Analytical Profiling of Belgian Kriek Beers

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Belgian Kriek Beers

• School example of Beer Mix Beverage
• It originates around 1900-1930
• Originally with the addition of fresh sour cherries into Lambic of 6 months
• Nowadays a mix of fresh fruit, fruit juices, aroma’s (natural like or synthetic) and different beers to start with (wheat beer – other top fermented beers)
Flow chart of fruit beer production

- Fresh sour cherries (traditional)
  - Lambic beer age 6-12 months
    - + 150-400g whole cherries/L
  - Fermentation
  - Centrifugation and/or filtration + bottling
  - Refermentation in the bottle
  - Pasteurisation
  - Distribution

- Fresh sour cherry juice (traditional)
  - Lambic beer age 6-12 months
    - + 25-35% cherry juice
  - Filtration + bottling
  - Pasteurisation

- Sour cherry extract & aroma
  - Other beer
    - + cherry aroma & concentrate
  - Filtration + bottling
  - Pasteurisation

Analytical Profiling of Belgian Kriek Beers. EBC Symposium on Beer Mix Beverages, 08-09 September, 2014, Vienna
Lambic production

- At least 30% of unmalted wheat
- Turbid mash method
- Aged hop cones
- Long boiling time of 4 to 5 hours
- Spontaneous mixed fermentation in which Lactic Acid Bacteria, *Saccharomyces* and *Brettanomyces* spp.
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**Distribution**
Analytical Profiling of 16 (A-P) kriekbeers
Analyses

- Bitterness profile (UPLC)
- Acids (HPLC)
- Sugars (HPLC)
- Aroma profile (HS-SPME-CGC-MS)
- Aldehydes (HS-SPME-CGC-MS)
Bitterness

![Bitterness Graph]

- **Total iso-α-acids content**
- **% Oxidized bitter acids**

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Bitterness

HPLC chromatogram - lager

Iso-α-acids

Oxidized fraction
Bitterness

Oxidized fraction

Iso-α-acids

HPLC chromatogram - filtered geuze
Bitterness

Oxidized fraction

Iso-α-acids

HPLC chromatogram- traditional geuze
Bitterness

![Graph showing bitter acids content in mg/L for different samples labeled A to P. The graph includes two lines: one for total iso-α-acids content and another for % oxidized bitter acids.](image-url)
Acids

![Bar chart showing total lactic acid levels for different samples labeled A to P. The chart indicates D-Lactic acid and L-Lactic acid concentrations.](chart.png)
Acids
Sugars

![Graph showing sugars in different categories across various samples.](Image)
Aroma profile

![Acetate esters graph](chart.png)

- **Isoamyl acetate**
- **Phenylethyl acetate**
Aroma profile

Acetate esters

mg/L

Ethyl acetate
Aroma profile

Ethyl esters

μg/L

Ethyl hexanoate  Ethyl octanoate  Ethyl decanoate
Aroma profile

[Bar chart showing higher alcohol levels in different beers labeled A to P. The chart displays two types of higher alcohols: 2-Methylbutan-1-ol and 3-Methylbutan-1-ol.]
Aroma profile
Aldehyde profile

![Bar chart showing aldehyde profile](image)
Aldehyde profile

![Aldehyde profile chart](chart.png)

- Methional
- Phenylacetaldehyde
Aldehyde profile
Aldehyde profile

![Aldehyde profile graph](image-url)
Aldehyde profile
Conclusions

• A wide variation of kriek beers
  o Sour
  o Sweet
  o natural / artificial kriek aroma
  o Body due to old hops

• Analytical fingerprinting is a perfect tool to distinguish or find similarities of competitors and flavour suppliers

• or to support in the quality insurance of aroma / sugar additions

• or to prove the traditional production methods
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