Wine Quality Aspects and Wine Tasting

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Familie
VITACEAE

Gattung
VITIS
Umfasst alle Rebengewächse, die Ranken entwickeln.

Untergattung
EUVITIS
Umfasst die meisten amerikanischen, europäischen und asiatischen Rebarten. Die wichtigsten sind unten genannt.

Untergattung
MUSCADINIA

Vitis vinifera
Die europäische Rebenart, die für den größten Teil der Weinproduktion verantwortlich ist. Zu ihr gehören u. a. die genannten klassischen Sorten, botanisch »Varietäten«.
Australia
Portugal
Parameters Affecting the Wine Quality

Determining factors

- Grape variety
- Grape ripeness
- Soil-composition
- Climate
- Yield
- Fermentation
  (single yeast strain vs spontaneous)
- Technology
  (reductive, oxidative, stainless steel, barrels)
- Ageing
Steps in Winemaking

- Harvest
  - Stemming
    - Crushing
      - Red and rosé wines
        - Fermentation and maceration
          - Pressing
            - Completion of fermentation
      - White wine
        - Maceration
          - Pressing
            - Fermentation
              - Malolactic fermentation (if desired)
                - Maturation and natural clarification
                  - Finishing and stabilization
                    - Bottling
                      - Cellaring and Ageing

What happens in the Barrel?

- Extractable compounds from wood pyrolysis
- New aroma compounds

Wine

O₂
Extractable Compounds from the Barrel

<table>
<thead>
<tr>
<th>Furanderivate</th>
<th>Furfural und Hydroxymethylfurfural (10–20 mg/l), Kochgeschmack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eichenlacton</td>
<td>Geruch nach Kokosnuss</td>
</tr>
<tr>
<td></td>
<td>1 mg/l Eichenlacton + 10 mg/l Furfural = Vanille Karamel und Sherryaroma</td>
</tr>
<tr>
<td>Vanillin</td>
<td>Schwellenwert 0,5 mg/l, Vorkommen 0,3–0,8 mg/l, durch Wechselwirkungen mit anderen Aromen stärkere Ausprägung</td>
</tr>
<tr>
<td>Syringaldehyd</td>
<td>aus dem Ligninabbau, Waldbeerenaroma, Schwellenwert 15 mg/l</td>
</tr>
<tr>
<td>Eugenol</td>
<td>Hauptaroma von Gewürznelken, durchschnittlich 20 μg/l im Wein</td>
</tr>
<tr>
<td>4-Methylguajakol</td>
<td>angebranntes Holz</td>
</tr>
<tr>
<td>4-Ethylphenol</td>
<td>Schwellenwert 80 μg/l, holzig rauchig, würzig, ab 440 μg/l Speck und Pferdestall</td>
</tr>
<tr>
<td>4-Ethylguajakol</td>
<td>Schwellenwert 20 μg/l, ab 70 μg/l Stall und Pferdeschweiß</td>
</tr>
<tr>
<td>4-Ethylphenol + 4-Ethylguajakol</td>
<td>ab 425 μg/l Pferdeschweiß und Rauchspeck</td>
</tr>
</tbody>
</table>
Barrel Alternatives

Innerstaves
Oak Chips

- Packaged loose in 40 pound woven plastic bags
- Pre-packaged in two 20 pound "infusion bags" fabricated with polyester netting for direct placement into tanks. These two polyester bags are shipped inside a 40 pound protective outer bag.
- Pre-packaged in 20-pound food grade nylon mesh bags, designed for direct placement into stainless steel tanks.
Steps in Wine Tasting

STEP 1: The Colour and Appearance

STEP 2: The Smell

STEP 3: The Taste
STEP 1 The Colour and the Appearance

A lot of information is transported by the colour of the wine

Red or White

Age

Grape Variety

Ripening Stage…….
Cross Modality

C. Calvo et al, EurFoodResTechnol, 2001(213), 99-103
Changes of the Colour

Two different mechanisms are responsible for the colour changes in red and white.

http://www.theworldwidewine.com
White Wine Colour Changes

2011

1 year

1986

26 years

2007

5 years

1975

37 years
Browning Reactions in Wine

Browning reactions is a severe problem in wine industry. Normally SO$_2$ is added as an antioxidant

Mechanisms based on:

- enzymatic browning
  Often correlated with caftaric and coutaric acid promoted by flavanols$^1$

- non-enzymatic browning
  Oxidation of wine phenols$^2$
  Oxygen activations
  Fe & Cu ions

1) Cheynier et al., Journal of Agricultural and Food Chemistry, 37(4), 1069–1071
2) Es-Safi et al., International Journal of Food Science and Technology 2000, 35, 63–74
Step 1 Formation of (+)-Catechin Dimer

Es-Safi et al., International Journal of Food Science and Technology 2000, 35, 63–74
Further Reaction

Es-Safi et al., International Journal of Food Science and Technology 2000, 35, 63–74
HPLC Monitoring

Es-Safi et al., International Journal of Food Science and Technology 2000, 35, 63–74
STEP 2: The Smell and the Volatile Fraction
Tasting Glass
Different Types

Burgundy 500 mL
Chianti 380 mL
Young White 210 mL
Bordeaux 860 mL
Chardonnay 350 mL
The Aroma Wheel

Ann Noble UC Davis
**Wine #1 Sauvignon Blanc 2016**

**Origin:** France, the Loire. This variety was introduced in the Steiermark in the 19th century by Archduke Johann. At that time, it was known as Muskat-Sylvaner.

**Parentage:** Natural crossing of Traminer and Chenin blanc. The former name (Muskat-Sylvaner) is no longer permitted for use, as it is misleading. There is no relation to any muscat or sylvaner varieties and, moreover, the Sauvignon blanc has no muscat aroma.

Grown worldwide, this variety has a characteristic bouquet, which can be intrusively unripe and grassy when the grapes are not fully ripe. When the grapes have good ripeness, they develop complex aromas of black currants, gooseberries and tropical fruit. The wines develop – according to the level of maturity – from discreet to very complex. The complex versions have wonderful ageing potential especially from malolactic fermentation and barrique maturation. When the grapes are very ripe, the complex aromas retreat and a powerful, spicy wine unfolds.

Relevant Aroma Compound

2-Isobutyl-3-methoxypyrazine

Sensory threshold: 1-2 ng/L

Odour descriptors: green bell pepper, green gooseberry, asparagus, vegetal

Required Instrumentation:
sample amount: 1 mL
HS-SPME or Arrows
TQ (MRM)
SIDA IBMP-d3 10 ng/L IS concentration
Wine #2 Gelber Muskateller

Origin: Unknown, but possibly from Italy or Greece

Parentage: It is one of the oldest grape varieties and yields different types, especially in Italy. Roter (Red) and Gelber (Yellow) Muscat are differentiated by the colour of their berries.

Delivers wines with a more or less intense citrus, elderberry blossoms and nutmeg aroma and flavour. With too little ripeness, the wines are low in extract and therefore thin and have marked acidity. The Muskateller is especially delicious as an aperitif and with appetizers.
Relevant Aroma Compound

Linalool
Sensory threshold: 15 µg/L
Odour descriptor: citrus, lavendar, coriander seeds, Earl Grey

Required instrumentation:
Sample amount: ~10 µL-1 mL
HS-SPME or Arrows
GC-SQMS (scan) or TQ
Wine #3 Mystery Wine

Please describe what you see, smell and taste

Can you identify the grape variety?

Can you identify the country of origin?

Can you identify anything about the vinification process?
Wine #4 Mistery Wine
Grape variety: Tinto fino (Tempranillo)
Wine #4 Gewürztraminer

Origin: Likely from southeast Europe. In the Middle Ages, the variety was found in Südtirol (South Tyrol), now in northern Italy. In fact, Traminer was named after the lively South Tyrolean town of Tramin, long-established in the wine trade.

Parentage: Selected from wild vines, Traminer is one of the oldest European varieties and was even likely known by the Romans as Vitis aminera. The variety is differentiated by its range of colours. Roter Traminer has red grapes; Gewürztraminer shows light red/pink grapes; and with yellow grapes it is the Gelber Traminer. These also deliver different spicy flavours influenced by their terroirs. Name-wise, all of the Traminer types can be referred to as Gewürztraminer. Traminer is often a natural crossing partner for other varieties, including the Grüner Veltliner (Traminer x St. Georgen).

The wines are low in acidity, but rich in extract and aromas (roses, lemon, forest berry, raisin, dried fruit), have good durability and excellent ageing potential. Prädikat wines often have a residual sweetness and a discreet, harmonious bitter touch.
Relevant Aroma Compound

cis Rose oxide
Sensory threshold: 0.2 µg/L
Odour descriptor: floral, rose

Required instrumentation:
HS-SPME or Arrows
Sample amount: ~1 mL
GC-SQMS (SIM) or TQ
Wine #5 Riesling Auslese

Origin: Germany, Oberrhein. The earliest documentation of the name was in 1435, in Rüsselsheim.
Parentage: Natural crossing of Weiβem Heunisch, Vitis sylvestris and Traminer. The variety was probably taken from wild vines on the Oberrhein (the Upper Rhine). Roter Riesling is a red grape variation, a bud mutation of the Weiβer Riesling. The Weiβer Riesling is not related to the Welschriesling variety.

Young Riesling wines exude charming fruitiness and flavour, and can develop into great and complex wines through ageing. For these, notes of stone fruit are dominant and include peach, apricot and exotic fruits. Riesling ripens slowly and reaches the highest quality as aged wines with rose-like scent. Depending on the level of ageing, they develop a pleasurable petrol tone, something that perhaps not all wine consumers like. When the late harvest grapes are infected with noble rot, then special wines are the result – Auslesen and Beerenauslesen styles with outstanding quality.
Relevant Aroma Compounds

1,1,6-Trimethyldihydronaphthalene (TDN)
Sensory threshold: 2 µg/L
Odour descriptor: petrol, kerosene

Required instrumentation:
HS-SPME or Arrows
Sample amount ~100 µL-1 mL
GC-SQMS or TQ
Summary

Wine has a very complex aroma composition, where sometimes tiny changes has a dramatic influence on the sensory perception.

Analytical methods based on GC can provided useful data for better understanding.

Headspace based sample prep method can dramatically improve the sensitivity and reduce the sample amount. 10 µL-1 mL is sufficient.

Depending on the concentration different instrumentations and methods are required to cover the sensitivity and the concentration range:

- GC-SQ (Scan or SIM), TQ (MRM), GCxGC (EI & NCI)
Thank you for your attention.......