NAB Product Development

Using extracts to enhance and differentiate flavor, aroma, and mouthfeel

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Scientist I – Hops and Brewing Innovation

Kalsec

Off Flavors and Missing Flavors in NA Beer

Undesirable “off flavors” or aromas formed via NAB process deviation

Sweet/Worty

Mouthfeel Differences

Oxidation Products

Flavors that are missing or removed due to NAB process deviation

Hop Aroma

Fermentation Esters

Lack of Ethanol

GC-MS Survey of NA and Full Strength (FS) Lagers

Goal: Utilize an untargeted or semi-targeted workflow to determine if there are any "global" differences between NA and full strength (FS) lagers.

14 Beers in total

N. America

2 Brewing Conglomerate
2 Brands Each
NA and FS from each brand
8 total beers

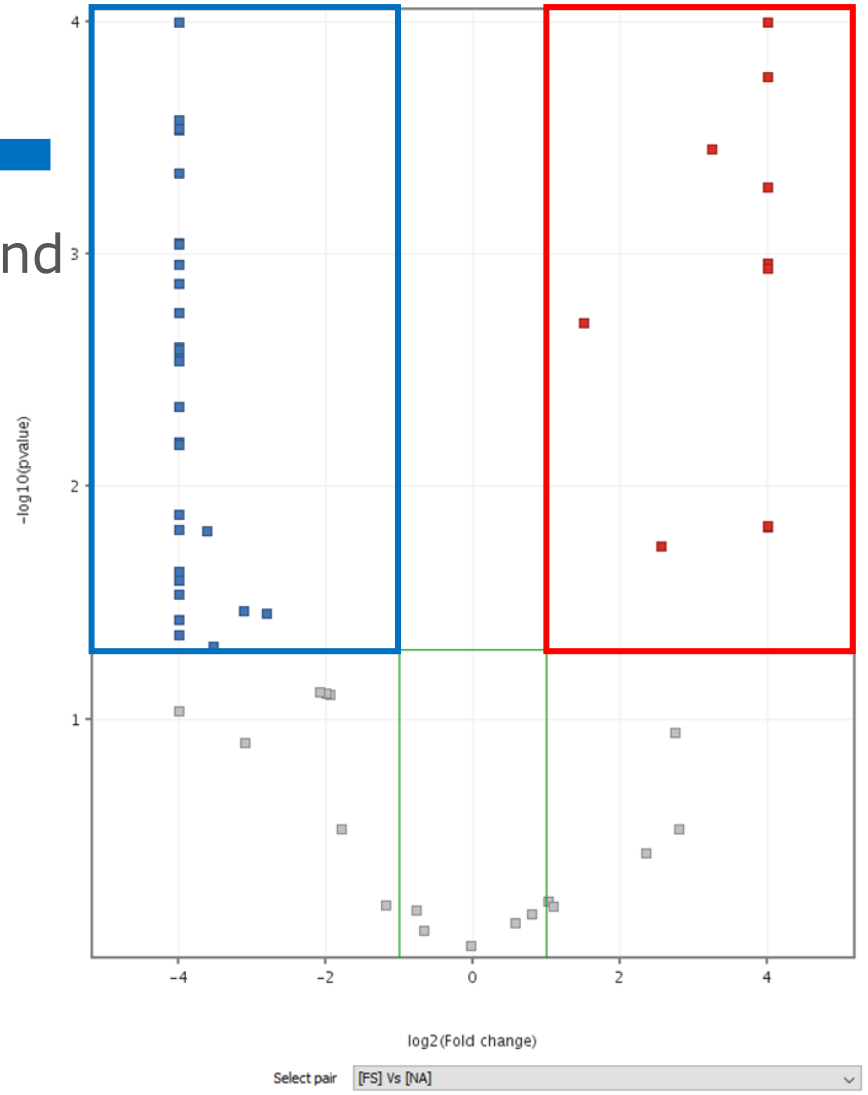
UK + EU

3 Breweries
1 Brand Each
NA and FS
6 total beers

Uncovering Differences

Compound Type
phthalate
degradation
flavor/degradation
??
2-ketone
plasticizer
flavor/degradation
MCFA
plasticizer
flavor/degradation
degradation
maillard
2-ketone
phthalate
ketone
terpene
2-ketone
phthalate
MCFA
LCFA
oxidation
oxidation
oxidation
oxidation
oxidation
terpene
???
oxidation
oxidation
???
diketone
???
flavor/degradation
plasticizer
oxidation
oxidation
oxidation
oxidation

Compounds found to be higher in NA beers



Compounds found to be higher in Full Strength beers

Compound type
MCFA
AA catabolism
Ethyl ester
Ethyl ester
Ferm. Ester
Ethyl ester
Ferm. Ester
Ferm. Ester
Ethyl ester
Ethyl ester
SCFA
Ethyl ester
Ethyl ester
Ethyl ester

Acronym Key

SCFA: Short chain fatty acid
MCFA: Medium chain fatty acid
LCFA: Long chain fatty acid
AA Catabolism: amino acid catabolism

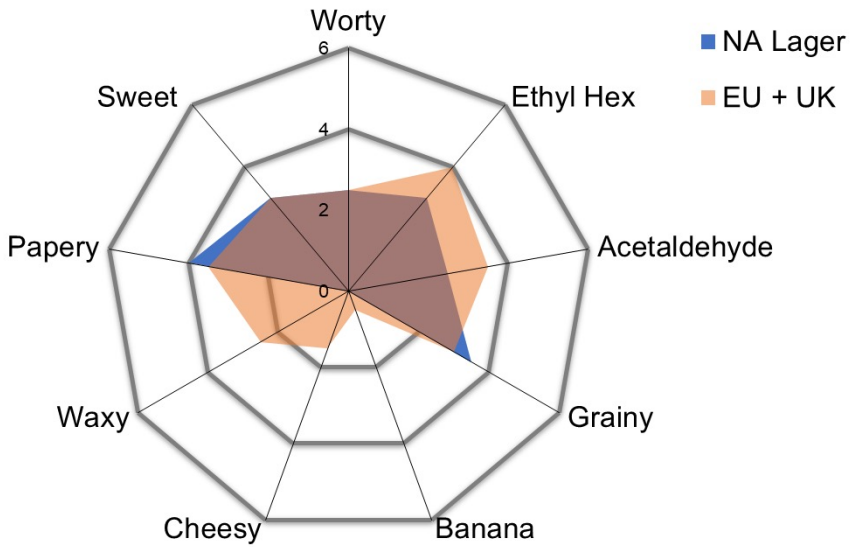
<u>FUTURE RESEARCH OPPORTUNITY</u>

Explore antioxidant treatment to prevent formation of oxidation and stress related compounds

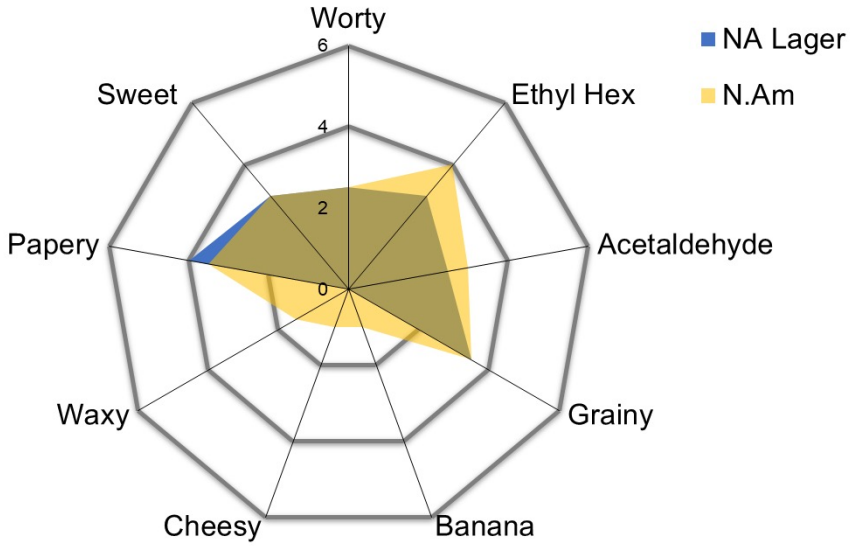
Formulation Opportunity

- Data Processing and Segmentation
- Flavor Chemist Development Work
- Sensory Panel Evaluation
- New Product Developed

UK+EU Lager Esters Prototype

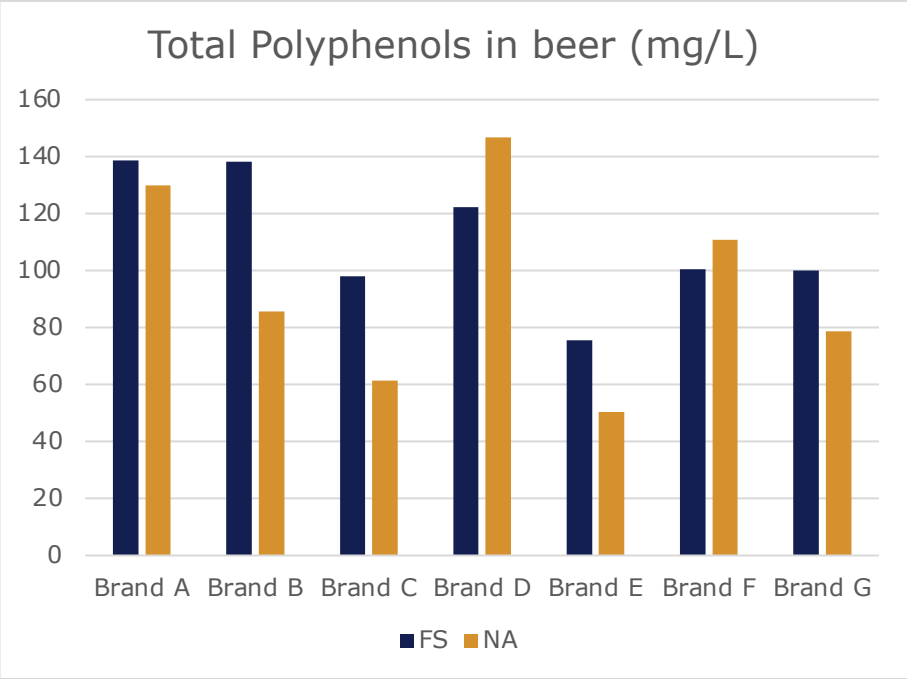


N. America Lager Esters Prototype



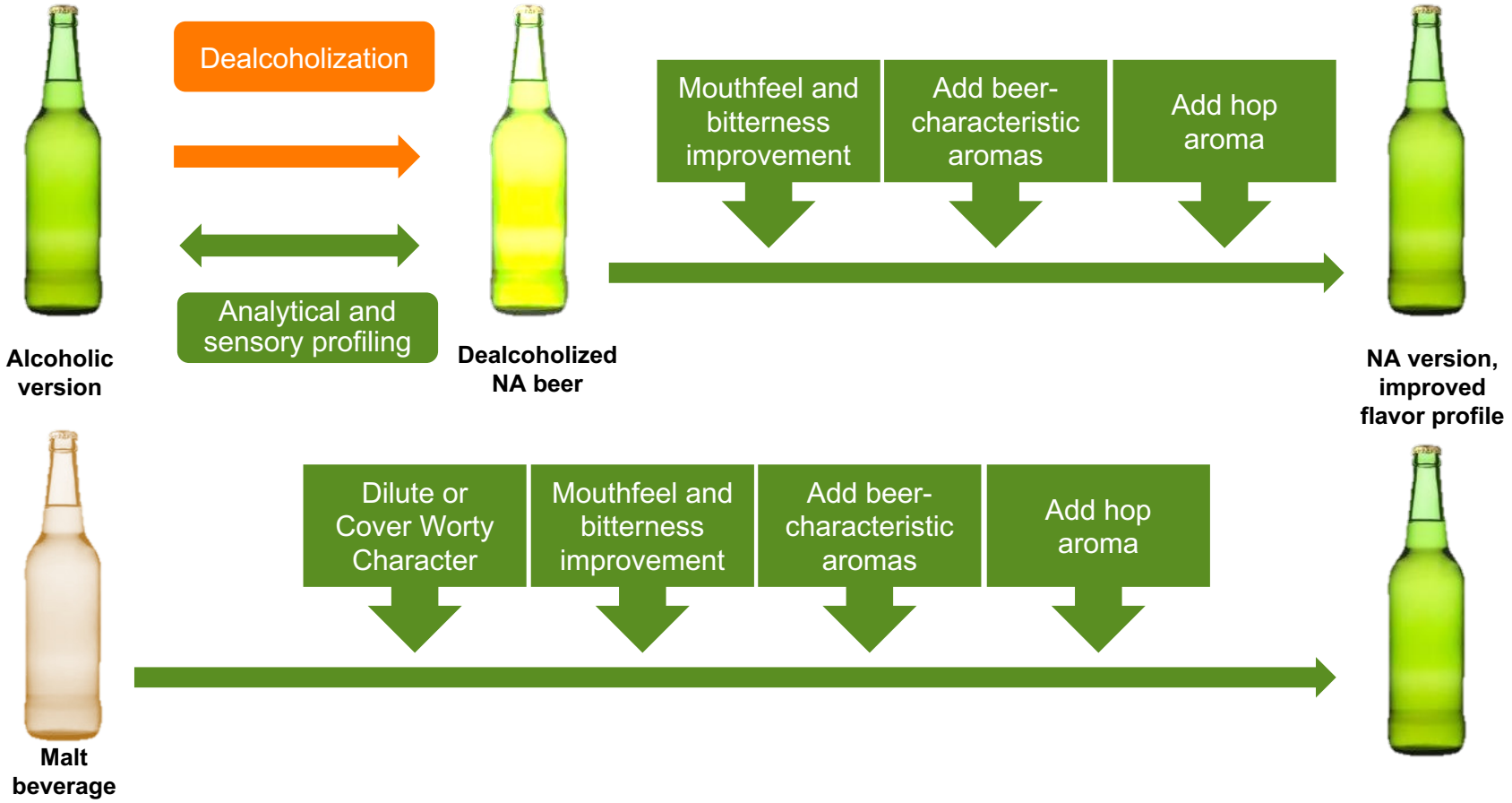
Mouthfeel Improvement

NA beers demonstrate approximately 15% lower polyphenol content by ASBC Method Beer-35

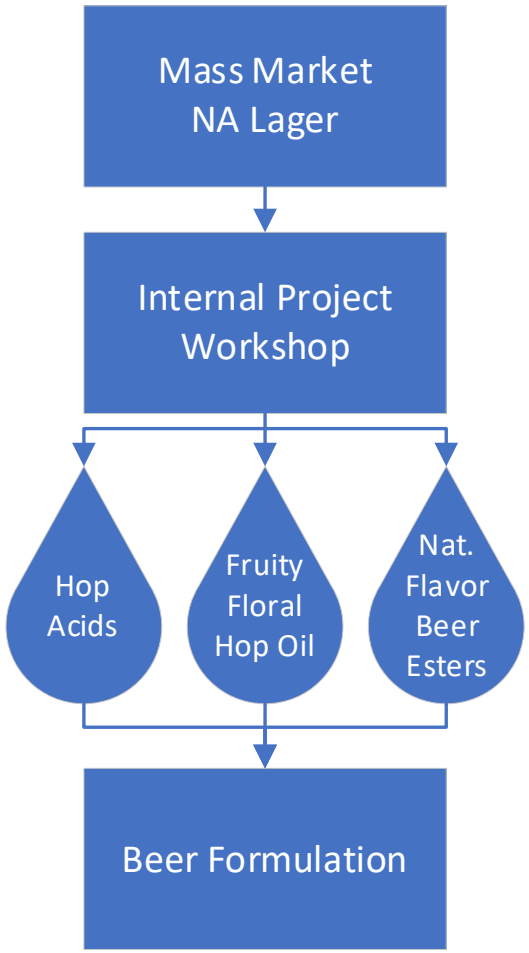


- Lower polyphenols likely to have a sensory effect on NA Beer
- A green tea extract was tested to increase overall polyphenols
- Internal sensory panel feedback
  - "Softer/thin mouthfeel"
  - "Smoother mouthfeel"
- Practical work with this extract has shown
  - Provides a drying effect
  - Improve mouthfeel character to be more beer like
  - Success of product is base dependent

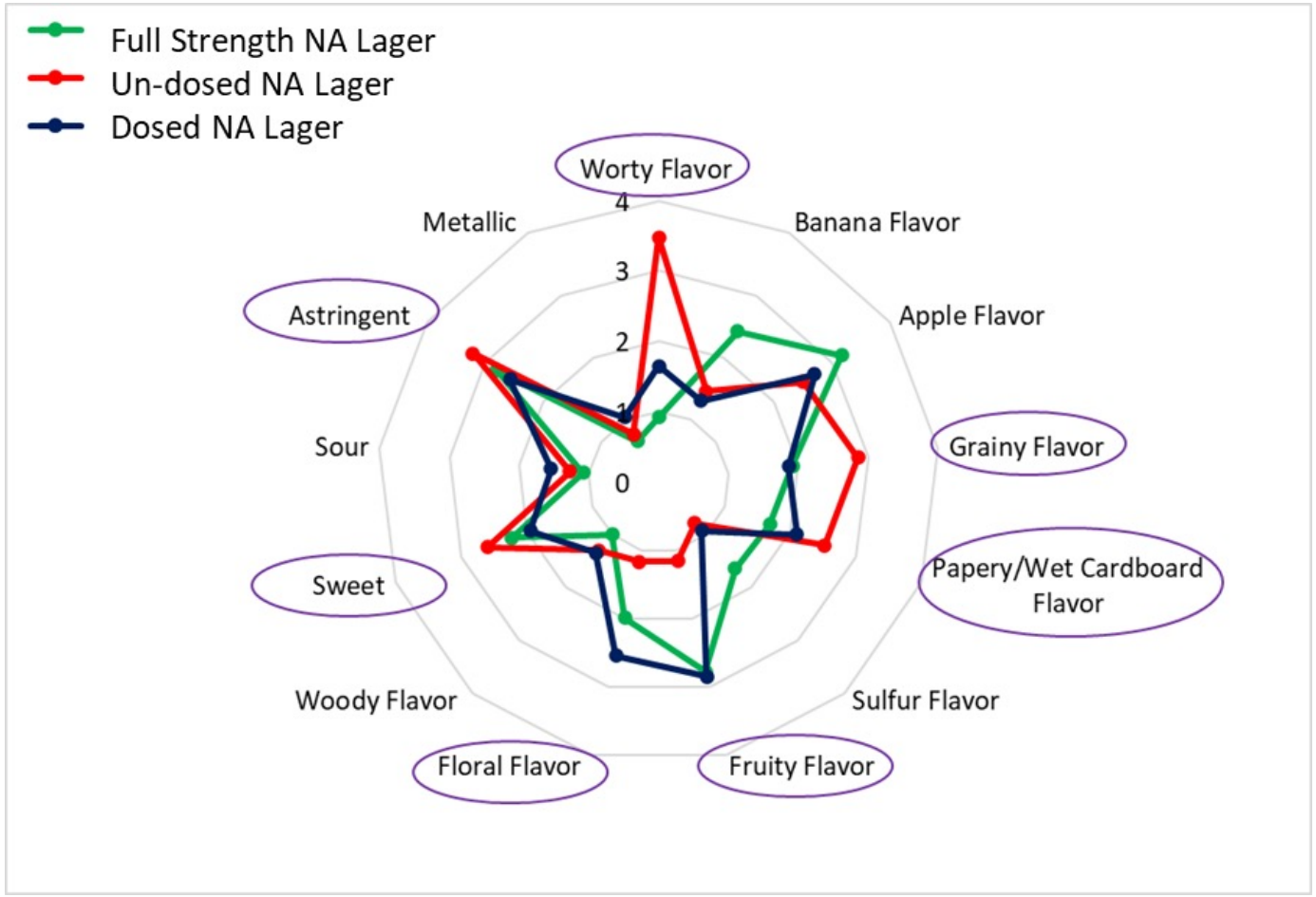
Case Study: NA Beer Improvement



Case Study: NA Beer Improvement

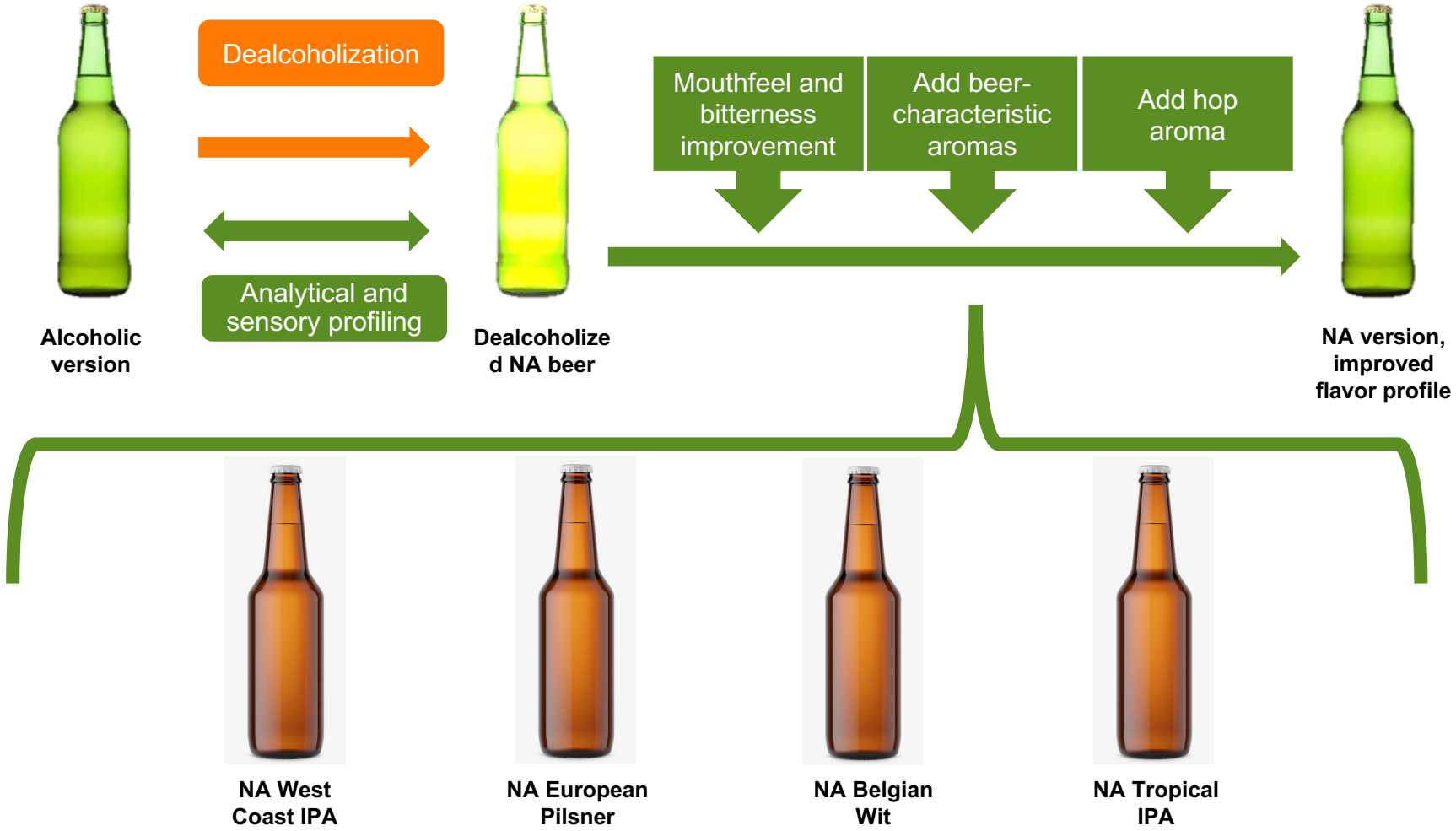


Sensory Profile



- Reduced
  - Worty
  - Grainy
  - Papery
  - Sweetness
  - Astringency
- Increased
  - Fruity
  - Floral

Case Study: NA Beer Differentiation



Takeaways

- Volatile differences between NA and FS beer
  - Oxidation products are higher in NA beer
  - Ethyl and fermentation esters are lower in NA Beer
- Non-volatile analytical differences
  - NA beers demonstrate approximately 15% lower total polyphenols
- Hops and other natural flavor extracts can offer solutions for improving and differentiating NA beer bases

Resources – Companies Offering NA Beer Solutions

kalsec®

Totally Natural Solutions

HOPZOIL™

symrise

DÖHLER
NATURAL FOOD & BEVERAGE INGREDIENTS

ASBC

MASTER BREWERS
EST 1887
ASSOCIATION OF THE AMERICAS