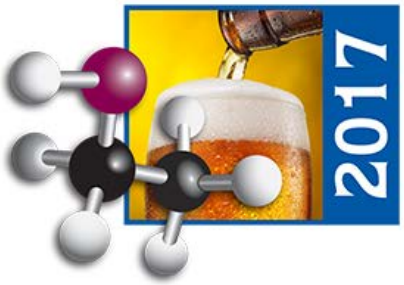


ASBC Annual Meeting

June 4–7 ■ Fort Myers, Florida

See what SCIENCE can brew for you

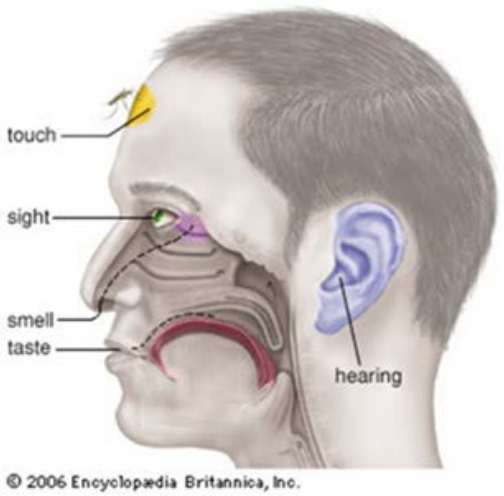
"IN-PROCESS SENSORY AND BEER FLAVOUR STABILITY"

Dr Boris Gadzov

FlavorActiV™

Why is beer flavour stability important?

Fresh beer .....



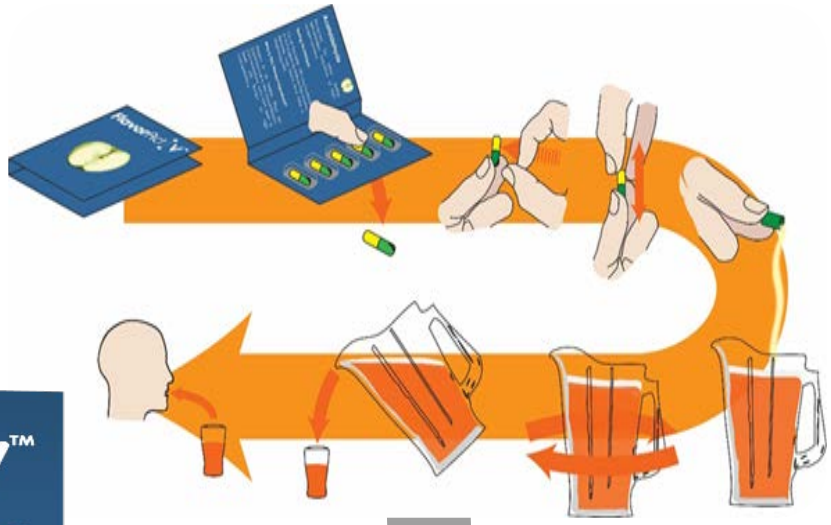
- **Tastes good**
- **Better drinkability = consumers buy more**
- **Longer shelf life = less consumer complaints**

Contents

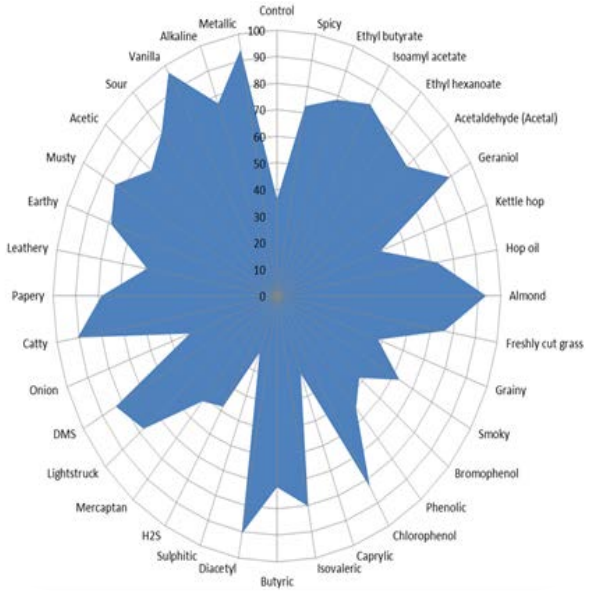
- In-process Sensory Evaluation Currently
- Study
- Results
- Conclusions
- Best Practices for Monitoring Beer Flavour Stability

Sensory Evaluation Currently

Training



Validation



Reference Standards

Trained Sensory Panel

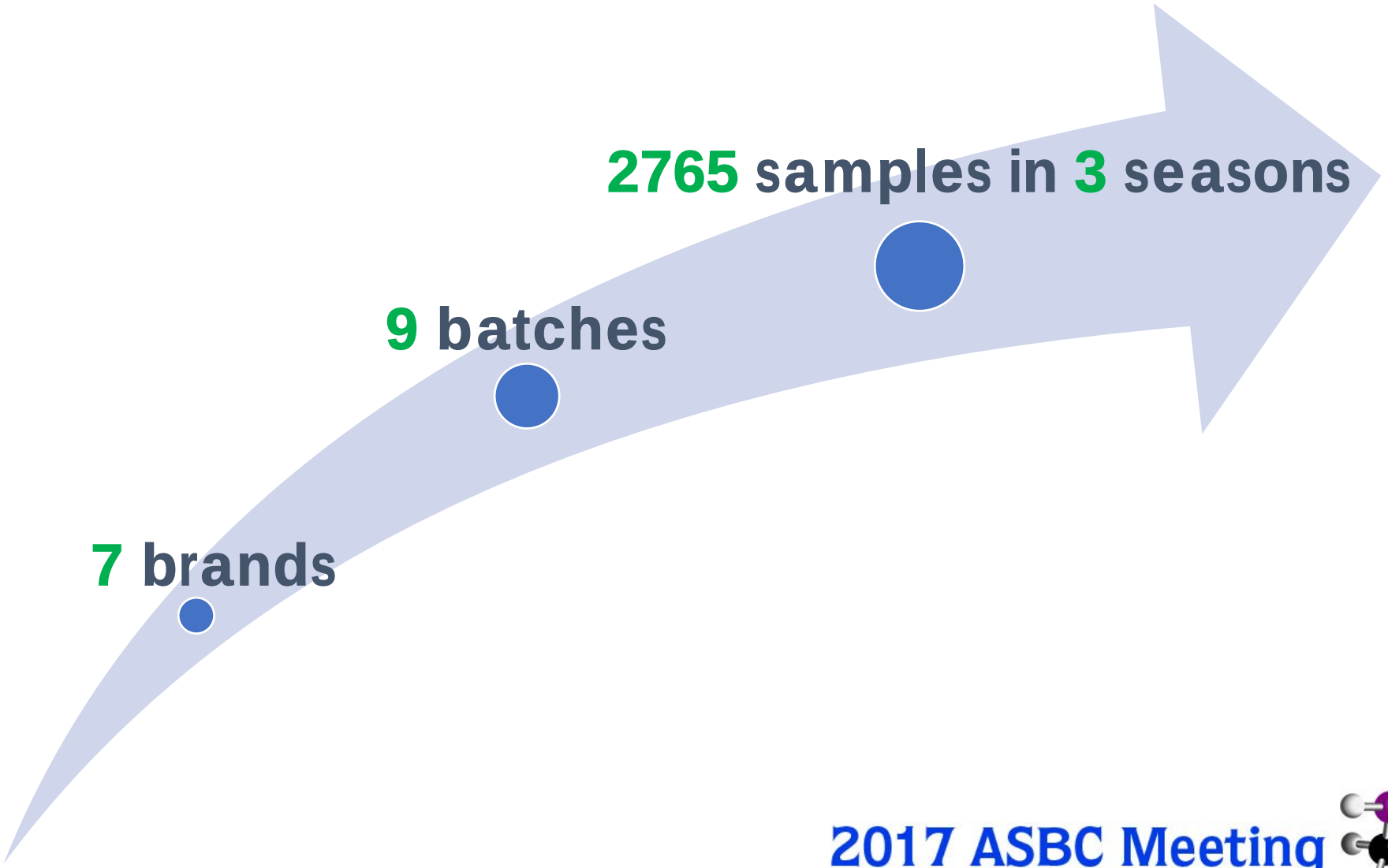
In-Process Taster Training

- Water
- Process gases
- Filter Aid
- Fermentation / Maturation

In-process sensory
Sample selection example

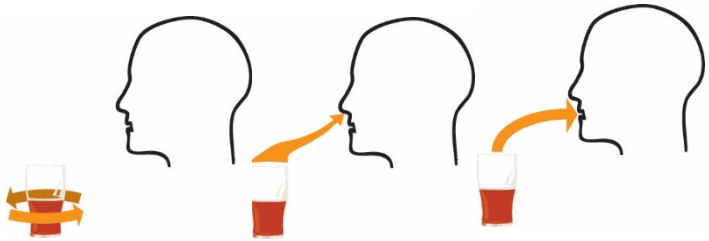
Sample type	Locations	Frequency of testing
Incoming water	Intake point, pre- and post-treatment	Daily
Brewhouse water	Brewhouse hot liquor tank	Daily
Fermenting beer	Fermenters	Every tank
Conditioned beer	Fermenters	Every tank
Filtered beer	Pre- and post-filter	Every filter run
Beer in bright beer tank	Bright beer tank	Every tank
Deaerated water	Deaerated liquor tanks	Daily
CO_2, O_2, air, N_2	Point of use	Daily
Filter aids	Representative bags	Weekly

Market Study Scenario



Measuring beer flavour stability

- **Taste (off-flavours recognition)**
- **Analytically (Resistance to Oxidation)**



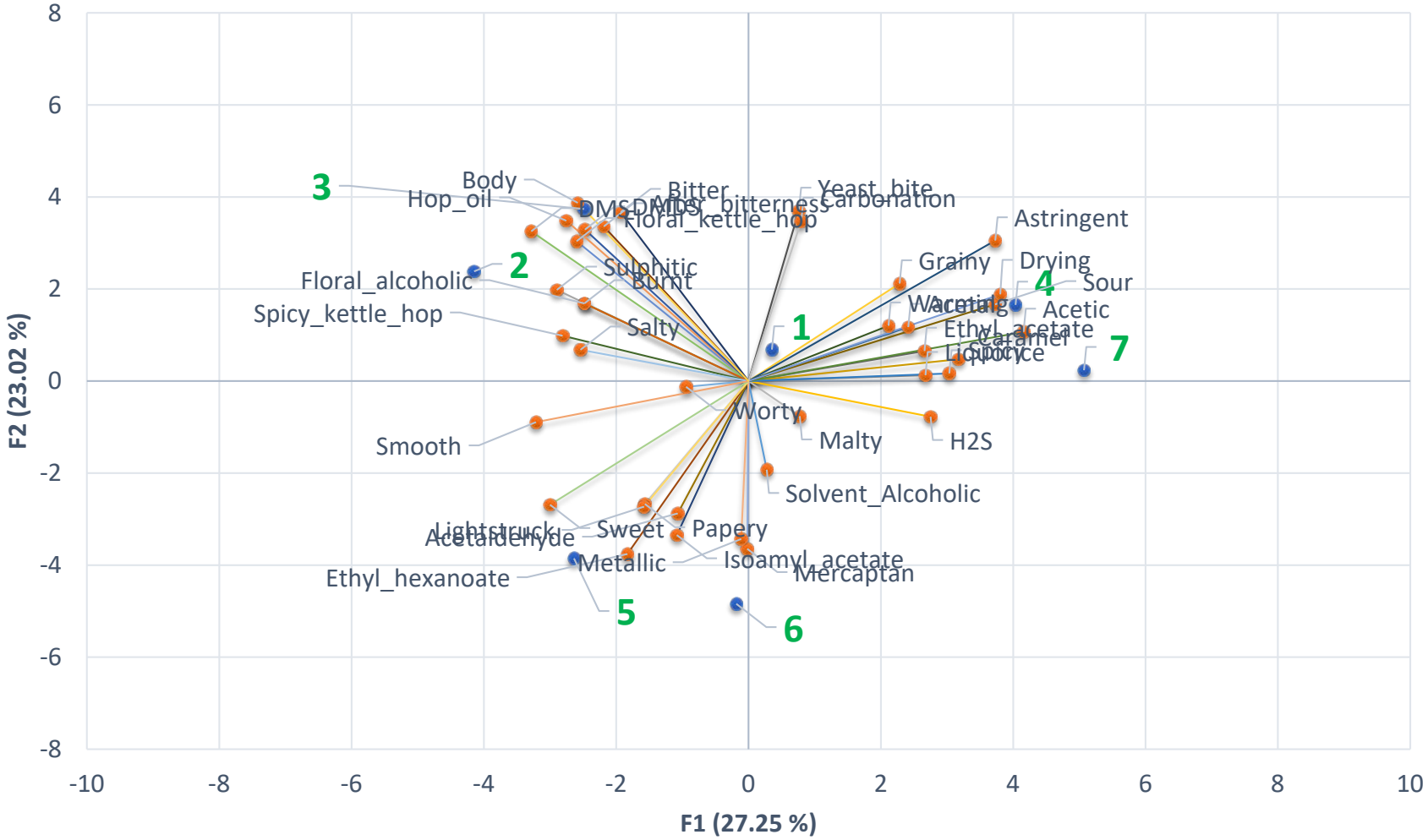
BRUKER Escan

Sensory Analysis

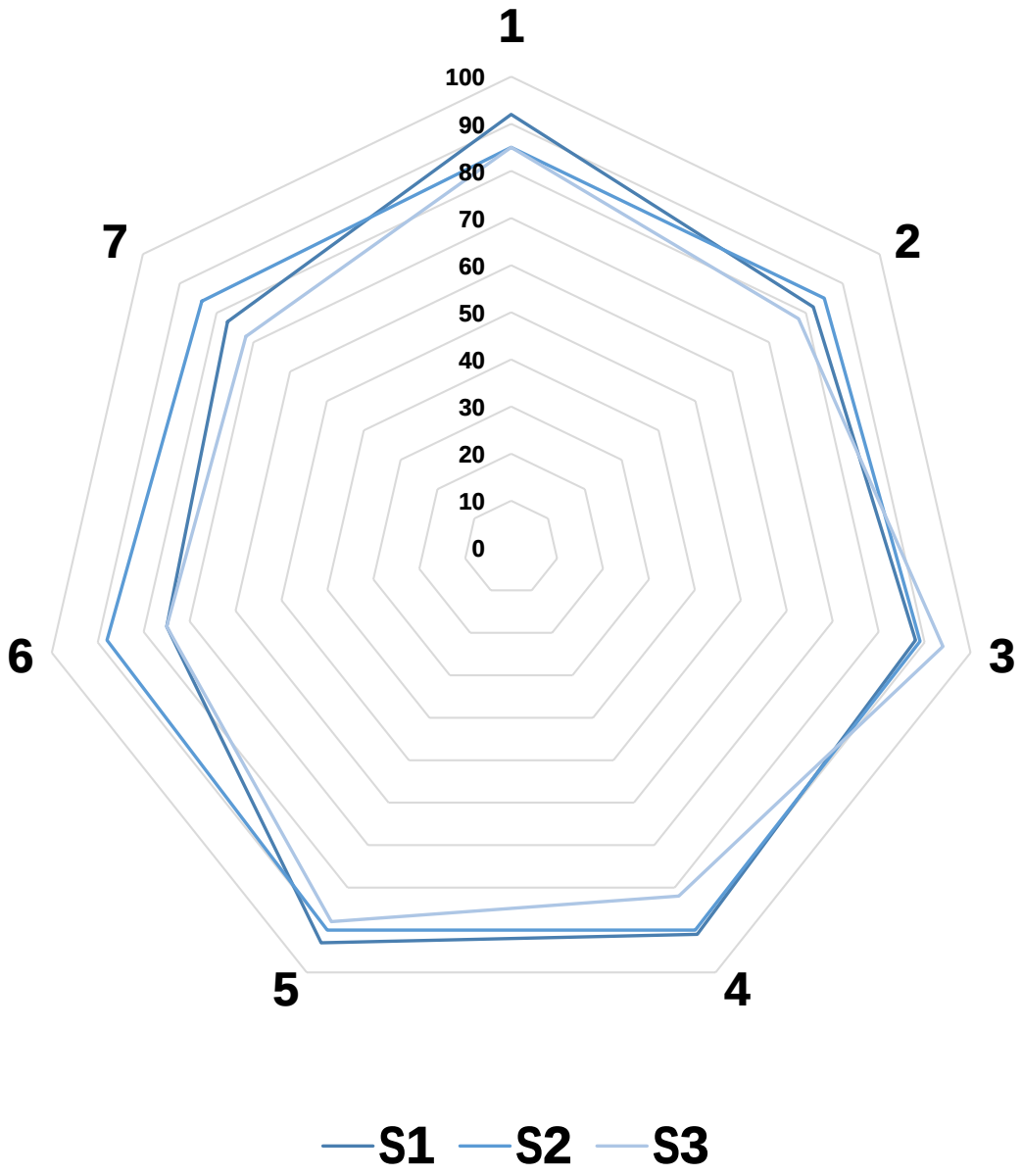
- In-process tasters
- Trained on 28 flavours
- Validated 6 times per year

Principal Component Analysis – Brand differentiation

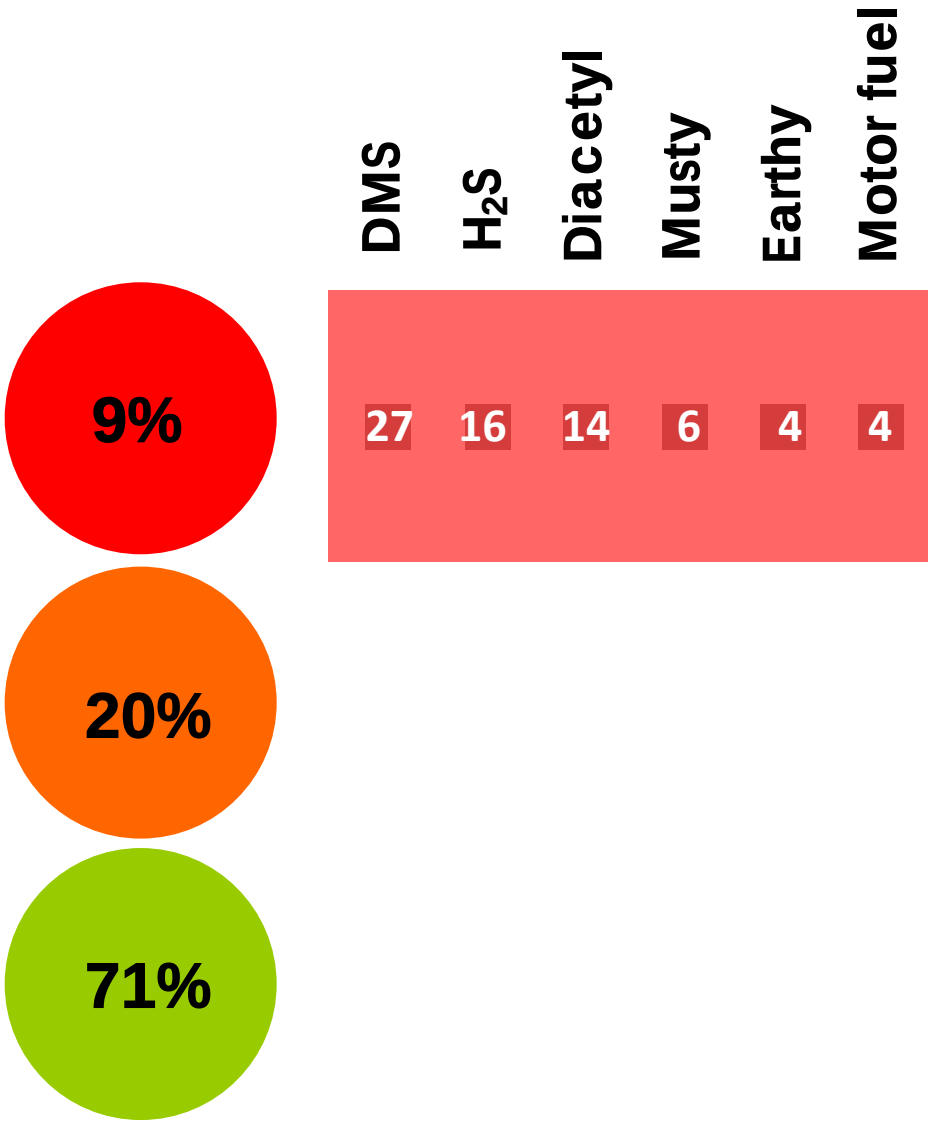
Biplot (axes F1 and F2: 50.27 %)



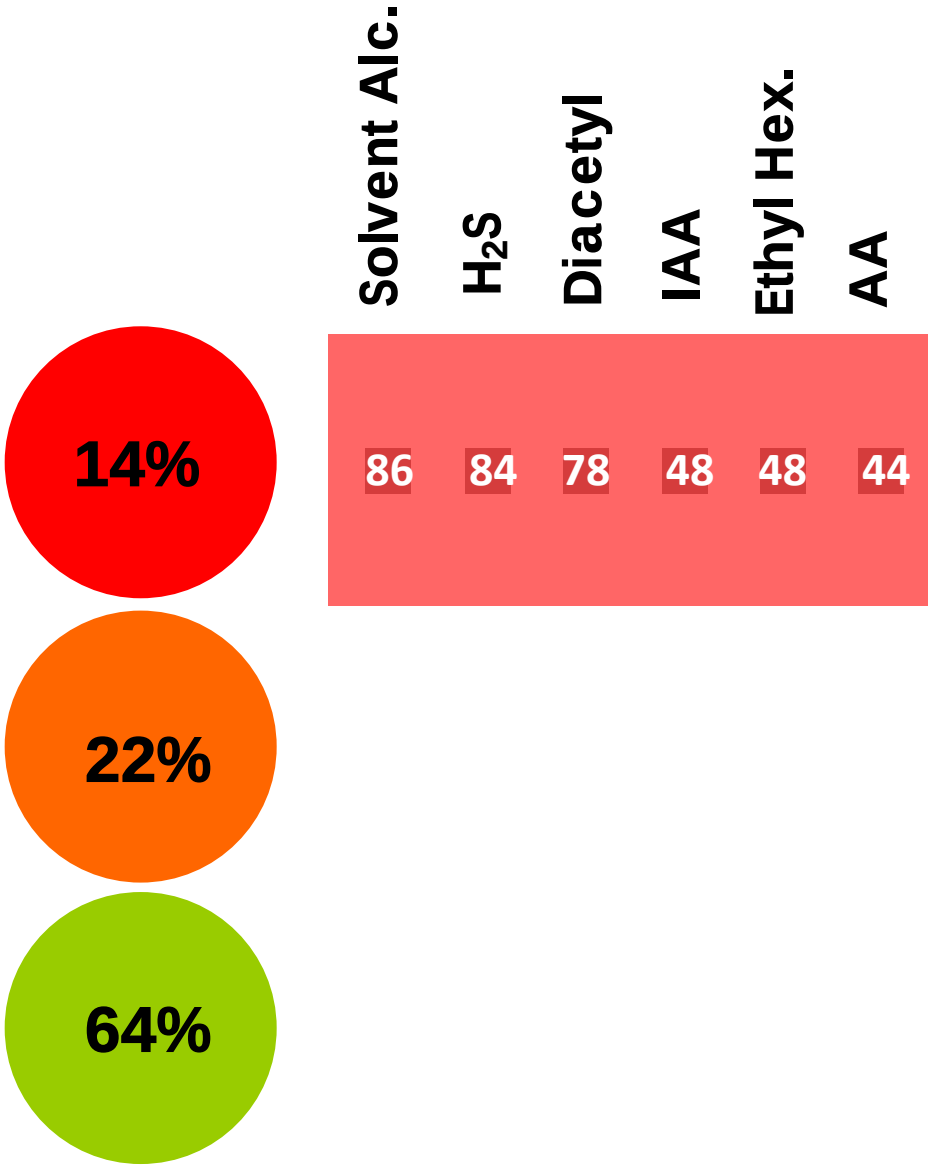
Consistency per Brand



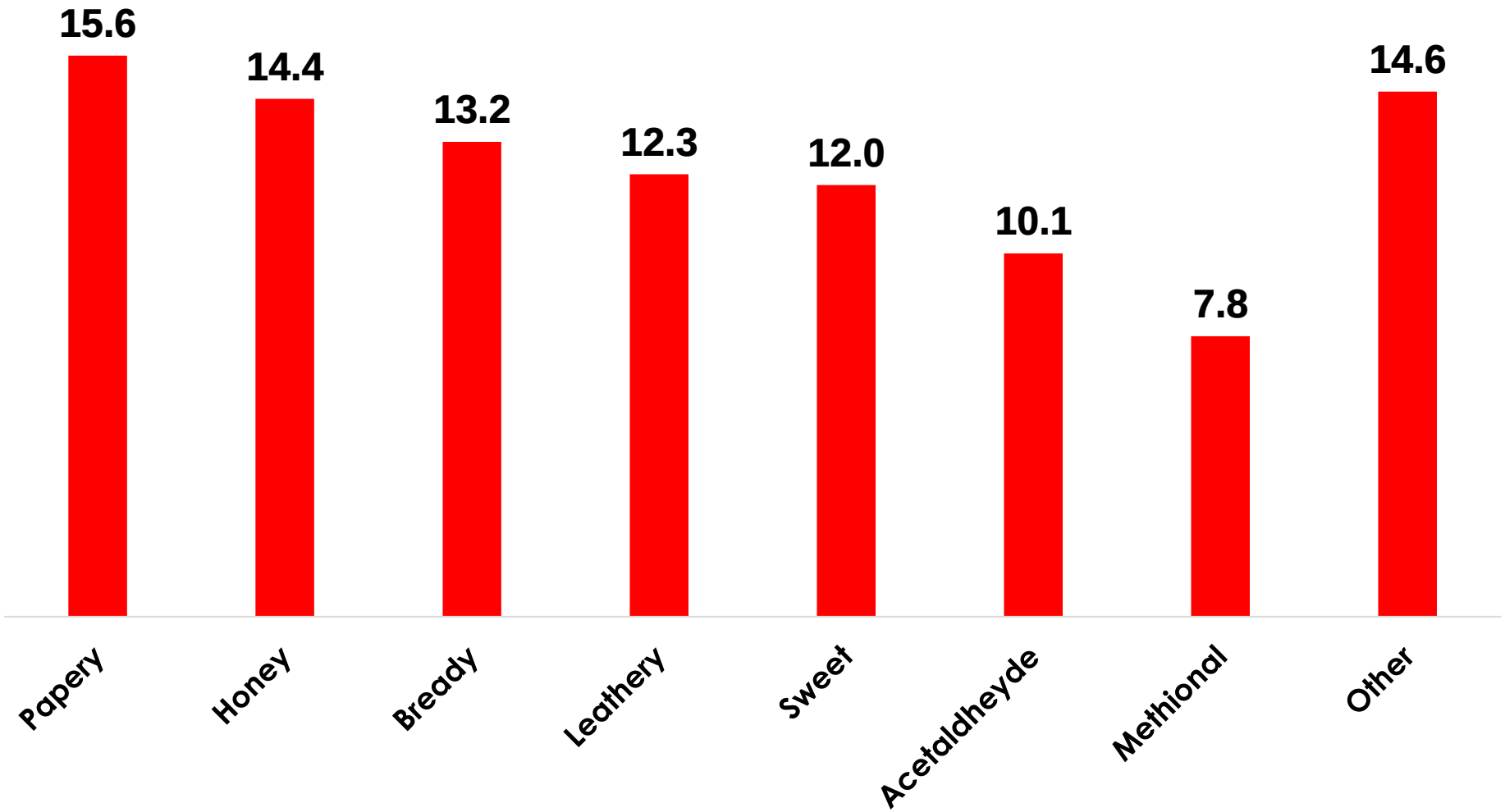
Process gases key non-conformances



Fermentation / Maturation key non-conformances



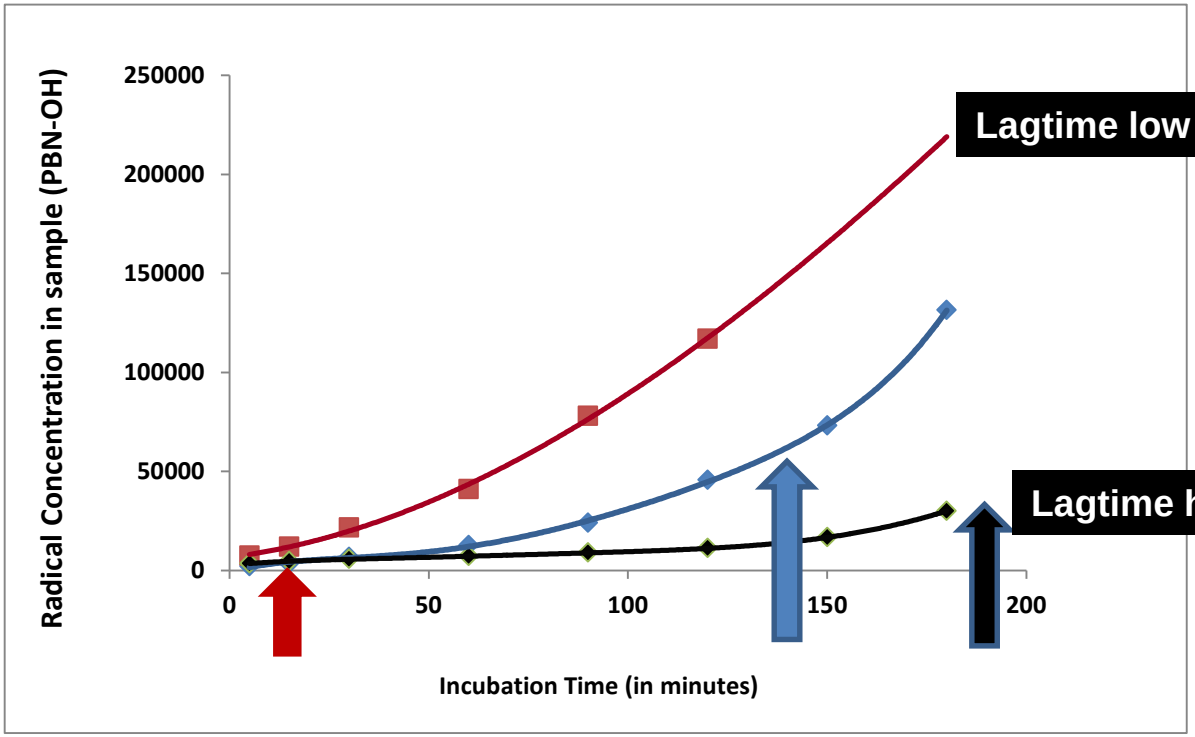
Packaged Beer key non-conformances-%



ESR results

Beer Brand	Start of Fermentation	Mid Fermentation	End of Fermentation	Packaged Beer
1			Oxidised	Oxidised
2			Oxidised	Oxidised
3				
4		Oxidised	Oxidised	Oxidised
5				
6	Oxidised	Oxidised	Oxidised	Oxidised
7		Oxidised	Oxidised	Oxidised

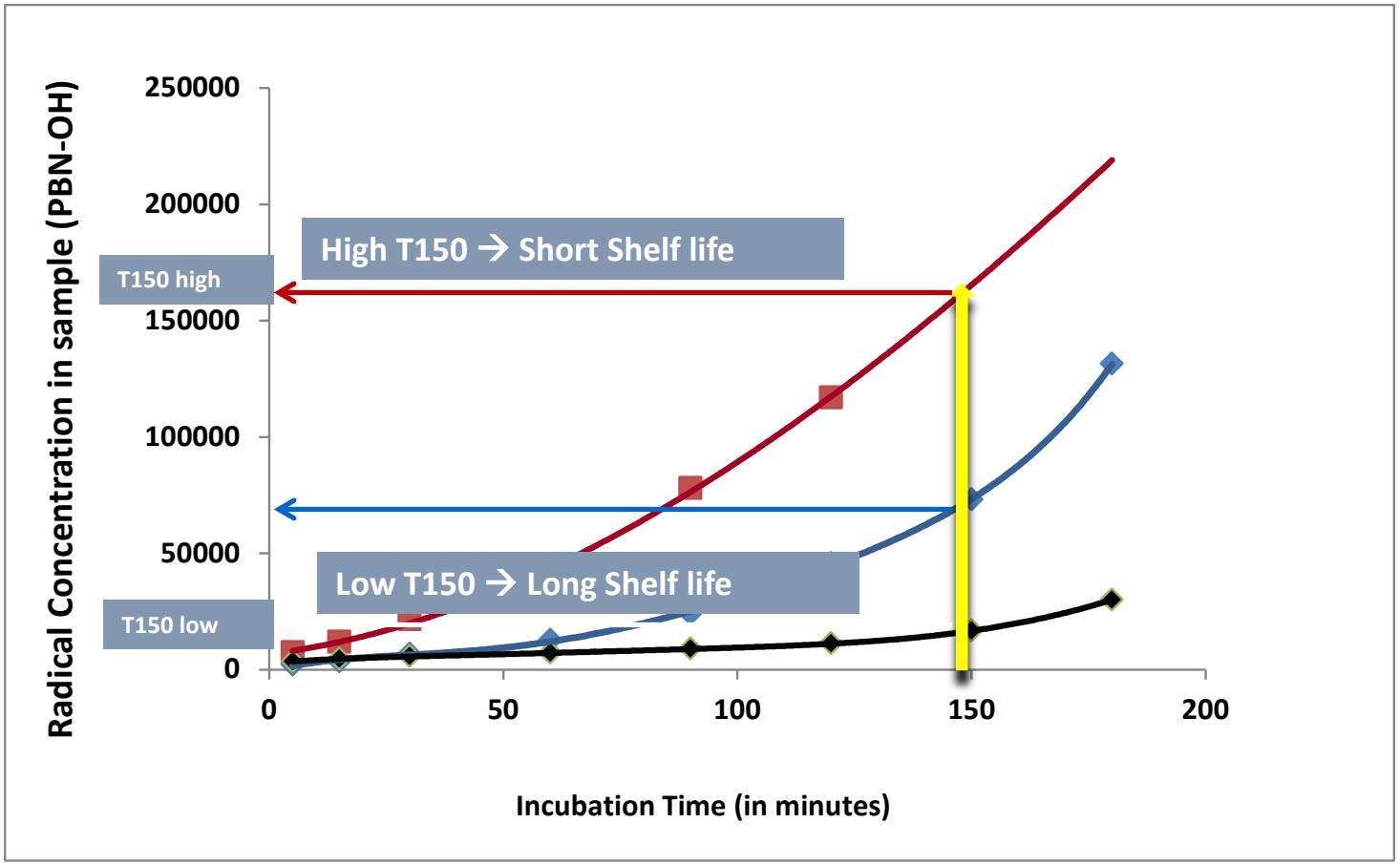
Lag Time



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

Measures the endogenous antioxidant content of the beer/wort

T150

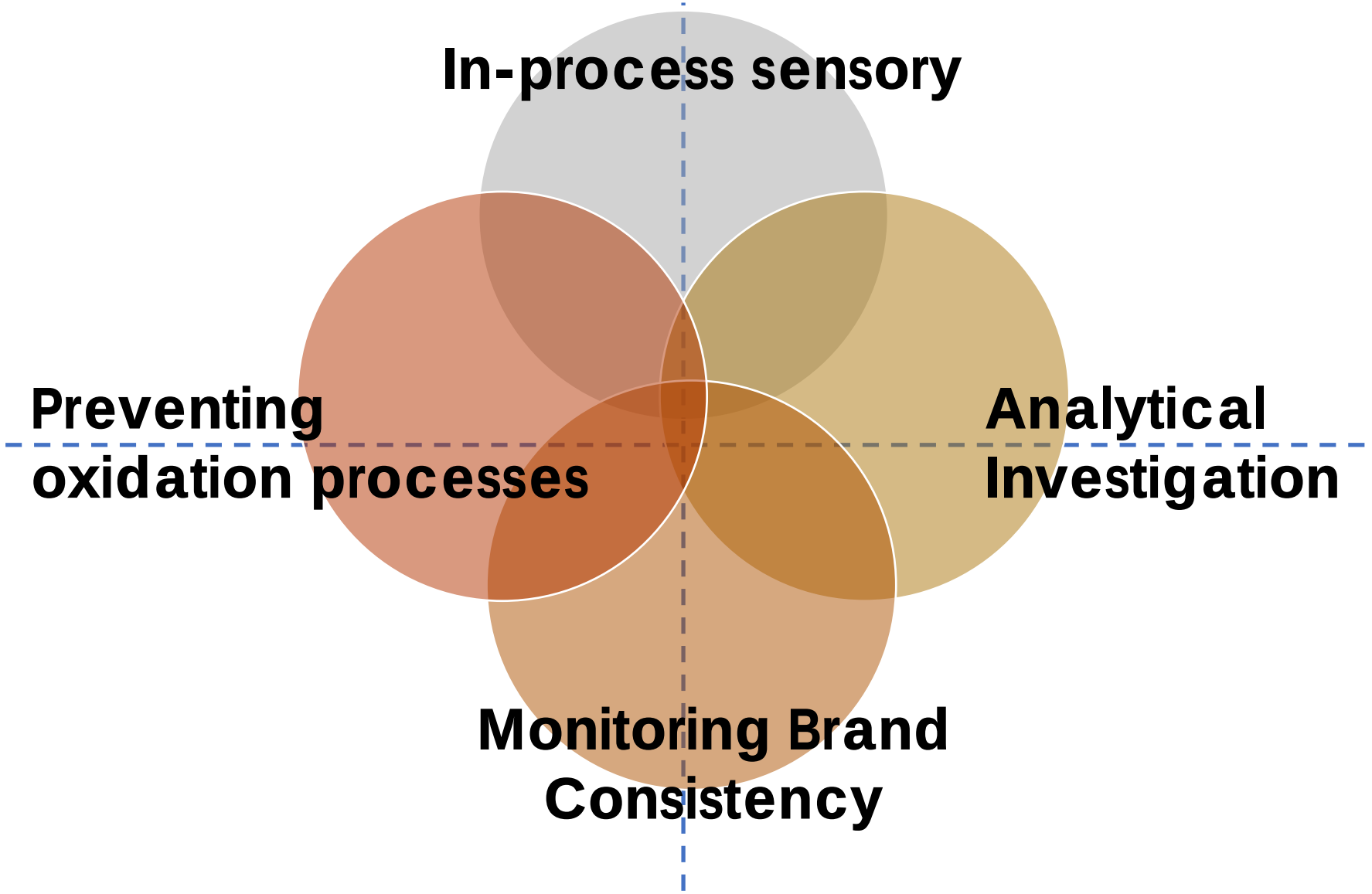


T150 = [radical] after 150 min incubation at 60^0C

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



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and

FlavorActiV's Global Customers