CHINOVA BIOWORKS

Microbial Control. Beer Quality.

FROM PRODUCTION TO PACKAGE

Jack Ryan / Chinova Bioworks

Vermont Craft Brewers Conference



How Much Heat Is Enough?



Reducing heat in non-alcoholic beer

Chiber™

CONTROL

Relevant spoilage organisms and safety hazards

QUALITY

The intended aroma and flavour

EFFICIENCY

Utility demand and processing time

Validate the process for the finished beer.

Four Parts. One Better Process.

01 Microbial risk in NA beer

02 Pasteurization and quality

03 Chiber™ for beer

04 Brewery trials and validation

01

NA Beer Changes The Risk

Removing ethanol changes which microorganisms can survive and grow.



Beer Has A Barrier System

Lower ethanol makes every remaining barrier more important.



Ethanol

Lower or absent in NA beer



pH + hops

Measure in the finished formulation



Nutrients

Residual availability varies with the process



Storage

Temperature and oxygen affect microbial behaviour

Source: Ceylan et al., Journal of Food Protection (2023)

Spoilage Control ≠ Food Safety



Selected pathogens survived.
Some grew under the conditions tested.

Assess the finished beer: pH, ABV, hops, nutrients and storage temperature.

ASource: Ceylan et al. (2023)

Know what you are testing against



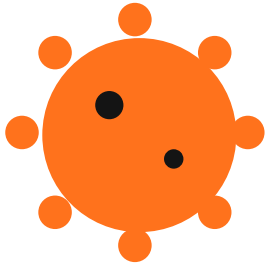
Bacteria

Beer-spoilage lactic acid bacteria and other formulation-dependent contaminants



Yeast

Wild and diastatic yeast, including relevant resistant forms



Pathogens

Relevant safety hazards in NA formulations that permit survival or growth

Strain, physiological state and beer composition affect resistance.

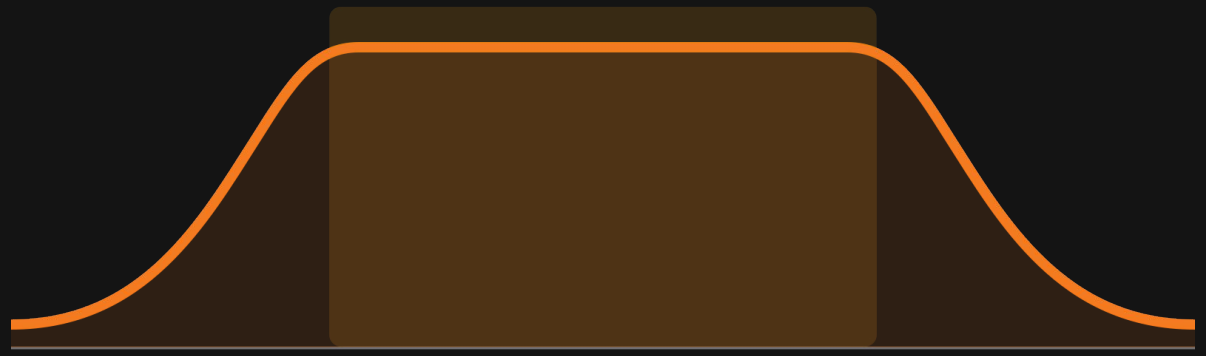
02

The Heat Trade-Off

Pasteurization: microbial kill, flavour and utility demand.



What A PU Actually Measures



HEAT UP HOLD COOL DOWN

$$PU = \int 1.393^{(T-60)}\, dt$$

T in °C; time in minutes

Curve is illustrative; actual kill depends on strain and composition.

1 PU

1 minute at 60 °C

Measure at the package cold spot.

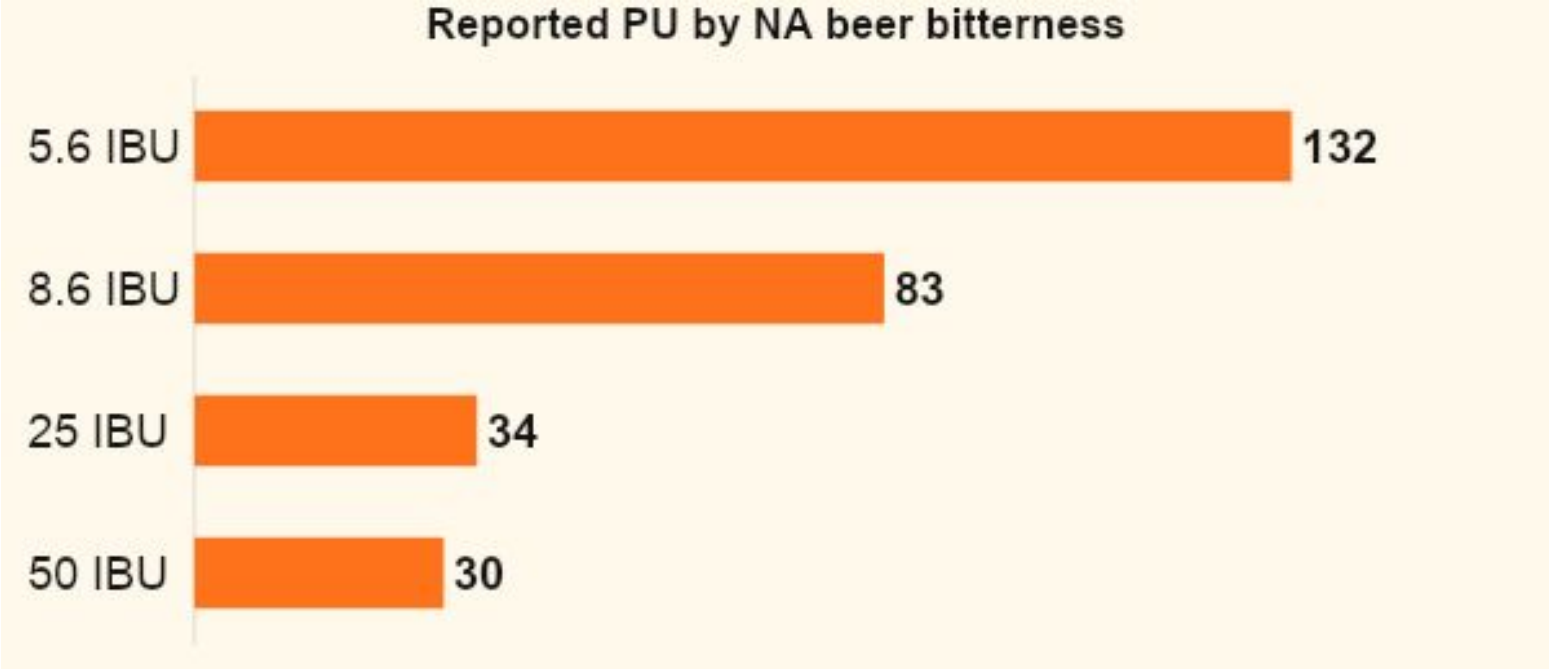
No Universal PU Target

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4.4×

Spread in reported PU requirements

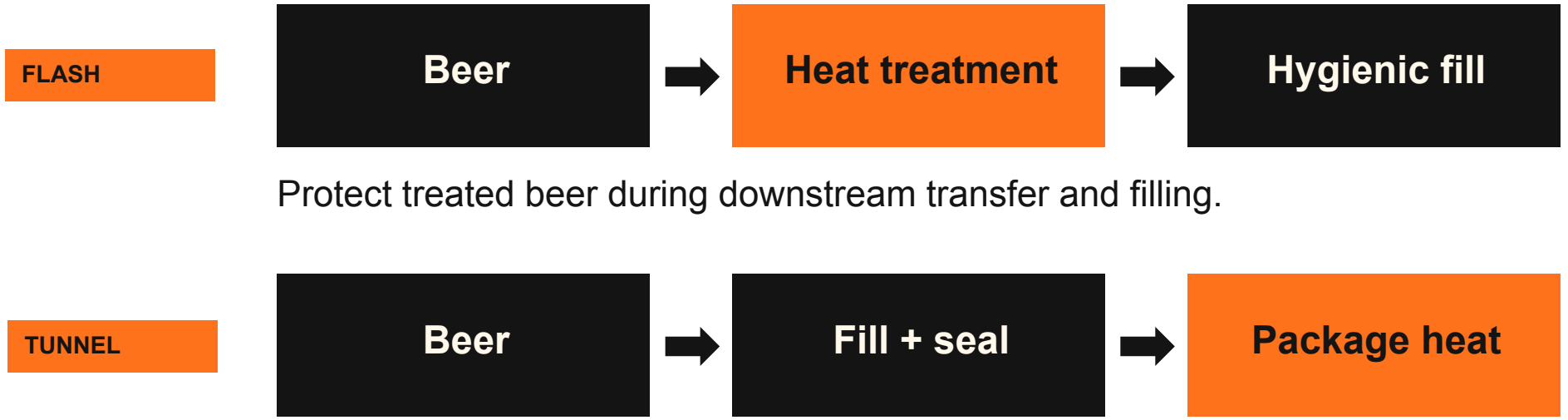
Between the 5.6 IBU and 50 IBU beers tested



The complete formulation matters. IBU alone does not establish the target.

Rachon, MBAA Technical Quarterly 61(2), 43–49 (2024)

Where Does The Kill Step Happen?



Flash pasteurization requires controls against contamination during filling.

Heat has three costs

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ENERGY	FLAVOUR	PRESSURE
+23%	**60 PU**	**~3 vol**
US wholesale power price, 2025 vs 2024	Reported sensory change in an NA hazy IPA	Reported can carbonation limit at 60 °C
EIA STEO	ASBC	Brewer reports

Context-specific examples. Assess actual costs, sensory effects and package limits.

One Heat Process. Three Outcomes.



Microbial lethality	Sensory freshness	Energy demand
May increase	**May decrease**	**May increase**
Depending on organism and beer matrix	Cooked or stale character; aroma, foam, colour or haze changes	Higher heating and cooling requirements

Equal PUs can produce different flavour effects.

The Energy Behind The Heat

Heating 1,000 L of beer from 20 °C to 60 °C

BEER VOLUME

1,000 L

TEMPERATURE RISE

20 → 60 °C

≈46

kWh

Sensible heat

Before equipment losses or heat recovery

$$Q = m \times c_{\square} \times \Delta T$$

Plant utility use also depends on steam, cooling, dwell time, throughput and heat recovery.

03

Chiber™ As An Added Hurdle

White button Mushroom-derived chitosan alongside existing brewery controls.



A System. Not A Single Ingredient.



01	02	03	04	05
Sanitation	**Formulation**	**Antimicrobials**	**Heat**	**Packaging**
CIP, filtration and hygiene	pH, ABV, hops and acid systems	Chiber™: mushroom-derived chitosan	Validated thermal kill	Protect the finished beer

Every control must work in the finished beer and its distribution conditions.



Mushroom-derived chitosan

Chiber™ For Beer

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0.1–0.2%

TYPICAL TRIAL RANGE

How it works

Cationic chitosan can interact with microbial surfaces.

What affects performance

pH, ionic strength, proteins, hops and molecular weight.

What to verify

Heat stability, physical compatibility and antimicrobial efficacy in the actual beer.

Confirm the dose basis and test efficacy in the finished beer.

Published Challenge Results

2,000 ppm (0.2%) Chiber™ / ~0.5% ABV / 20–22 °C



Listeria undetectable

Five spoilage organisms decreased; most undetectable

Salmonella and E. coli O157:H7 undetectable

Results apply to the organisms and conditions tested.

Brown, MBAA Technical Quarterly 61(2), 40–42 (2024)

Two Beers. Two Challenge Examples.

0.1% CHIBER™

Matched

Tunnel-pasteurized NA beer

Comparable antimicrobial performance against four spoilage microorganisms in one comparison.

0.2% CHIBER™

28 days

With spoilage organisms undetectable

Six spoilage organisms; ~3 log CFU/mL inoculum; ~20 °C; one NA beer.

Chinova NA beer white paper (2026), pp. 4–5.

Three Preservation Pathways To Test

OPTION	CANDIDATE PROCESS	VALIDATION REQUIREMENT
A · Current	Tunnel pasteurization	Current validated process
B · Combined	Chiber™ + reduced tunnel PU	Verify control at the lower heat treatment
C · No tunnel	Chiber™ without tunnel pasteurization	Product-specific safety validation by a process authority

Development scenarios: the lowest suitable treatment must be validated.

Chinova white paper (2026), pp. 2, 5–6

Lower PU. Measure The Savings.

Illustrative model · subject to product and process validation

PU TREATMENT

70%

lower PU treatment

≠

MODELLED TUNNEL ENERGY

35–50%

energy reduction

100 → 30 PU

Confirm savings with plant measurements.

Three Questions. Three Kinds Of Proof.

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01

Microbial control

Does Chiber™ inhibit or kill the relevant organisms?

Challenge study

02

Lower heat

Can reduced heat deliver the required performance?

PU ladder vs current process

03

Beer quality

Does the combined process improve sensory results?

Blinded sensory panel

04

Make The Evidence Count

Compatibility, challenge testing, sensory results and economics.



Bench → Pilot → Scale

01 BENCH

Compare 0.1% and 0.2% Chiber™ with an untreated control after 24 hours. Select organisms and dose.

02 PILOT

Compare dose and PU combinations in packaged challenge studies and blinded sensory tests.

03 SCALE

Measure utilities, pressure and throughput. Complete food-safety review and commercial monitoring.

Chinova white paper (2026), pp. 9–10

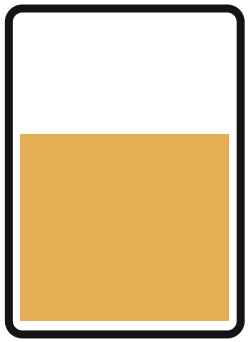
Where Chiber™ Fits In The Process

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Brew / ferment	Post-ferment	Pre-package	Package
Establish the starting load and conventional controls.	Measure pH, IBU, ABV and compatibility.	Candidate dosing point. Confirm dispersion and hygiene.	Verify closed-container stability and shelf life.

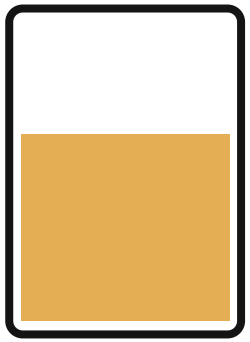
Check fining, filtration and haze stability. Confirm requirements in each market.

Screen Compatibility Before Microbiology



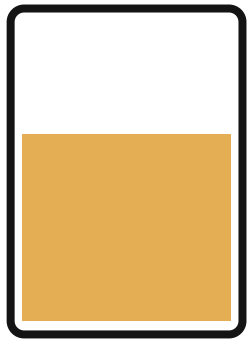
Untreated

Compare after 24 hours



0.1% Chiber™

Compare after 24 hours



0.2% Chiber™

Compare after 24 hours

Potential interactions

Binding in protein-rich or haze-active beers.

Beer quality

Foam, sediment, filtration, aroma and haze.

A Four-Arm Pilot Isolates The Effects

	NO CHIBER™	WITH CHIBER™
Standard heat	A · Current process	B · Chiber™ + standard heat
Reduced heat	D · Reduced heat only	C · Chiber™ + reduced heat

Measure microbes, blinded sensory scores and actual utility consumption.

Proposed study design. Use a documented safety protocol; do not distribute untreated or under-processed samples.

Challenge Study Requirements

Build The Challenge Before The Trial.

01 **Targets**

Relevant spoilage organisms and safety hazards

02 **Worst case**

Formulation, storage, inoculum and processing variations

03 **Decision rules**

Defined log-reduction or no-growth acceptance thresholds

04 **Repeatability**

Replicates, real-time shelf life and revalidation

Sensory Assessment

A freshness claim needs a blinded panel



01

MATCH

Samples

Same lot, packaging, oxygen, storage and age

02

BLIND

Method

Blinded panel and difference testing on fresh and aged beer

03

MEASURE

Measures

Aroma, cooked character, staling, haze, foam and colour

Make the business case measurable

MEASURE	
Utilities	Steam, electricity and cooling per hL
Operations	Dwell time and line throughput
Quality	Rejects, sensory results and shelf life
Cost	Chiber™, testing, revalidation and process changes

ACCEPTANCE CRITERIA

- **Equivalent control**
  No loss of safety or shelf-life performance
- **Quality improvement**
  Meaningful sensory advantage, if present
- **Operating improvement**
  Measured utility or throughput benefit

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Chiber™

Mushroom-derived preservation

Key Takeaways

4

Things To Take Back To Your Brewery

NA beer

Assess hazards for each formulation.

Pasteurization

Use challenge data to establish the PU target.

Quality + cost

Measure sensory changes and utility use.

Chiber™

Test compatibility and efficacy in the finished beer.

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Q&A

Let's Talk Beer Quality.

Jack Ryan

Chinova Bioworks

chinovabioworks.com



Chiber™

Natural preservation

MycoKleer™

Beverage clarification

References

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Modelling Pasteurization and Staling Effects
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