



Brewery Yeast Handling

Florian Kuplent
Urban Chestnut Brewing Co
St. Louis/Wolnzach

District Northwest

October 20, 21, 2017

Eugene, Oregon

Introduction

- It's not just all about hops...
- Yeast has large influence on beer flavor
- Some very simple techniques and procedures can help to improve yeast handling in the brewery and, ultimately, beer quality



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Overview

- Sourcing Brewing Yeast
- Culture Collection Storage
- Yeast Propagation
- Brewery Yeast Handling and Fermentation



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Sourcing Yeast: Overview

- Many sources are available:
 - Isolating yeast (bottled beers, nature)
 - Liquid yeast (other brewery, yeast supplier)
 - Slants (yeast supplier)
 - Dry yeast
 - Own yeast collection



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Sourcing Yeast: Isolating Yeast

- Options:
 - Bottle conditioned beers
 - Nature
- Pro:
 - Low cost
- Con:
 - Labor intensive
 - Lack of information on yeast properties



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Sourcing Yeast: Liquid Yeast

- From other brewery or yeast supplier
- Pro:
 - Convenient
- Con:
 - Dependence on third party
 - Limited selection of strains



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Sourcing Yeast: Agar Slants

- Pro:
 - Easy handling
 - Large selection of strains
 - Reliable source if right partner is chosen
- Con:
 - Own lab and brewery prop system required



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Sourcing Yeast: Dry Yeast

- Pro:
 - Convenient
 - Easy storage
 - Flexibility
- Con:
 - High cost
 - Limited number of available strains



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Sourcing Yeast: Own Yeast Collection

- Pro:
 - Control over entire process
- Con:
 - Labor and equipment intensive
 - Need to define strategy for long term storage



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Sourcing Yeast: Summary

- Best solution will depend on needs and equipment of brewery
- Combination of sources might be best option



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Culture Storage: Options

- Liquid culture
- Distilled water storage
- Agar slants
- Low temperature freezer
- Cryogenic storage



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Culture Storage: Preface

- Sterile techniques need to be used for all procedures
- Whatever method is chosen for long term storage – always have backups in place
 - Storage in geographically different locations
 - Emergency plan for equipment failures, power outages, etc.



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Culture Storage: Liquid Culture

- Yeast is stored in wort filled flasks at low temperatures (33-35°F)
 - Storage in natural environment
 - Slow fermentation takes place
 - Re-propagation periodically necessary
 - Pro: low cost, easy to handle
 - Con: labor intensive, microbiological risk, risk of genetic drift over time, short storage time (weeks)



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Culture Storage: Dist. Water Storage

- Yeast is stored in vials filled with distilled water at low temperatures (33-35°F)
 - Cultures need to be re-propagated periodically
 - Very limited research available
 - Pro: low cost, easy to handle
 - Con: labor intensive, microbiological risk, risk of genetic drift over time, limited storage time (years ?), lack of scientific data on success of method



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Culture Storage: Agar Slants

- Yeast is stored on wort agar in tubes at low temperatures (33-35°F)
 - Yeast is streaked on agar slants and incubated
 - Mineral oil prolongs storage time
 - Cultures need to be re-propagated periodically
 - Pro: low cost, easy to handle
 - Con: labor intensive, microbiological risk



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Culture Storage: Low Temp. Freezer

- Yeast is stored at very low temp (-80°C)
 - Yeast is frozen in vials filled with glycerol solution in mechanical freezers
 - Long storage times have been tested (decades)
 - Pro: safe and tested method
 - Con: expensive equipment, freezer can fail



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Culture Storage: Cryogenic Storage

- Yeast is stored in liquid nitrogen (-196°C)
 - Yeast is frozen in vials filled with glycerol solution in liquid nitrogen freezers
 - Long storage times have been tested (decades)
 - Pro: safe and tested method, no risk of genetic drift
 - Con: relative expensive equipment, safety



UNITED WE BREW.

District Northwest

October 20, 21, 2017
Eugene, OR

Culture Storage: UCBC St. Louis



UNITED WE BREW.

District Northwest

October 20, 21, 2017
Eugene, OR

Culture Storage: Summary

Combination of storage option is advisable:

- Medium term storage on agar slants (for production strains)
- Long term storage in low temp freezer or liquid nitrogen
 - Partnership with local university or yeast bank



UNITED WE BREW.

District Northwest

October 20, 21, 2017
Eugene, OR

Yeast Propagation: Overview

- Fermentation with the goal to grow yeast
- Can be carried out with very limited equipment
- Automated solutions are available from various suppliers



UNITED WE BREW.

District Northwest

October 20, 21, 2017
Eugene, OR

Yeast Propagation: Lab Equipment

- Required:
 - Autoclave
 - Propagation flasks/bottles of various sizes
 - Bunsen burner
- Optional:
 - Lab Shaker
 - Laminar flow hood
 - Microscope and hemocytometer



UNITED WE BREW.

District Northwest

October 20, 21, 2017
Eugene, OR



Yeast Propagation: Lab Procedure

- Step up rate from 1 : 20 in early stage to 1 : 5 in later stages of propagation
- Precise temperature control not essential
- Using a lab shaker will speed up process and increase cell mass
- Autoclaved wort is an ideal media
- Final volume of lab prop should depend on initial volume of plant propagation



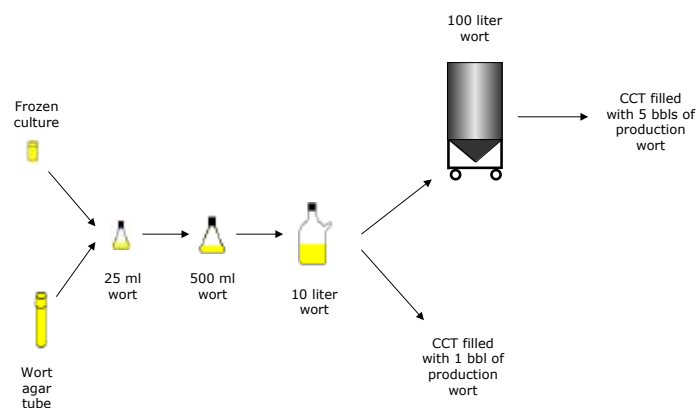
UNITED WE BREW.

District Northwest

October 20, 21, 2017
Eugene, OR



Yeast Propagation: Example



UNITED WE BREW.

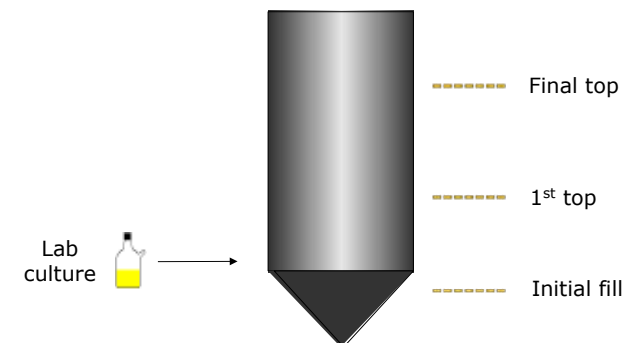
District Northwest

October 20, 21, 2017
Eugene, OR



Yeast Propagation: Brewery

- Can be carried out in CCT
- Subsequently top off fermenter



UNITED WE BREW.

District Northwest

October 20, 21, 2017
Eugene, OR



Yeast Propagation: Propagator

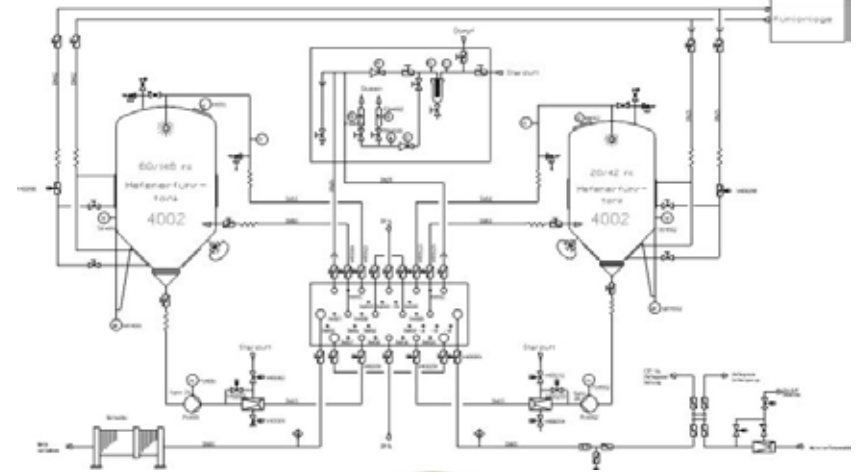
- Different designs are available from various manufacturers
- Older designs are based on Hansen Propagator
 - Designated wort storage and propagation tanks
 - “Normal” fermentation
- Modern designs use continuous aeration to increase biomass



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Yeast Propagation: Modern System



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Yeast Propagation: UCBC St. Louis



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Yeast Propagation: Quality Control

- Check final lab stage for microbiological contaminants using nutrient broth
 - Easy way to determine microbiological status
 - e.g. NBB-B, MRS, Raka-Ray
- Brewery prop should be checked during every step
 - Cell count
 - Extract



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Fermentation: Overview

- Wort aeration
- Pitching
- Flocculation
- Cooling
- Harvest
- Yeast washing

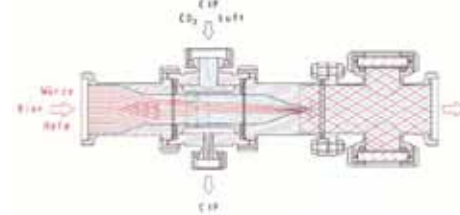


District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Fermentation: Wort Aeration

- Oxygen is essential for yeast growth
- Insufficient aeration of wort can lead to stalled fermentations
- Modern aeration devices create very fine bubbles which evenly distribute air in the wort



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Fermentation: Pitching

- Measure yeast cell count after pitching
 - Consistent pitch cell counts will improve consistency of fermentations
- Measure viability of stored yeast (methylene blue)
 - Discard yeast that has over 5% dead cells
- When filling a fermenter with multiple brews, pitch yeast into first brew
 - Reduces risk of contamination



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Fermentation: Flocculation

- Flocculation is highly yeast strain dependent
- Yeast flocculation at **the end** of fermentation is essential
- Premature flocculation leads to unfinished beer
 - Can be caused by:
 - poor malt quality
 - Microbiological infection
- Reduced flocculation leads to filtration issues
 - Influenced by Calcium and Zinc levels (Zinc min. 0.12 mg/l wort)



District Northwest

UNITED WE BREW.
October 20, 21, 2017
Eugene, OR

Fermentation: Yeast Harvest

- Conditions in cone are not optimal for yeast
 - High CO₂ concentration
 - No access to nutrients
 - Early harvest is advisable
- Discard bottom part of cone (high percentage of dead cells, trub, hop particles)
- If using a pump use a positive displacement pump (reduced shear stress on yeast)



UNITED WE BREW.

District Northwest

October 20, 21, 2017
Eugene, OR

Fermentation: Short Term Storage

- Cool yeast down to ~ 35° F right after harvest
- Avoid oxygen pick-up
- Re-pitch as soon as possible
 - If yeast needs to get stored for longer periods add fresh wort to bring to provide nutrients



UNITED WE BREW.

District Northwest

October 20, 21, 2017
Eugene, OR

Fermentation: Yeast Washing

- Sterile water wash:
 - Not recommended – microbiological risk too high
- Acid wash:
 - Only recommended to be used when absolutely necessary
 - Target pH 2.0 – 2.5 using phosphoric acid
 - 4h residency time – then rinse with sterile water



UNITED WE BREW.

District Northwest

October 20, 21, 2017
Eugene, OR

Summary

- Yeast is one of the most important drivers of beer aroma and taste
- Yeast handling directly influences beer quality
- Good yeast handling doesn't require expensive equipment



UNITED WE BREW.

District Northwest

October 20, 21, 2017
Eugene, OR



Thank you! Questions?

Florian Kuplent

florian@urbanchestnut.com