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Super Critical Fluid Extraction

Skill Course



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Modifiers for SCFE



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Need of modifiers

CO₂ is the most used solvent to perform SFE.

Main drawback of CO₂ in natural products extraction is its low polarity.

Low polarity limits its ability to extract polar components from the raw material.

Even at high densities (with increased dielectric constant), CO₂ has a limited ability to dissolve high-polarity compounds.

To address this problem, small amounts of co-solvents (modifiers) are added to the CO₂ stream.

The addition of modifiers to CO₂ can improve the extraction efficiency by raising the solubility of the solutes.



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- The amount of modifier added to the supercritical fluid should be lower than 10–15%.
- The most used modifiers are methanol, ethanol, and water.
- The critical point of the mixture (CO_2 :modifier) is different than that of pure compounds.
- It also depends on the proportions of each of the solvents.

Mechanisms



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Two mechanisms have been proposed by Pereira and Meireles to explain the effects

1. Solute–co-solvent interactions, caused by increase in solvent polarity;
2. Matrix swelling that facilitates the contact of the solute by the solvent

C. Pereira and M. Meireles, Food Bioproc. Technol., 2010, 3, 340.



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Disadvantages of modifiers

- Unlike supercritical CO₂ Modifiers are liquids at room conditions.
- So, liquid residues are obtained in extracts and remaining matrix after SFE.
- Modifiers like methanol should not be used in the extraction of natural products since this is a toxic solvent
- It can prevent the further use of the extracts, for instance, in food applications.
- Water as a modifier has several drawbacks such as the formation of ice blockages due to the Joule–Thompson effect in the separator vessel.
- Possibility of ionization and hydrolysis of compounds.
- Foam formation by reacting with saponins present in plant materials.