



Aromatic Yeast Nutrients as Beer Flavour Boosters

Who is AEB



Our beginnings: Began in 1963 as the Agency of Enology of Brescia – Perfecting the art & science of winemaking

Today: expanding knowhow and delivering expertise to beer brewing and next generation beverages

AEB Brewing's focus is in brewing yeasts, fermentation (alcohol, acetic, lactic), aroma and flavour development, sustainable biotechnologies beer production including low and no alcohol beers, optimising production processes for brewing consistency, quality, and stability

Developing **Creative Collabs** with amazing brewers around the world

Consumer Preference



- ❖ Continued demand for tropical fruit aromas in hop-forward beers
- ❖ Ongoing need to be innovative and add new flavor profiles
- ❖ Low and non alcohol beers with greater aroma & flavour notes

How brewers enhance beer aroma



- Add Sauvignon grape skins to the mash instead of late hopping or to the beer during dryhopping (Phantasm)
- Use ‘thiolised’ yeast created via gene editing (hybridization)
- Use yeast strains altered using GM techniques to promote thiol expression
- Adding enzymes to fermentation
- **But there another way ...**

Yeast nutrients with Fragrant, Fruity & Sauvignon grape aromas



Yeast nutrients developed from AEB Group's winemaking division specifically for brewing to give fragrant, fruity and Sauvignon grape aromas

FERMOPLUS® Fragrance

Enriched with **Phenylalanine**
Precursor of Phenylacetaldehyde (floral, hyacinth) & 2-Phenylethanol (floral, rose)

FERMOPLUS® Fruity

Enriched with **Leucine & Isoleucine**
Precursors of isoamyl alcohol & isoamyl acetate (banana), ethyl propionate (apple) & ethyl butanoate (pineapple)

FERMOPLUS® Sauvignon

Enriched with Sauvignon grape skin tannins
Precursors of polyfunctional thiols (lime, green apple, passion fruit and white peach)

Typical composition:

- **Pre-treated yeast hull** – source of mannoproteins
- **Autolysates of yeast (aka lysate)** – source of proteins, vitamins, fibre, micronutrients
- **L-ascorbic acid**

Product Development - Aromaglow



- Combination of three nutrients Fermoplus Fruit, Frangrance and Sauvignon
- Inclusion of grape skin tannins
- Pre-treated yeast hull for mannoproteins
- Autolysates of yeast - source of proteins, vitamins, micronutrients
- L-Ascorbic acid (antioxidant)
- 2 g/hl of FAN per 40g/hl dose

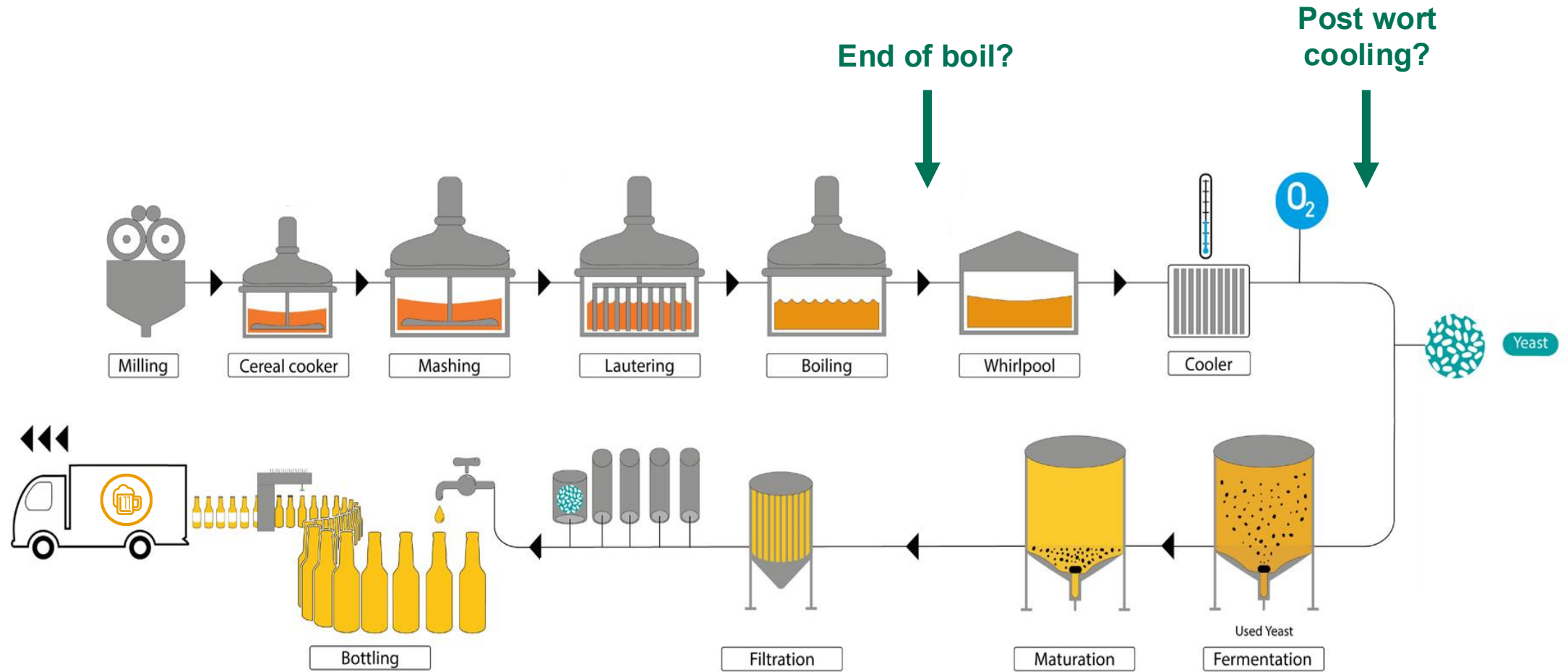
AEB's UNIQUE FORMULATION



Precursor of:

Isoamyl alcohol/ isoamyl acetate (banana)
ethyl propionate (apple)
ethyl butanoae (pineapple)
Phenylacetaldehyde (floral, hyacinth)
2-phenylacetaldehyde (floral, rose)
Polyfunctional thiols (such as 3-MH, 3-MHA, 4-MMP)

Nutrient addition > Hot wort or Cold wort?



Nutrient addition - temperature considerations



Hot wort temp = 85 - 103°C

Cold wort temp = 9 - 25°C

Deactivation temperatures for:

- Pantothenic acid (B5) 80°C
- Biotin (B7) 75°C
- Thiamine (B1) 70°C
- m-Inositol (B8) 45°C

> Recommend cold wort addition

Experimental design for enhancing aroma



OMINIPOLLOS HATT IPA DOUBLE BATCH

OG: 15.1°P
ALCOHOL CONTENT: 6,2%ABV



**Dry Active Yeast: AEB F. New-E: 60 g/hl
+ AEB Yeast Nutrient: 40 g/hl total**

FERMOPLUS Aromaglow

Added:

- Into cold wort [20 g/hl]
- Into beer when spunding / first dryhopping [20 g/hl]

Esters



CONCLUSION

A marked increase of specific esters was found in the treated batch in comparison the control one. This indicates that the use of the nutrients does promote the formation of esters in the beer.

				Control	Test
E S T E R S	Linear acidic ethyl esters	Ethyl heptanoate	mg/L	0.0973	0.136
	Linear acidic ethyl esters	Ethyl Octanoate (Ethyl Caprylate)	mg/L	0.546	0.579
	Linear acidic ethyl esters	Ethyl nonanoate	µg/L	54.1	72.5
	Linear acidic ethyl esters	Ethyl dodecanoate	µg/L	19.8	24.9
	Fermentative esters	Ethyl L-Lactate	mg/L	2.96	5.57
	Fermentative esters	Isoamyl Octanoate (Isoamyl Caprylate)	µg/L	11.2	12.6
	Fermentative esters	Phenylethyl acetate	µg/L	17.5	32.8
	Esters of varietal origin	Valerate of Ethyl	µg/L	12.0	13.1
	Esters of varietal origin	Ethyl Vanillate	µg/L	8.05	9.28
	Esters of varietal origin	Methyl Hexanoate (Methyl Caproate)	µg/L	13.1	14.8
	Esters of varietal origin	Methyl dihydrojasmonate	µg/L	11.4	13.6
	Esters of varietal origin	Methyl Salicylate	µg/L	19.0	30.0

Terpenes



CONCLUSION

A significant increase of all the terpenes was found in the test batch in comparison the control one. This indicates that the use of the nutrients does have a relevant impact on the formation of desired terpenes in beer.

Compound	Molecule		Control	Test	Aroma & Flavour Descriptor
T E R P E N E S	Citral cis	mg/L	14.5	20.1	citrus
	Citral trans	mg/L	0.194	0.320	citrus
	Citronellol	µg/L	19.4	40.7	citrus
	Eucalyptol (1,8-Cineole)	µg/L	3.10	3.47	eucalyptus, medicinal
	Geraniol	mg/L	1.14	1.34	floral, geranium
	Geranic Acid	µg/L	83.5	88.2	floral, geranium
	Geranyl acetate	µg/L	7.67	13.7	floral, geranium
	Limonene	µg/L	47.6	64.7	citrus fruits
	(E)-Hotrienol [(5E)-3,7-dimethyl-1,5,7-octatrien-3-ol]	mg/L	5.89	8.43	floral
	Linalool	mg/L	0.987	1.16	floral, rose
	Linalool Oxide <Cis-	µg/L	47.1	51.6	varietal (earthy, herbal, floral, sweet)
	Linalool Oxide <Trans-	µg/L	21.6	27.0	varietal (earthy, herbal, floral, sweet)
	Nerol	mg/L	0.665	0.732	varietal, floral, rose
	(±)-Cis-Nerolidol	mg/L	0.179	0.177	floral
	(±)-Trans-Nerolidol	µg/L	32.5	34.2	citrus, lemongrass
Terpineol <Alpha-	mg/L	0.252	0.296	floral (lily)	

Norisoprenoids – terpene precursors compounds



CONCLUSION

The use of **the nutrients** promoted a clear **increase** of norisoprenoids in **the test batch**.

Compound	Molecule		Control	Test	Aroma & Flavour Descriptor
NORISOPRENOIDS	Ionone <(E)-, Alpha-	ng/L	N.R.	N.R.	violet
	β-Damascenone	μg/L	49	67	exotic fruits, green apple
	TDN (1,1,5-Trimethyl-1,2-dihydronaphthalene)	μg/L	14.1	17.6	
	Trans-β-Ionone	μg/L	0.258	0.320	violet
	Vitispirano	μg/L	0.252	0.328	

Sensory Evaluation - Omnipollos Hatt IPA



4 of 8 tasters found a significant difference between the two samples.
All those who recognized the difference **preferred sample TEST.**

CONTROL

Visual: Straw yellow and cloudy in appearance, little foam formation.

Flavour: Pronounced tropical fruit on the nose (mango), fruity-peppery in taste paired with eucalyptus. Powerful hopburn and sharp menthol finish.

Bitterness: Strong bitterness, lasting chili spiciness



TEST

Visual: Straw yellow and cloudy in appearance, little foam formation.

Flavour: Pronounced tropical fruit on the nose (mango), also **slightly citrusy (unripe grapefruit)** in taste. **Light hopburn** and somewhat sharp finish.

Bitterness: Strong bitterness, not too long lasting.



Significance level = 95%
8 Sensory panellists

Yeast nutrients - efficient, natural, sustainable



- The yeast nutrients evaluated enhance the conversion of aroma-active thiol precursors, while increasing esters, terpenes, and norisoprenoids.
- They also improve sensory balance, optimizing sweetness, bitterness, mouthfeel, and overall roundness, while reducing aldehydes, ketones, and lactones associated with aging, and thereby supporting flavor stability
- Additionally, their use can reduce reliance on high-thiol hop varieties and excessive dry-hopping, lowering raw material costs, beer losses, water usage, and GHG emissions linked to spent hops.

**Yeast nutrients can boost aroma profiles of beer
in an efficient, more natural and sustainable way**

Nutrient Aromas - Tricks of the Trade



In order to promote higher ester levels, it is important to:

- Aeration:
 - It is known that wort oxygenation reduces ester levels. Reduce to 8 g/hl.
- Yeast pitching:
 - Overpitching leads to lower ester formation. 50 g/hl is enough.
- Fermentation temperature:
 - The higher the temperature, the higher ester levels. Consider increasing the temperature by a degree after 72 hours when the highest activity of the yeast takes place). Keep the fermentation at this elevated temperature until the yeast reaches FG.
- Spunding:
 - Do not spund the beer before the 4th day of fermentation. Hydrostatic pressure stresses out the yeast leading to lower ester formation.

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