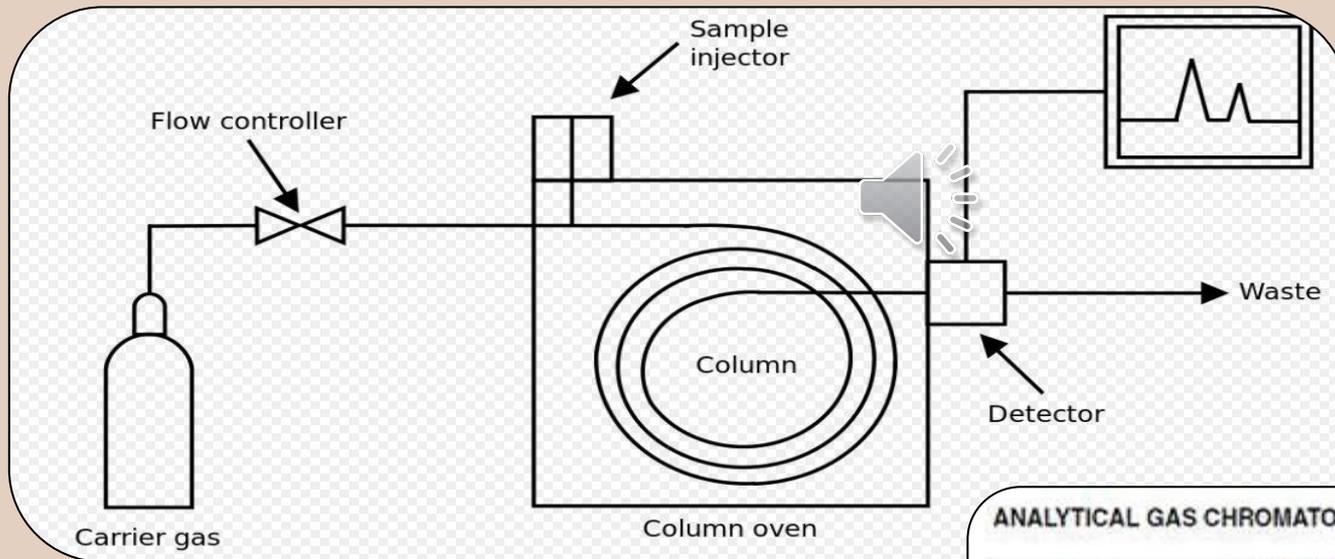
- A complex, undesirable series of chemical reactions involving oxygen that produces a series of breakdown products which degrade the quality of an oil.
  - produces rancidity in oil, with accompanying off flavours and smells.
- Oxidation progresses at different rates depending on:
  - temperature, light, availability of oxygen, the presence of moisture and metals (such as iron) and the type of oil (saturation level)

# Lipid Peroxidation

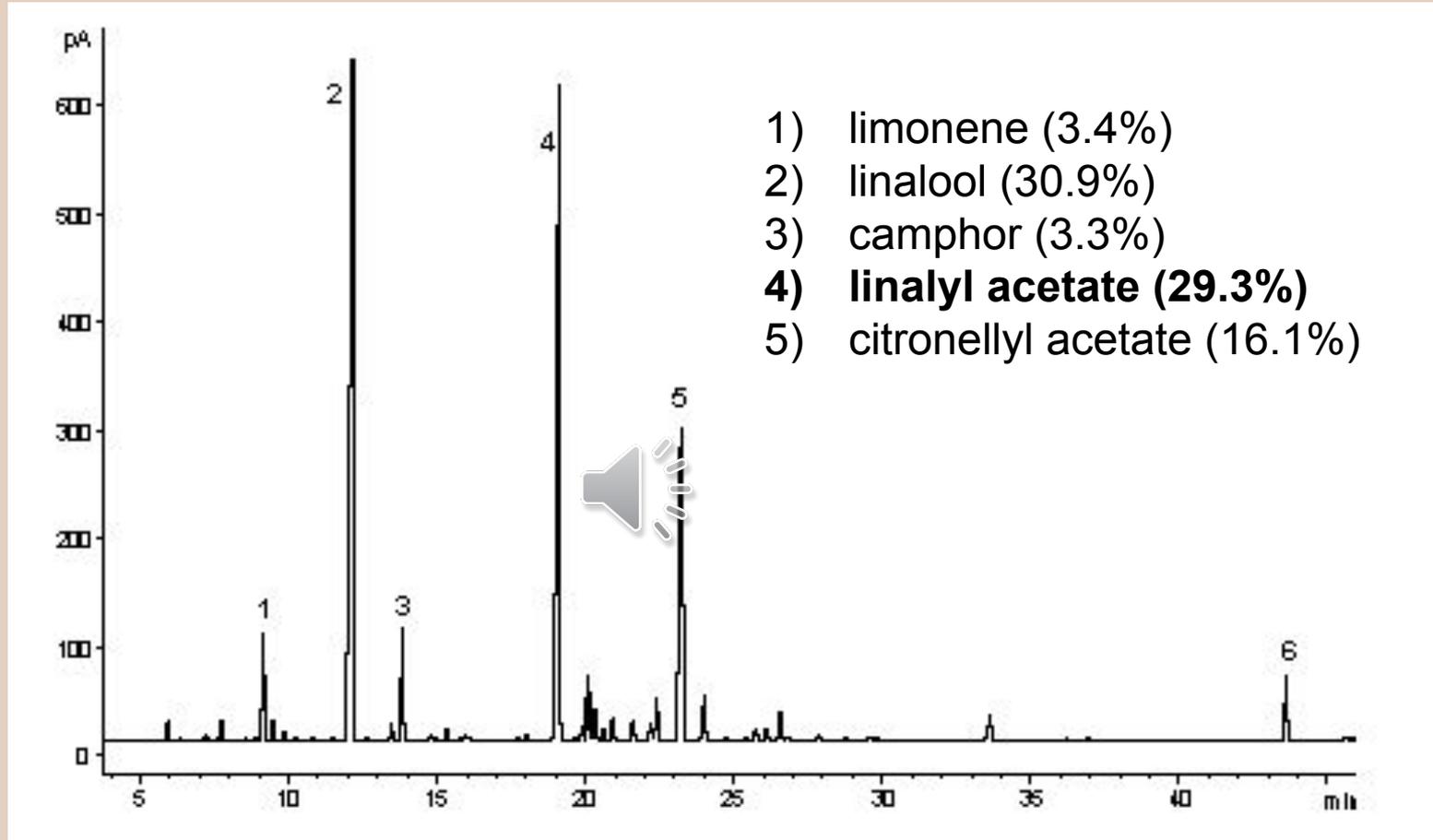


# Assessing Quality via Gas Chromatography

- Quality is assessed by separating and measuring each chemical component in the sample



# GC/MS Analysis of True (Garden) Lavender Essential Oil



*Lavandula officinalis* Chaix (= *L. angustifolia* Mill.)

Image courtesy International Centre of Science and High Technology, UNIDO

# Other Quality Measurements

- Peroxide value (POV)

- The Peroxide Value measures the concentration of peroxide, which is a product of oxidation, and is useful for determining the level of rancidity in unsaturated fats and oils
- Peroxide values of fresh oils are less than 10 milliequivalents/kg; when the peroxide value is between 30\* and 40 milliequivalents/kg, a rancid taste is noticeable.

- pH

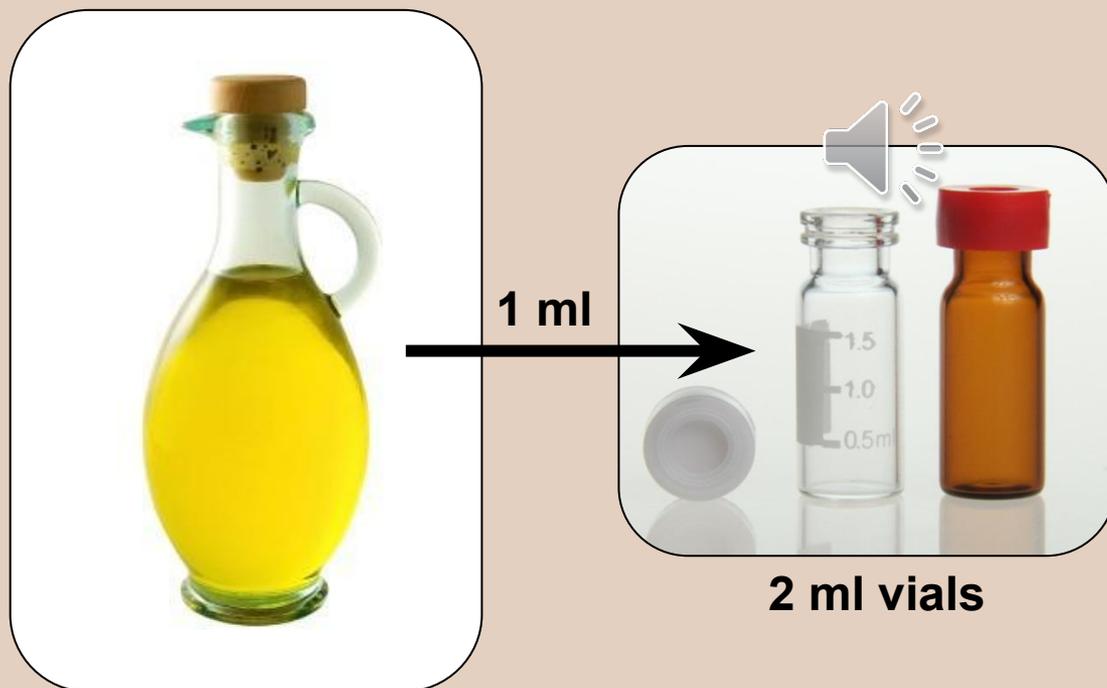
- Formation of acidic oxidation products reduces pH

- Conductivity

- Changes in conductivity due to volatile organic acid secondary oxidation products in fatty oils

# Impact of different storage conditions on the quality of selected essential oils

- Claudia Turek, Florian C. Stintzing
  - Food Research International 46(2012):341-353

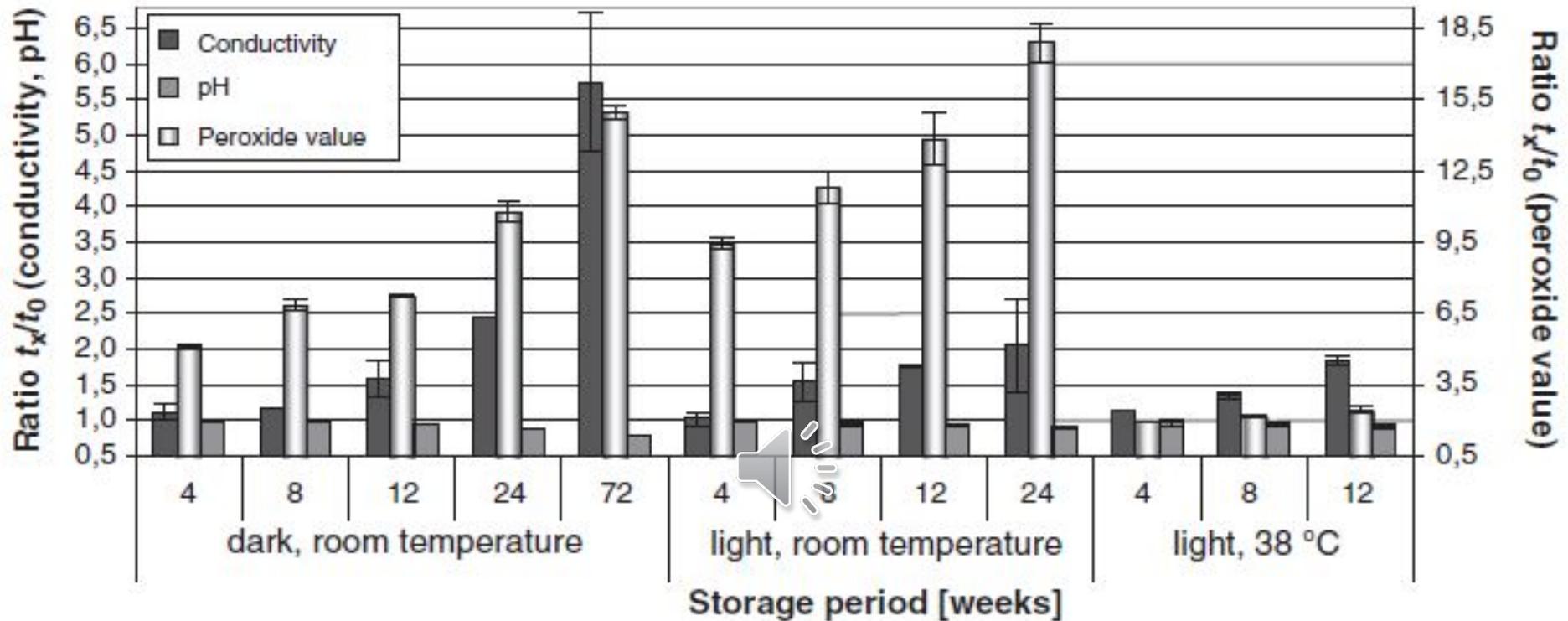


**Control: Dark bottles, 23°C in the dark for 72 weeks**

**Tests: Clear bottles, 23°C in 24h light for 24 weeks or 38°C in 24h light for 12 weeks**

**Lavender oil**

(flowering tops of *Lavandula angustifolia* MILL., Lamiaceae, Vigalex, Sofia, Bulgaria)



## Broad Conclusions

1. Peroxide Value increases with storage time and temperature
2. pH decreases with time and temperature
3. Conductivity increases with time and temperature

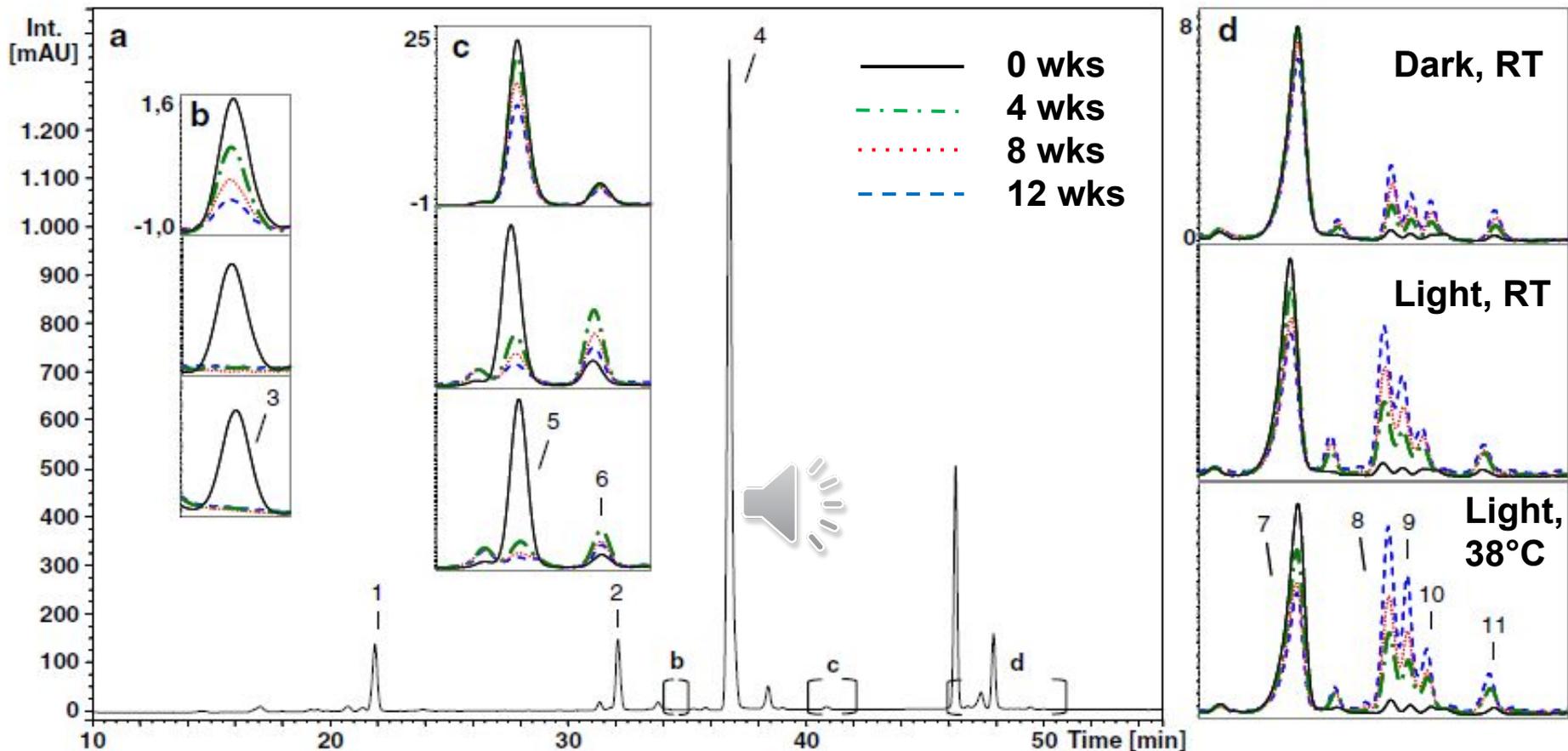
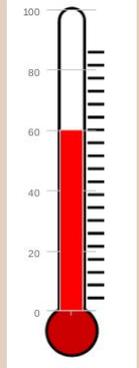


Fig. 7. a) HPLC fingerprint of essential oil from lavender at 220 nm (dilution 1:500). Detailed sections from b) 34.3–35.0 min (280 nm), c) 40.2–42.2 min (250 nm), d) 46.0–51.0 min (280 nm); b–d) solid line at starting point, dotted-dashed line after 4 weeks, dotted line after 8 weeks, scattered line after 12 weeks of storage (upper: dark, room temperature; middle: light, room temperature; lower: light, 38 °C). Peak assignment of characteristic compounds: 1 linalool, 2 linalyl acetate, 3 not identified, 4 ocimene, 5–11 not identified.

# Preventing Oxidation

- Temperature
  - One of the main contributing factors of oxidation in oil.
  - Reduce temperature to the lowest possible level throughout the processing, packaging, storage and shipping stages.
- Oxygen exposure (in the air)
  - a catalyst for production of free radicals.
  - seal all containers with the smallest possible headspace, reduce the area of the oil in contact with air and/or cover the oil with an inert gas (like nitrogen) at all possible points.
- Light (UV) can trigger the oxidative degenerative cascade.
  - Reduce the exposure of the oil to direct light by using brown glass/plastic containers or black plastic bags.



# Preventing Oxidation

- Moisture in combination with these other factors can accelerate oxidation.
  - If possible limit the amount of water in the oil to less than 0.2%.
- Transition metals, in particular transition metals like iron (and copper), can act as pro-oxidants.
  - If possible, you may need to change equipment (e.g. no brass valves), limit time in contact with and/or remove transition metals from the oil to reduce oxidation.



# A Few Words on Salt

- Pure salt will only absorb water at relative humidity levels greater than about 75%
- Mineral impurities in common salt (e.g. magnesium chloride) are very hygroscopic (water loving)
- Common salt absorbs water until it completely dissolves.
  - More salt = more water removal
- Other options include:
  - Anhydrous silica
  - Anhydrous sodium sulphate
  - Anhydrous magnesium sulphate



# Magnesium Sulphate Heptahydrate

- Commonly referred to as Epsom Salts
- Drying to remove the water yields anhydrous  $\text{MgSO}_4$
- $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}_{(s)}$



# Optimum Storage Conditions



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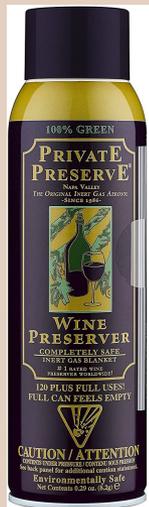


(if needed)

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# Contact Information

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