

Plant Extraction

From Practice to Theory

Extraction of essential oil from iris : different practices and underlying theory

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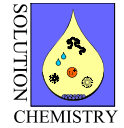


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**UNESCO
World Heritage**





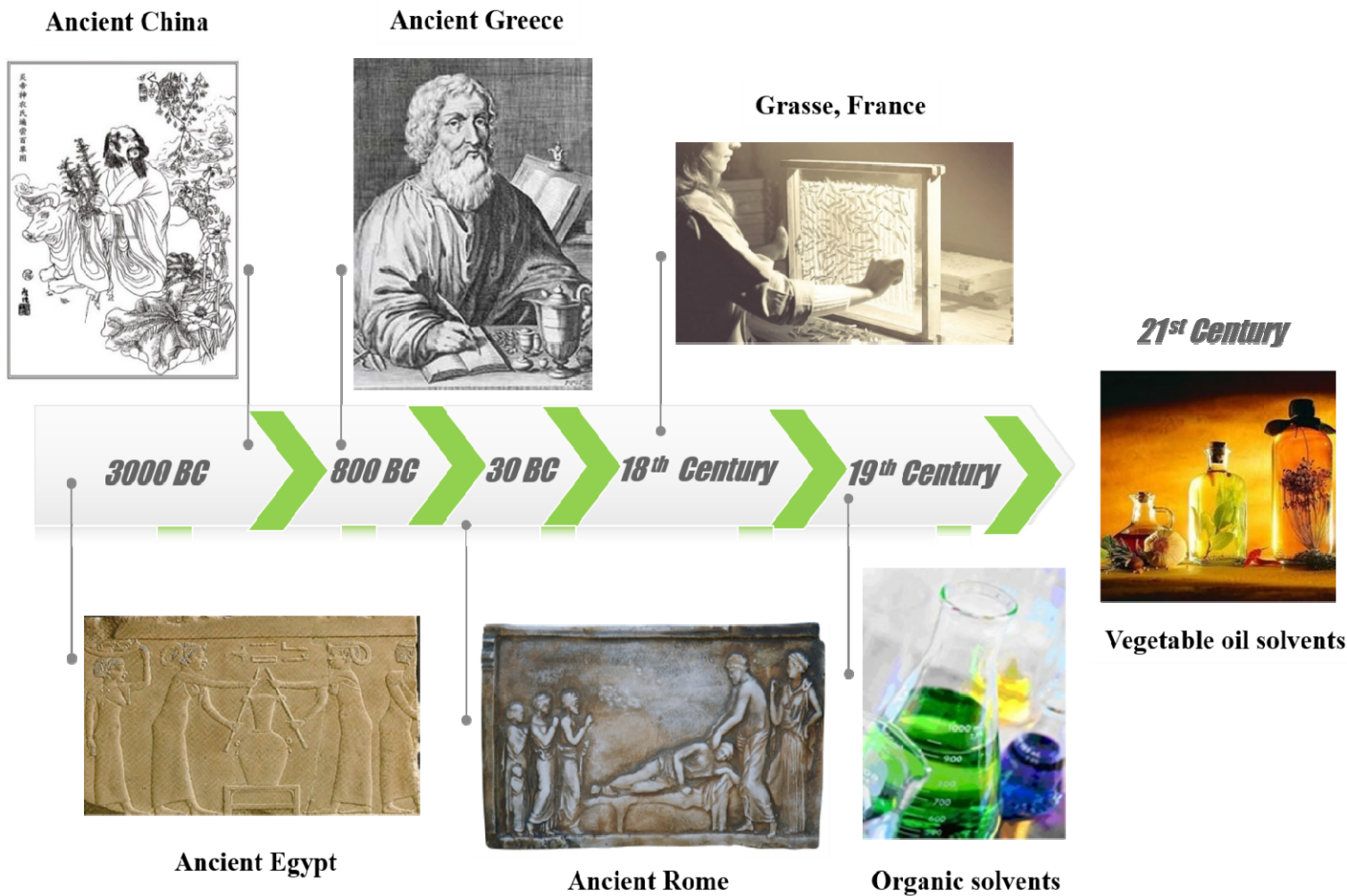
Green Solvents
from sustainable resources

Green Ionic Liquids
from sustainable resources

Green Reactions
in aqueous solutions

Green Surfactants
Hydrotropes
from sustainable resources





Drugs, dyes, food additives, perfums ...

Planting

Harvesting

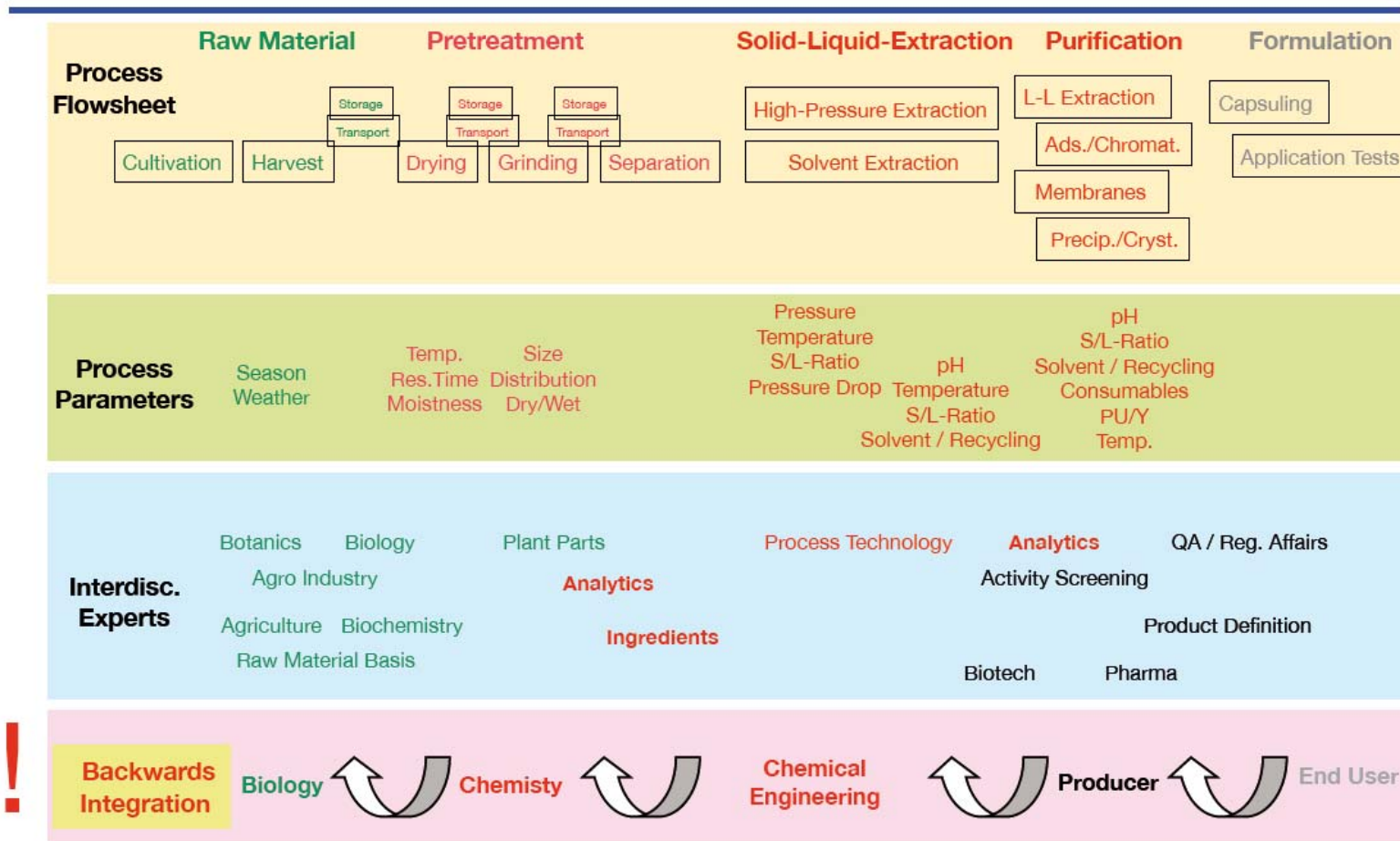
SLE

DSP

Products



Plant-based Extract Production

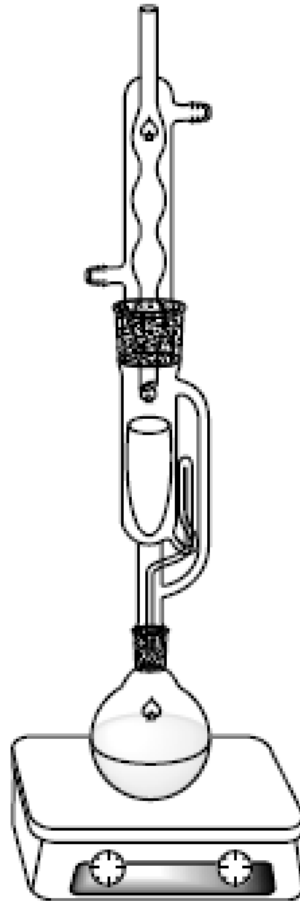


Economical Importance (worldwide):

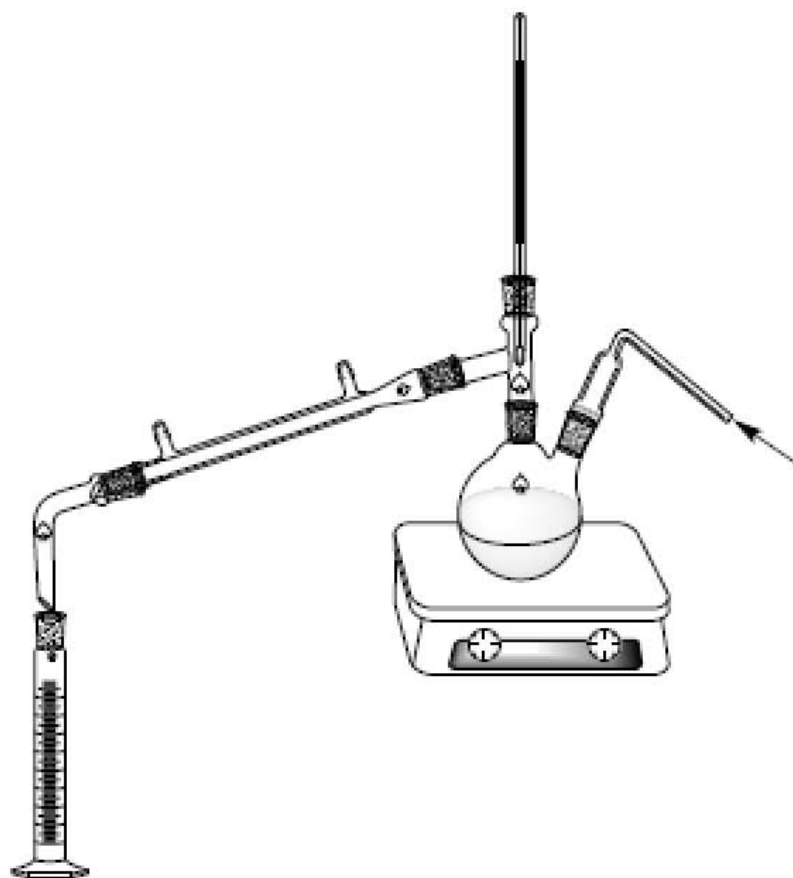
- Phytopharmaceuticals: 100 Billion (bn) USD (\$)
- Cosmetics, Wellness Products: 200 bn \$
- Aroma, Perfumes: 10 bn \$
- Food supplements, functional foods, nutraceuticals: 500 bn \$
- Agrochemicals 1 bn \$

Some typical plant extraction processes

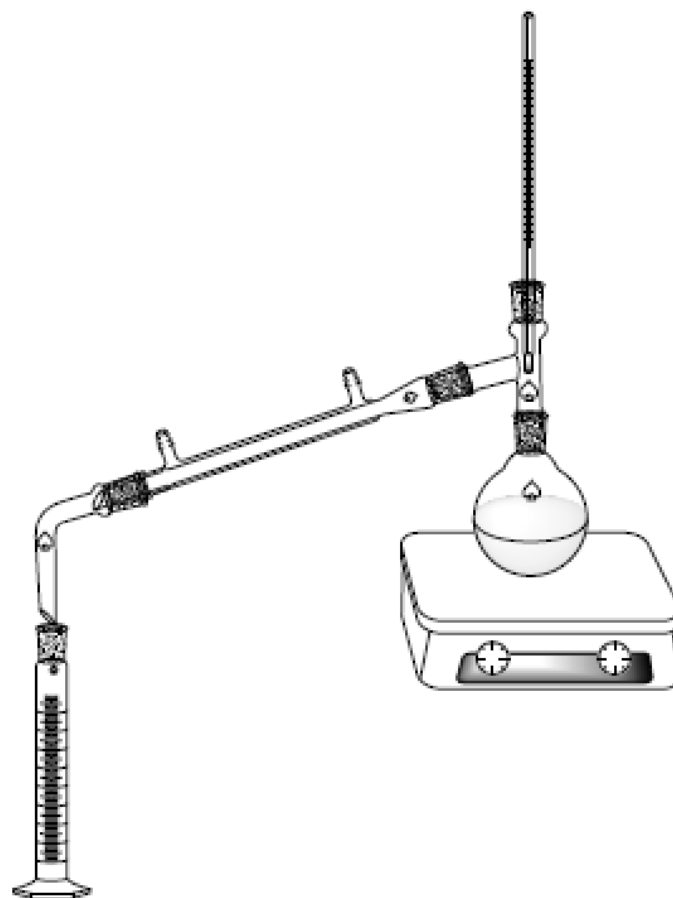
- Maceration and digestion
- Soxhlet extraction
- Steam distillation
- Hydrodistillation
- Percolation
- Extraction with supercritical CO₂ (scCO₂)
- Extraction with solvents



Sketch of a Soxhlet extraction apparatus. At first the vapor of the solvent runs up the uptake and condenses above the extraction thimble. If the fluid level rises over the kink of the siphon arm, the whole saturated extraction solution runs down in the flask again.



Sketch of a steam distillation apparatus. Steam is introduced through a small inlet into the flask, extracts the wanted substances and takes them along in the condenser, where water and essential oil get liquid again. Both phases were collected in the graduated measuring glass.



Sketch of a hydro distillation apparatus. Water is heated directly in the flask, extracts the wanted substances and takes them in the condenser like in steam distillation. Water and oil get liquid again and are collected in the graduated measuring glass.

Definition of an essential oil:

Absolue:

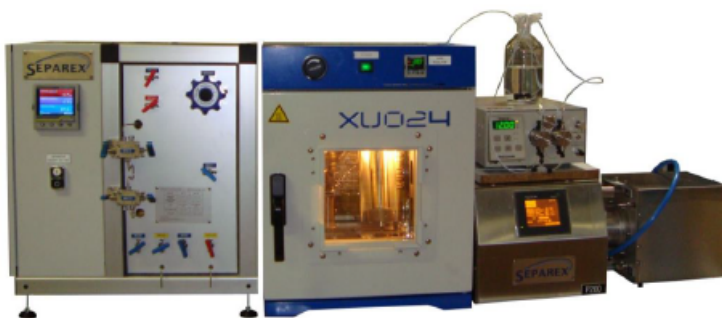
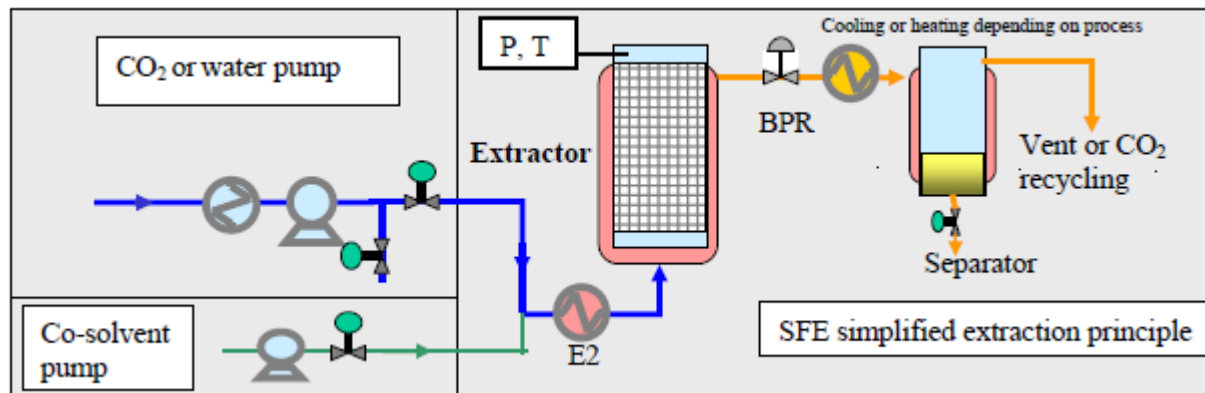
Concrète:

SEPAREX
 Supercritical Fluid Technology

13PE457-C

Multi-solvent

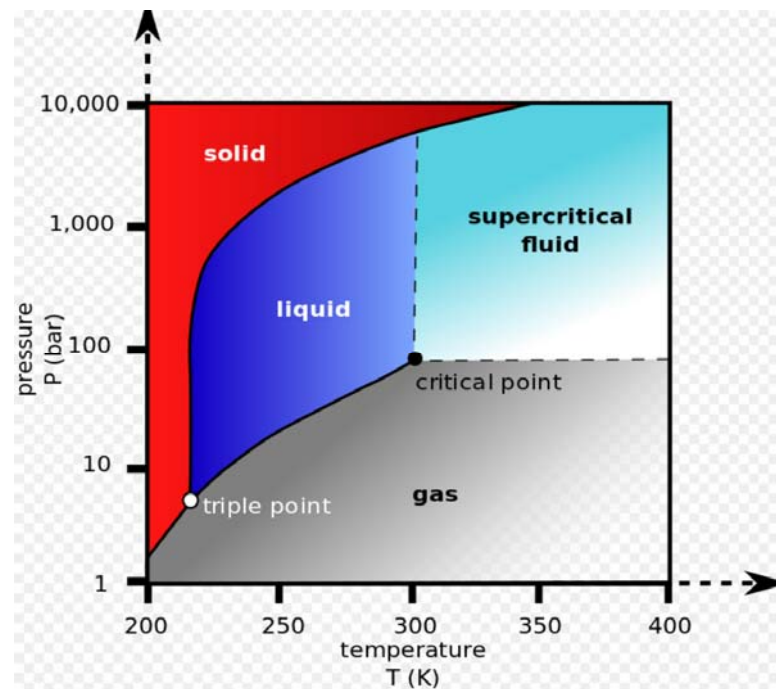
LAB SFE 100 ml



SFE 100 ml in basic configuration

SFE 100 ml is versatile “multi-solvent” extraction equipment designed at the same time for :

- **Supercritical CO₂ Extraction up to 1000 bar (15 000 PSI) / 150°C** allowing very high pressure extraction with very large operating parameter ranges and new opportunities to use supercritical CO₂ as solvent
- **High pressure and Subcritical water extraction up to 300 bar / 250°C**
- **Pressurized liquid extraction (PLE) “high-speed” and “high pressure” ethanol extraction**





Picture of the Iris Germanica at the Botanical Garden of University of Regensburg



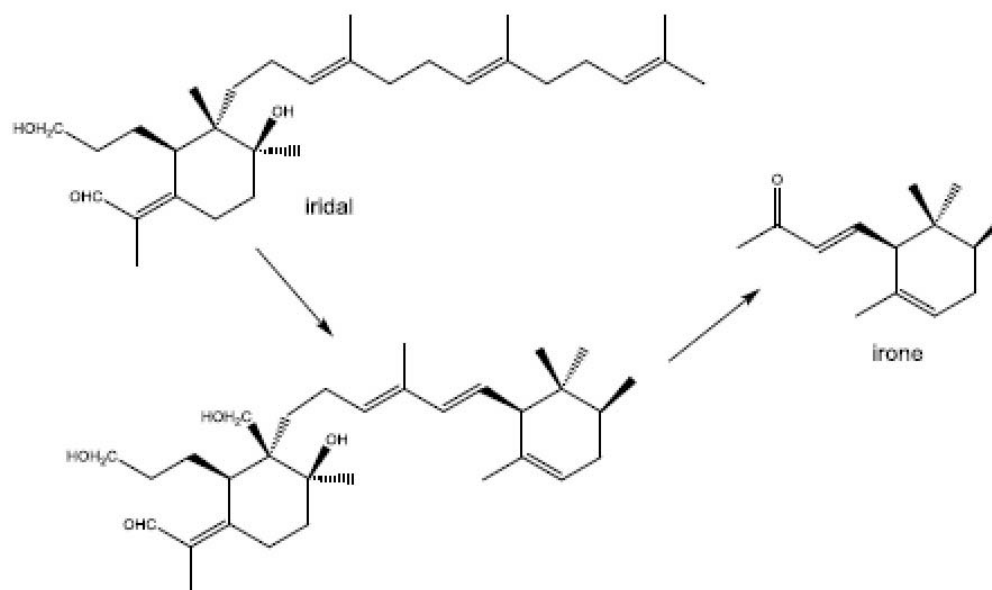


Figure 3: Reaction of an iridal to an alpha-irone [6]

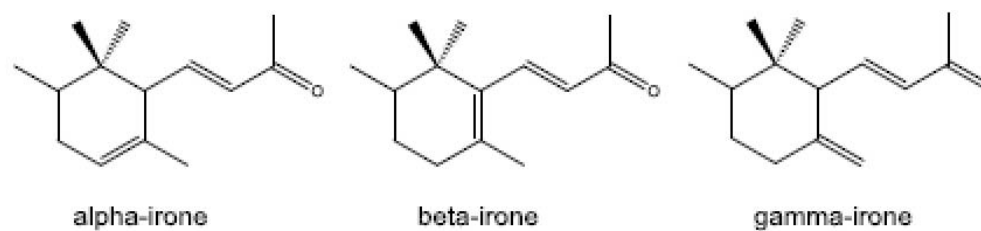
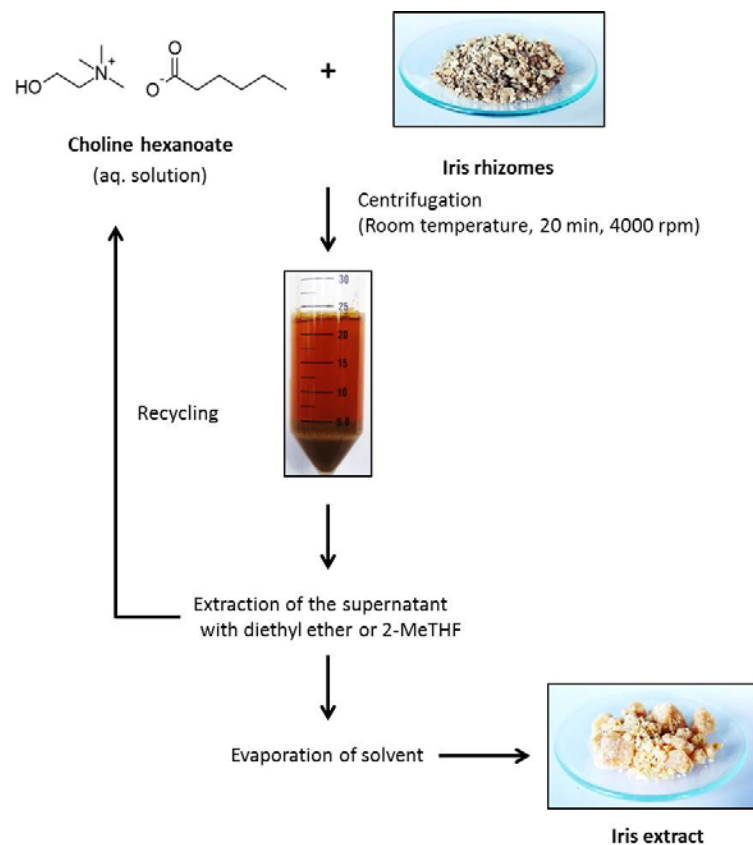


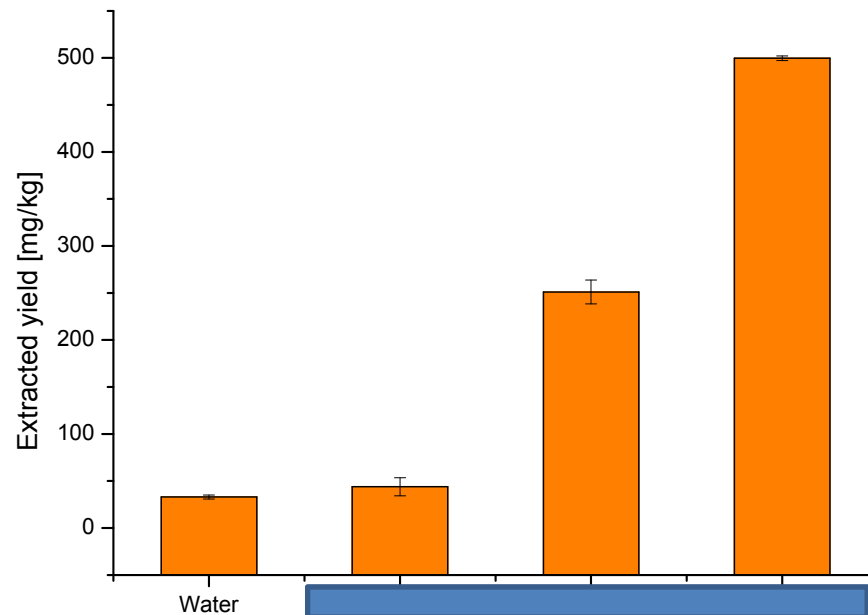
Figure 2: Structures of alpha-, beta- and gamma-irone [7]

Extraction of *Iris pallida* Lam. with choline-based ionic liquids



Various aq. solutions of ILs are studied regarding the particle size of the rhizomes, the extraction time, the solid-liquid ratio and the concentration of each IL solution. Nine year old rhizomes are taken for the experiments. The yield of irones from iris rhizomes is determined via HPLC-UV with α -ionone as internal standard.

Effect of different solvents on the extraction yield of irones



Extraction conditions:

- Extraction time: 30 min
- Extraction temperature: 25 °C
- Solid liquid ratio: 1 g rhizomes/ 15 mL solvent

The extracted amount is given in mg irones per kg iris rhizomes. To determine the total irone content Soxhlet extractions (6 h) are carried out.^[1] The average irone content is 639 ± 40 mg/kg dry mass.

[1]: B. Roger, X. Fernandez, V. Jeannot, J. Chahboun, *Phytochem. Anal.*, **2010**, 21, 483-488.

End of Lecture 7