Battling Biofilms in Beer Draught Lines
Bridget Gauntner
Market Quality Specialist
Bell’s Brewery, Inc.

Darla M. Goeres, Ph.D.
Research Professor of Regulatory Science
Center for Biofilm Engineering, Montana State University
Draught Beer Quality Subcommittee
Industry wide recommendations
Version 1 published in 2009
Version 4 published in 2019
Cleaning Essentials

How often?

- Caustic every 2 weeks
- Acid every 3 months

15 minutes recirculation

Temperature
- 80°-110° F

Chemical
- 2-3% caustic solution

Mechanical Work
- Recirculating pump

Time
<table>
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<tr>
<th>Cleaning method challenges</th>
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<td>Beer line tubing materials</td>
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<td>Age of beer lines</td>
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<td>Line cleaning frequency</td>
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<td>Sales velocity</td>
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Darla Goeres, PhD
Research Professor of Regulatory Science
darla_g@montana.edu
Center for Biofilm Engineering
Montana State University
Biofilm bacteria are a self-organized, cooperative community of microorganisms embedded in a matrix of extracellular polymeric substances.
Why do we care about biofilm?

- Tolerant to antimicrobials
- Public health
- Structure & equipment degradation
- Safety
- Aesthetics & taste
- Bioremediation & biofuels
Biofilm & Beer
Biofilm grows in compromised tubing

Images of beer line tubing collected from a bar

Images of etched beer line tubing in the laboratory
Research Question

- Does beer draught line tubing aged to simulate 1, 2 and 5 years of cleaning support more biofilm growth?
- Is the resulting biofilm more challenging to kill?

L. Miller, 2020
Age Vinyl Beer Tubing

Circulate: caustic (14 days, 15 min*); acid (3 months, 15 min**)
Rinse with water
Fill with beer for 7 days @ RT
Repeat

*390 minutes
**60 minutes
Inoculum

Prepared in Barney Miller Medium + pale ale beer:

- *Pediococcus damnosus* ATCC 29358
- *Acetobacter aceti* ATCC 15973
- *Lactobacillus rhamnosus* ATCC 8538

Prepared in Yeast Peptone Dextrose:

- *Saccharomyces cerevisiae* (Safale yeast packet)

Incubated at 4 °C for 3 days. Target density = $10^4 - 10^6$ CFU/mL
Experimental Design

Combine inoculums + flat pale ale

Recycle: 10 mL/min 1 hr/day 2 days

Sample

Treat with caustic (no recycle)

Rinse with water

Sample

Fill with Barney Miller + pale ale (24hr)

Sample
Results: tubing visually changes after 2 years of simulated treatment
Results: more biofilm harvested from aged tubing; more regrowth
Results: caustic was effective against biofilm in aged tubing
Images confirm plate counts: 48 hr growth
Images confirm plate counts: following treatment
Images confirm plate counts: regrowth
Summary

- Data demonstrated a trend between biofilm accumulation and age of tubing.
- Extended exposure to caustic and acid compromised tubing integrity.
- Caustic effectively killed/removed biofilm, regardless of tubing age.
- Biofilm recovered more quickly in aged tubing, suggesting the caustic will cease to be as effective as system ages.
Recommendation

- Always consider biocide and material compatibility
- Consider changing system components ‘more frequently’
- Challenge the industry to develop a biosensor that monitors microbial contamination in real time to optimize cleaning protocols
Cheers

Brewers Association
Chuck Skypeck

SBML
Evan Turner

darla_g@montana.edu
THANKS!