CENTRAL EUROPEAN CEBC BREWERS CONFERENCE

BarthHaas®

HOPS IN, HOPS OUT

BIGGER IMPACT AND LESS WASTE

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Territory Manager

THE POWER OF DRY-HOPPING

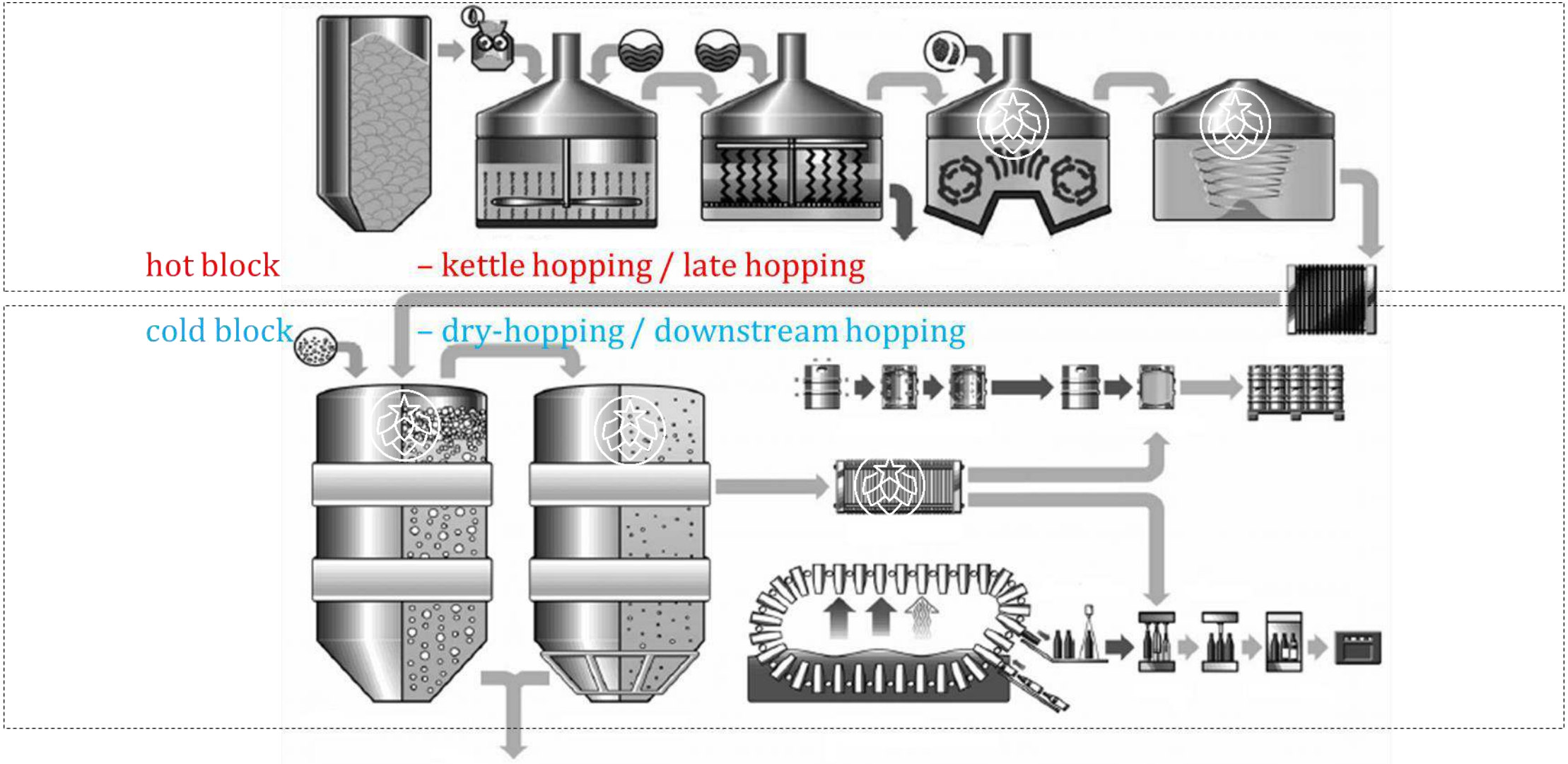
Adding Value

- Product:
  - flavor, character, beer style, marketing
- Brewing Technology:
  - stability, drinkability, polyphenols

HOPS IN, HOPS OUT: BIGGER IMPACT & LESS WASTE

What's behind the magic?

HOPS ADDITION TIMING



DECISION STEPS

Product Profile

Raw Materials

Technology

HOPS IN, HOPS OUT: BIGGER IMPACT & LESS WASTE

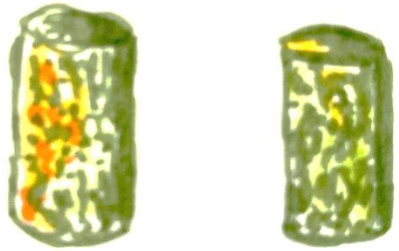
Flavor in Lupulin Glands

Hop Oil	Aroma Precursors ?	**Total Resins**
Monoterpenes – 70%		Alpha/Beta
Sesquiterpenes – 50%		Humulinones/Hulupones
Oxygenated Compounds – 25%		Hard resins
Thiols – 1%		Prenylflavonoids

WHAT DO YOU WANT TO USE?

Hop Cones

Hop Pellets



-Normal Pellets
-Enriched Pellets

Hop Extracts

-CO2 Extract
-Hop Oil
-Hop Oil Products

WORKING WITH HOP CONES

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Pros

- It is the real stuff
- Specific flavor/aroma
- Easy to restrain

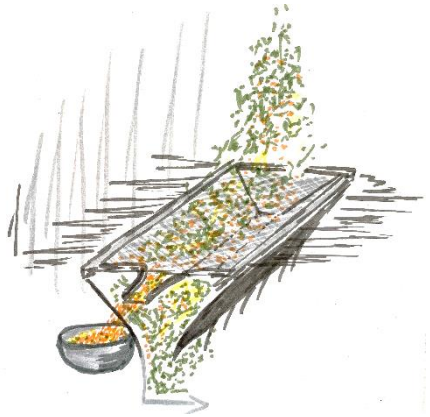
Hop Cones

Cons

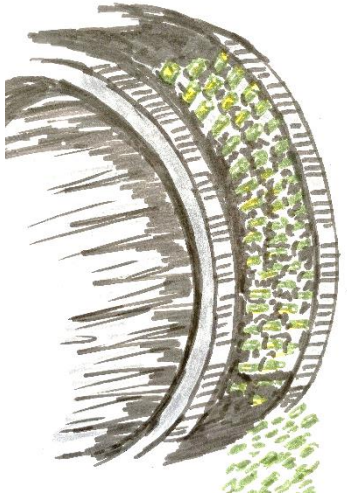
- Not homogeneous
- Contains oxygen
- Prone to oxidation
- Low aroma utilization
- High beer losses
- Removal procedure
- Storage room

HOW CONES BECOME PELLETS

Milling



Sieving (enriched)



Pressing

Enriched Pellets:
Lupomax Pellets

Normal Pellets:
Type 90
BBC Pellets

WORKING WITH PELLETS

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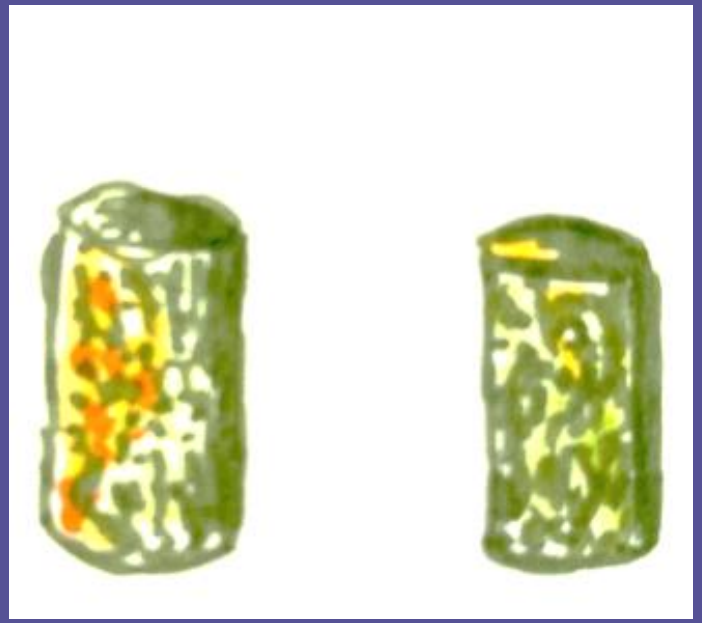
Pros

- Homogeneous hop material
- Oil/alpha can be standardised
- High contact area
- Reduced beer losses with enriched pellets
- Higher aroma yield
- Less storage needed

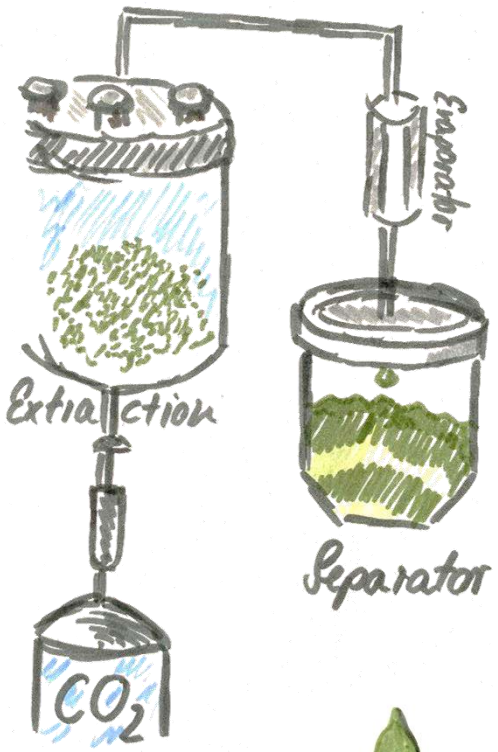
Hop Pellets



Cons

- Solid material in a liquid
- Removal system
- Beer losses due to swelling/absorption

HOW PELLETS BECOME EXTRACTS



CO2 Extract

- Normal CO2 Extract is not suitable for dry hopping but for kettle additions
- Requires emulsifier/ carrier

Incognito®

- Oil-enriched hop extract – for whirlpool addition
- **Delivers some dry hop character**
- **No carrier required**

Spectrum

- Liquid dry-hopping addition
- **Delivers an intense dry hop character**
- **No emulsifier or solvent required**

WHAT ARE THE BENEFITS OF USING EXTRACTS?

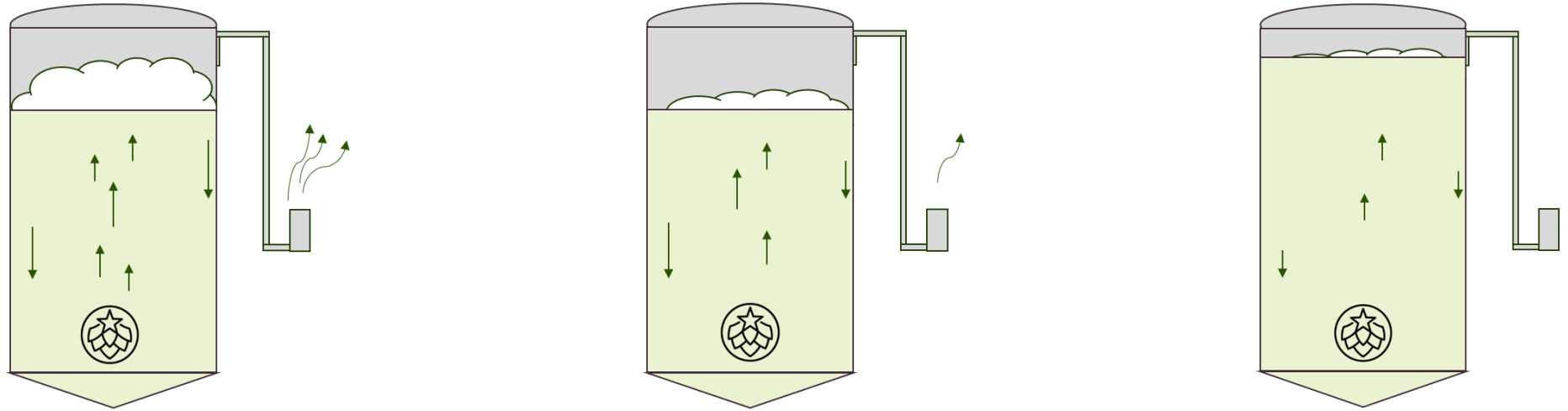
- Homogeneous and very stable
- Oil can be standardised
- No solid material
- Less oxygen intake
- No beer losses
- No need for removal
- Higher aroma yield
- Lower supply chain costs
- No hop creep

- Requires a carrier

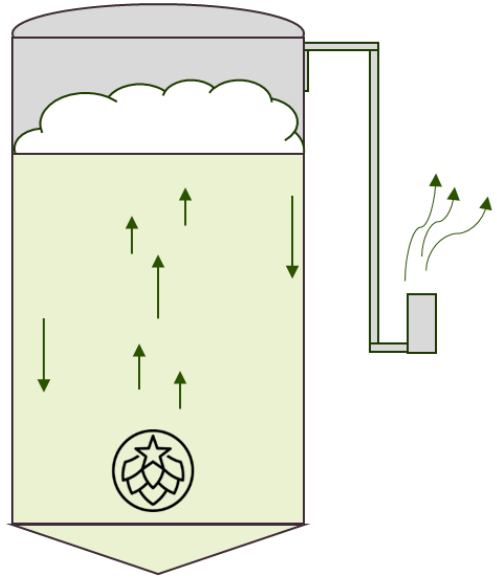
- No additives/carriers

HOW TO MANAGE DRY-HOPPING

Main Fermentation → Maturation → Lagering

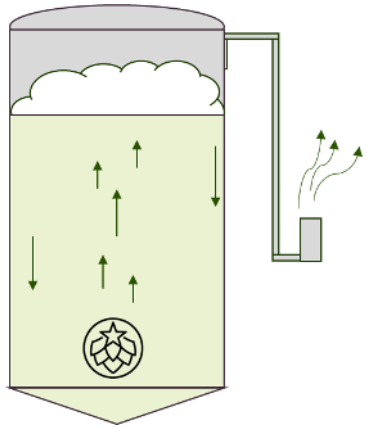


MAIN FERMENTATION



12°C-25°C

MAIN FERMENTATION

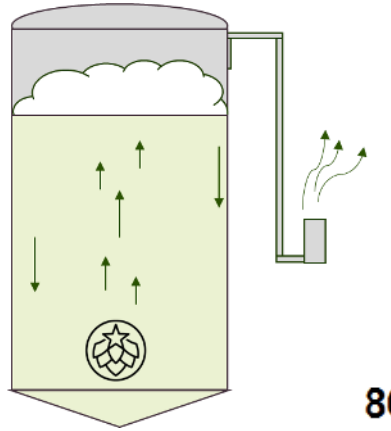


12°C-25°C

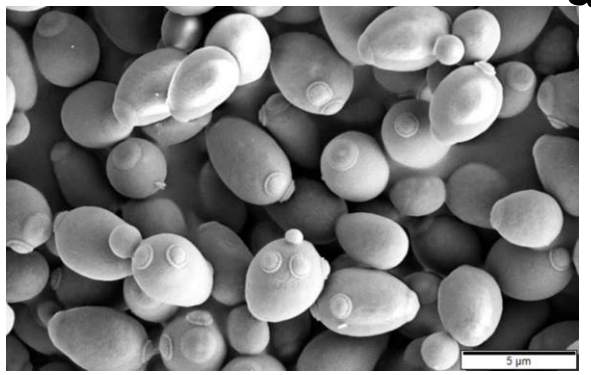
MAIN FERMENTATION

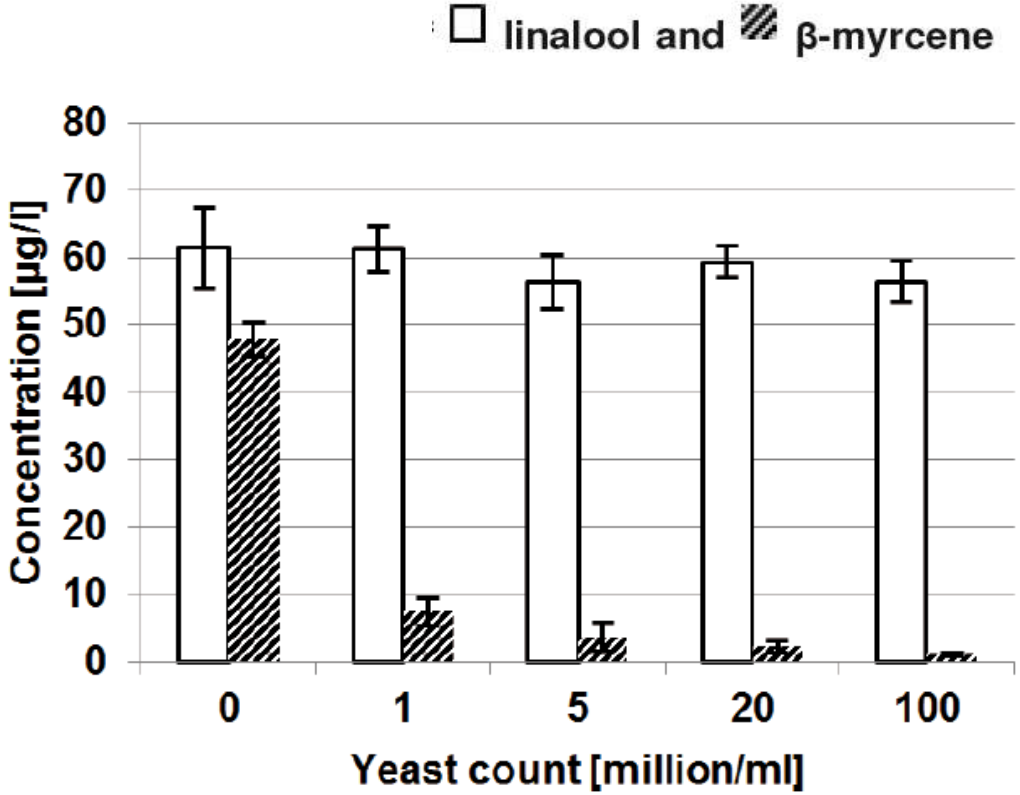
Loss of flavor components

Evaporation and adsorption of terpenes (e.g., β-myrcene) by the brewing yeast



Huge surface





MAIN FERMENTATION

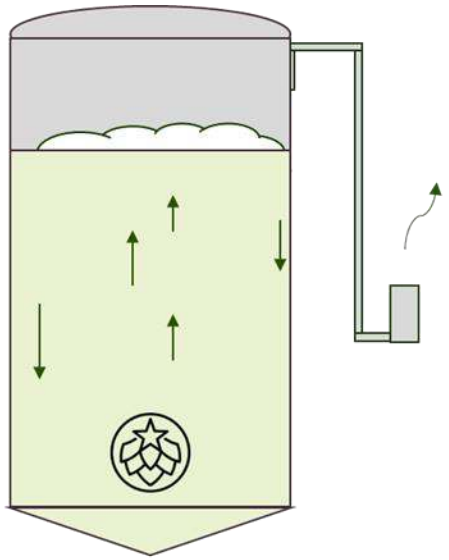
Pros

- Temperature: increase extraction
- Oxygen scavenging by the yeast increases stability
- Natural agitation: good blending
- Release of flavor potential: biotransformation

Cons

- Yeast cannot be reused
- Evaporation/CO_2-stripping and adsorption of aroma components
- Floatation of hop particles, Foaming
- Hop creep
- Low ethanol in beginning:
  - Microbiological risk
  - Lower extraction

MATURATION (YEAST HARVESTED)



10 to 20°C

MATURATION (YEAST HARVESTED)

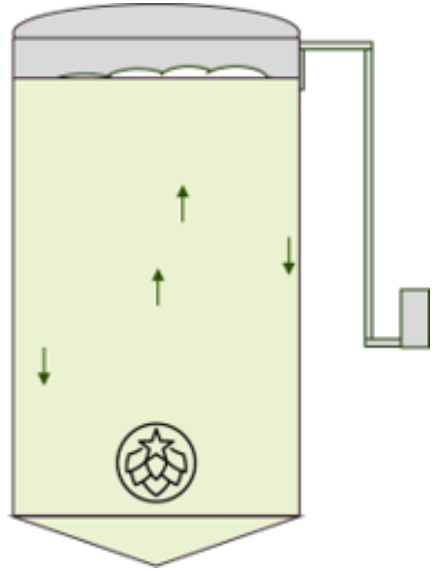
Pros

- Temperature + Ethanol: increase extraction
- Reduced oxygen scavenging (yeast): stability
- Agitation with jacket cooling: good blending
- Improved flavor yield: Closed system, Enzyme activity

Cons

- Still adsorption on yeast surface and evaporation
- Still potential for foaming and hop creep

LAGERING



-2 to 4°C

LAGERING

Pros

- Ethanol: increase extraction
- Lowest losses of flavor components
- Closed system, minimal yeast count, enzyme activity
- No foaming

Cons

- Low temperatures
- No agitation
- Delayed extraction of flavor components
- No scavenging effect
- Hop creep at later stages possible

IN SUMMARY

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Main Fermentation	Maturation	Lagering
High extraction ✓	High extraction ✓	Good extraction ✓
Excellent mixing ✓	Good mixing ✓	Minor losses ✓
Oxygen scavenging ✓	Reduced losses ✓	
	Oxygen scavenging ✓	
<u>But</u>:		<u>But</u>:
Challenging working conditions ☜	**Suitable for all levels of experience & balanced flavors** ☜	Challenging working conditions ☜
Good yeast management ☜		High level of experience is recommended ☜

THE RIGHT TIMING AND FLAVOR IMPACT

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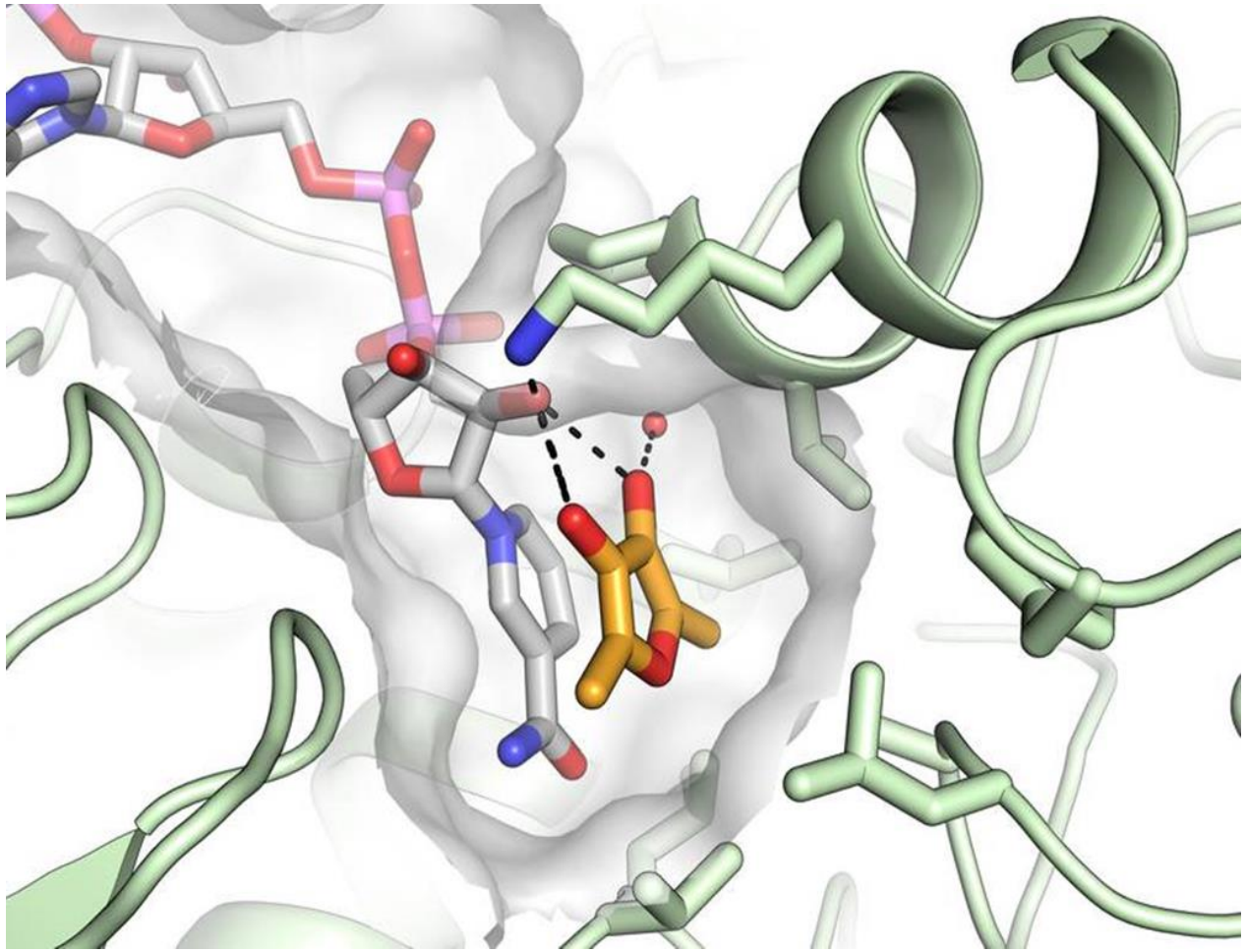
Main Fermentation → Maturation → Lagering

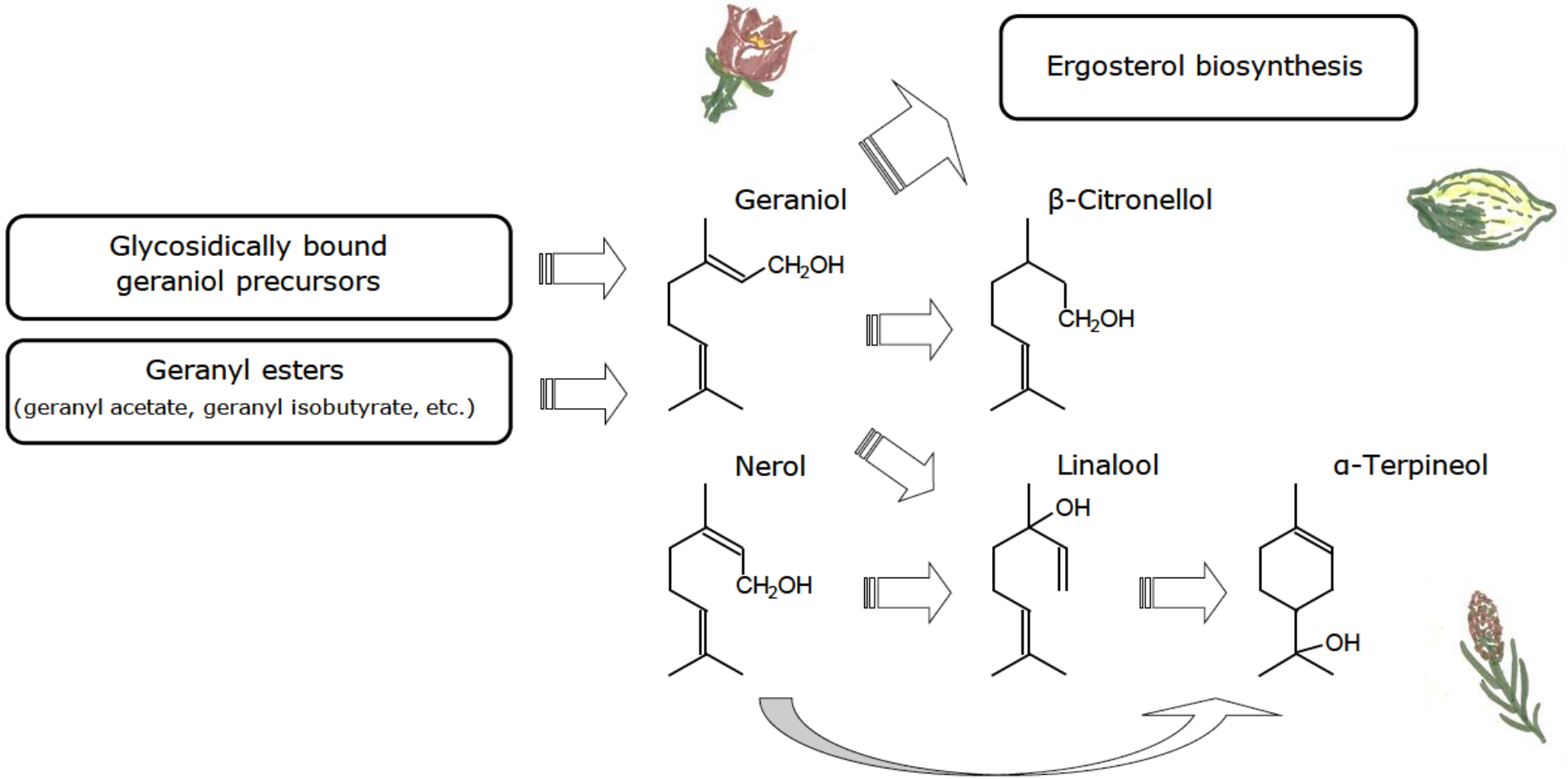
BIOTRANSFORMATION – AROMA PRECURSORS

Precursors are odorless larger molecules that contain certain aroma compounds

Released through enzyme activity



BIOTRANSFORMATION - PRECURSORS



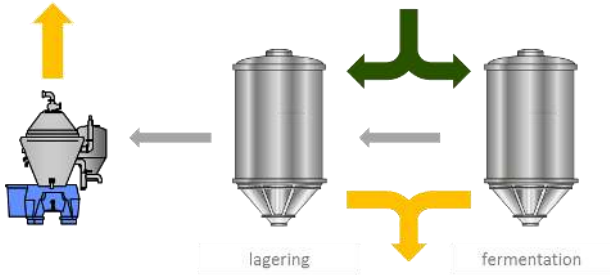
THE NOT-SO-SEXY ASPECT OF DRY HOPPING

Dry hopping depends on:

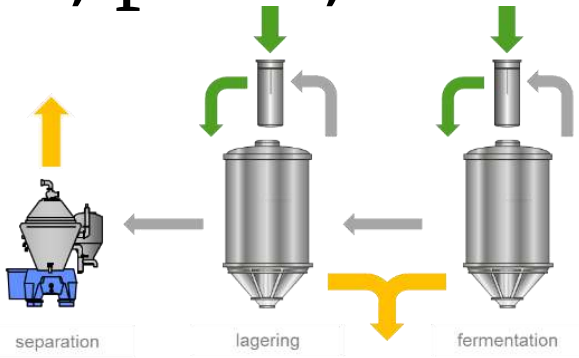
- Hop product properties
- Beer parameters (alc., temp, etc.)
- ***Hop dosing:***
  - engineering
  - process type (static/dynamic)
  - contact time
  - tank geometry and scale

HOP IN – FINALLY!

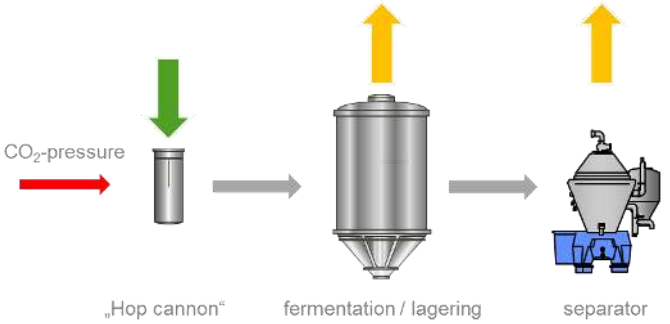
- Direct addition (cones, pellet, extract)



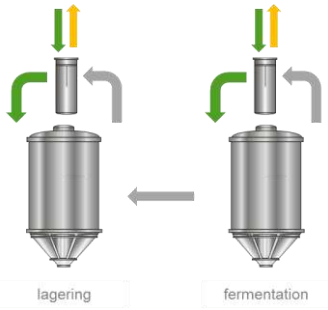
- Hop Slurry



- CO2-blow (“Hop-Cannon”)



- Hop Percolation



HOP OUT – REALLY?

http://blog.brewingwithbriess.com/whats-dan-brewing-in-the-briess-pilot-brewery/

https://conical-fermenter.com/Conical-Fermenter-2-BBL-Jacketed.html

https://www.inderst.it/de/bereich/landhandel/produkte/saft-wein-cider/pressen/zubehor/eckrohrsieb-einfach-dn25-01mm

Standpipe / Racking arm:

- beer drainage above sediment
- high beer losses
- microbiological hazards
- needed for centrifuges with low solid capacities

Sieving (pipe strainers)

- retention of particles > 500 µm
- low solid capacity
- microbiological hazards
- “trap-filter“ for unsettled particles

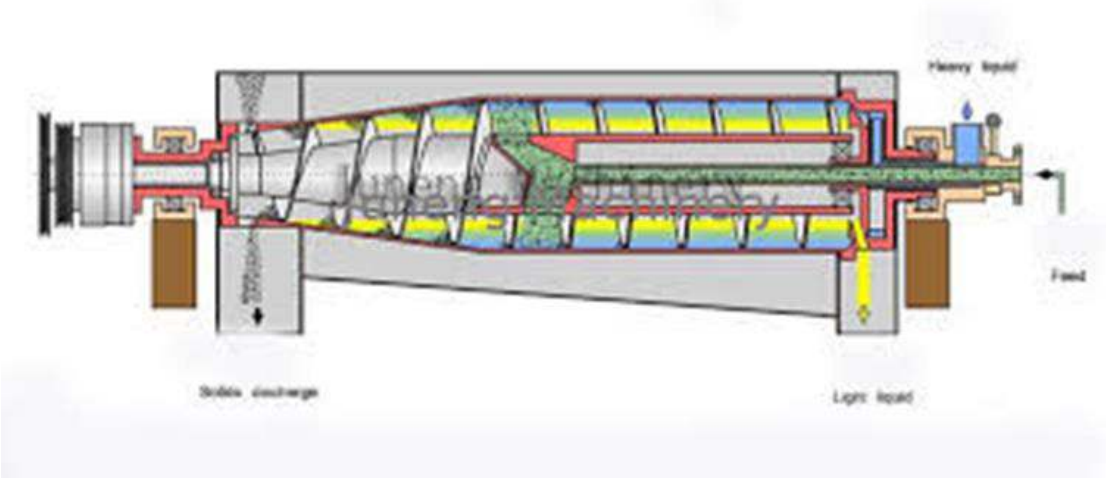
HOP OUT

Centrifuge:

- defined separation of hop particles
- low beer losses through dry-hopping
- needs to be adjusted on high solid contents

Decanter:

- best for solid – liquid separation
- lowest beer losses
- high degree of automation
- inert gas obligate
- cost intensive!



A CASE STUDY

Citra® T90
Alpha acids= 12.14%

VS.

Citra® CO2 Extract B
Alpha acids= 47.50%

CHALLENGES OF BREWING HOPPY BEERS

- Wort losses vs Flavor intensity
- Hop dosing and Equipment restrictions
- Fermentation challenges

TRIAL SPECIFICATIONS

- 10 HL Batch Size
- Target ABV: 6.3%
- Target IBU: 50
- Target EA: 2.5° Plato
- Pale and Neutral Malts

- Deliver all IBU through Kettle, 80% through Whirlpool additions (whirlpool T = 94°C, Residency time* = 1h)

- Dosage Rates of Hop Products:
  - T-90 617g/HL (A.A.= 12.1%)
  - Extract B 158 g/HL (A.A.= 47.5%)

YIELD LOSS RESULTS

Yield Loss Results			
Citra Hop Product	Alpha % HPLC	Kg Wt. Added at WHP (50 IBU)	% Yield Loss
T-90 Pellet	12.14%	6.147	13.9
Extract B	47.54%	1.578	4.2

The *less vegetation* added to your system, the *less yield loss* you get.

CONCLUSIONS

- *Sensory findings in this trial:*
  - Many similarities across products, however:
    - T-90 pellets: Most vegetal, onion, garlic, catty, pine
    - Extract B: Least vegetal, onion, garlic and catty. Trend toward increased levels of cream caramel, sweet fruit, stone fruit.

- Depending on targeted flavor output and efficiency considerations, brewers have the option of effectively using extracts AND pellets to achieve similar results.

OTHER EXAMPLES

1. Amundsen/Lean Green Lupulin Machine

- *«The most efficient DIPA ever. 40hl tank. Yield from a beer with similar recipe but no Incognito or Spectrum would be 31hl. For this beer it was 35.8hl. That's an **additional 4.8hl** to package and sell.» (BBC+Spectrum)*

2. Frau Gruber

- *«Absolutely fantastic. 40hl batch. **Yield from this beer was 6hl higher** compared to a beer with similar beer but only pellet dry hopped.» (Lupomax+Spectrum+BBC)*

CONCLUSION

think first – think twice!

- *define what you want/need*
- *there's no need to waste money*
- *flexibility is the key*

hop-in is easy… hop-out is not

- *hop extracts are easy to use and starting to be very popular*
- *a centrifuge is expensive but could be worth the investment*
- *hop percolators are more and more common*
- *care about your process, microbiology and oxygen*
- *there is always a perfect process for your status-quo*

QUESTIONS AND ANSWERS