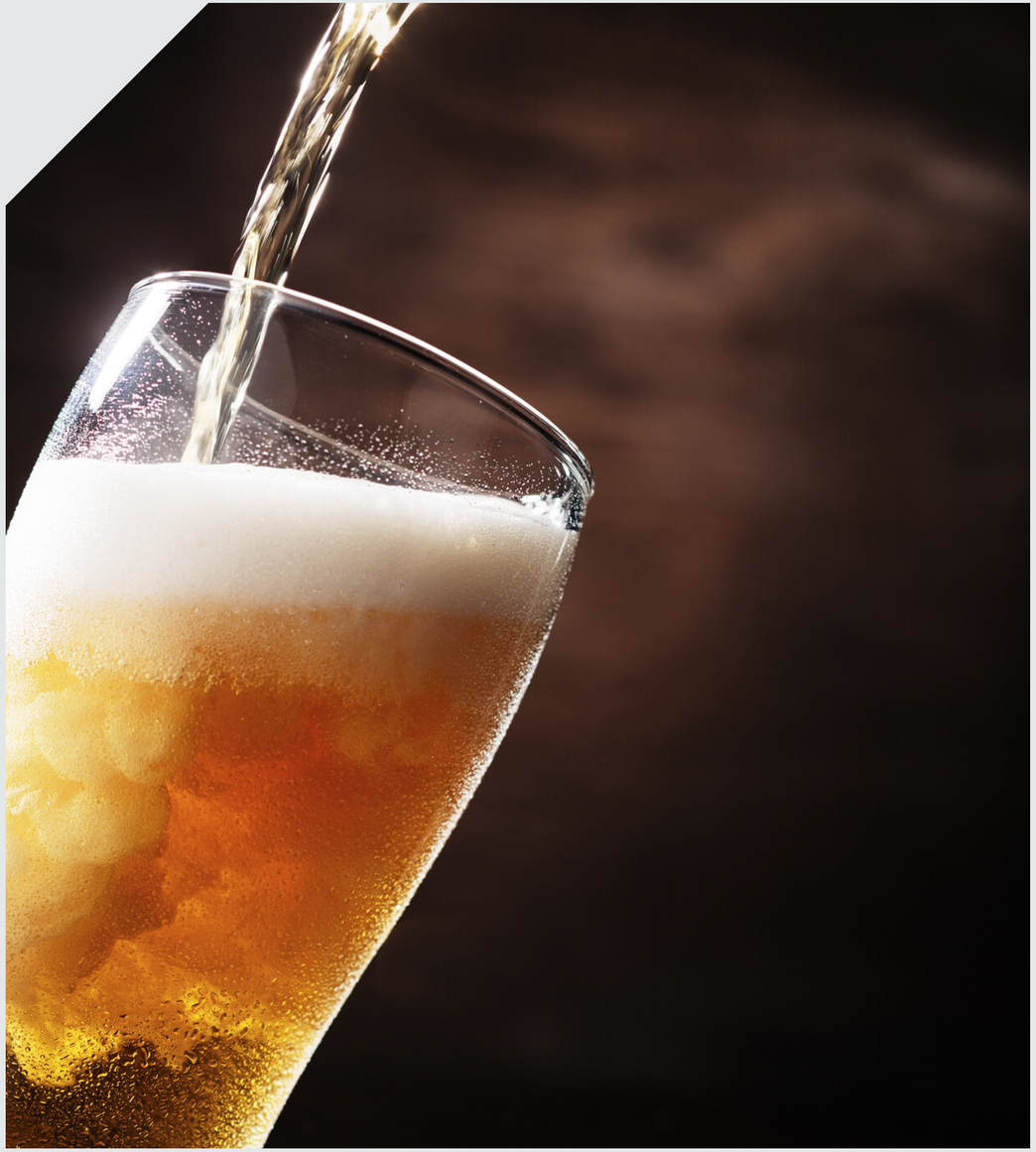
Advanced Homebrew Lab Skills

May 13, 2022

Amy Todd
Zymology Labs, LLC 2022

Agenda

- How do we define quality?
- Record your way to better beer - document control and equipment
- Count your way to better yeast health
- Wash and grow your way to cleaner yeast
- Collect and grow your way to wild beer
- Identify spoilage concerns
- Taste your way to better quality



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The UNIVERSITY of VERMONT

ZERO GRAVITY CRAFT BREWERY
EST 04 BVT

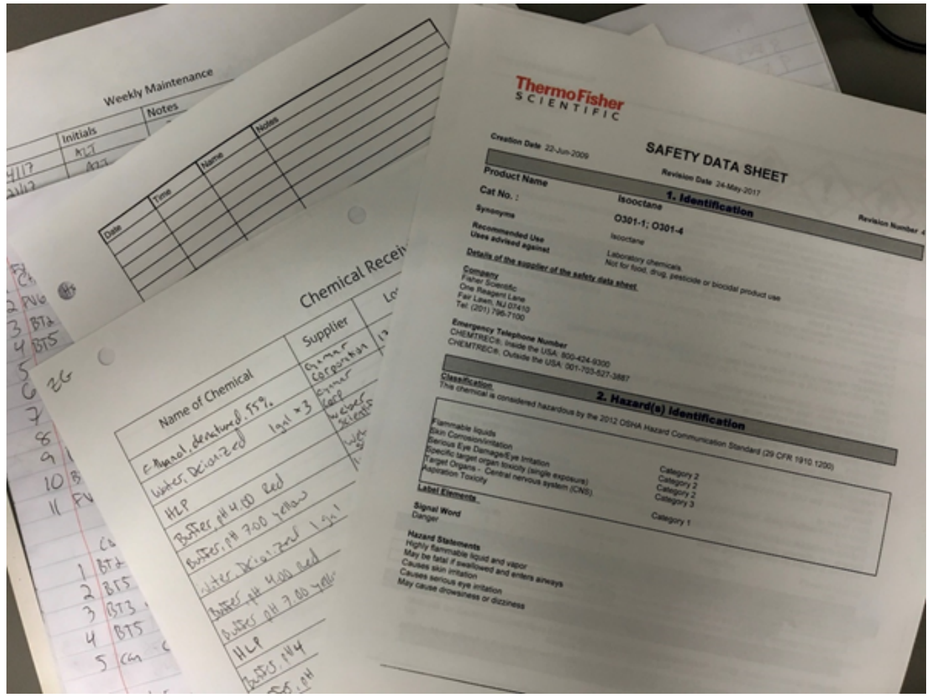
BEN & JERRY'S

AMERICAN BREWERS GUILD
BREWING SCHOOL

Zymology Labs LLC
Fermented Beverage Analysis

MAGIC HAT BREWING COMPANY

document control and equipment



- brew day logs
- ingredients
- equipment
  - pH meter
  - hydrometer
  - thermometer
- fermentation notes
- sensory notes
- recipe development
- calculations

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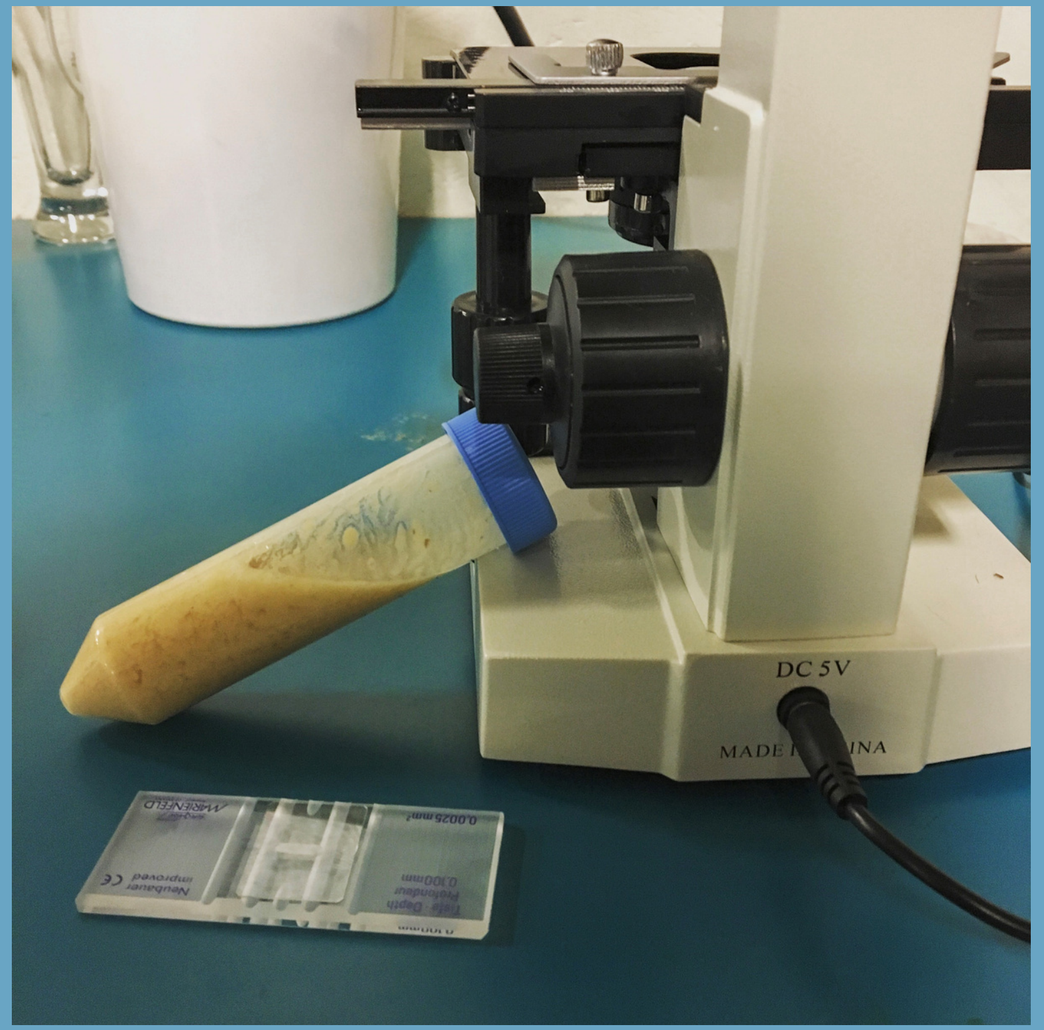
OMAX
WALTER
DISTILLED
WATER
Kimwipes
KIMTECH
SCIENCE BRAND
Delicate Task Wipers
Essuie-tout pour tâches délicates
Paños para tareas delicadas
280

Procedure

- collect homogenous yeast sample
- 1:100 dilution
- load hemocytometer
- count cells
- optional methylene blue stain
- calculate
- pitch
- repeat



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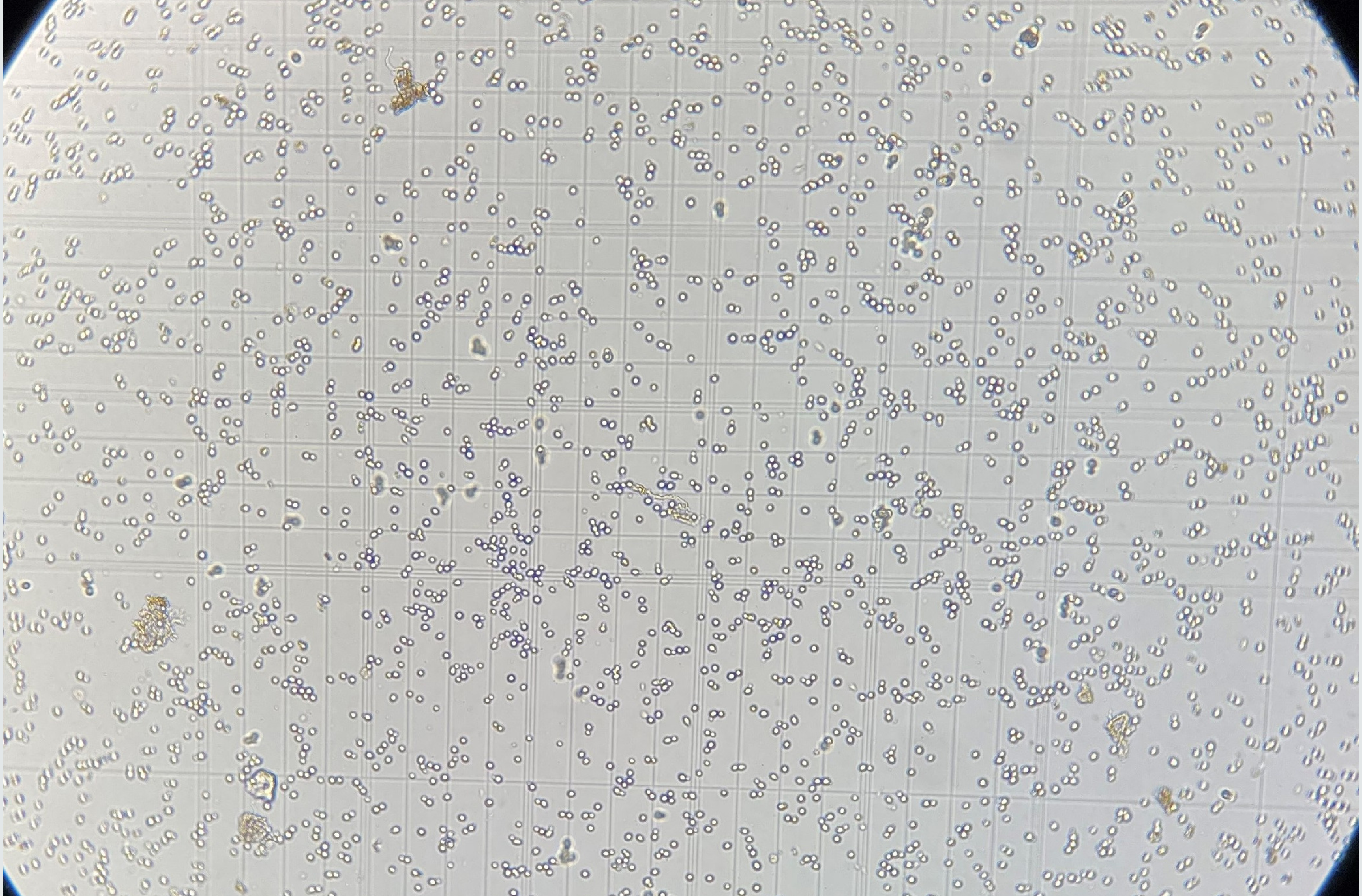

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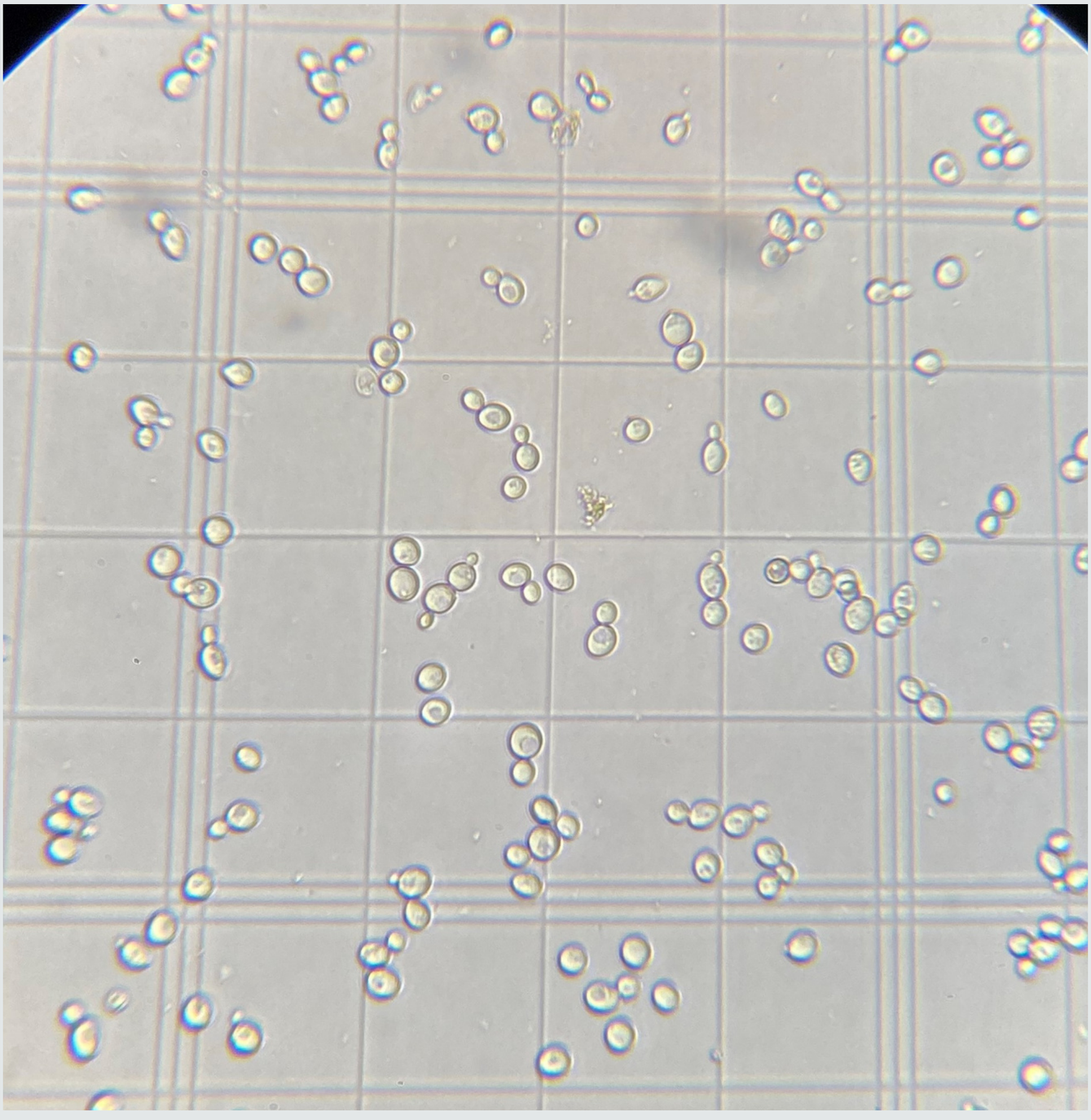

Calculations

Number of cells needed – Pitch rate

Starting point - 1 million cells per mL per degree Plato for ales
1.5 to 2 million cells per degree Plato for lager

$$\text{Degree Plato wort} \times \frac{1\text{x}10\text{\^{}}6 \text{ viable cells/mL wort}}{1^\circ \text{ Plato}} = \text{viable cells/mL wort}$$

Example: For a 12°P beer you would need 12,000,000 viable cells/mL wort

$$12 \times \frac{1\text{x}10\text{\^{}}6 \text{ viable cells/mL wort}}{1^\circ \text{ Plato}} = 12{,}000{,}000 \text{ viable cells/mL wort}$$

plato = (-1 * 616.868) + (1111.14 * sg) – (630.272 * sg^2) + (135.997 * sg^3)
SG = 1+ (plato / (258.6 – ((plato/258.2) *227.1)))

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Calculations

Total cells needed:

$$\text{gallons wort} \times \frac{3.785\text{L wort}}{1\text{ gal wort}} \times \frac{1000\text{mL wort}}{1\text{L wort}} \times \frac{\text{viable cells}}{\text{mL wort}} = \text{total cells needed}$$

Example: If you are brewing 5 gal you need 2.27x10^11 cells

$$5\text{gal wort} \times \frac{3.785\text{L wort}}{1\text{gal wort}} \times \frac{1000\text{mL wort}}{1\text{L wort}} \times \frac{1.2\text{x}107}{\text{mL wort}} = 2.27\text{x}10\text{^}11\text{ cells}$$

Yeast cells/mL or g slurry:

$$\frac{(\text{cell count})(5)(\text{dilution})}{\text{Chamber volume (0.0001mL3)}} = \text{yeast cells/mL or g slurry}$$

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Calculations

Example: if you count 350 viable cells in 5 squares on the hemocytometer

$$\frac{(350\text{cells})(5)(100)}{(0.0001\text{mL})} = 1.75\text{x}10\text{^}9 \text{ yeast cells/mL or g slurry}$$

Amount of yeast needed:

$$\frac{\text{Total cells needed}}{\text{Yeast cells/mL slurry}} = \text{volume of yeast slurry required (mL)}$$

Example: $\frac{2.27\text{x}10\text{^}11 \text{ cells}}{1.75\text{x}10\text{^}9 \text{ yeast cells/mL slurry}} = 129 \text{ mL}$

$$\frac{\text{Total cells needed}}{\text{Yeast cells/g slurry}} = \text{volume of yeast slurry required (g)}$$

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Calculations

Example: if you count 303 viable cells in 5 squares on the hemocytometer

$$\frac{(303\text{cells})(5)(10)}{(0.0001\text{mL})} = 1.515\text{x}10\text{^}8 \text{ yeast cells/mL or g slurry}$$

Amount of yeast needed:

$$\frac{\text{Total cells needed}}{\text{Yeast cells/mL slurry}} = \text{volume of yeast slurry required (mL)}$$

Example: $\frac{2.27\text{x}10\text{^}11 \text{ cells}}{1.515\text{x}10\text{^}8 \text{ yeast cells/mL slurry}} = 1{,}498 \text{ mL}$

$$\frac{\text{Total cells needed}}{\text{Yeast cells/g slurry}} = \text{volume of yeast slurry required (g)}$$

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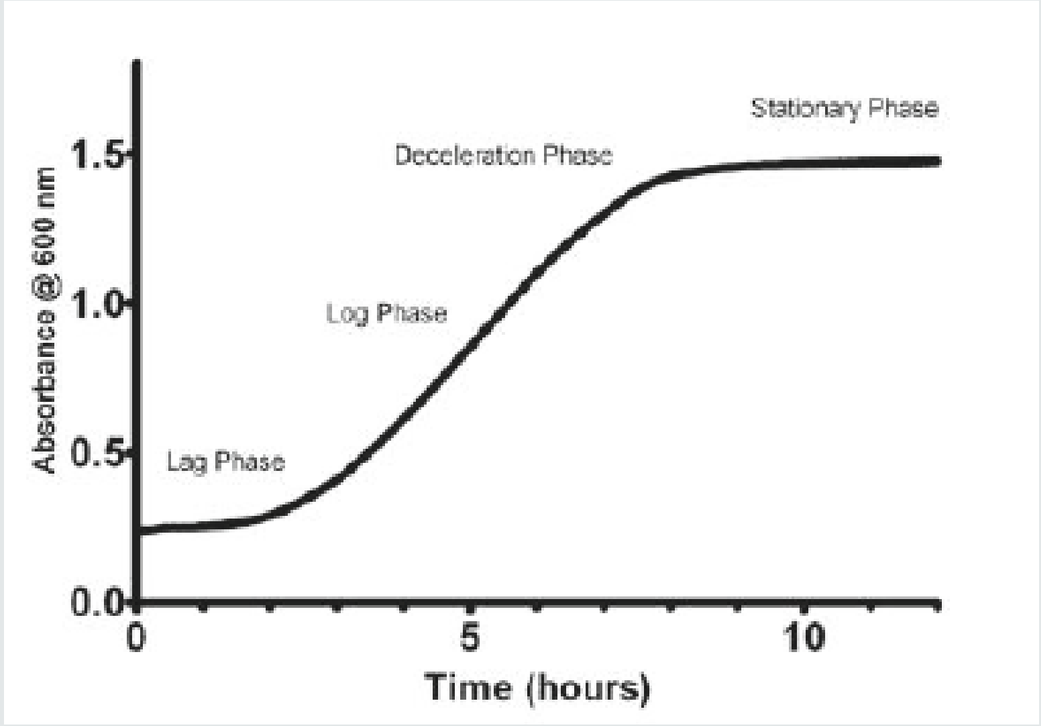
Yeast Starter

- 1-2 L Erlenmeyer flask
- DME or 1.020-1.040 strength wort
- water
- stir plate/stir bar (optional)
- tinfoil or airlock
- yeast
- time

https://byo.com/resource/build-a-yeast-starter/



Alsuhaim, H. & Vojisavljevic, Vuk & Pirogova, Elena. (2013). Effects of Non-thermal Microwave Exposures on the Proliferation Rate of Saccharomyces Cerevisiae Yeast. 10.1007/978-3-642-29305-4_14.

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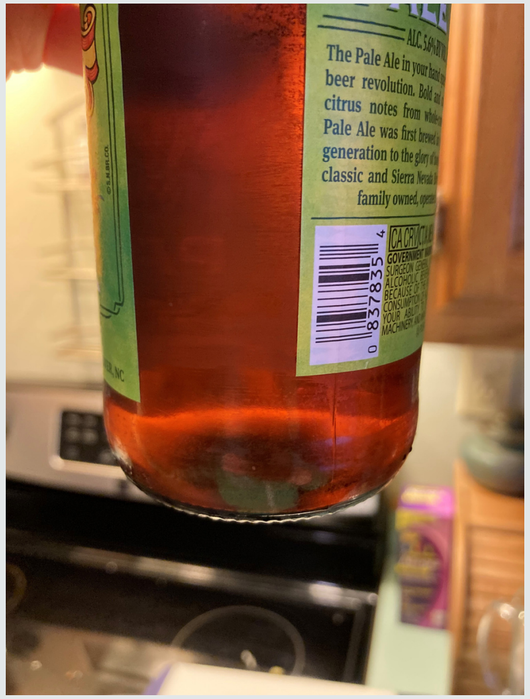
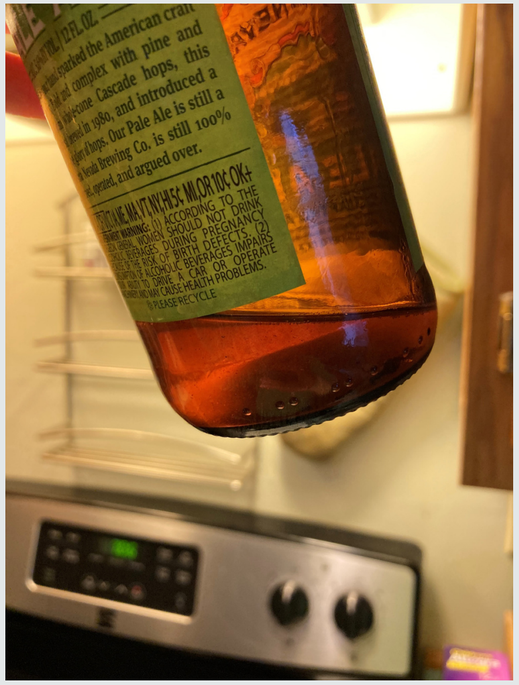
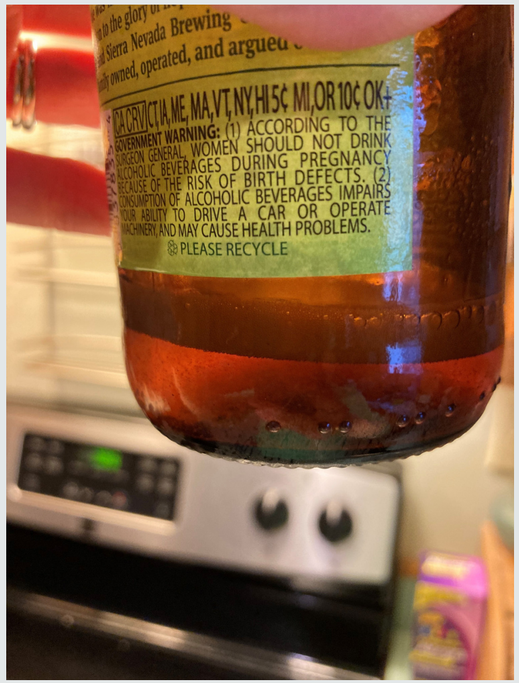
Yeast starter from bottle dregs

What you need

- yeast starter items
- unfiltered and unpasteurized beer







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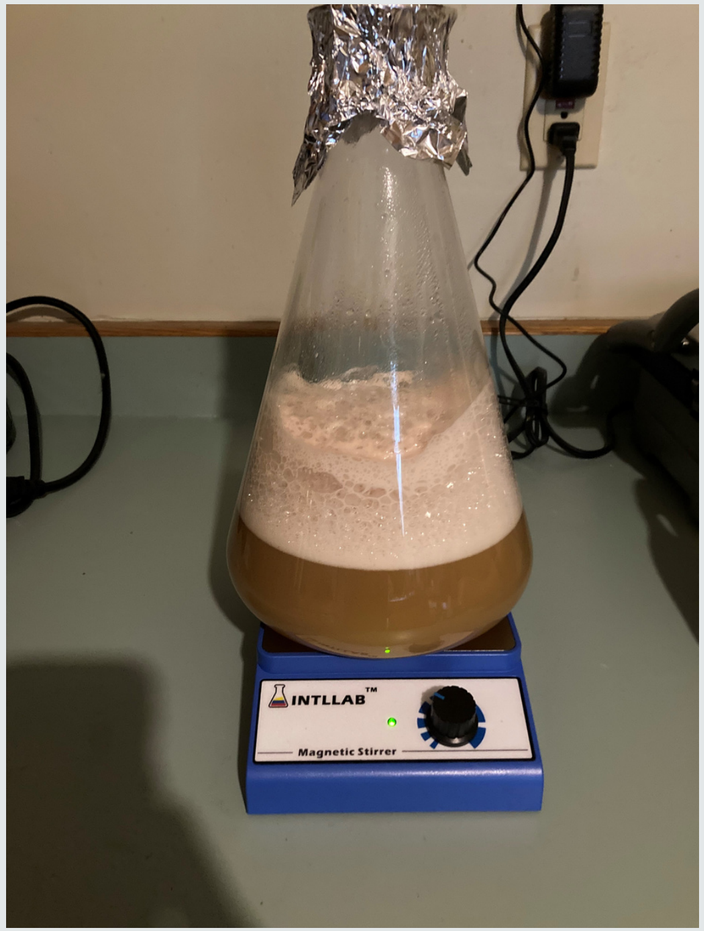
Yeast starter from bottle dregs

Day 1

Day 2



Day 4

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Yeast Rinsing

- boil water/mason jars
- rack beer
- add cool, boiled water
- collect beer/trub/water
- let settle 30 min
- collect top yeast/water layer and leave trub behind

or

- collect off secondary
- date and generation

storage

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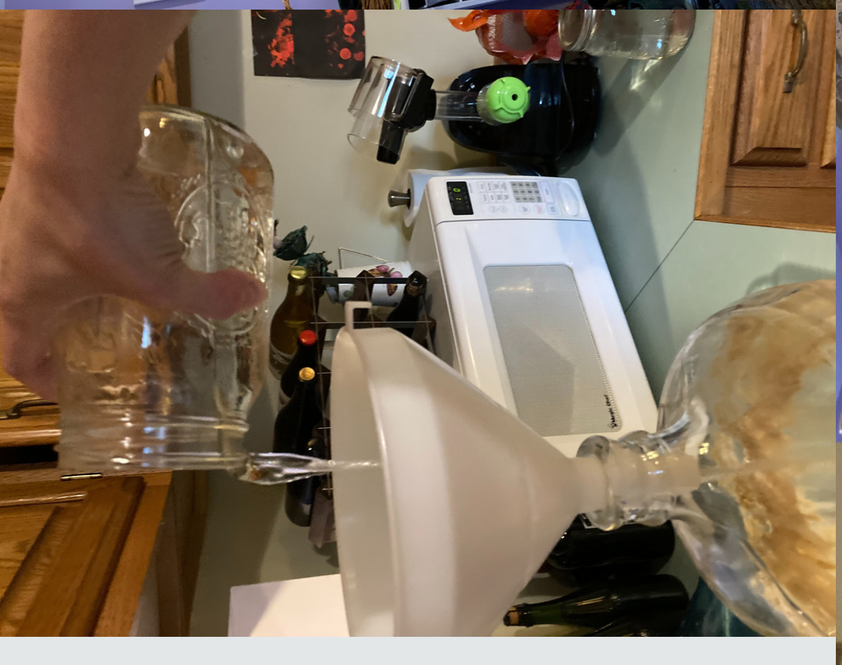

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Yeast Washing

From American Homebrewers Assocociation "Yeast Washing & Yeast Rinsing: What's the Difference?"

- Cool yeast to 36-40°F (2-4°C). This temperature must be maintained throughout the process.
- Determine how much yeast is needed to ferment your homebrew recipe, and place it in a suitable, sanitized container.
- Once you are two hours from pitching the yeast, start the the acid washing process.
- Thoroughly mix in food-grade phosphoric acid until the pH of the slurry is between 2.0-2.5 pH.
- Hold the yeast at this pH and temperature for 60-90 minutes, while stirring continuously.
- Pitch entire mixture into the the fermenter with wort.

https://www.homebrewersassociation.org/how-to-brew/yeast-washing-yeast-rinsing-whats-difference/

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Agar plates and slants

What you need

- 2-3g agar
- 2-3 grams DME or dilute wort (wort agar)
- 100mL water
- small flask
- 50 grams potato (potato dextrose)
- 1 cup water (potato dextrose)
- 2 grams sugar (potato dextrose)
- 2 gram agar (potato dextrose
- sterile plates and test tubes
- alcohol lamp or bunsen burner
- autoclave (slants)

https://suigenerisbrewing.com/index.php/2015/03/18/new-video-casting-agar-plates/

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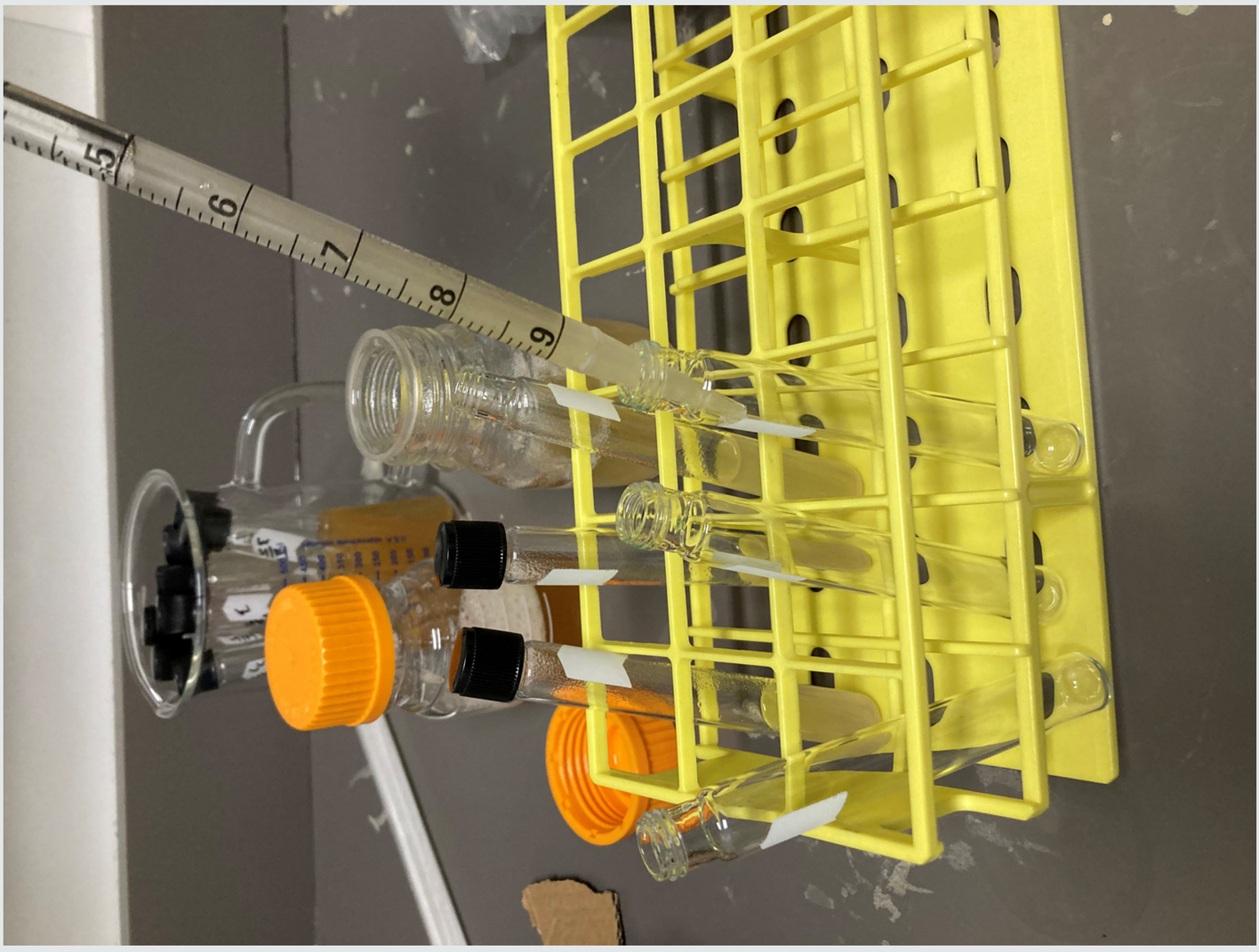

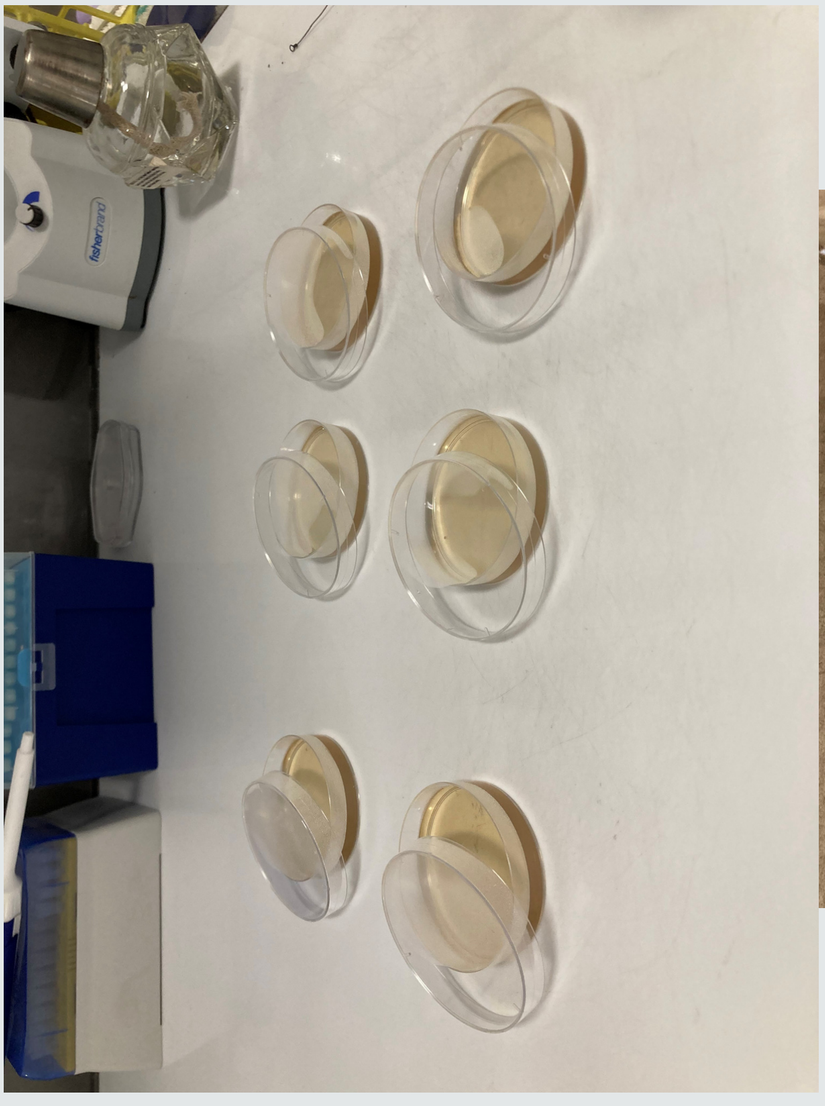

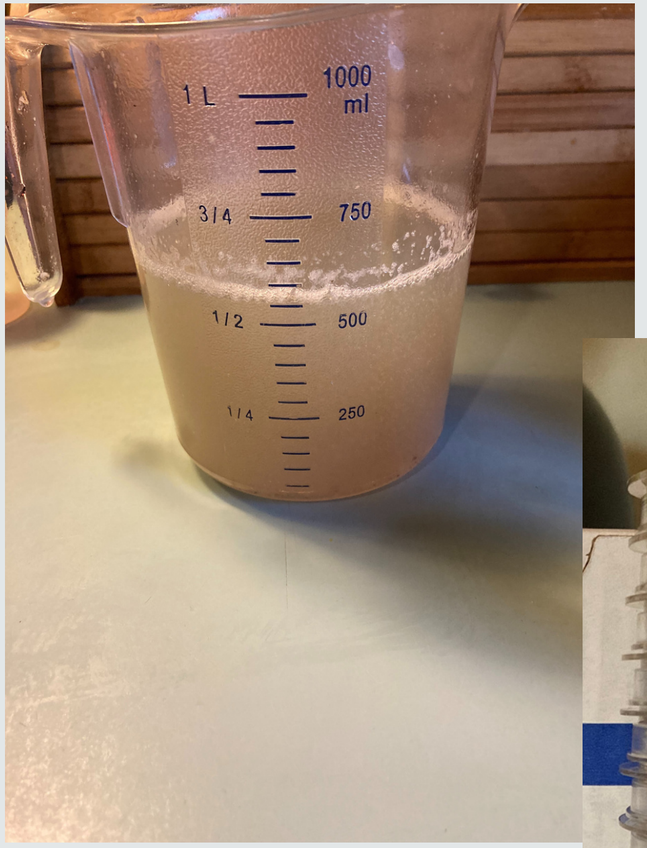

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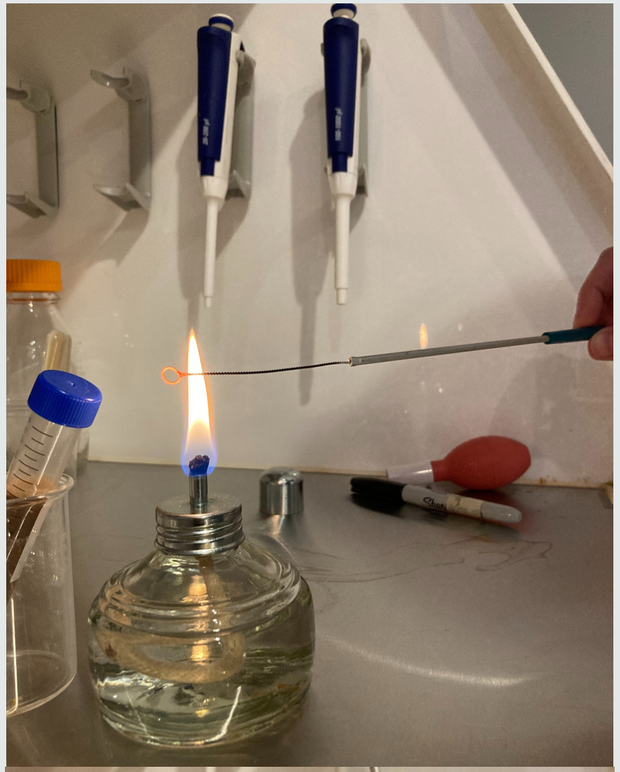
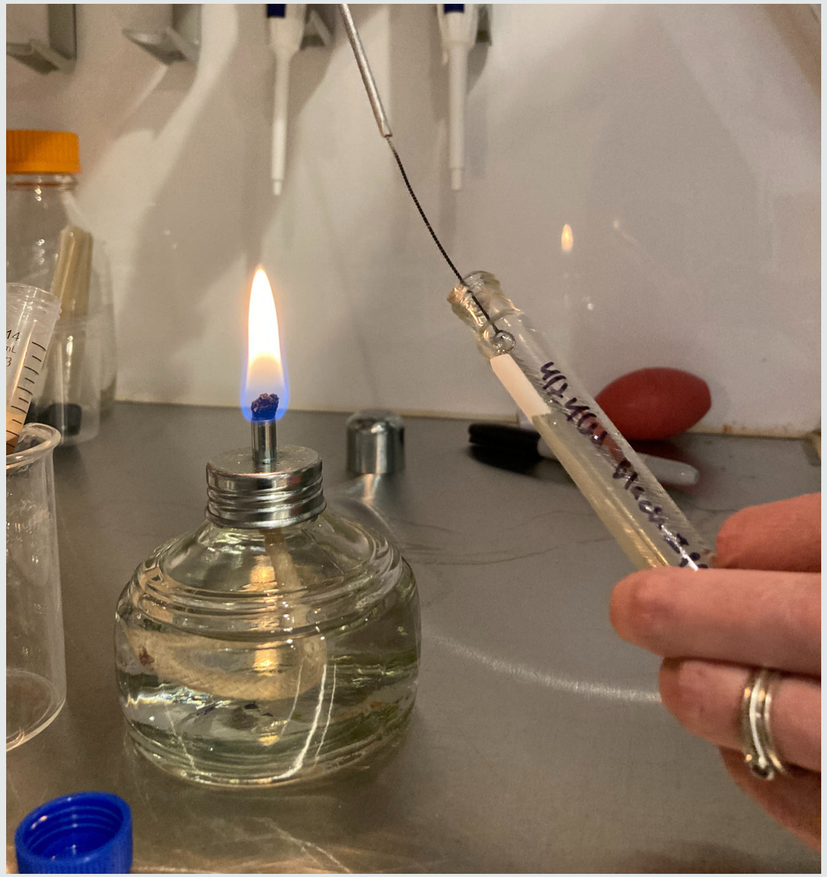
Yeast starter from a slant or plate





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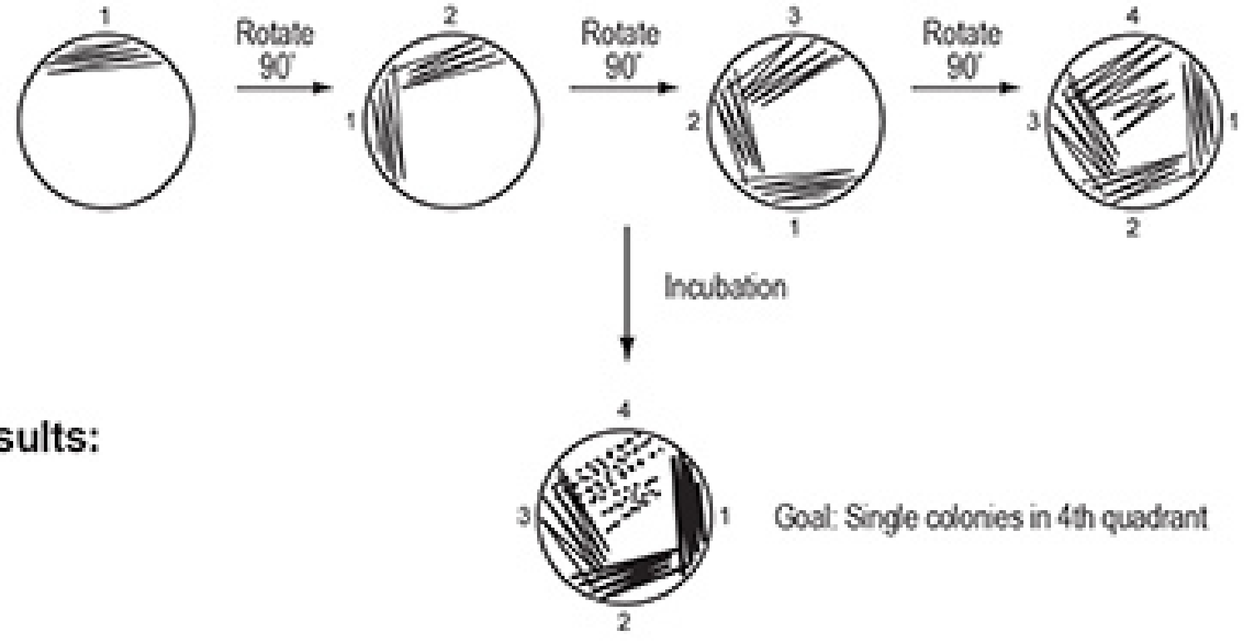
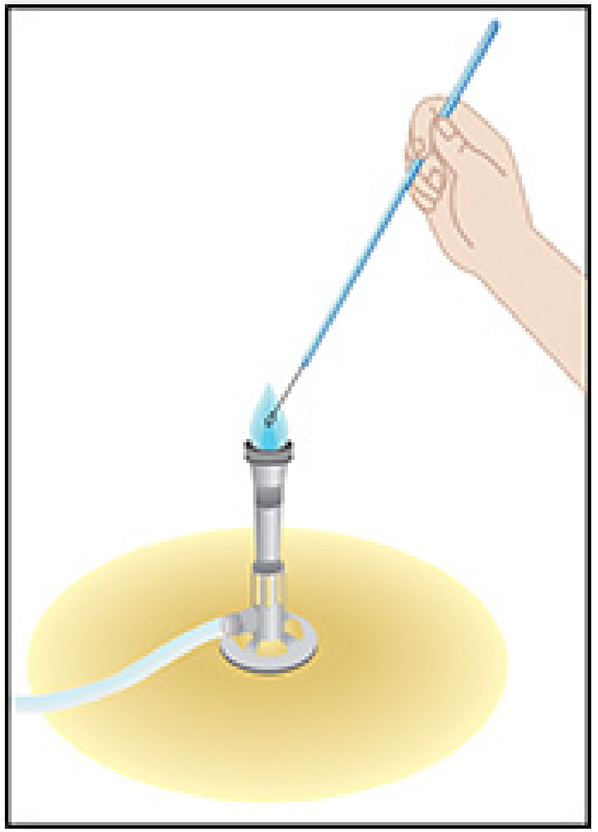
A

Quadrant Method Streak Pattern:

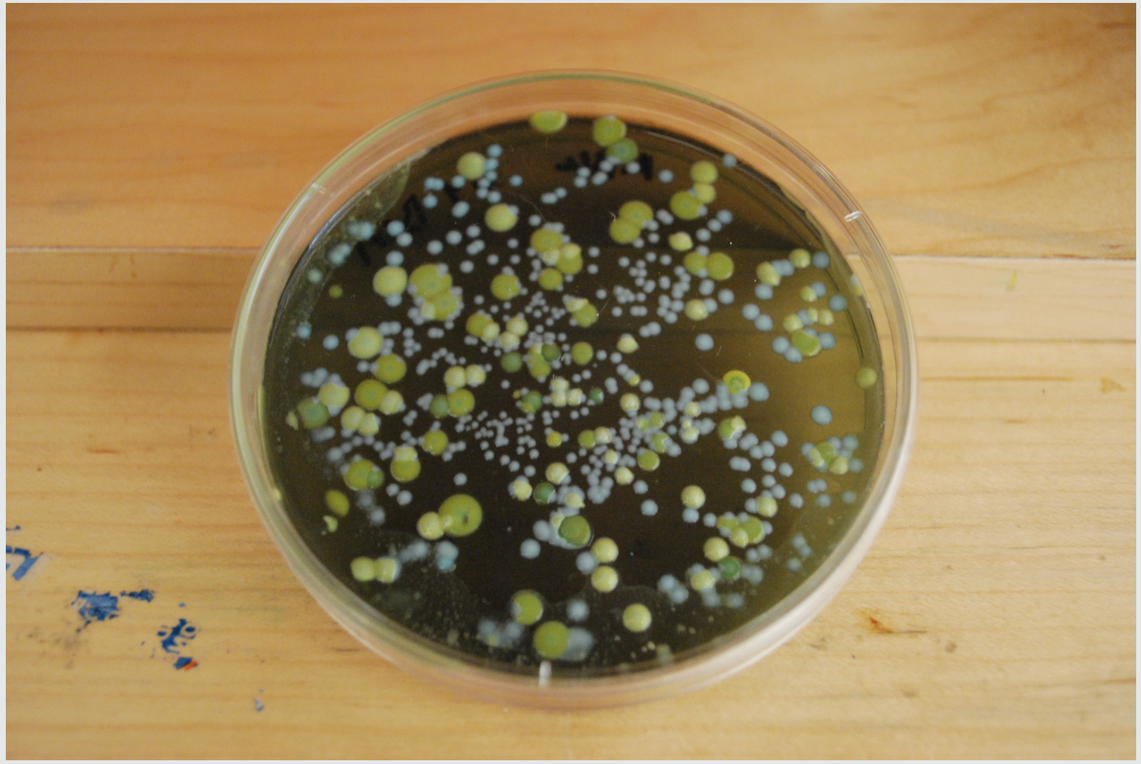


Results:

B



https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4846335/#:~:text=Procedures%20described%20include%20(1)%20streak,plate%20to%20another%20in%20an



Malt with Bromocresol Green Agar. Mix of Saccharomyces, Brett, and Pediococcus. 3 colony morphologies.
https://bkyeast.wordpress.com/2012/02/19/selective-media-part-i/

Potato Lactose UI Agar. Mix of Saccharomyces, Brettanomyces and Pediococcus. 3 colony morphologies seen.
https://bkyeast.wordpress.com/2012/02/19/selective-media-part-i/

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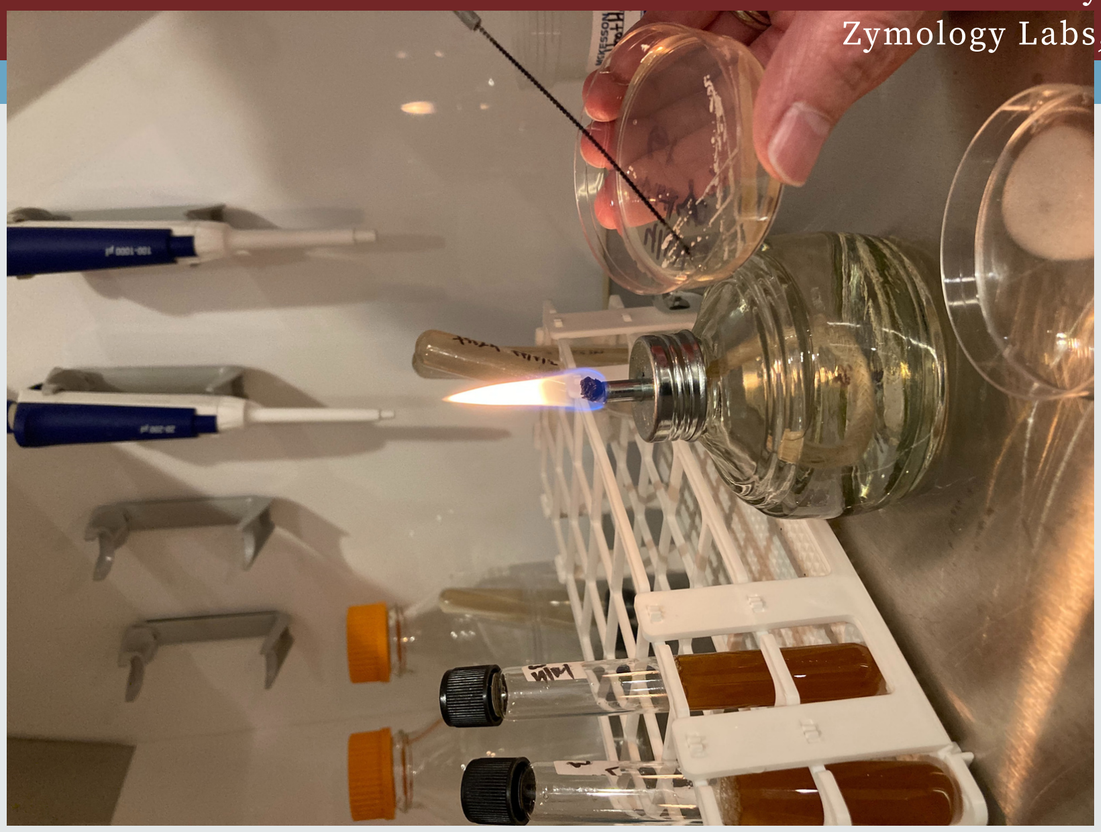
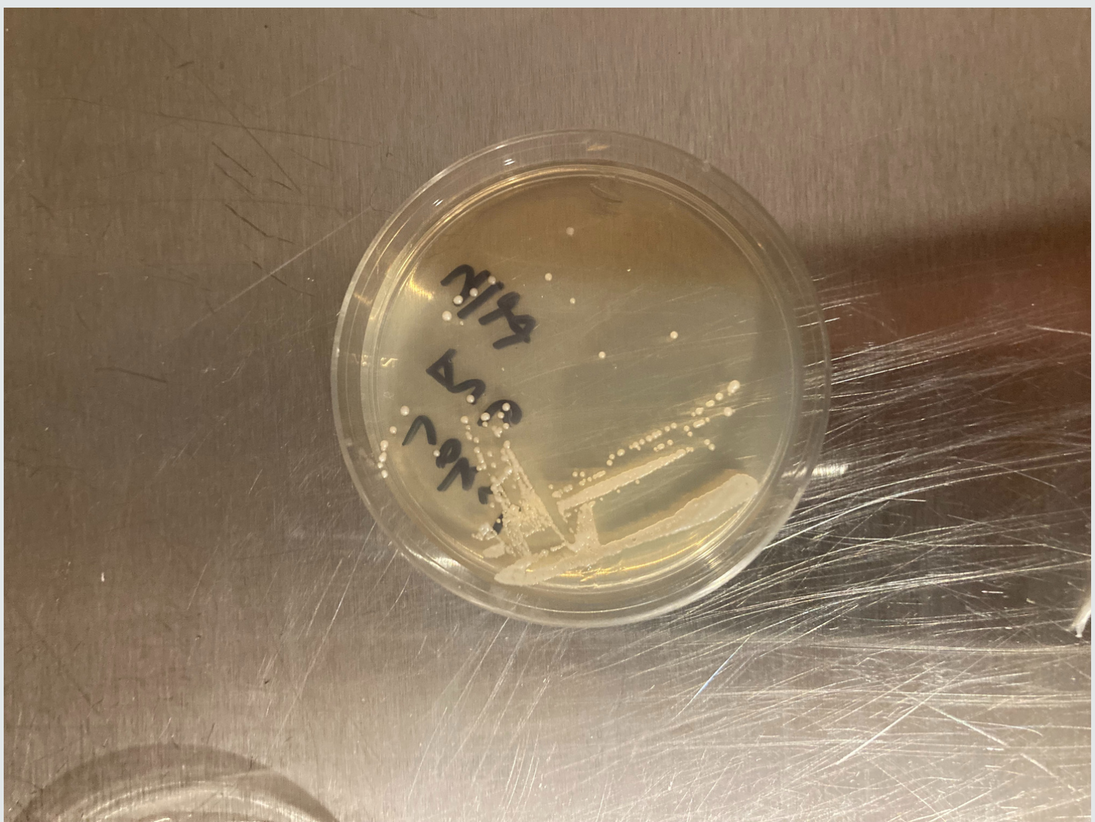
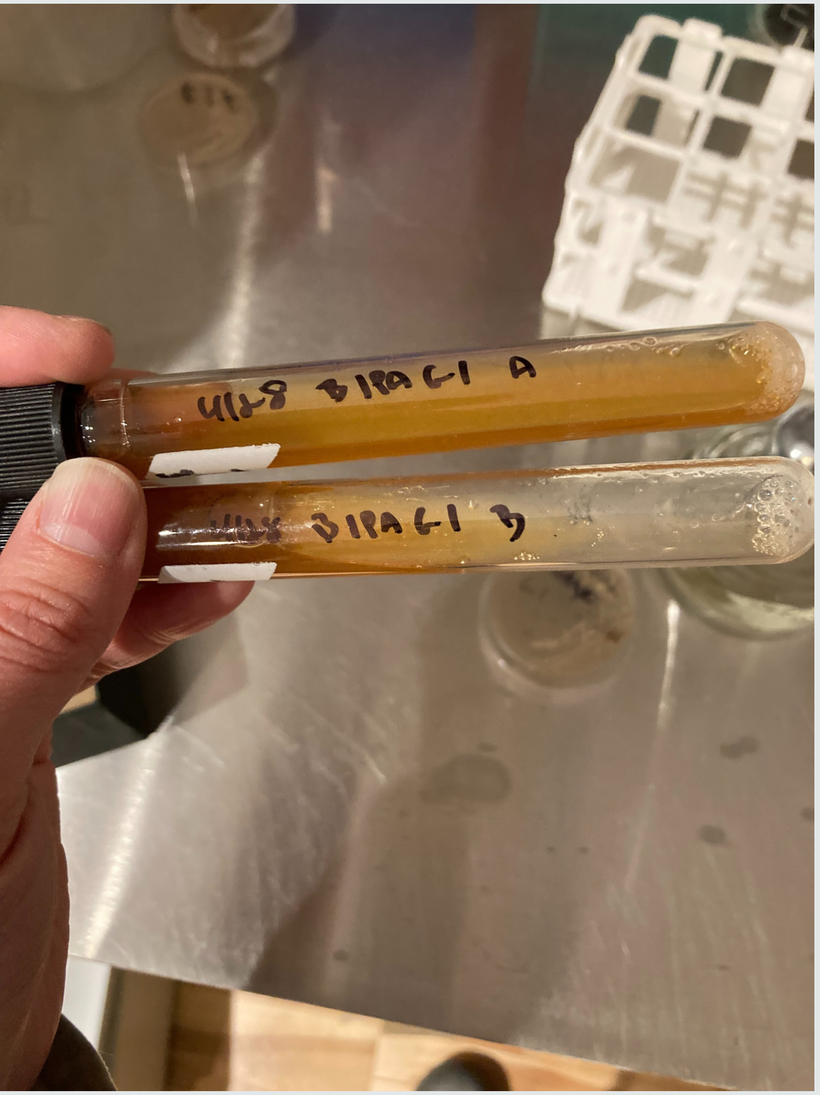
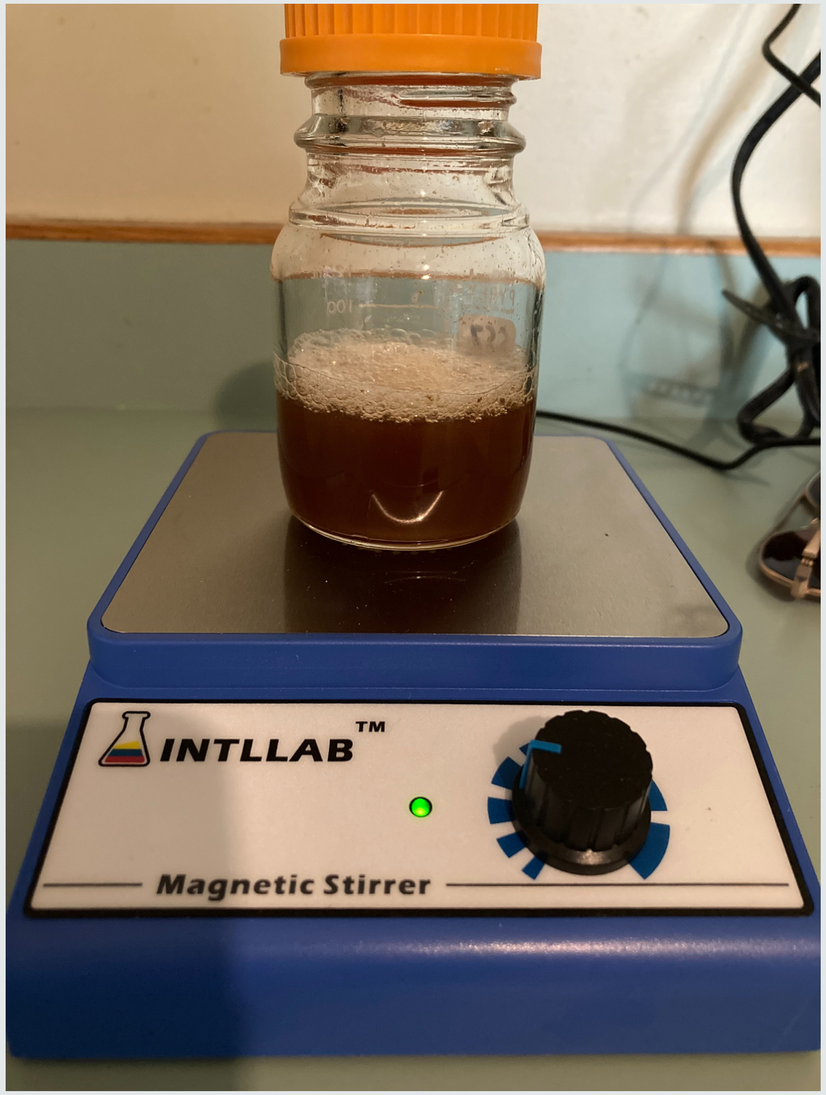






5mL



50mL

500mL

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Collecting Wild Yeast

Yeast starter jars, fruit/vegetables, environmental swabs

What you need

Wild yeast starter jar

- sterile mason jar
- cheesecloth or mesh lining
- 1-1.25L water
- 100grams DME or wort
- ~1gram of hops
- 1/4 tsp lactic acid
- 1/8 volume cheap vodka/whiskey/run

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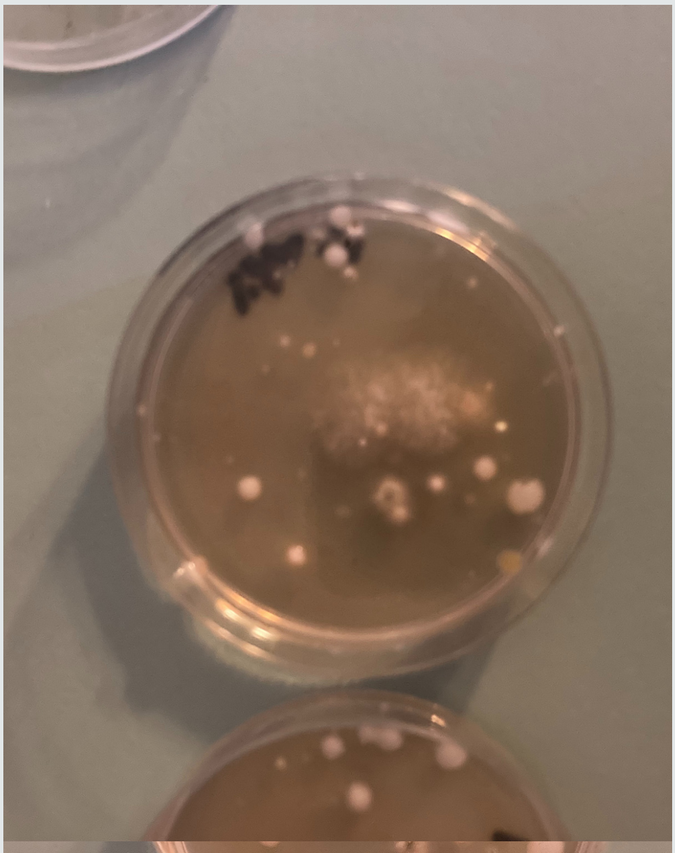
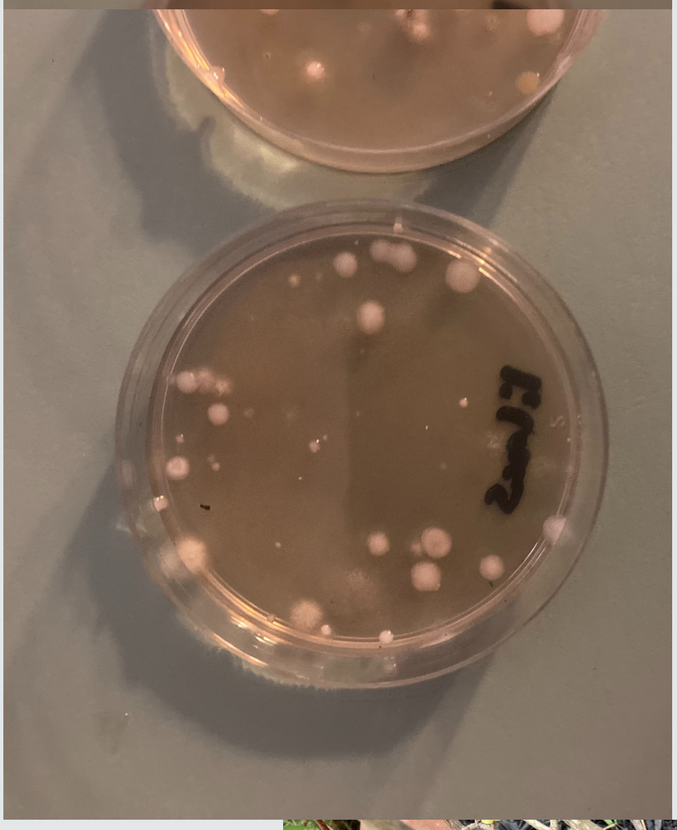
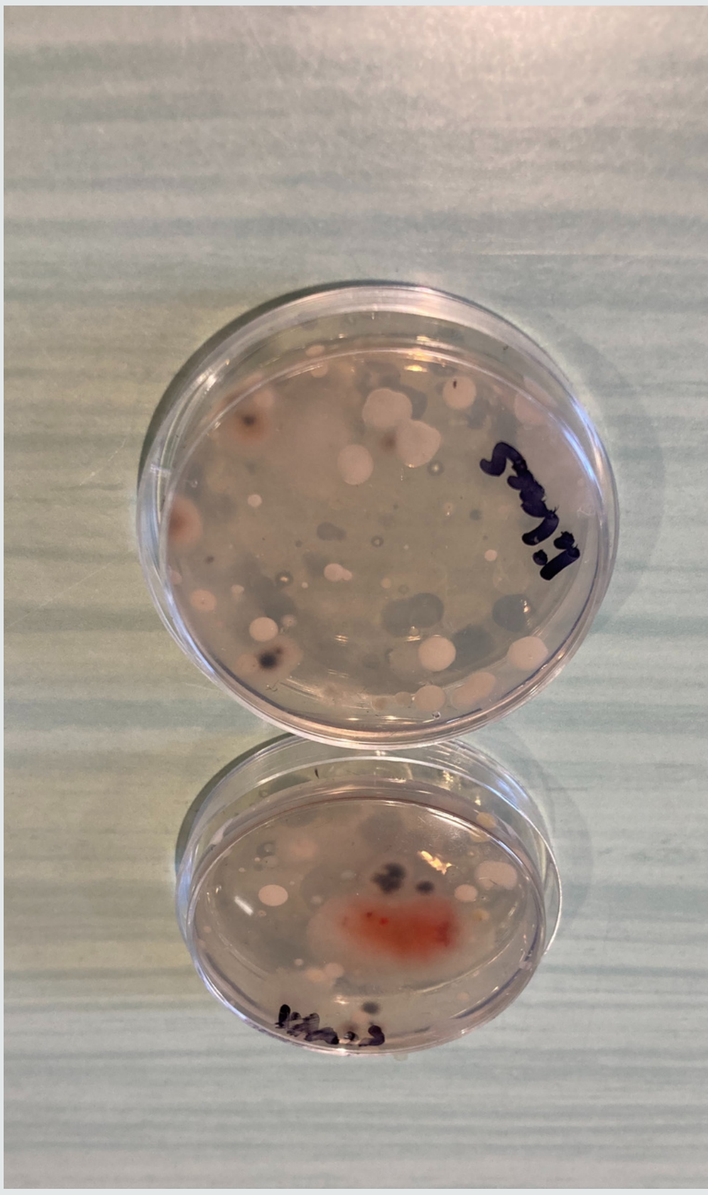


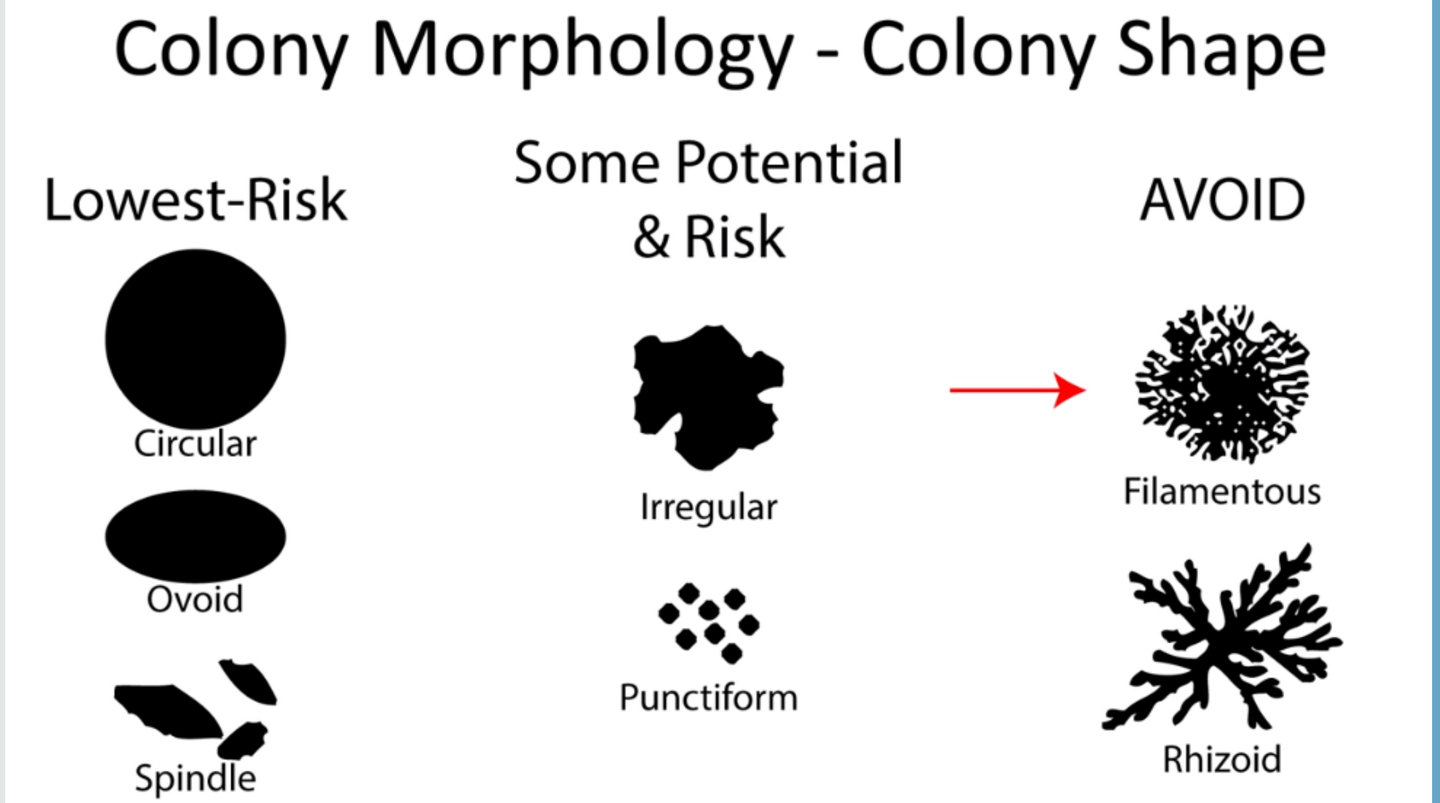


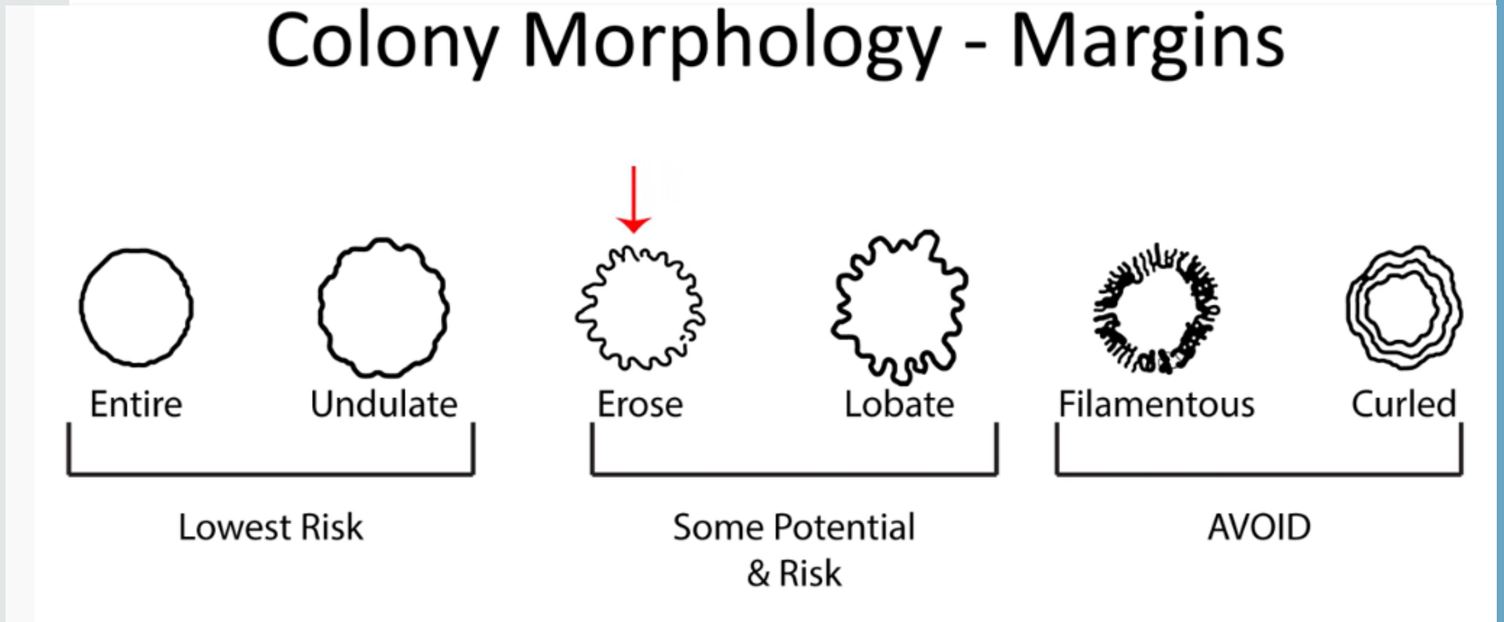


Is it safe?

- clear or white good
- pink/red bad
- yellow/golden avoid
- filamentous/fuzzy - avoid
- mucoid avoid
- wait at least 2 weeks before trying to plate
- Sui Generis Brewing
- isolating strains

https://www.youtube.com/watch?v=abQNl6WIdc8&t=2s





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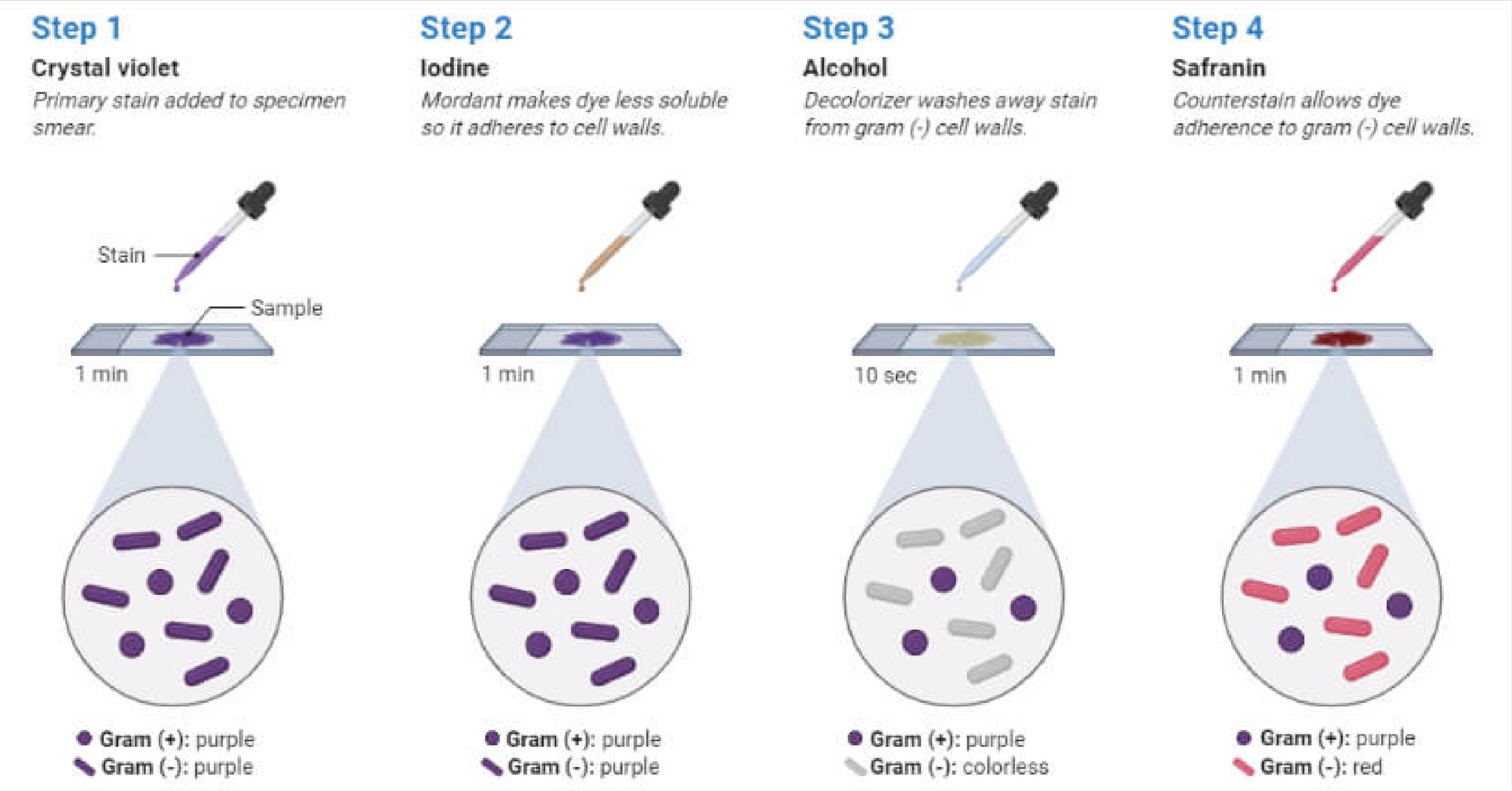
Gram Stain



https://microbenotes.com/gram-stain-principle-reagents-procedure-and-result-interpretation/

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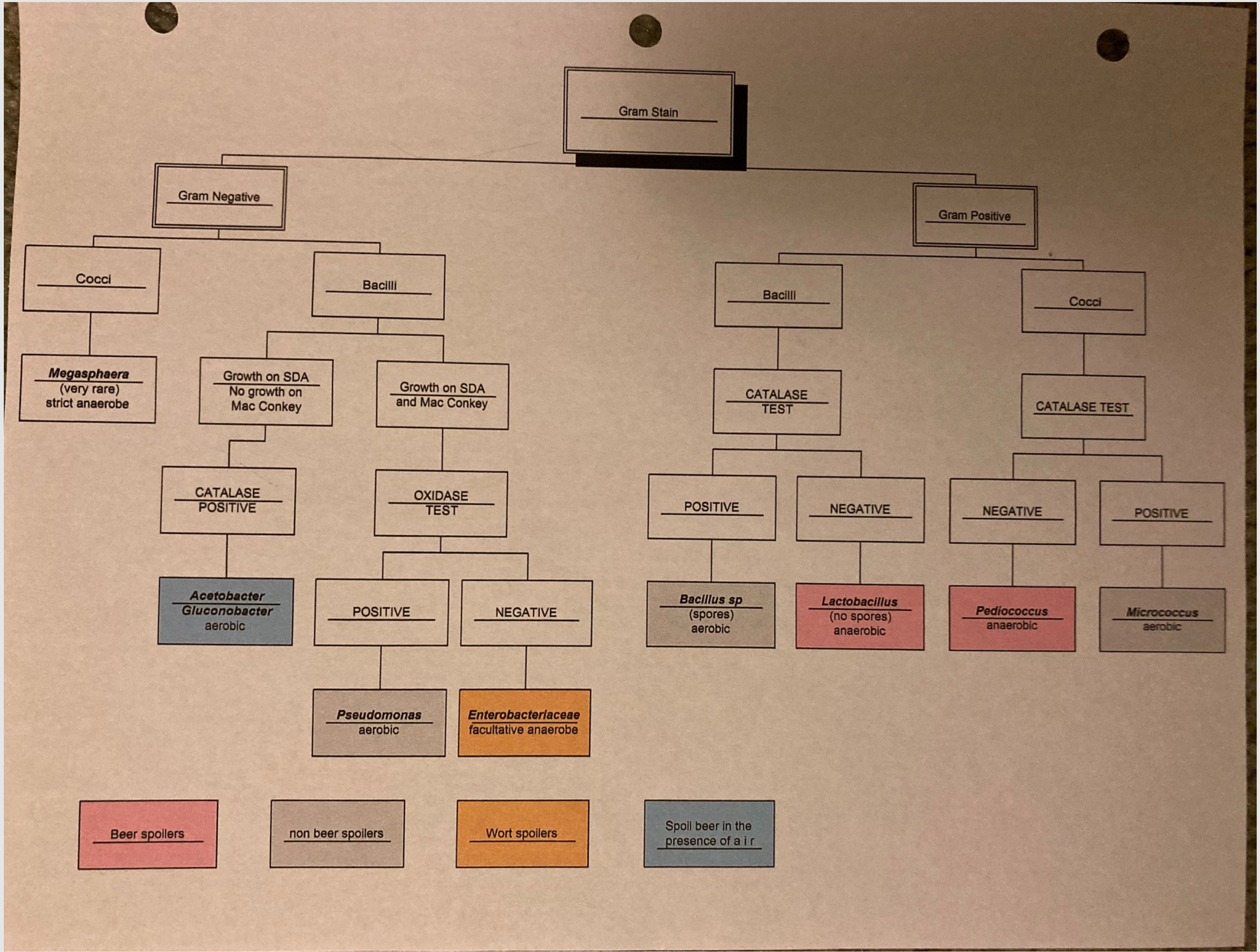

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Forced Fermentation

What you need

- 1L Erlenmeyer flask
- Tinfoil
- Stir/hot plate
- Magnetic Stir bar
- Hydrometer/graduated cylinder
- ~500mL of wort
- Yeast 25-50mL– use the same yeast that the main fermentation uses

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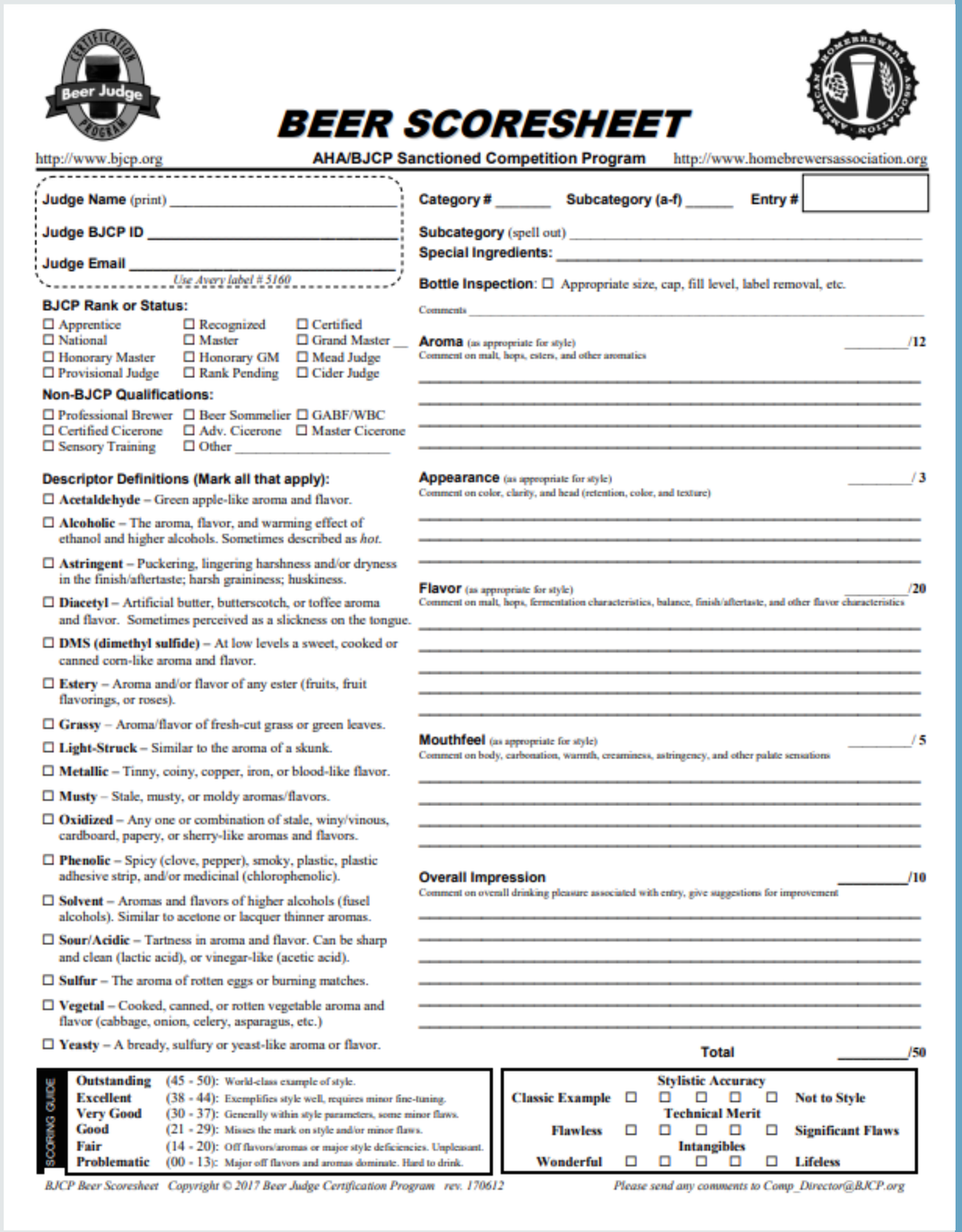
Sensory

- BJCP
- Cicerone
- Under the Jenfluence
- True to style/target
- R&D
- Bottle release
- Evaluation
- Training
  - BJCP Guidelines for Doctoring Beer
  - Grocery store
  - Spike kits
  - Triangle/tetrad



BEER SCORESHEET

http://www.bjcp.org — AHA/BJCP Sanctioned Competition Program — http://www.homebrewersassociation.org

Judge Name (print) _____
Judge BJCP ID _____
Judge Email _____
Use Avery label # 5160

Category # _____ **Subcategory (a-f)** _____ **Entry #**
Subcategory (spell out) _____
Special Ingredients: _____

Bottle Inspection: ☐ Appropriate size, cap, fill level, label removal, etc.
Comments _____

BJCP Rank or Status:
☐ Apprentice ☐ Recognized ☐ Certified
☐ National ☐ Master ☐ Grand Master
☐ Honorary Master ☐ Honorary GM ☐ Mead Judge
☐ Provisional Judge ☐ Rank Pending ☐ Cider Judge

Non-BJCP Qualifications:
☐ Professional Brewer ☐ Beer Sommelier ☐ GABF/WBC
☐ Certified Cicerone ☐ Adv. Cicerone ☐ Master Cicerone
☐ Sensory Training ☐ Other _____

Descriptor Definitions (Mark all that apply):
☐ **Acetaldehyde** – Green apple-like aroma and flavor.
☐ **Alcoholic** – The aroma, flavor, and warming effect of ethanol and higher alcohols. Sometimes described as *hot*.
☐ **Astringent** – Puckering, lingering harshness and/or dryness in the finish/aftertaste; harsh graininess; huskiness.
☐ **Diacetyl** – Artificial butter, butterscotch, or toffee aroma and flavor. Sometimes perceived as a slickness on the tongue.
☐ **DMS (dimethyl sulfide)** – At low levels a sweet, cooked or canned corn-like aroma and flavor.
☐ **Estery** – Aroma and/or flavor of any ester (fruits, fruit flavorings, or roses).
☐ **Grassy** – Aroma/flavor of fresh-cut grass or green leaves.
☐ **Light-Struck** – Similar to the aroma of a skunk.
☐ **Metallic** – Tinny, coiny, copper, iron, or blood-like flavor.
☐ **Musty** – Stale, musty, or moldy aromas/flavors.
☐ **Oxidized** – Any one or combination of stale, winy/vinous, cardboard, papery, or sherry-like aromas and flavors.
☐ **Phenolic** – Spicy (clove, pepper), smoky, plastic, plastic adhesive strip, and/or medicinal (chlorophenolic).
☐ **Solvent** – Aromas and flavors of higher alcohols (fusel alcohols). Similar to acetone or lacquer thinner aromas.
☐ **Sour/Acidic** – Tartness in aroma and flavor. Can be sharp and clean (lactic acid), or vinegar-like (acetic acid).
☐ **Sulfur** – The aroma of rotten eggs or burning matches.
☐ **Vegetal** – Cooked, canned, or rotten vegetable aroma and flavor (cabbage, onion, celery, asparagus, etc.)
☐ **Yeasty** – A bready, sulfury or yeast-like aroma or flavor.

Aroma (as appropriate for style) _____/12
Comment on malt, hops, esters, and other aromatics

Appearance (as appropriate for style) _____/ 3
Comment on color, clarity, and head (retention, color, and texture)

Flavor (as appropriate for style) _____/20
Comment on malt, hops, fermentation characteristics, balance, finish/aftertaste, and other flavor characteristics

Mouthfeel (as appropriate for style) _____/ 5
Comment on body, carbonation, warmth, creaminess, astringency, and other palate sensations

Overall Impression _____/10
Comment on overall drinking pleasure associated with entry, give suggestions for improvement

Total _____/50

SCORING GUIDE

Outstanding	(45 - 50):	World-class example of style.
Excellent	(38 - 44):	Exemplifies style well, requires minor fine-tuning.
Very Good	(30 - 37):	Generally within style parameters, some minor flaws.
Good	(21 - 29):	Misses the mark on style and/or minor flaws.
Fair	(14 - 20):	Off flavors/aromas or major style deficiencies. Unpleasant.
Problematic	(00 - 13):	Major off flavors and aromas dominate. Hard to drink.

Stylistic Accuracy
Classic Example ☐ ☐ ☐ ☐ ☐ Not to Style
Technical Merit
Flawless ☐ ☐ ☐ ☐ ☐ Significant Flaws
Intangibles
Wonderful ☐ ☐ ☐ ☐ ☐ Lifeless

BJCP Beer Scoresheet Copyright © 2017 Beer Judge Certification Program rev. 170612 — *Please send any comments to Comp_Director@BJCP.org*

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resources

Alsuhaim, H. & Vojisavljevic, Vuk & Pirogova, Elena. (2013). Effects of Non-thermal Microwave Exposures on the Proliferation Rate of Saccharomyces Cerevisiae Yeast. 10.1007/978-3-642-29305-4_14. - file:///C:/Users/a/Downloads/Hamad_Elena_WC2012.pdf

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Aroxa - https://www.aroxa.com/
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https://underthejenfluence.beer/
Avoiding Off-Flavors - Brew Your Own (byo.com)
https://dev.bjcp.org/exam-certification/program/studying/beer-exam-study-guide/doctoring-beer/
Podcasts - "False Bottomed Girls," "Bean to Barstool," "Check Your Beer"

Zymology Labs resources

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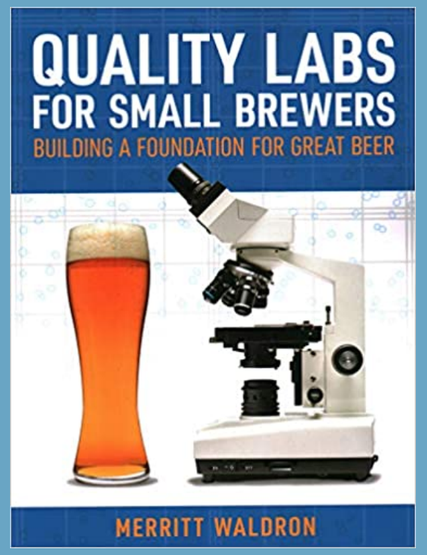
resources

- ASBC
- MBAA
- BYO
- Beer Quality Handbook series
- BA Quality Management
- Fellow brewers/homebrewers
- Amy@Zymologylabs.com
- BYO20 for 20%

@zymologylabs.com



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