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| **Name of the project:** | **Digitization of chemistry experiments to improve the quality and support chemistry teaching in secondary schools** |
| **Acronym:** | **ChemIQSoc** |
| **Project number:** | **2021-1-SK01-KA220-VET-000027995** |

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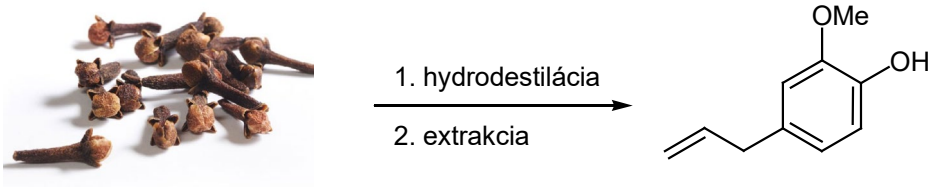
# Tittle: Preparation of eugenol

## Work instructions

**Task:** Isolate crude eugenol (4-allyl-2-methoxyphenol) from cloves.

### Theory

Steam distillation of dried clove buds (*Syzygium aromaticum*) provides a hydrodistillate from which crude natural eugenol is isolated by extraction.




**Equipment:** laboratory stands, distillation flasks, adapters, thermometer, condenser, cooling water inlet and outlet hoses, allonge, separating funnel, Erlenmayer flasks with stopper, funnel, filter paper, rotary vacuum evaporator (rotavap)

**Chemicals:** dichloromethane, hydrochloric acid (35%), sodium hydroxide

### Procedures:

1. **All work is carried out with safety goggles!**

*Isolation of eugenol by steam distillation*

1. Set up the apparatus for steam distillation, put crushed cloves (5 g) in the distillation flask, turn on the water heating and cooling in the condenser. Collect the hydrodistillate in a collecting vessel until it is clear.
2. Transfer the hydrodistillate to an extraction funnel and extract with 3 × 30 ml of dichloromethane ($CH_2Cl_2$). Wash the combined organic layers with 2 × 30 ml of 10% aqueous NaOH, acidify the combined aqueous layers with 35% HCl and re-extract with 2 × 30 ml of $CH_2Cl_2$. Dry the combined organic layers with anhydrous sodium sulfate ($Na_2SO_4$), filter off the drying agent and evaporate the filtrate under vacuum on a rotary evaporator to isolate crude natural eugenol as a pale-yellow oil.

## Management of chemical substances

| Chemicals | Form | H-statements | P-statements |
|---|---|---|---|
| Dichloromethane | Liquid, 97% | H315, H319, H351, H335, H336, H373 | P261, P281, P305 + P351 + P338 |
| HCl | Liquid, 35% | H290, H314 | P260, P280, P303 + P361 + P353, P304 + P340 + P310, P305 + P351 + P338 |
| NaOH | Solid | H314, H290 | P280, P305 + P351 + P338, P310 |

## Sources of risk and assessment of risk severity

There is no risk when following all the principles for working with chemicals and using personal protective equipment (gloves, goggles, lab coat).

## Waste management method

Dispose of waste materials in a marked container. Do not return unconsumed residues to storage bottles. Dispose of broken glass in a marked container.

## Risk reduction measures

Avoid direct exposure, use protective equipment. Do not expose to prolonged or repeated exposure. In the event of an accident or if you feel unwell, inform the teacher immediately. These substances or their containers must be disposed of as hazardous waste. Do not eat, drink, smoke. Wash your hands with warm water and soap or treat them with a reparative cream after work or when interrupting work.