

Novel process for the recovery of food-grade CO₂ and aromas from wine fermentation off-gas

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Introduction

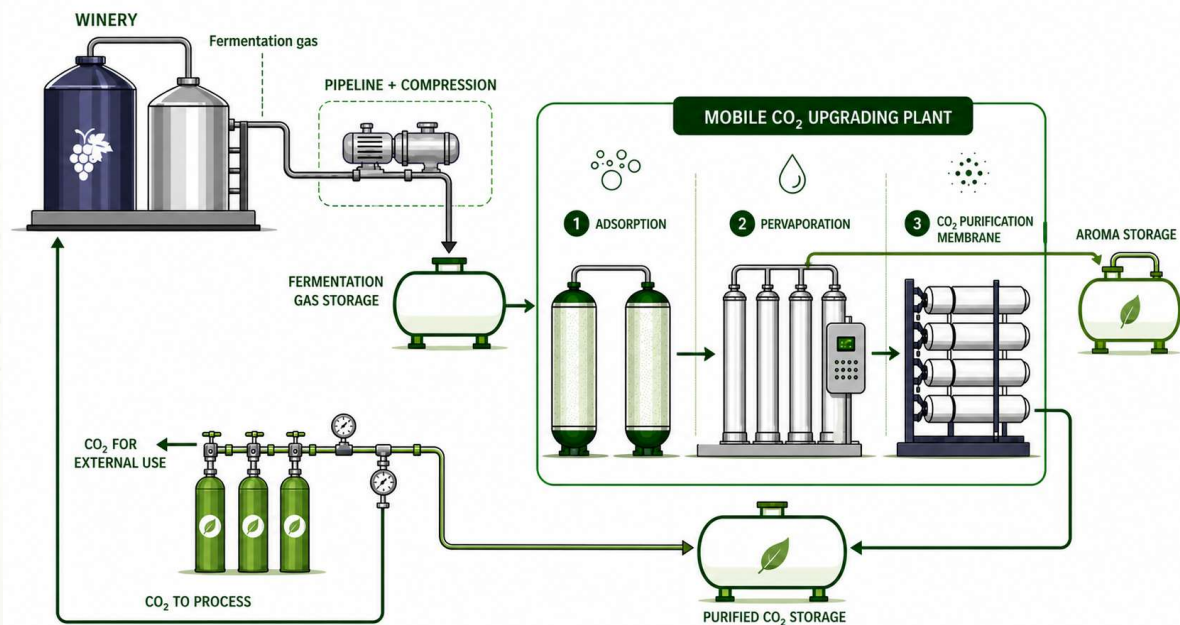
The CERNET project develops carbon capture and utilisation (CCU) solutions for bio-based industries.

Winery fermentation releases high-purity biogenic CO₂ (85–99%), typically vented to atmosphere.

Fermentation off-gas also contains valuable aroma compounds, currently not recovered.

This represents an opportunity for circular valorisation in the beverage sector.

CERNET technological concept for CO₂ capture and aroma recovery



Preliminary results

Fermentation off-gas contains a complex mixture of VOCs, including:

- Alcohols (ethanol, methanol)
- Esters (ethyl acetate)
- Aldehydes (acetaldehyde)
- Organic acids (acetic acid)
- Ketones and higher alcohols
- Sulfur compounds detected at low levels but critical for CO₂ purity

Results confirm:

- High potential for simultaneous CO₂ purification and aroma recovery
- Need for integrated multi-step separation

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Objective

- To develop a modular and integrated process for:
 - Producing food-grade CO₂
 - Recovering a concentrated aroma fraction from winery fermentation off-gas.

Process concept

- Three-step upgrading strategy:
 1. Selective adsorption → removal of sulfur compounds
 2. Absorption–pervaporation → recovery and concentration of aromas
 3. Membrane contactors → CO₂ purification under mild conditions
- Three-step upgrading strategy:
 - Purified CO₂ (food-grade)
 - Aroma-rich stream for beverage applications