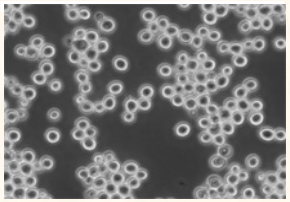


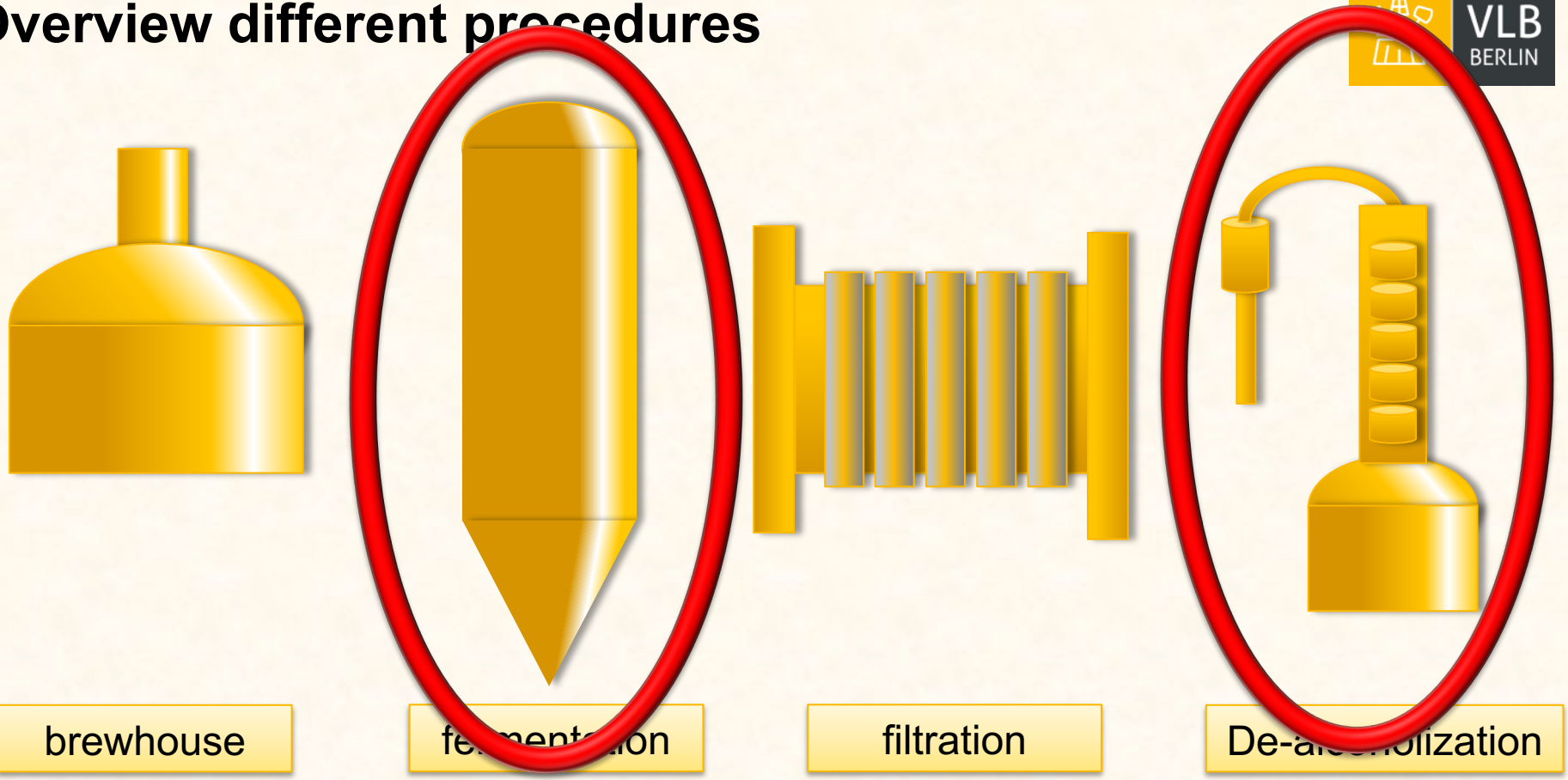
Versuchs- und Lehranstalt für Brauerei in Berlin (VLB) e.V.

Production methods for alcohol-free Beer (NAB)- an overview

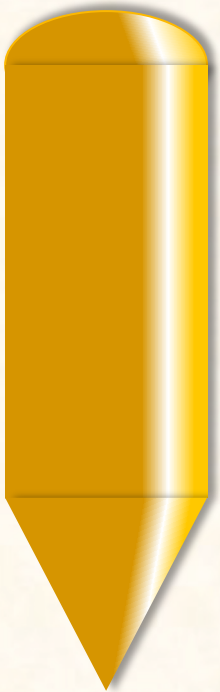
VLB
BERLIN

Topic worldwide

Overview different procedures



Overview different procedures



fermentation

Immature & worty character

sweet

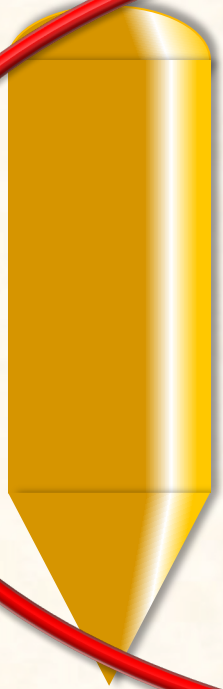
Overview different procedures

Low in light volatiles/ empty oxidized – thermal

Slightly acidic- Membrane

De-alcoholization

Overview different procedures



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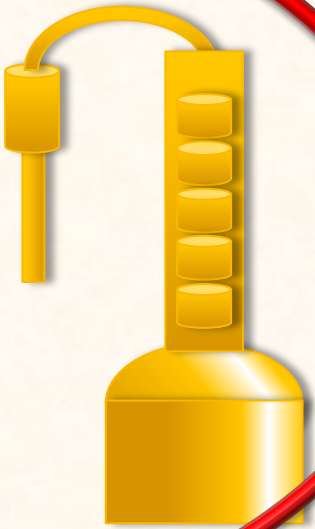

brewhouse

fermentation

De-alcoholization

Brewhouse possibilities

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Overview different procedures in the brewhouse

Differentiation between

1. Wort for dealcoholization
2. Wort of „incomplete“ fermentation
3. Wort for “Aroma“ beer for blending

Process parameters:

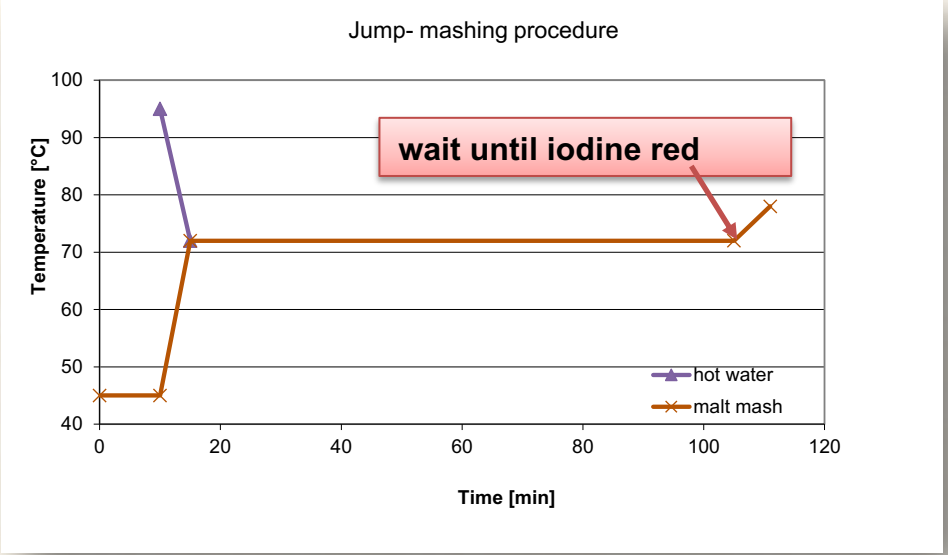
- Use of special malts
- Mashing procedure: low fermentation degree
- Hop dosage
- Original gravity
- pH-optimization

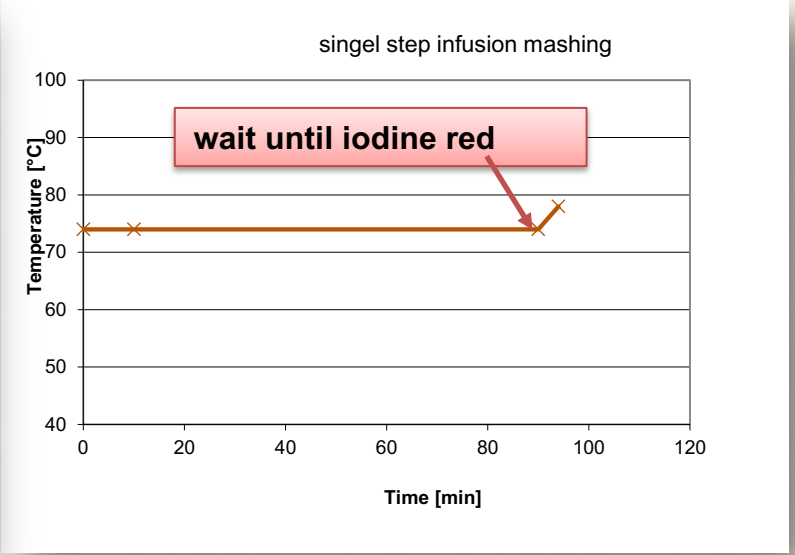
brewhouse

Overview different procedures in the brewhouse

Mashing procedure: low fermentation degree

- "Jump" mashing process ~ 50% ADF
- single step infusion around 72-74°C ~ 60% ADF
- Original gravity: 8 - 9 °P





Biological methods during fermentation

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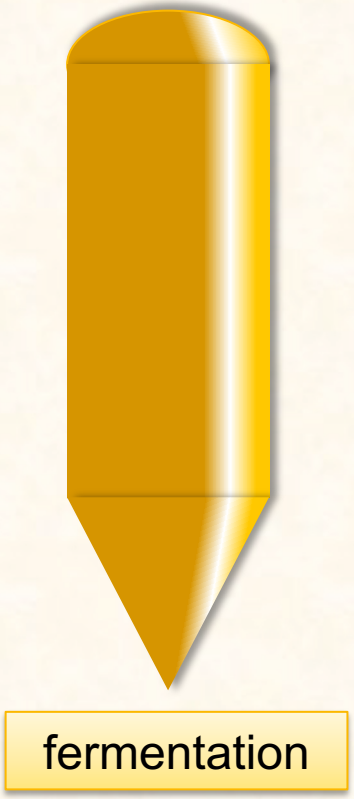
Overview different procedures during fermentation

Complete fermentation

1. Beer for dealcoholization
2. "Aroma" beer for blending



Incomplete Fermentation

1. Interrupted fermentation
2. Cold contact procedure
3. Use of maltose- negative Yeast

Interrupted Fermentation

Interruption of fermentation at

fermentation degree of app. 10 %→ alcohol < 0,5 vol.%

- OG 7 to 8 °Plato and Mashing procedure: shortened β-amylase rests to build less fermentable sugars
- Acidification of cast wort to beer-pH
- Fermentation at 5 to max. 8 °C (24 to 72 hours)
- To achieve interruption yeast count should be 0,1 mill. cells / mL using: separator, filter, pasteurizer
- Maturation at 0 °C
- Filtration and stabilization with silica gel and PVPP
- **Pasteurization needed**

Yeast Cold Contact Process

Pitching temperature at -2 to max. 0°C

Well mixing of yeast and wort

- Low OG 6-8 % and pH- adjustment
- No aeration is necessary; oxygen-poor wort
- Cold contact for 24 to 48 hours
- Ethanol production < 0,1 vol.% !!!!
- **Pasteurization needed**

Source: Patent by Dr. F. Schur; Rheinfelden, CH (1983/1990)

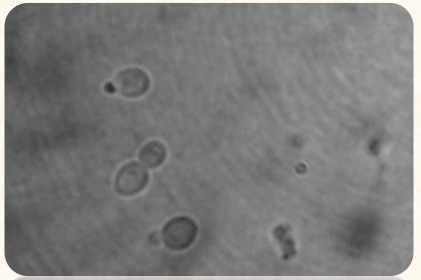
„Incomplete“ Fermentation: Use of maltose negative Yeast

Yeast is not able to ferment maltose

Significant decrease in wort flavour compounds

- Glucose, fructose or saccharose is assimilated
- Adjusting pH-value to beer pH is necessary
- Low alcohol formation (up 0,5- 1,0% ABV)
- **Pasteurization needed**

Saccharomycodes ludwigii



Saccharomyces rosei

De-alcoholization

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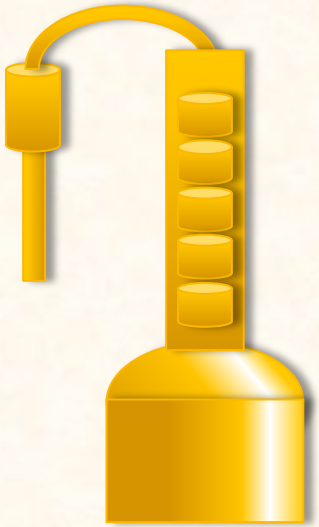
Overview different procedures of dealcoholization

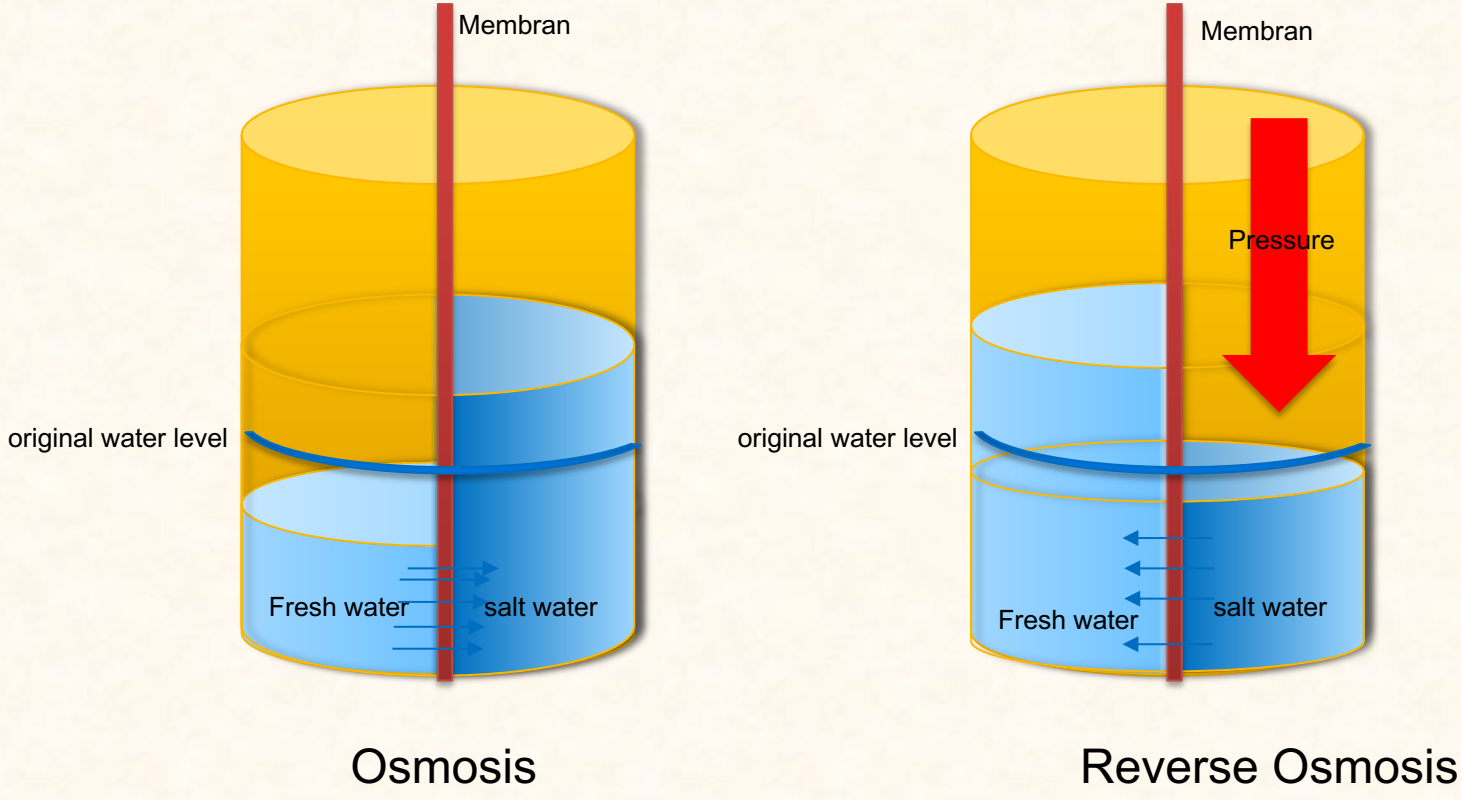
Dealcoholization

1. Thermal procedures
2. Membrane based procedures: Dialysis/ reverse osmosis



Dealcoholization

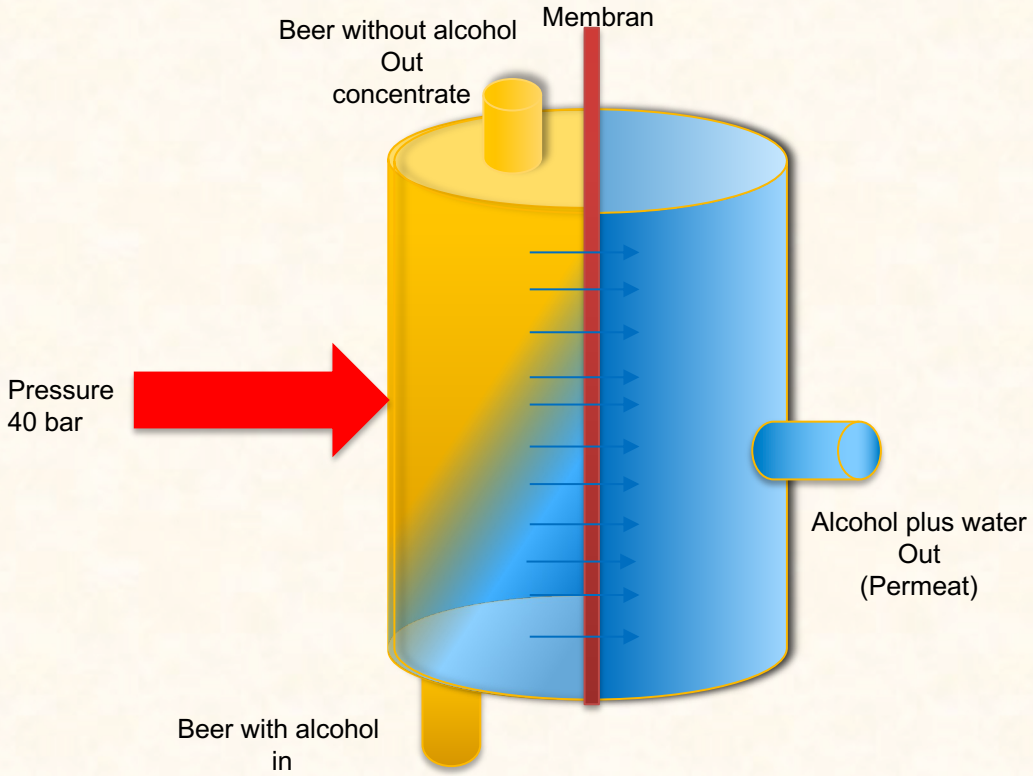
Membran-based – Reverse Osmose



Osmosis

Reverse Osmosis

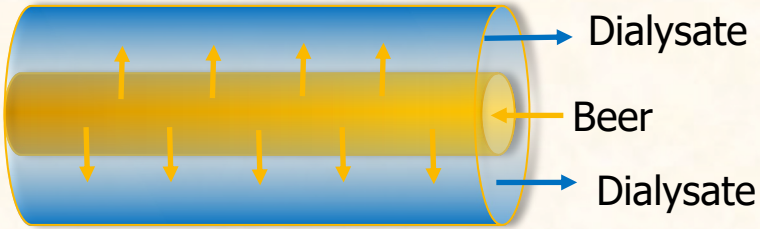
Membran-based – Reverse Osmose



Beer de-alcoholisation

Dialysis

- Hollow fibre membranes / modules
- Diffusion take place by mass transfer by concentration gradient (no pressure difference)
- Counter current flow
- Operation pressure 0.5 ± 0.1 bar (beer side)
- Operation temperature 1 °C to max. 6 °C (cooling)

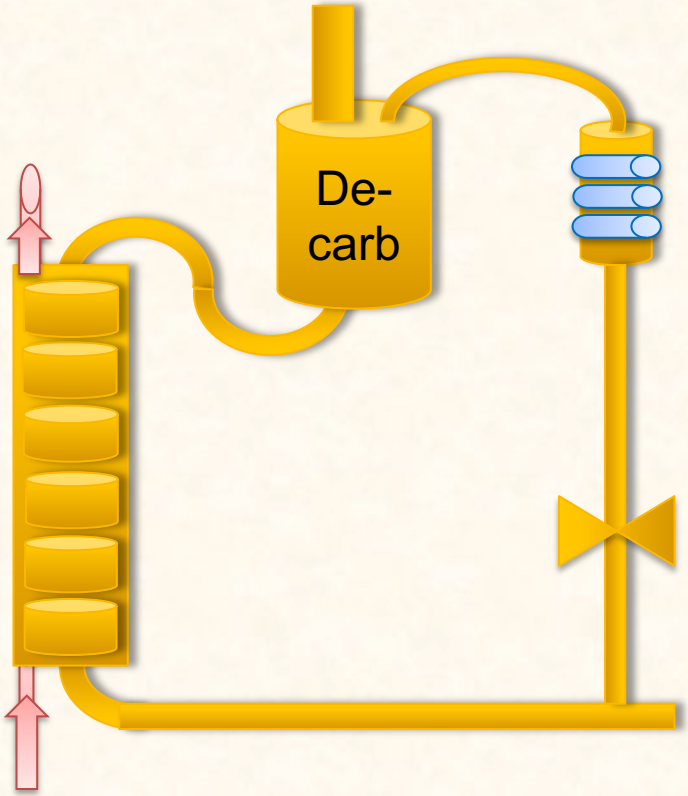


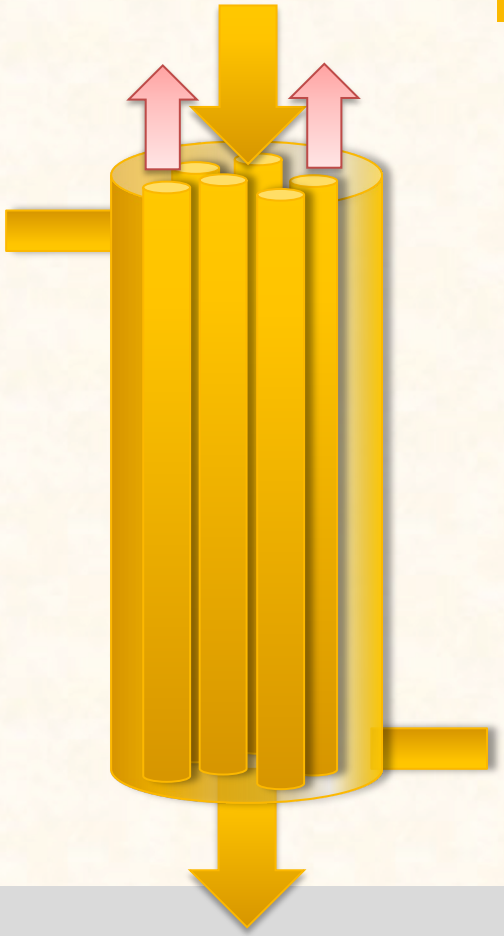
Thermal Beer De-Alcoholization Procedures

- General Aspects -

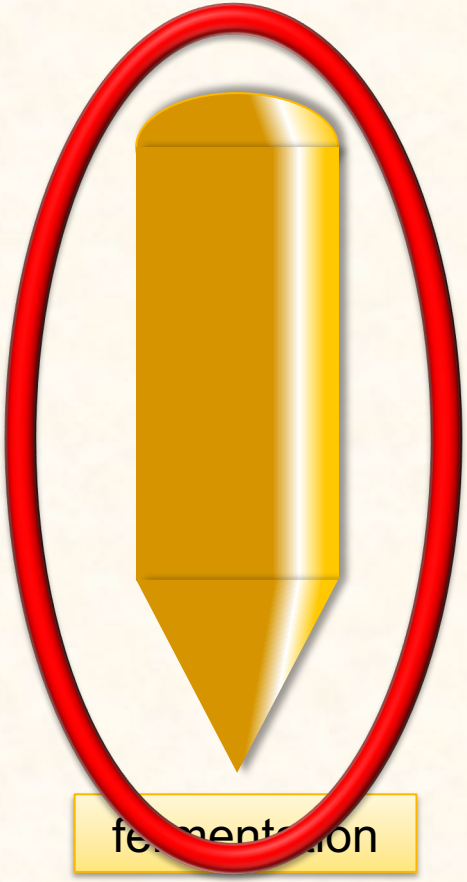
+ Stripping vs. Distillation
+ Applying vacuum distillation(0,04 to 0,2 bar absolute) at 30-60°C
  → avoiding thermal impact
+ Moderate heat transfer rate, depending on “degree of de-alcoholization”
  (production of alcohol-reduced beers or alcohol-free beers)
+ Also evaporation of aroma components (HAA, esters)
+ Because of heat input removal of CO_2 → carbonization required

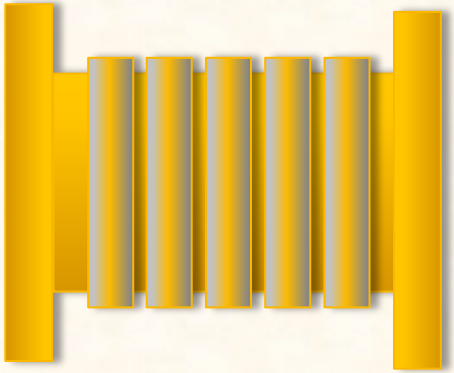
Thermal Beer Dealcoholization Procedures

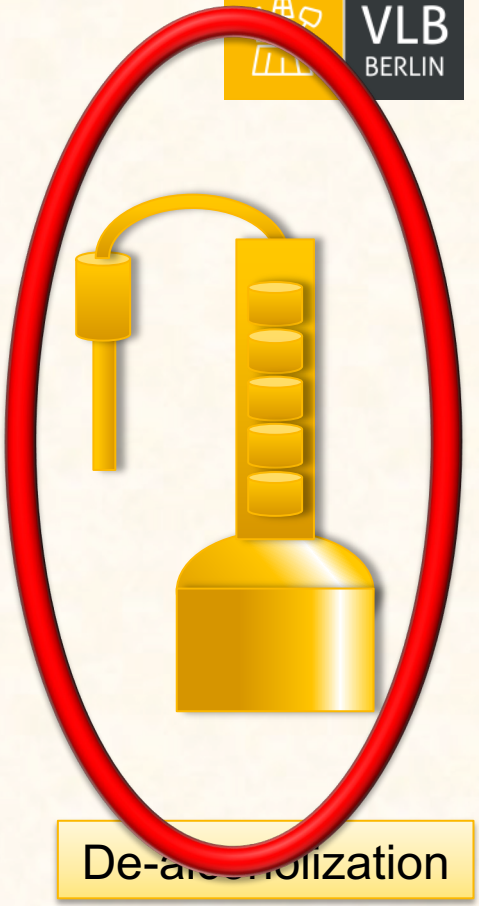




Take a way







brewhouse

fermentation

filtration

De-alcoholization

Product- safety

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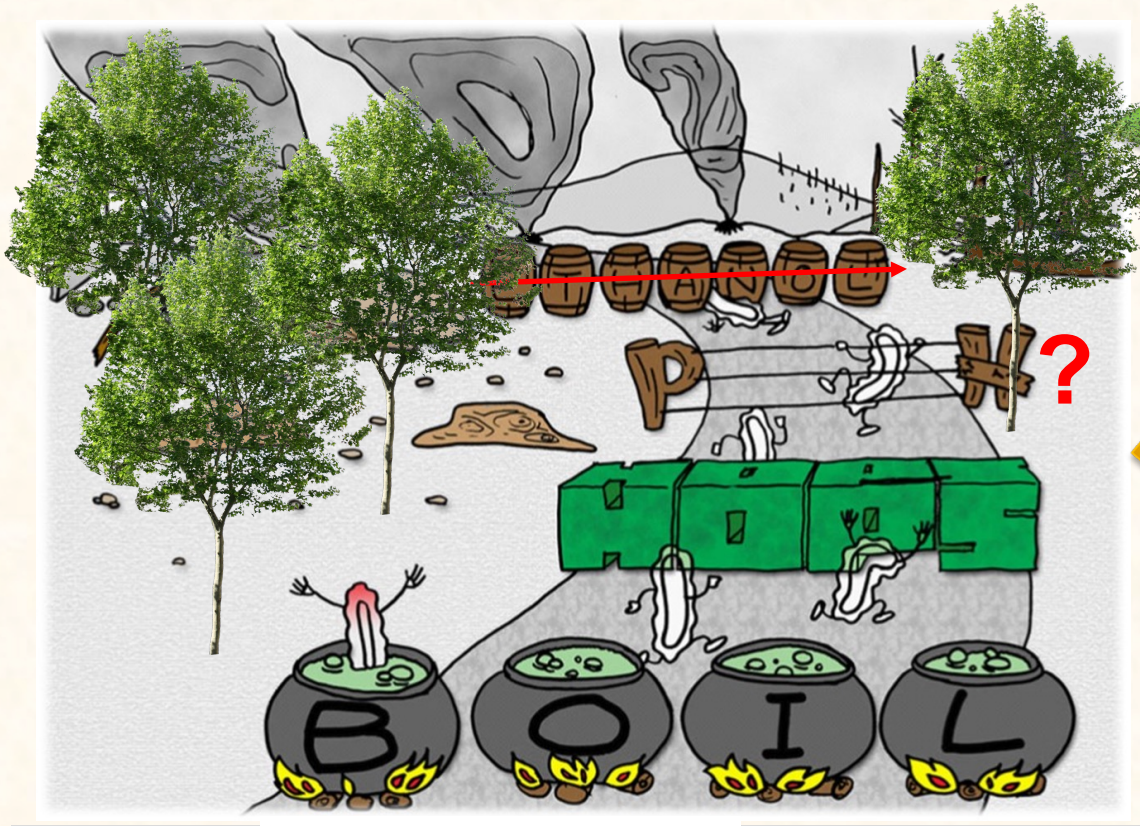
Product- safety- „normal beer“

- CO_2
- ABV
- pH
- hops
- boil

Figure 1. Pathogens cannot survive in beer owing to the antimicrobial 'hurdles', including the kettle boil, hop bitter acids, low pH, ethanol, carbon dioxide (CO_2) and the lack of nutrients and oxygen (depicted by the wasteland). Artwork by Ms Peggy Hsu. Reproduced with permission from Elsevier *(5)*.

Product- safety- NAB



°P

CO_2

pH

hops

boil

Microbiological spoilage

Yeast

Bacteria

Changes over time

CO_2

ABV

Figure 1. Pathogens cannot survive in beer owing to the antimicrobial 'hurdles', including the kettle boil, hop bitter acids, low pH, ethanol, carbon dioxide (CO_2) and the lack of nutrients and oxygen (depicted by the wasteland). Artwork by Ms Peggy Hsu. Reproduced with permission from Elsevier *(5)*.

Thank you for your attention!

VLB Berlin

FI Bier- und Getränkeproduktion

Jan Biering

biering@vlb-berlin.org

www.vlb-berlin.org