KU LEUVEN

FLAVOUR PLUS

Volatile fingerprinting of coriander and orange peel in view of improved flavour-consistency of specialty beers and distilled spirits

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INTRODUCTION

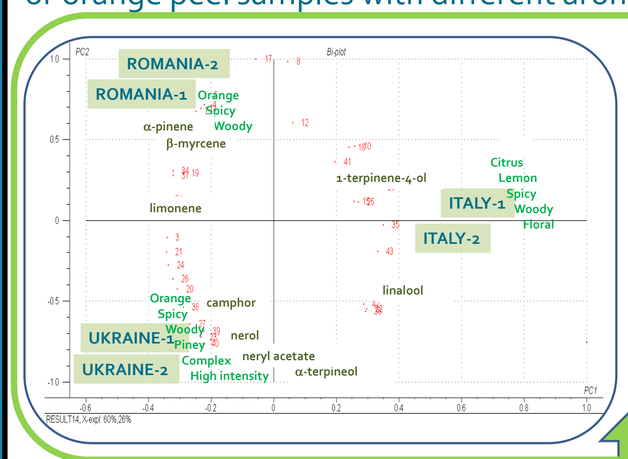
Particular flavouring herbs play a crucial role in the unique sensory properties of specialty beers. Variability in intrinsic aromatic quality of the herbs (due to origin, climate conditions, processing, storage, …) represents however a serious problem in view of consistent flavour quality of the end product. In this respect, a methodology based on HS-SPME GC-MS/O is used for (1) fast and accurate quality control of botanicals used in brewing and distilling, and (2) improved control of aromatisation based on key-impact odorants.

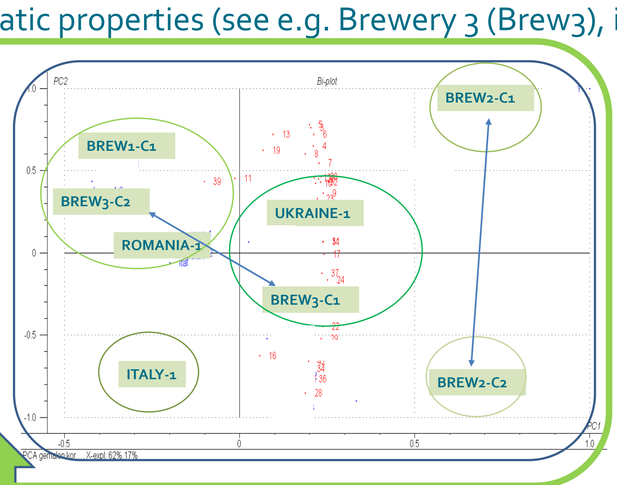
MATERIALS AND METHODS

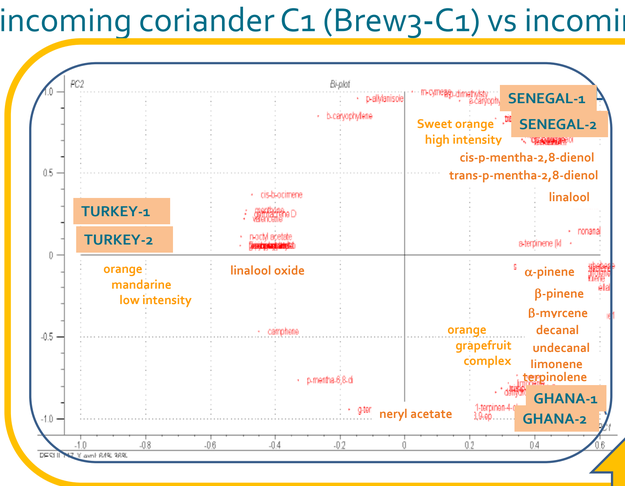
Raw materials: coriander (*Coriandrum sativum* L; origin: Ukraine, Italy, Romania and orange peel (*Aurantii dulcis pericarpium tot;* origin: Ghana, Senegal, Turkey); **Alcohol extracts**: 4g ground coriander or orange peel in 40 mL Ethanol/water (75/25% v/v), 7 days; **Analytical profiling** of ground coriander/orange peel and alcohol extracts via HS-SPME GC-MS; **Determination of key-odorants** in coriander and orange peel via HS-SPME GC-MS/O; **Sensory evaluations** of alcohol extracts and beer aromatised with alcohol extracts via descriptive and triangular tests

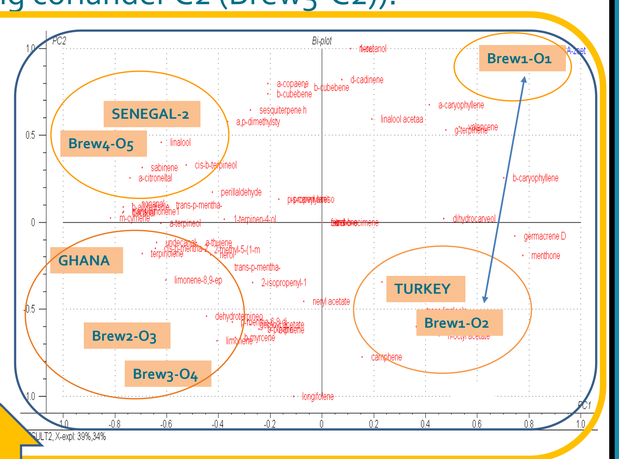
DISCRIMINATION OF CORIANDER AND ORANGE PEEL VIA HS-SPME GC-MS

The bi-plots of PCA based on the total composition of the volatile fraction (variables) of coriander and orange peel samples (objects) demonstrate the separation of the samples according to their origin/aromatic characteristics. This approach allows to evaluate the aromatic quality of incoming samples. Clearly, breweries receive coriander or orange peel samples with different aromatic properties (see e.g. Brewery 3 (Brew3), incoming coriander C1 (Brew3-C1) vs incoming coriander C2 (Brew3-C2)).





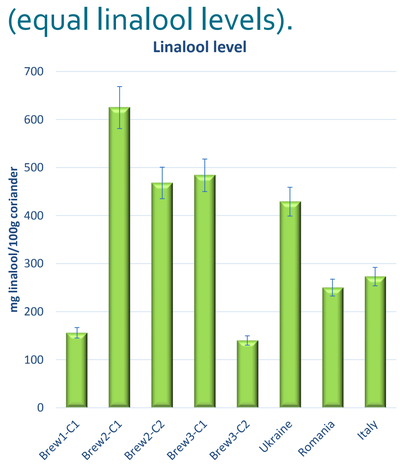




DETERMINATION OF KEY-IMPACT COMPOUNDS

Linalool

= Predominant key-odorant in coriander (55-70% of total volatiles). Level is used for standardised aromatisations (equal linalool levels).



CORIANDER

- α-pinene
- β-myrcene
- limonene
- linalool
- camphor
- nerol
- neryl acetate
- α-terpineol
- 1-terpinen-4-ol

Key-impact compounds for odour/aroma

MONITORING incoming samples
- absolute level
- relative composition

AROMATIC PROPERTIES

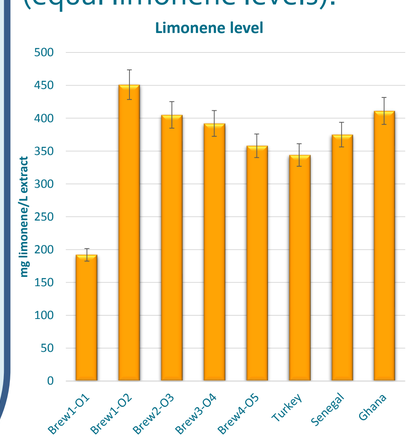
On the basis of additions for **aromatisation** in brewing/distilling practice for **improved aroma-consistency**

ORANGE PEEL

- α-pinene
- β-pinene
- β-myrcene
- limonene
- terpinolene
- linalool
- decanal
- undecanal
- neryl acetate
- α-terpineol
- linalool oxide
- *cis*-p-mentha-2,8-dienol
- *trans*-p-mentha-2,8-dienol

Limonene

= predominant key-odorant in orange peel (>90% of total volatiles). Level used for standardised aromatisations (equal limonene levels).



SENSORY EVALUATIONS CORIANDER

Triangular tests – Alcohol extracts (10% v/v) – FRESH SAMPLES	Correct answ.(out of 12) (α=sign.lev.)
No standardisation (equal vol.)	
Ukraine vs Italy	11 (α=0.001)
Ukraine vs Romania	9 (α=0.05)
Italy vs Romania	10 (α=0.01)
Ukraine vs Brew3-C1	5 (α=0.3)
Brew2-C1 vs Brew2-C2	11 (α=0.001)
Brew3-C2 vs Romania	6 (α=0.20)
Standardised extracts (equal linalool)	
Ukraine vs Italy	9 (α=0.05)
Ukraine vs Romania	6 (α=0.20)
Italy vs Romania	9 (α=0.05)

Alcohol extracts (fresh coriander)

- °aromatic differences between different origins/brew samples
- °differences less pronounced with standardised extracts (i.e. equal linalool level)

Alcohol extracts (stored coriander, 12months, 20°C)

- °decrease of aroma intensity, no off-flavours via GC-MS/O
- °via standardisation (linalool level): aroma fresh ≈ aged

Beer aromatised with alcohol extract (fresh and stored)

- °addition level determines whether origins are discriminated
- °standardised additions: differences less pronounced
- °addition: equal linalool level: no difference fresh/stored

Beer aromatisation with alcohol extract – FRESH	Correct answ. (/12) (α=sign.lev.)
Addtion rate: 250 µL extract	
Ukraine vs Romania	5 (α=0.3)
Addition rate: 500 µL extract	
Ukraine vs Romania	10 (α=0.01)
Addition rate: (standardised addition)	
Ukraine vs Romania	6 (α=0.20)
Ukraine vs Italy	8 (α=0.10)
Beer aromatisation with alcohol extract - STORED	
Addition rate: 500 µL extract	
Ukraine 0 months vs 12 months	10 (α=0.01)
Addition rate: standardised addition	
Ukraine 0 months vs 12 months	5 (α=0.3)

CONCLUSIONS Volatile fingerprinting of botanicals via HS-SPME GC-MS is a fast and powerful tool for evaluating the aromatic quality of incoming samples. When combining the total analytical passports with data derived from key-impact odorants for each type of botanical, brewers and distillers dispose of a powerful tool for improved control of aromatisation of the final product (beer/spirit). The high potential of the proposed methodology in view of improved flavour-consistency was demonstrated via (advanced) aromatisation of final beer with alcohol extracts and will be further investigated via conventional aromatisation in real brewing practice.

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