“IN-PROCESS SENSORY AND BEER FLAVOUR STABILITY”

Dr Boris Gadzov
Why is beer flavour stability important?

Fresh beer ..... 

• Tastes good

• Better drinkability = consumers buy more

• Longer shelf life = less consumer complaints
Contents

• In-process Sensory Evaluation Currently

• Study

• Results

• Conclusions

• Best Practices for Monitoring Beer Flavour Stability
Sensory Evaluation Currently

Training

Validation

Reference Standards

Trained Sensory Panel
In-Process Taster Training

- Water
- Process gases
- Filter Aid
- Fermentation / Maturation
## In-process sensory sample selection example

<table>
<thead>
<tr>
<th>Sample type</th>
<th>Locations</th>
<th>Frequency of testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incoming water</td>
<td>Intake point, pre- and post-treatment</td>
<td>Daily</td>
</tr>
<tr>
<td>Brewhouse water</td>
<td>Brewhouse hot liquor tank</td>
<td>Daily</td>
</tr>
<tr>
<td>Fermenting beer</td>
<td>Fermenters</td>
<td>Every tank</td>
</tr>
<tr>
<td>Conditioned beer</td>
<td>Fermenters</td>
<td>Every tank</td>
</tr>
<tr>
<td>Filtered beer</td>
<td>Pre- and post-filter</td>
<td>Every filter run</td>
</tr>
<tr>
<td>Beer in bright beer tank</td>
<td>Bright beer tank</td>
<td>Every tank</td>
</tr>
<tr>
<td>Deaerated water</td>
<td>Deaerated liquor tanks</td>
<td>Daily</td>
</tr>
<tr>
<td>CO₂, O₂, air, N₂</td>
<td>Point of use</td>
<td>Daily</td>
</tr>
<tr>
<td>Filter aids</td>
<td>Representative bags</td>
<td>Weekly</td>
</tr>
</tbody>
</table>
Market Study Scenario

7 brands

9 batches

2765 samples in 3 seasons

2017 ASBC Meeting
Measuring beer flavour stability

- Taste (off-flavours recognition)
- Analytically (Resistance to Oxidation)
Sensory Analysis

- In-process tasters
- Trained on 28 flavours
- Validated 6 times per year
Principal Component Analysis - Brand differentiation

Biplot (axes F1 and F2: 50.27 %)
Process gases key non-conformances

- DMS: 27%
- H₂S: 16%
- Diacetyl: 14%
- Musty: 6%
- Earthy: 4%
- Motor fuel: 4%

- 9%
- 20%
- 71%
Fermentation / Maturation key non-conformances

<table>
<thead>
<tr>
<th>Solvent Alc.</th>
<th>H₂S</th>
<th>Diacetyl</th>
<th>IAA</th>
<th>Ethyl Hex.</th>
<th>AA</th>
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</thead>
<tbody>
<tr>
<td>86</td>
<td>84</td>
<td>78</td>
<td>48</td>
<td>48</td>
<td>44</td>
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</tbody>
</table>
Packaged Beer key non-conformances-%

- Papery: 15.6%
- Honey: 14.4%
- Bready: 13.2%
- Leathery: 12.3%
- Sweet: 12.0%
- Acetaldehyde: 10.1%
- Methional: 7.8%
- Other: 14.6%
## ESR results

<table>
<thead>
<tr>
<th>Beer Brand</th>
<th>Start of Fermentation</th>
<th>Mid Fermentation</th>
<th>End of Fermentation</th>
<th>Packaged Beer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td><strong>Oxidised</strong></td>
<td><strong>Oxidised</strong></td>
</tr>
<tr>
<td>2</td>
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<td><strong>Oxidised</strong></td>
<td><strong>Oxidised</strong></td>
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<td>3</td>
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<tr>
<td>4</td>
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<tr>
<td>6</td>
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<td><strong>Oxidised</strong></td>
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<tr>
<td>7</td>
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<td><strong>Oxidised</strong></td>
<td><strong>Oxidised</strong></td>
<td><strong>Oxidised</strong></td>
</tr>
</tbody>
</table>
Lag Time

Lag Time = inflection point at which rate of radical formation starts increasing exponentially

Measures the endogenous antioxidant content of the beer/wort
T150 = [radical] after 150 min incubation at 60°C
Conclusions

• Two out of Seven Brands showed consistency over 90%
• In-process Tasting and ESR analysis showed that most of the oxidation processes in beer originates from the Mid and End Fermentation
• Oxidation processes which occurring in the production are one of the key reasons for brand inconsistency
• Detecting and Preventing Oxidation process in early stage of production seems to be critical
• Aligning In-process Sensory and ESR analysis gives significant advantages in early detection of Oxidation processes in the production
Best Practices for Monitoring Beer Flavour Stability

- In-process sensory
- Preventing oxidation processes
- Monitoring Brand Consistency
- Analytical Investigation
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and

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