

# Craft NA Beer Production: Methods, Marketing, Regulations, and Shelf Stability

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# Agenda

- The Challenges of NA Beer
- Methods for Making NA Beer
- Market and Marketing Considerations
- Regulation and Compliance
- Spoilage and Shelf Stability
- Solutions from ABV Technology



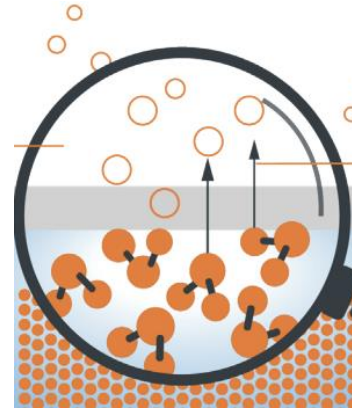
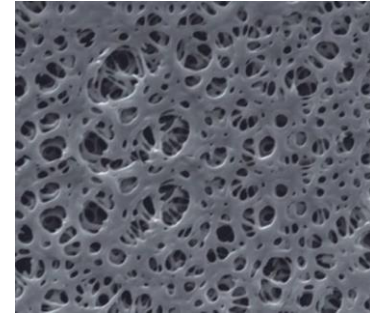
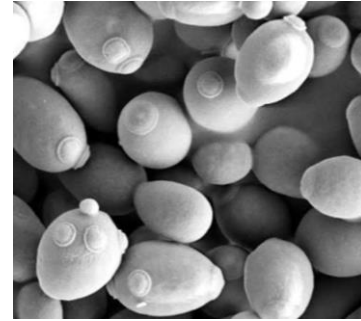
# The Challenges

- Craft NA demand continues to grow rapidly
- *Health and safety conscious consumers* are driving this
- Pandemic accelerated a shift in consumer preferences
- NA offerings in the tap room diversify access and increase volume
  
- Several technologies exist for making craft NA beer
- Each has distinct advantages and disadvantages
  
- So, how do craft breweries make and market high-quality NA products?



# Methods for Making NA Beer

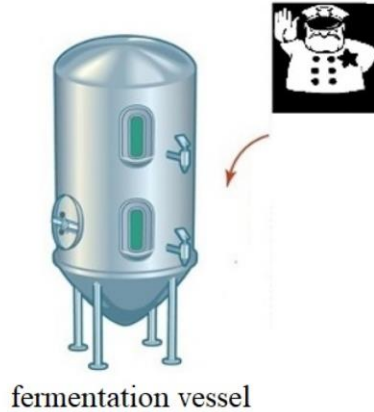
1. Halted Fermentation and Specialized Yeasts
2. Membrane Filtration Processes
3. Thermal and Evaporative Separation
4. Hybrid Methods



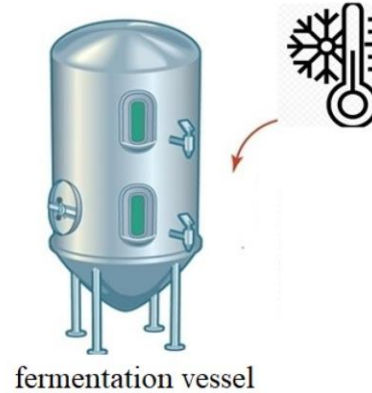
# Halted Fermentation and Specialized Yeasts



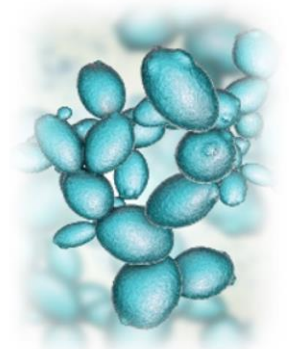
Changed mashing process



Arrested or limited fermentation process



Cold Contact Process



Special yeast



# Halted Fermentation and Specialized Yeasts

- Prevent yeast from producing too much ethanol
- Ferment less, colder and / or more slowly
- Ferment beer to a high gravity and dilute
- Use specialized yeasts that produce less ethanol:
  - *Saccharomyces chevalieri* (fermentis.com)
  - *Hanseniaspora uvarum* (escarpmentlabs.com)
  - *Torulaspota delbrueckii* (whitelabs.com)
  - *Saccharomyces ludwigii* (whitelabs.com)
  - *Saccharomyces cerevisiae* (aromas) (EvodiaBio)
- BENEFITS:
  - Low cost to entry, uses most existing equipment
- CONCERNS:
  - Recipe modification and yeast culture challenges



# Specialized Yeast NA Beer Recipe Example\*

## Low Alcohol Pilsner

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**Brew Method:** All Grain

**Style Name:** German Pilsner

**Boil Time:** 60 min

**Efficiency:** 76% (ending kettle)

### STATS:

**Original Gravity:** 1.016

**Final Gravity:** 1.013

**ABV:** 0.5%

**IBU:** 19.19

**SRM:** 1.44

### FERMENTABLES:

German - Pilsner (88.2%)

German - Wheat Malt (5.9%)

German - Caramel Pils (5.9%)

### YEAST:

WLP603 *Torulaspora delbrueckii*

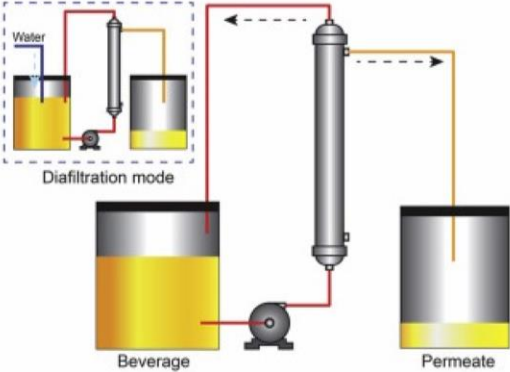
**Flocculation:** Medium

**Attenuation:** 26%

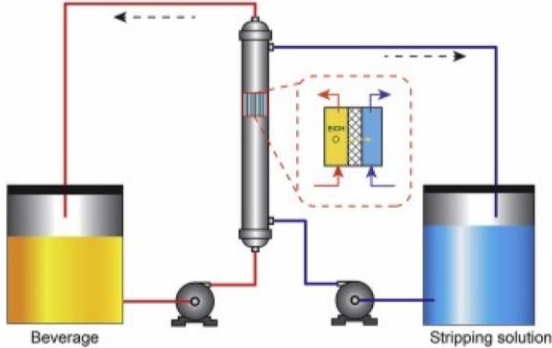
**Fermentation Temperature:** 10°C



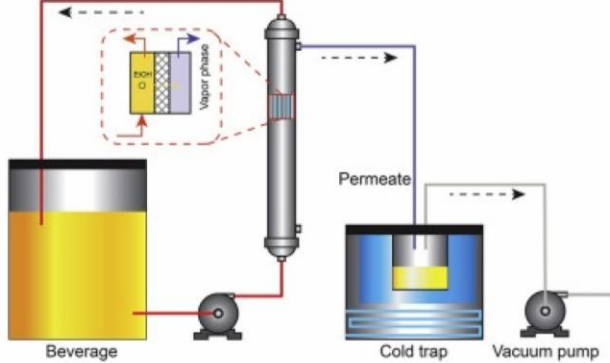
# Membrane Filtration Processes



Reverse osmosis (diafiltration)



Dialysis, Osmotic distillation



Pervaporation





# Membrane Filtration Processes

- Start with fully-fermented beer
- Separation by size and/or concentration across a semi-permeable membrane
- Multiple membrane filtration types for different stages or passes
- Aromatic separation stage + ethanol separation stage
- BENEFITS:
  - Low temperature operation avoids thermal degradation
  - Easily scalable
  - Dual outputs for NA and hard seltzer base
- CONCERNS:
  - Recipe limitations and membrane clogging



# Membrane Process Examples



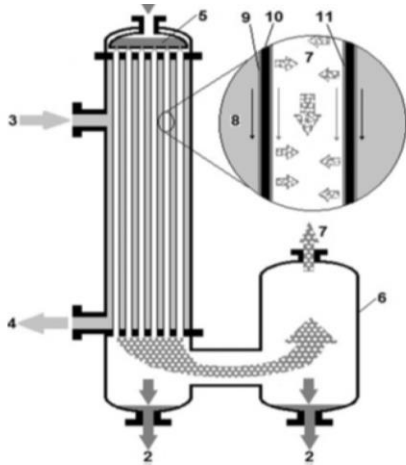
GEA AromaPlus



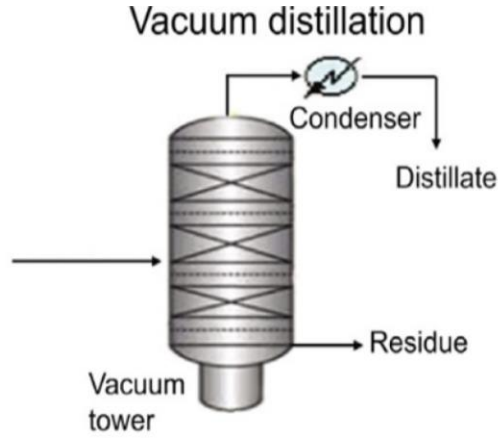
Probrew Alchemator



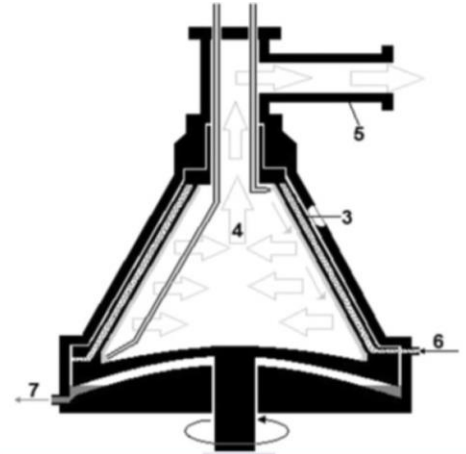
# Thermal and Evaporative Processes



Falling film evaporation



Continuous vacuum rectification



Thin layer evaporation



# Thermal and Evaporative Processes

- Start with fully-fermented beer
- Separation is by boiling point in multiple stages or passes
- Vacuum pressure option keeps temperatures low
- BENEFITS:
  - Recipe flexibility and scalability
  - Dual outputs for NA and hard seltzer base
- CONCERNS:
  - High utilities costs



# Thermal and Evaporative Processes Examples



Flavourtech  
SCC 1000



Centec  
DeAlcoTech



ABV Technology  
Equalizer



# Summary of Methods

Method	Halted / Specialized Yeasts	Membrane Filtration Processes	Thermal and Evaporative Methods
Equipment Cost	Low	Medium/High	Medium/High
Speed	Fast	Medium	Medium/Fast
Consumables	High	Medium	Low
Quality	Low - High	High	High
Utilities	Low	Medium	High
Recipe Flexibility	Low - Med	Med	High
R&D Time	High	Med	Low

## Notes

Unique flavors and aromas usually only available through fermentation

Ethanol as a solvent is important for processes such as dry-hopping



# Recipe Modifications to Optimize Processes

- Body / Mouthfeel
  - Aroma / Nose / Flavor Retention
  - Head Retention
  - Acidity and pH
  - Clarity / Haze
- 
- See ABV Technology's "Recommendations for Making NA Beer and Hard Seltzer" document



# Process Characterization and Prediction

Equalizer 1000	Sub Category	Flavor / Odor / Mouthfeel	Compound(s)	NA, FMB, MIX, or OUT	Boiling Point (C)	Typical Concentration (mg/L)	Average Taste threshold (mg/L)	Descriptor
Aromatic, Fragrant, Fruity, Floral	Hoppy	Hop oil	Hop Oil Extract (Humulene)	NA Mostly	106	0.0002-0.063	0.05-0.63	like hoppy ale
Aromatic, Fragrant, Fruity, Floral	Hoppy	Dry hop	Isovaleric Acid	NA 82%	176	90-300	1-1.5	Cheesy, old hops, sweaty, cheesy, rancid
Aromatic, Fragrant, Fruity, Floral	Hoppy	Kettle-Hop	β-damascenone	MIX	116	0.00028 NA	0.025	berries, fruity green jammy berry tropical tobacco plum honey
Aromatic, Fragrant, Fruity, Floral	Floral	Perfumy	1-Propanol	FMB 90%	97			Rose, Perfumy
Aromatic, Fragrant, Fruity, Floral	Floral	Geraniol	Geraniol	NA Mostly	230	0.1	0.35	floral, rose water
Aromatic, Fragrant, Fruity, Floral	Floral	2-Phenylethanol	2-Phenylethanol	NA 70%	225	0.0012 NA		Fruit, Honey, Lilac, Rose, Wine
Aromatic, Fragrant, Fruity, Floral	Acetaldehyde		Acetaldehyde	MIX (NA 52%)	20.2		5	Granny Smith apples, jolly ranchers, latex paint, black olives, fresh cut pumpkin
Aromatic, Fragrant, Fruity, Floral	Fruity		Isobutyl isobutyrate	NA	148.6	0.5-1.5		Fruity
Aromatic, Fragrant, Fruity, Floral	Fruity	Strawberry	Ethyl Lactate	FMB 91%	154			Fruity, strawberry
Aromatic, Fragrant, Fruity, Floral	Fruity	Raspberry	Ethyl Acetate	MIX (NA 59%)	77.1	0.00239 NA	7.5	Nail polish remover, (at high concentrations) Raspberry, Pear (at low concentrations)
Aromatic, Fragrant, Fruity, Floral	Fruity	Pear	Isoamyl Acetate	MIX (NA 65%)	142	1.19851 NA	1.1	Like bananas or pear drops, along with circus peanuts and candy
Aromatic, Fragrant, Fruity, Floral	Fruity	Pear	Ethyl Acetate	MIX (NA 59%)	77.1	0.00239 NA	7.5	Nail polish remover, (at high concentrations) Raspberry, Pear (at low concentrations)
Aromatic, Fragrant, Fruity, Floral	Fruity	Melony	Butyraldehyde	MIX (NA 53%)	74.8			Melon
Aromatic, Fragrant, Fruity, Floral	Fruity	Blackcurrant	p-menthane-8-thiol-3-one	FMB Mostly	56		0.0019	Catty, like blackcurrant juice or tom cat urine
Aromatic, Fragrant, Fruity, Floral	Fruity	Banana	Isobutanol	FMB 87%	108	0.00024 NA		Alcohol, bananas, vinous
Aromatic, Fragrant, Fruity, Floral	Fruity	Banana	Isoamyl Acetate	MIX (NA 65%)	142	1.19851 NA	1.1	Like bananas or pear drops, along with circus peanuts and candy
Aromatic, Fragrant, Fruity, Floral	Fruity	Apple	Malic Acid	NA	306			Cidery, tart, fruit-like sourness
Aromatic, Fragrant, Fruity, Floral	Fruity	Apple	Isobutyl Acetate	MIX (NA 68%)	116			Papaya, apple
Aromatic, Fragrant, Fruity, Floral	Fruity	Apple	2-methylpropanol	FMB Mostly	108			Apple, Bitter, Cocoa, Wine
Aromatic, Fragrant, Fruity, Floral	Fruity	Citrus	alpha-Terpineol	NA 76%	219	0.001-0.19	0.33-2	Citrus, woody, lemon, lime, soapy
Aromatic, Fragrant, Fruity, Floral	Fruity	Citrus	Ethyl Butyrate	NA 73%	121	0.00047 NA	0.3	Tinned pineapple, mango, papaya



# Market: Non-alcoholic beer is everywhere!

- NA is a fast-growing category
  - NA Beer has become healthy and fashionable
  - Providing alternative choices is a must for breweries
  - \$20b global market size today, \$29b by 2026
- Major beer companies are investing massively
  - Heineken 0.0: Matching # of regular Heineken taps by 2025
  - Bud Zero: Announced that NA beer will be 20% of global sales by 2025
  - New or re-branded: Guinness, Amstel, Coors, Labatz, Miller, Old Milwaukee, ...
- Craft Beer Companies are Joining the Category
  - Craft beer market shrinking, down 2% in 2019
  - NA beer market growing, up 72% in 2019
  - NA and hard seltzer fastest growing categories
- Athletic Brewing raised \$50M in May 2021
- 6/10 people don't drink alcoholic beer



# Marketing

- NA recipe and season planning: Make a calendar and plan for NA recipes
- Avoid the A vs. NA strategy
- Naming your NA beer: Are we out of puns yet?!
- Old and New Channels:
  - OBT: Other Brewer's Tap Rooms
  - Bottle shops
  - Grocery stores
  - Online + interstate shipping



# NA Beer Regulation and Compliance

- TTB Considerations:
  - Labeling (See TTB Summary Presentation from Sept 9, 2021 CBC)
  - COLAs and Formulas for input alcoholic beverages
- FDA Considerations:
  - Food Safety
  - Hard <0.5% ABV limit



# Non-Alcoholic | Example

This product is domestically bottled, so **Nontaxable under section 5051 I.R.C.** must appear on the label

**Non-Alcoholic** is an optional statement, but if used, the label must also state in direct conjunction **Contains less than 0.5% alcohol by volume**

Since you can't use **Beer** you may describe the product as a **Brew** instead, but it is not acceptable as the class



This product cannot be labeled as **beer**. It must be labeled with a class designation of **malt beverage, cereal beverage, or near beer**, under 27 CFR 7.24(d)



LUPULIN BREWING



1 pint 9.4 fl oz / 750 ml

FRESH N/A BREW TO-GO!   
*Crowler*



KEEP COLD



DRINK FRESH



RECYCLE

BREWED & CANNED BY:

LUPULIN BREWING  
- BIG LAKE, MN -

CONTAINS LESS THAN 0.5% ALC/VOL  
NONTAXABLE UNDER SECTION 5051 I.R.C.



LUPULINBREWING.COM



# NA Beer Spoilage and Shelf Stability

- New risks with low ethanol beer
- Oxygen, pH, fermentable sugars, and shelf life
- Use of Preservatives: KS, KMBS, DMDC (valcorin), Chiber, and others
- Pasteurization
- QA/QC Best practices



# Societal Benefits

- Reduce of domestic violence and assault
- Reduce drunk driving accidents
- Reduce cancer risk
- According to the CDC, excessive alcohol consumption costs the US economy \$249B annually:
  - Healthcare – \$28 billion
  - Workplace productivity – \$179 billion
  - Collisions – \$13 billion
  - Criminal Justice- \$25 billion
- Existential Dilemma:
  - “NA Beverages are to the Alcohol Industry what Climate Change is to the Energy Sector”



# Equalizer

Making great NA beer starts with great beer. Why? Fermentation.

Two-stage evaporative vacuum separation is best-in-class technology choice.

Gentle, repeatable, and fully automated process for making *all styles* of NA beer. Easy to use and clean.

Intelligent software with real-time cloud monitoring service ensures quality and uptime.

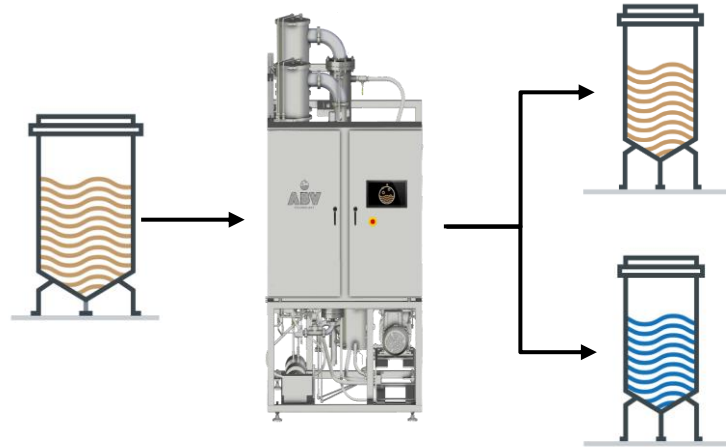
Patent filed in June 2020 for EQ-1000. Continuation in part for EQ-1100 in Q4 2021.





# The Equalizer Process

Input Beverage:  
Between 3.5% and 10%  
1bbl/hr throughput  
Capacity 6,000 bbl/year



Output 1: Non-Alcoholic Beer (NACB).  
Retaining most of the flavor and profile  
of the original, and is low calorie.

Output 2: Hard Seltzer. NO gluten (but  
not “gluten free”). NO flavor. NO color.  
NO sugar. Low Calories.



# Ways to work with us

- Processing Services
- Partnership Program
- Equipment Purchase



# Some of our customers in MN



# Our Service Partners



**RESTAURANT  
BREWHOUSE**



# Analyzer

Measurement of ABV is either inaccurate, expensive, or time consuming for craft breweries.

Errors in this measurement are expensive: recalls due to mislabeling are commonplace. Esp. in NA products.

Current features: ABV, specific gravity, and caloric content.



# Thank you!



# Further Reading and References

1. “Low Calorie Beers, Low Alcohol Beers, and Non-alcoholic Brews”, Rehberger, AJ, The Practical Brewer, Master Brewers Association of the Americas.
2. ”Non-Alcohol Beers; Craft Brewing’s Growing Niche”, Kitsock, G., New Brewer, April 2020.
3. “The Beer Bible”, Alworth, J.
4. “Psychological Theories of Drinking and Alcoholism”, Leonard KE, Blane, HT.
5. “Production of Alcohol-Free Beer”, Montanari, L., et. al.
6. “Setting up your Quality Plan; Building a Framework”, Waldron, M. New Brewer, Dec 2021

