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## Biorefinery of coriander seeds cultivated in France

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Coriander (*Coriandrum sativum* L.) is an annual crop belonging to the *Apiaceae* family and is commonly used as a condiment or a spice in the Mediterranean area. The seeds are characterized by their potential to provide both an essential and a vegetable oil. While the former fraction is traditionally obtained through hydrodistillation, the latter may be extracted by twin-screw extrusion. This further renders a press cake which could be valorized through its transformation into agromaterials.

The main objectives of this study were to determine the chemical composition of hydrodistilled essential oil from coriander seeds cultivated in France and to evaluate VOC emission rates from two types of agromaterials generated from delipidated or non-delipidated coriander cake. The main components of the essential oil were linalool,  $\gamma$ -terpinene, camphor and limonene. Enantiomeric distribution of linalool showed an enantiomeric excess of (S)-linalool (75.2%).

VOC emissions of agromaterials were mainly due to the presence of essential oil in the press cake. Linalool was the most abundant compound with an emission rate of about  $140 \mu\text{g}\cdot\text{m}^{-2}\cdot\text{h}^{-1}$  for the non-delipidated material. This value was lower than  $2 \mu\text{g}\cdot\text{m}^{-2}\cdot\text{h}^{-1}$  for the delipidated material. Next to this, a substantial emission of the solvent used for lipid extraction was detected.

**Keywords:** *coriander seed, essential oil, agromaterials, VOC emissions*

# Biorefinery of coriander seeds cultivated in France

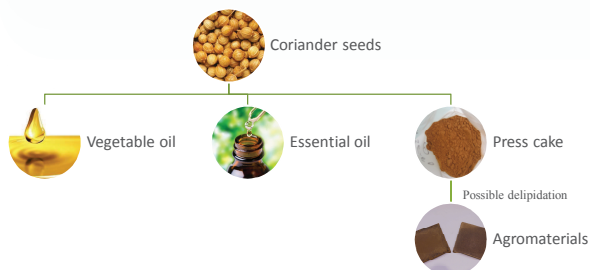
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## Introduction



- Obtention of essential oil through hydrodistillation
- Analysis of essential oil composition
- Evaluation of VOC emission rates from agromaterials
- Comparison of emissions from panels with delipidated/non-delipidated cake



## Material & Methods

### Hydrodistillation

- Coriander seeds (*Coriandrum sativum* L.) of French origin
- Clevenger apparatus
- 200 g mixed seeds with 2 L distilled water (1:10 ratio)
- Distilled for 5 hours

### Essential oil analysis

- GC-FID/MS (TG-5MS (30 m x 0.25 mm x 0.25 μm))
- GC-FID (Rt-DEXsa (30m, 0.25mm ID, 0.25μm))
- Identification through retention indices and mass spectra (NIST 2.0 library)

### Emission rates

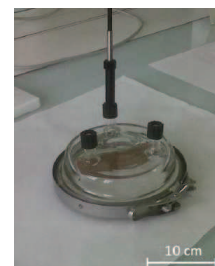
- Emission glass chamber of 620 mL
- Qualitative analysis: static mode with SPME fibres (Carboxen/PDMS, PDMS, PA)
- Quantitative analysis: dynamic mode with Tenax TA cartridges

Two thermopressed agromaterial samples (exposition surface ~ 90 cm<sup>2</sup>):

- one delipidated with cyclohexane
- one non-delipidated

### VOC emissions analysis

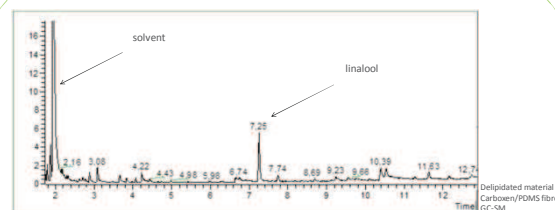
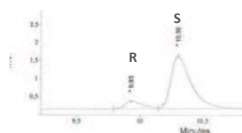
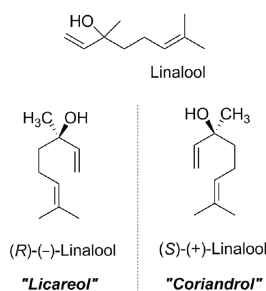
- GC-FID/SM (TG-5MS (30 m x 0.25 mm x 0.25 μm))
- ATD/GC/FID (DB1 (60 m x 0.32 mm x 1 μm))



## Results & Discussion

Composition (%)	This study	Essential oil from France [1]	Essential oil from Brazil [2]	Essential oil from Vietnam [1]	Essential oil from Pakistan [3]
α-pinene	1.4	5.6	3.9	3.5	1.6
p-cymene	2.8	1.6	2.2	0.6	1.1
Limonene	3.4	1.9	1.3	n.d.	0.3
γ-terpinene	7.9	5.0	4.6	1.7	4.2
Linalool	71.9	71.7	77.5	87.8	69.6
Camphor	4.8	4.2	2.6	n.d.	0.4
Linalyl acetate	1.5	2.9	n.d.	1.1	n.d.
Geranyl acetate	3.1	3.0	1.1	3.5	5.0

- Essential oil yield: 0.71 ± 0.02 % (n=3)
- Main components: linalool, γ-terpinene, camphor and limonene
- Enantiomeric distribution of linalool: enantiomeric excess of (S)-linalool (75.2%)



- VOC emissions of agromaterials mainly due to the presence of essential oil in the press cake.
- Linalool most abundant compound
- Linalool emission rate: 140 μg.m<sup>-2</sup>.h<sup>-1</sup> for the non-delipidated material, less than 2 μg.m<sup>-2</sup>.h<sup>-1</sup> for the delipidated material
- Substantial emission of the solvent used for lipid extraction was detected for the delipidated material

## Conclusion

- Essential oil composition for coriander seeds of French origin was consistent with studies of other regions
- Linalool as the principal constituent
- Enantiomeric excess of (S)-linalool of 75.2%
- VOC emissions of agromaterials due to essential oil in the press cake
- Non-delipidated press cake: linalool as the main compound
- Delipidated press cake: cyclohexane as the main compound
- Attention should be drawn to elimination of solvent traces in press cakes

## References

- [1] Uitterhaegen E., 2014. Coriander oil - extraction, applications and biologically active molecules. Master's dissertation, Faculty of Bioscience Engineering Universiteit Gent, Belgium.
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