LANXESS

Nagardo®

How non-alcoholic beer can benefit from natural protection with Nagardo®

NABLAB Brewing Conference | Lindemans Satellite Brewery

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Non-alcoholic beers are on the rise - and require additional protection

Emerging consumer needs in the beer market

- Global market for no/low alcohol beer is increasing in size and relevance
- Combination of sugar residues and no/low alcohol is an ideal environment for **yeast growth** which can lead to

0.0% **Alcohol generation → Regulatory issues**

CO_2 generation → Safety concern

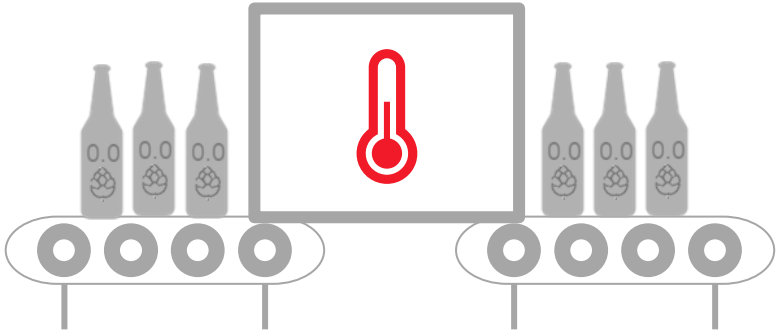
Sensory effect → Consumer disappointment

- Relevant for all packaging, but kegs especially sensitive once on draft
- Nagardo® can deliver an additional layer of microbiological safety

So far there was only one option to protect NAB against secondary spoilage

TODAY

Post heat treatment of packaged product

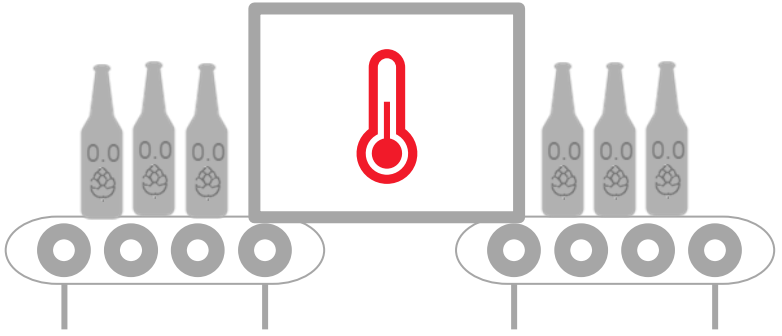


+ Proven technology for glass bottles and cans
– No or limited suitability for KEG and PET bottles
– High energy demand and physical footprint
– No persistent protection

But a real innovation that closes the gaps has recently been added to the toolbox

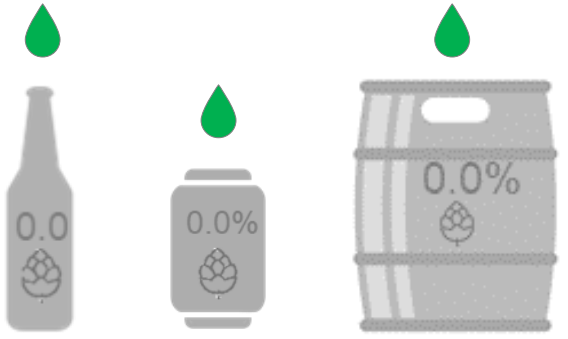
LANXESS Energizing Chemistry

TODAY Post heat treatment of packaged product



- \+ Proven technology for glass bottles and cans
- – No or limited suitability for KEG and PET bottles
- – High energy demand and physical footprint
- – No persistent protection after opening

NEW Natural Preservation



- \+ Innovative natural technology
- \+ No limitations in packaging
- \+ No energy demand or physical footprint
- \+ Persistent natural protection

When it comes to protection against microorganisms for self-defense there is one specialist: mushrooms

Natural glycolipids derived from mushrooms

- Mushrooms have an arsenal of strategies against microbial competitors, e.g. **glycolipids**

- Source organism of natural glycolipids (trade name Nagardo®) is an edible mushroom from French Guiana
- Produced by fermentation without genetic or chemical modification


Source organism of Nagardo®: Sweet Osmanthus Ear (*Dacryopinax spathularia*)

We found the missing puzzle piece: a natural preservative able to meet industry requirements

LANXESS
Energizing Chemistry

>100,000
substances screened

Natural
Natural origin without genetic or chemical modification

Performance
Strong antimicrobial efficacy and efficiency

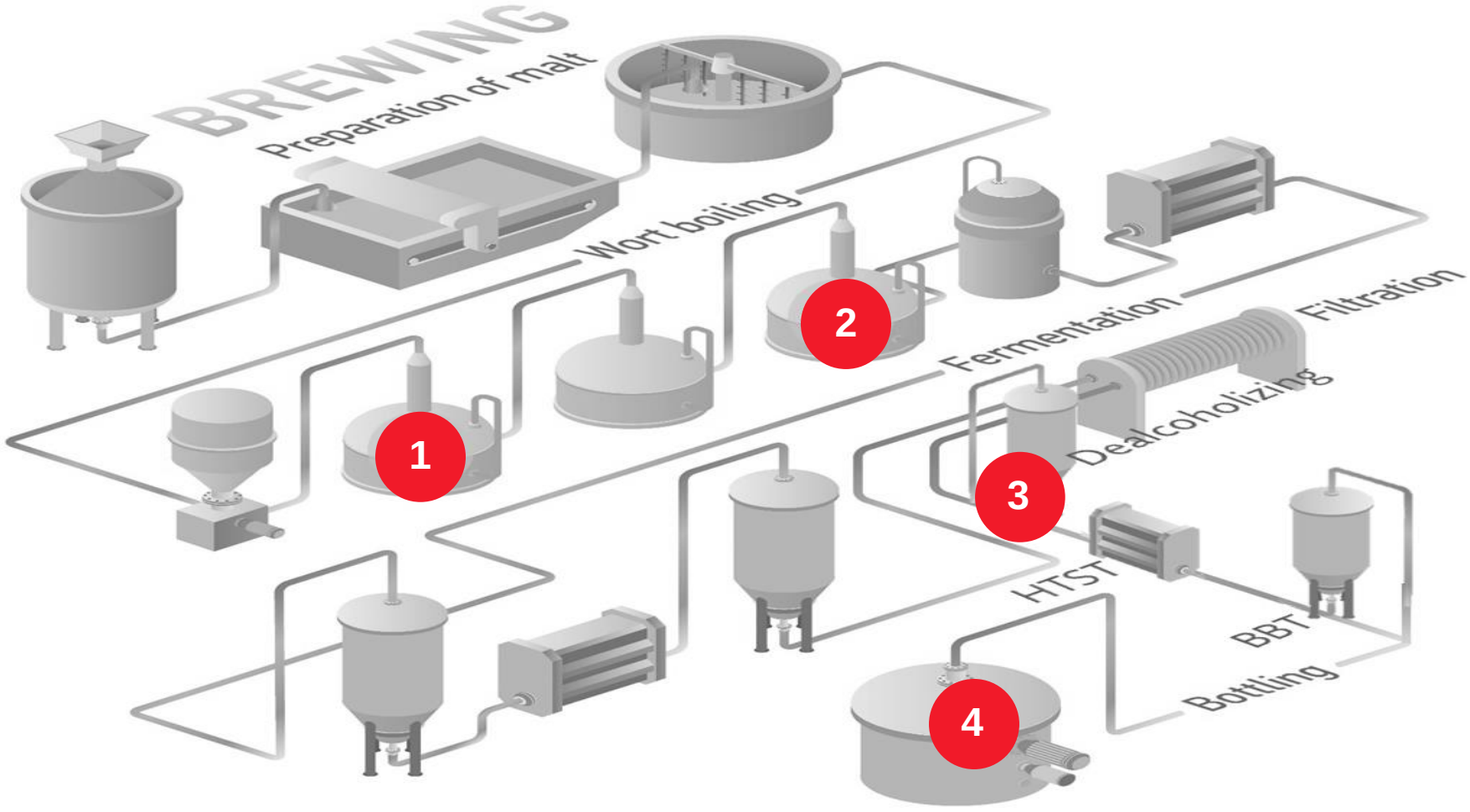
Safety
Completely safe for consumption

Sensory
No impact on taste or color

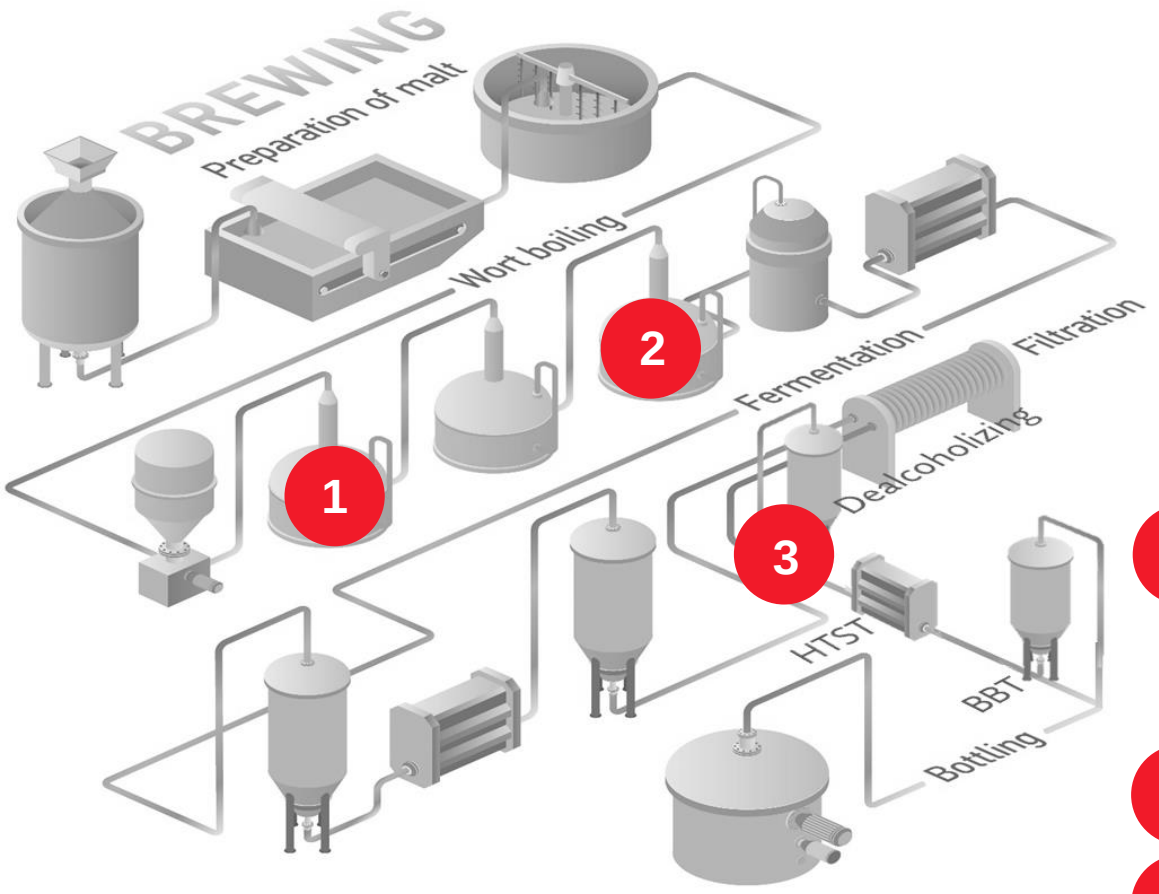
Nagardo®

Persistent protection and easy handling via aqueous stock solution

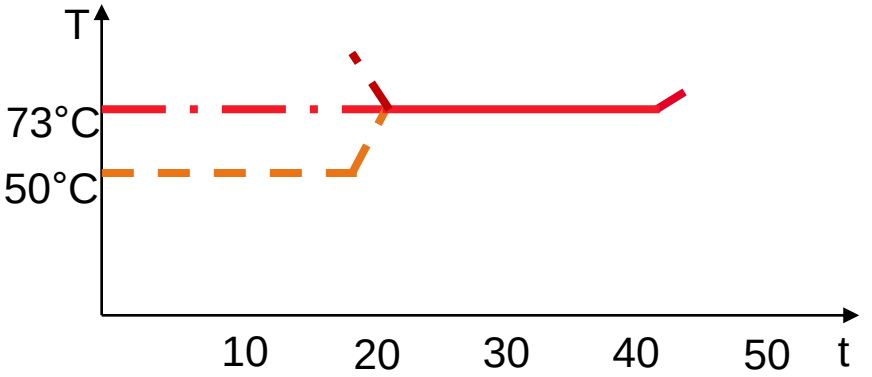
Strong hurdle concept from brewhouse to bottling required to produce a microbiologically safe NA beer



Factors to improve microbiological stability in the biological production process within the brewhouse



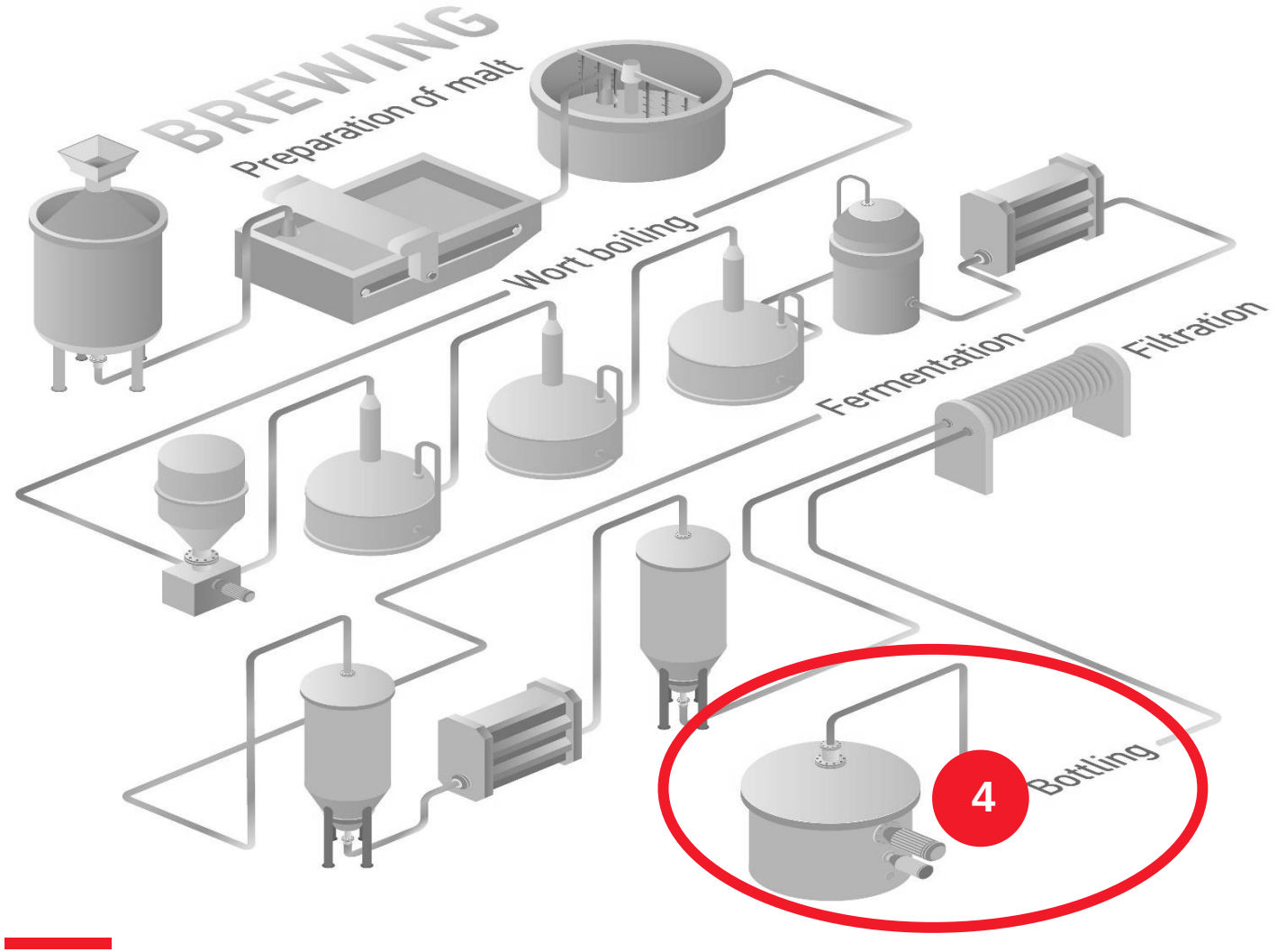
Minimize fermentable sugars, acidify of wort and reduce cell count before bottling are key factors



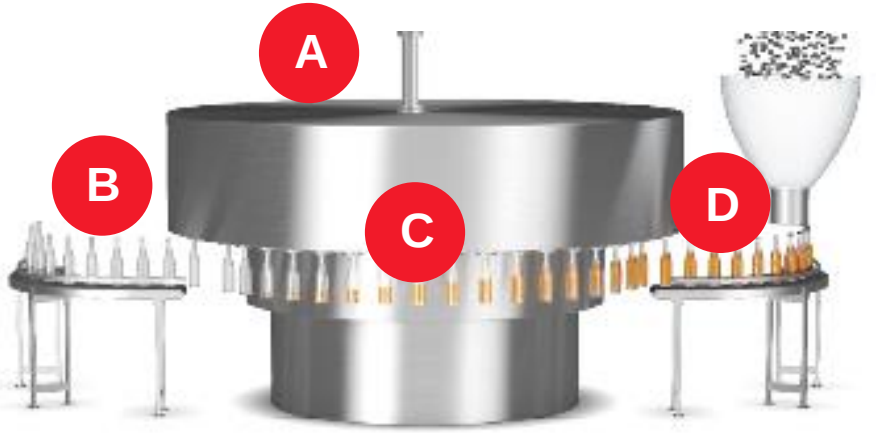
1. Target gravity: around 7°Plato [1.0277 SG]
   - Option 1: constant temperature until mash-out
   - Option 2: mash-in at 50°C after 20 min hot water addition to increase to 73°C
2. Acidification: pH < 4.5 as drop during fermentation is too low
3. Flash pasteurization (150-220 PU) or membrane filtration (viable cell count <<50 cfu/ml)

Dealcoholizing = optional, either thermal or membrane process
HTST = high temperature, short time → thermal treatment/pasteurization
BBT = bright beer tank

Nagardo® helps to control secondary contamination during product filling into bottles, cans or KEGs



Product packaging is a very sensitive area thus cross-contamination needs to be controlled



- **A** Filler environment
- **B** Packaging material
- **C** Filling equipment
- **D** Neck flushing/rinser

Application of Nagardo® requires some upfront testing because tailored dosage is key

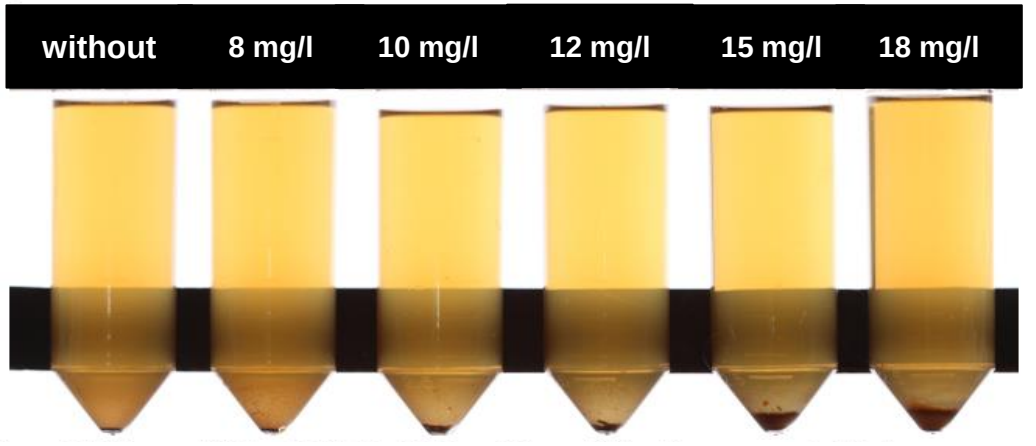
Efficacy and dosage

- Dosage level mainly dependent on:

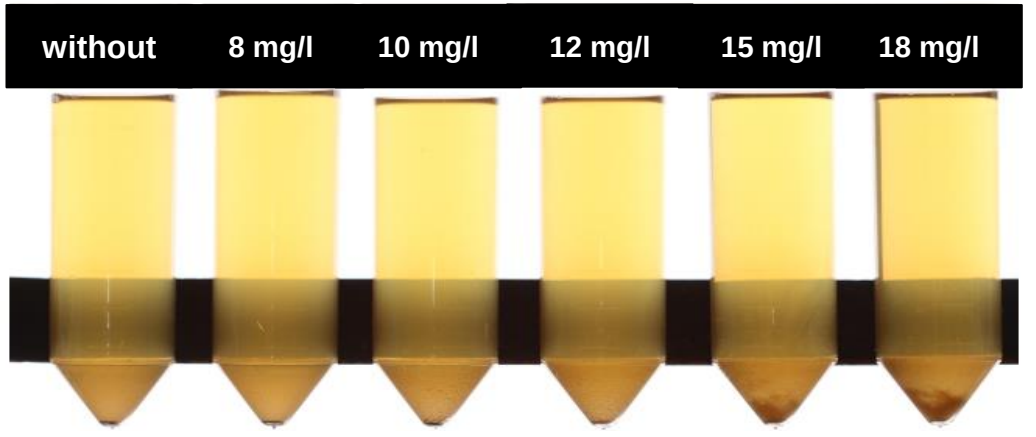
  Turbidity: The cloudier, the more Nagardo®

  Production: Slightly higher dosage for NAB made by biological methods, due to higher nutrient content and pH value

- Add different dosage levels to your beer, storage cold and ambient for 28 days and visually evaluate physical stability
- Optimum dosage usually **10 – 20 mg/l** Nagardo®
- Nagardo® is very effective against spoilage yeasts, including *S. cerevisiae var. diastaticus* and *Brettanomyces spp.*

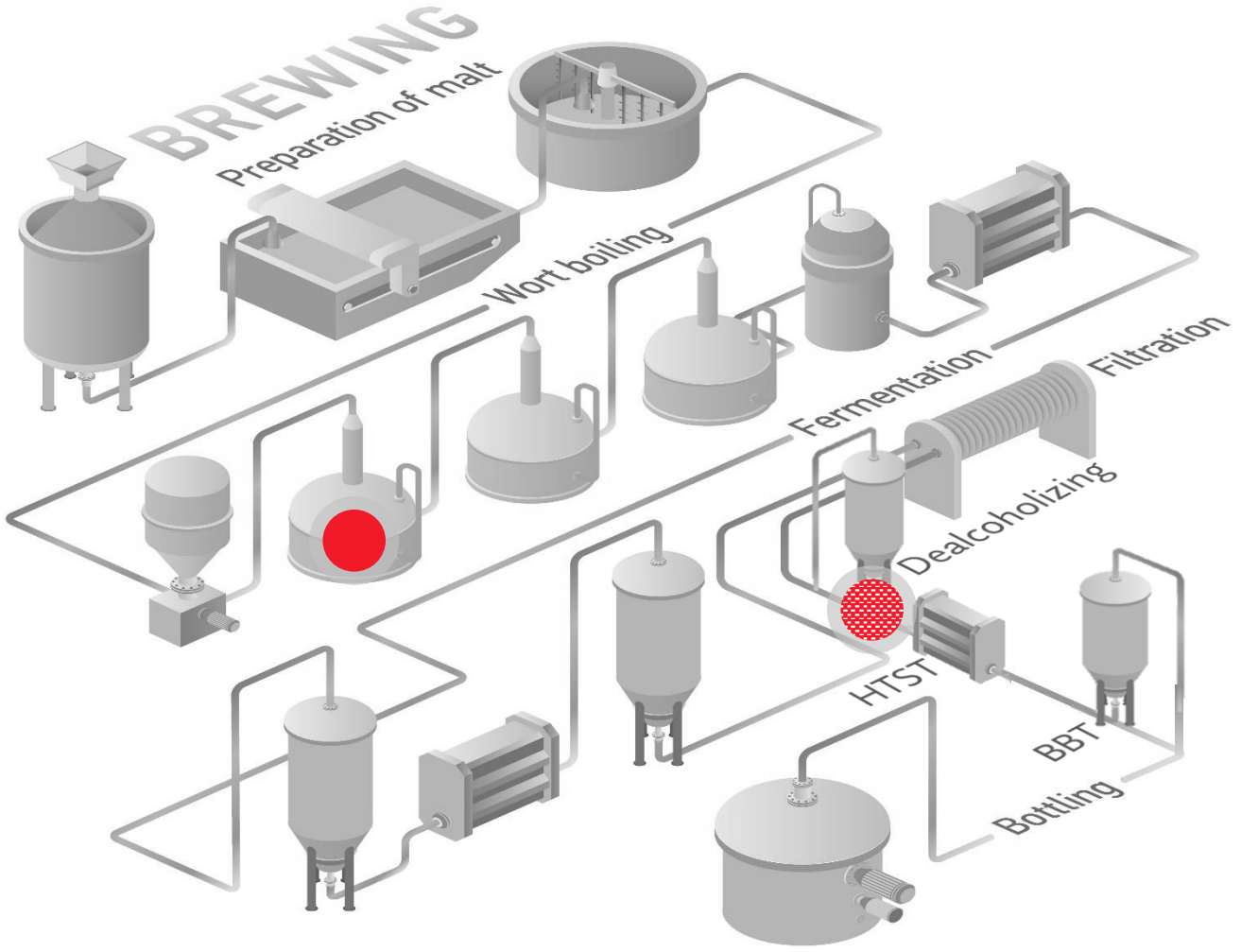


ambient storage conditions for 28 day



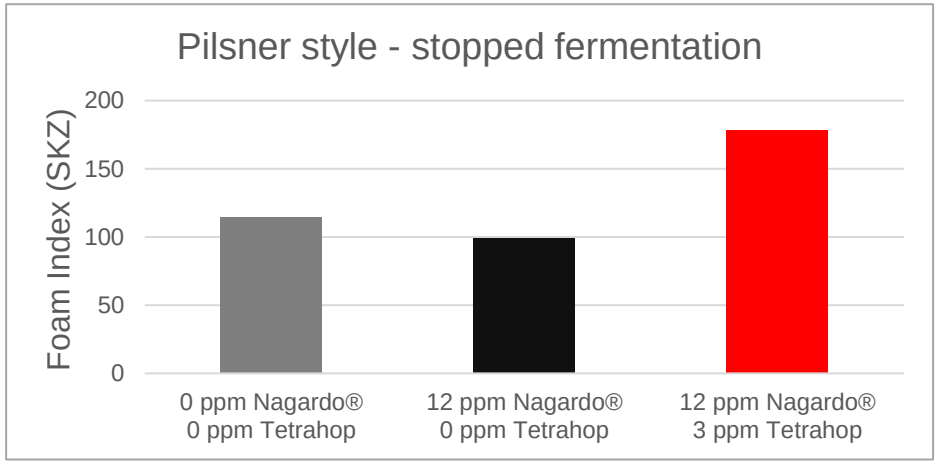
cold storage conditions for 28 day

Glycolipids may affect foam stability but can be easily compensated



Glycolipids have surfactant properties potentially leading to different head retention

- Option 1: Adjustment of the recipe towards increased wheat malt content
- Option 2: Addition of foam stabilizing hop extracts, e.g. tetrahop or alpha-extract into prefiltered or centrifuged beer



Lab scale experiment: direct addition of Tetrahop and Nagardo® into the bottle followed by Steinfurth foam tester measurement

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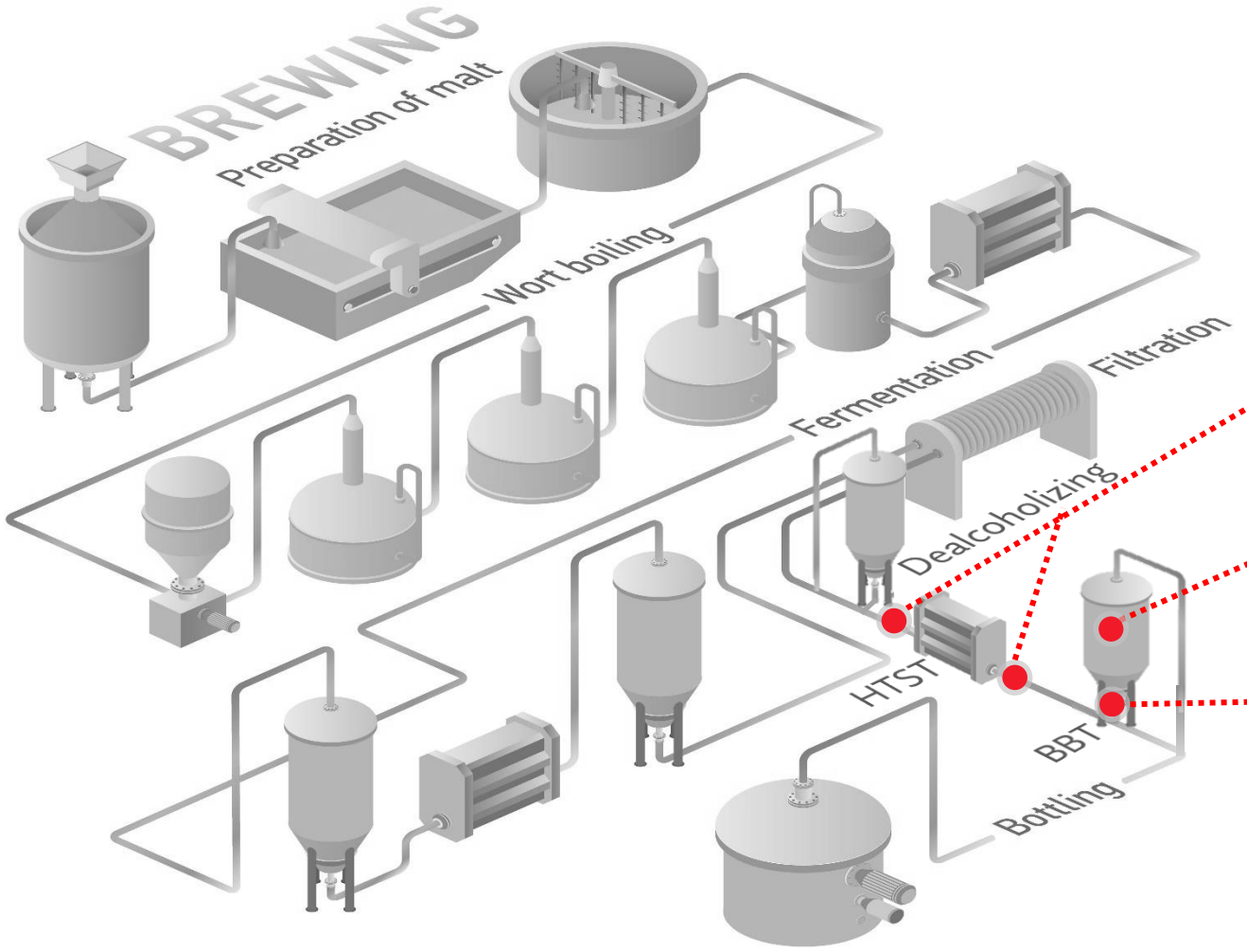
Different ways to add Nagardo® stock solution using existing equipment



Nagardo® stock solution is added **after centrifugation or filtration** and **after dealcoholizing** to avoid losses

Inline dosing before or after HTST, utilizing same system as for flavors

Addition into **empty BBT**, distribution via **CO_2 injection**

Addition into **filled BBT**, distribution via **dry hopping system**

Dealcoholizing = optional, either thermal or membrane process
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Non-alcoholic beer on draft can finally become reality!

LANXESS Energizing Chemistry

Key use case: Enable NAB on draft

- Once connected to tap KEGs have high risk of spoilage
- Cleaning status of draft system often unknown
- Actual shelf life not predictable
- **Difficult for outlets to anticipate in NAB growth**
- **Persistent protection required while staying “free from” artificial preservatives**

Nagardo® prolongs shelf life on draft to enable further category growth

Save energy while flexibilizing operations

Key use case: Reduce energy consumption

- **Thermal in-package treatment** like tunnel or chamber pasteurization is energy intensive
- Do not always meet manufacturing needs due to large physical and CO_2 footprint and mode of operation
- **Can be a hurdle to achieve sustainability goals and operational flexibility**

Nagardo® + HTST or filtration are a viable solution to save energy & flexibilize operations

HTST: High temperature – short time

Please feel free to contact us

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