

# Problem Fermentations

...and how to troubleshoot them

Neva Parker  
White Labs

## ROOT CAUSE ANALYSIS

How we find answers

## 4 Most Common Problems

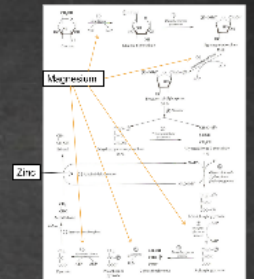
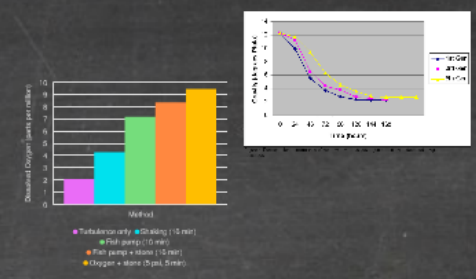
Root cause for the problem  
Fix (prevent) the problem

THANK YOU FOR YOUR ATTENTION

Neva Parker  
nparker@whitelabs.com



- Problems with pitching yeast
- Low viability, viability yeast health
- Natural mutations, as with German wheat strains, Belgian strains
- Other factors that inhibit good fermentation performance: Low temp, low oxygen, low nutrients



1. No aeration or stable fermentation

Low Viability or vitality

Under- or Over-Pitching

Low Dissolved Oxygen

Lack of Nutrients

Can more oxygen be added?  
What about more yeast?  
More nutrients?

Try Step-by-Step Guide

- If you can raise the temp 2 degrees & raise the yeast
- Add more oxygen if attenuation is still low or less

WHAT DID WE LEARN TODAY?  
Fermentation is a metabolic process, and yeast are living organisms.  
Fermentation and yeast handling affect yeast condition.  
Yeast condition affect subsequent fermentations.  
Know & UNDERSTAND your fermentations

If all else fails:  
Add more ACTIVE 1 fermenting yeast.  
Add more nutrients, but this is difficult to do in a sterile way.

## COLLECTION



- Conical Fermenters: Best practices**
- Timing - end of fermentation, depending on strain
  - Remove as soon as possible without making integrity of beer
  - Discard the first runnings
  - Use only the middle pack
- Carboys: Best practices**
- Timing - end of fermentation
  - But less critical than with conicals
  - Transfer beer from carboy then transfer yeast to a sterile container
  - Use only the middle pack

## STORAGE

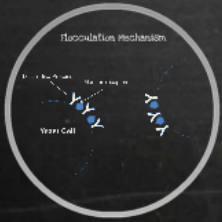
Objective: Keep metabolic activity to an absolute minimum in order to preserve viability and vitality

- HOW?
- Cool the yeast quickly and keep it cold (38-40F)
  - Keep air/oxygen contact to an absolute minimum (o2HP)
  - Store yeast for as short a time as possible
  - Time results in viability loss due to glycogen depletion, ethanol stress, CO2 stress

GLYCOGEN  
Energy reserve stored by yeast during times of starvation  
Presence of oxygen signals metabolism of glycogen

If possible - resolve the ISSUE.  
If not, start over with fresh yeast

Identify systems or subsystems in activity flow and dependencies.  
Make them visible through all levels of detail.

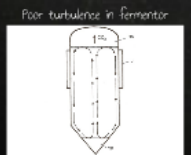


Yeast is not flocculating



2. Quick step in yeast vitality  
Poor yeast collection or storage

3. Change in flocculation  
Yeast is flocculating too early



Poor turbulence in fermenter

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## ROOT CAUSE ANALYSIS

How we find answers

## 4 Most Common Problems

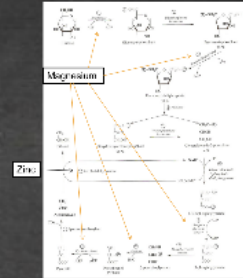
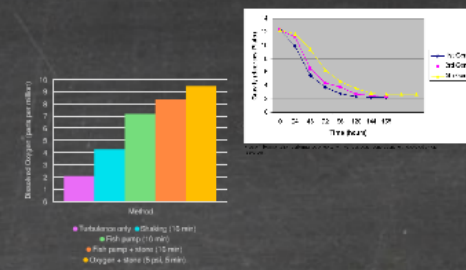
Root cause for the problem  
Fix (prevent) the problem

- 1. Slow, sluggish or stalled fermentation
- 2. Quick stop in yeast viability
- 3. Change in flocculation
- 4. Fermentation off-flavors

- Problems with pitching yeast
- Low viability, viability, yeast health
- Natural mutations, as with German wheat strains, Belgian strains
- Other factors that inhibit good fermentation performance: Low temp, low oxygen, low nutrients



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- Low Viability or vitality
- Under- or Over-Pitching
- Low Dissolved Oxygen
- Lack of Nutrients

Can more oxygen be added?  
What about more yeast?  
More nutrients?

My Step-by-Step guide  
1. If you can, raise the temp a degree & raise the yeast.  
2. Add more oxygen if atmosphere is still hot or less.

WHAT DID WE LEARN TODAY?  
Fermentation is a metabolic process, and yeast are living organisms.  
Fermentation and yeast handling affect yeast condition.  
Yeast condition affect subsequent fermentations.  
Know & UNDERSTAND your fermentations

If all else fails:  
Add more ACTIVE 1 fermenting yeast.  
Add more nutrients (but this is difficult to do in a sterile way)

## COLLECTION



### Conical Fermenters: Best practices

- Timing - end of fermentation, depending on strain
- Remove as soon as possible without risking integrity of beer
- Discard the first runnings
- Use only the middle pack

### Carboys: Best practices

- Timing - end of fermentation
- But less critical than with conicals
- Transfer beer from carboy, then transfer yeast to a sterile container
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## STORAGE

Objective: Keep metabolic activity to an absolute minimum in order to preserve viability and vitality

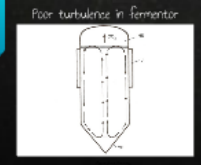
### HOW?

- Cool the yeast quickly and keep it cold (38-40F)
- Keep air/oxygen contact to an absolute minimum (why?)
- Store yeast for as short a time as possible
- Time results in viability loss due to glycogen depletion, ethanol stress, CO2 stress

GLYCOGEN  
Energy reserve stored by yeast during times of starvation

Presence of oxygen signals metabolism of glycogen

If possible - resolve the ISSUE.  
If not, start over with fresh yeast



Poor turbulence in fermenter

Yeast is not flocculating.



Problem with pitching yeast: flocculation, often yeast populations

Yeast is flocculating too early



Flocculation Mechanism

Yeastly updates to improved methods, show real improvements  
This yeast has been through at least 3 "updates"



Diacetyl  
Buttery popcorn that mounds

Esters & fusels  
Excessive fruit, bubblegum, excessive 'hot' aroma

Phenolics  
Antiseptical odor, upon bacterial plating

1. Fermentation off-flavors

2. Slow, sluggish or stalled fermentation

3. Change in flocculation

4. Fermentation off-flavors

5. Quick stop in yeast viability

6. Poor yeast collection or storage

7. Poor turbulence in fermenter

8. If possible - resolve the ISSUE. If not, start over with fresh yeast

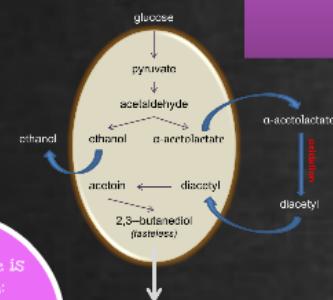
# Problem Fermentations

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## ROOT CAUSE ANALYSIS

How we find answers



### Diacetyl

Buttered popcorn  
Slick mouthfeel

Slow or incomplete fermentation  
Yeast flocculating too soon  
Removal of yeast from beer too soon

### Esters & fusels

Excessive fruit, bubblegum  
Excessive "hot" aromas

Insufficient temperature control  
Underpitching yeast

Once these are formed - they stay  
Focus on PREVENTION



How we find answers

dependent on:  
Activity, time, and  
temperature

Make sure you have  
enough of these 3  
things!

# 4 Most Common Problems



1. Slow, sluggish  
or stalled  
fermentation

2. Quick drop  
in yeast viability

3. Change in  
floculation

4. Fermentation  
off-flavors

Root cause for the problem  
Fix (prevent) the problem

THANK YOU FOR YOUR ATTENTION

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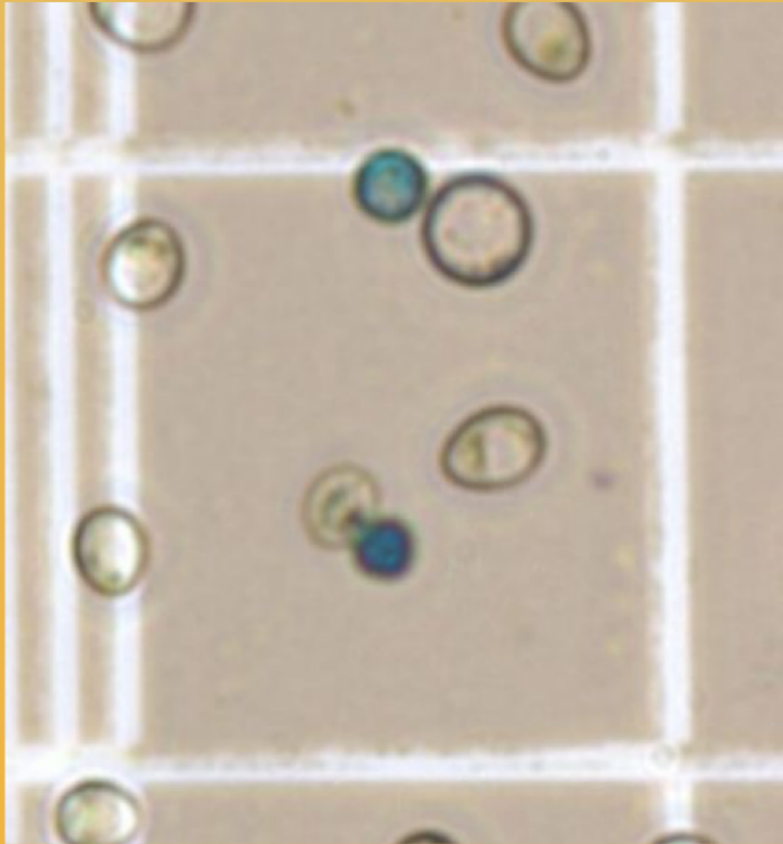
# ROOT CAUSE ANALYSIS

How we find answers



1. Slow, sluggish  
or stalled  
fermentation

Low viability or  
vitality

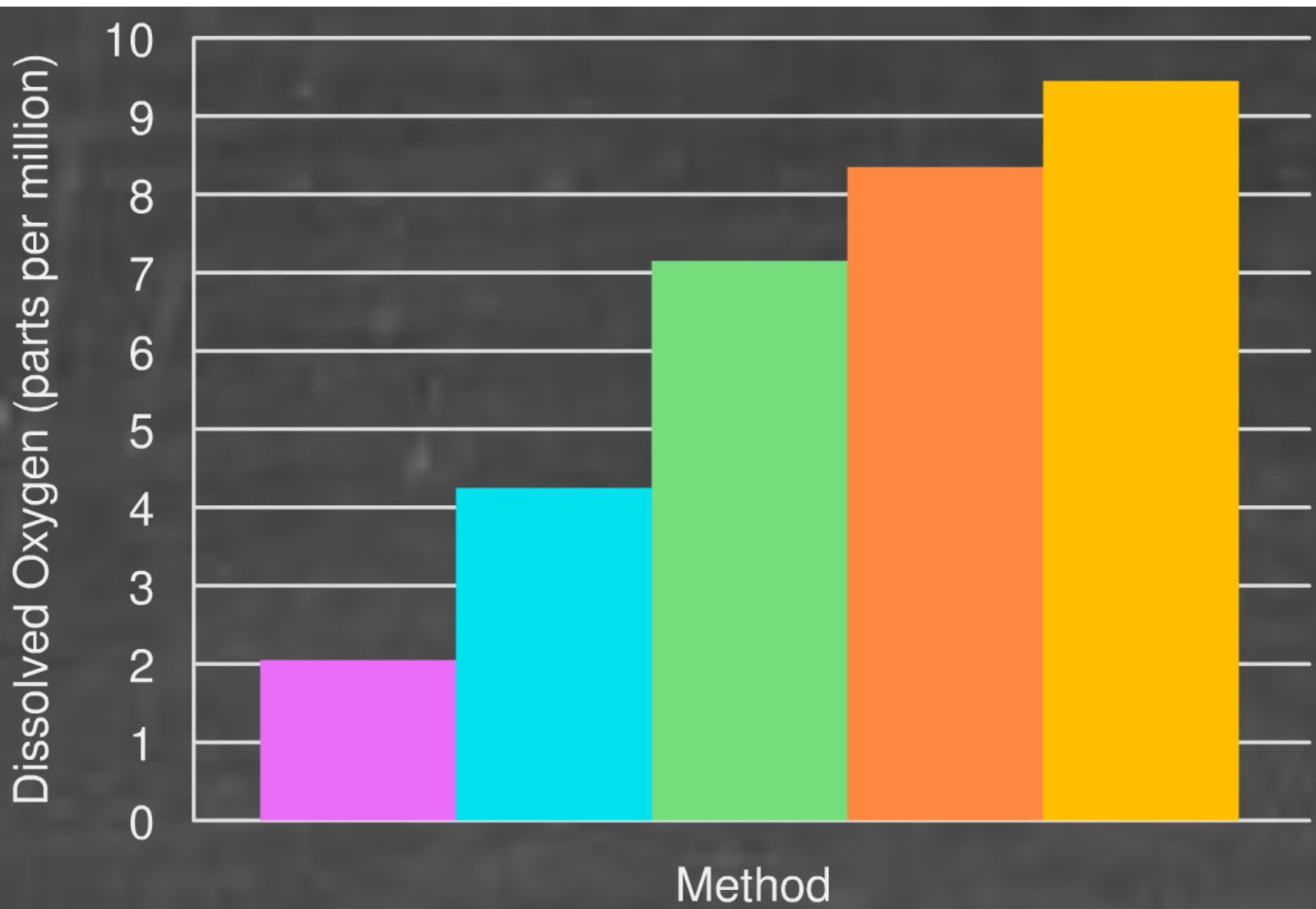




Under- or Over-  
Pitching

Low Dissolved

Oxygen



- Turbulence only
- Shaking (10 min)
- Fish pump (10 min)
- Fish pump + stone (10 min)
- Oxygen + stone (5 psi, 5 min)

Gravity (u

Figure 4  
resource



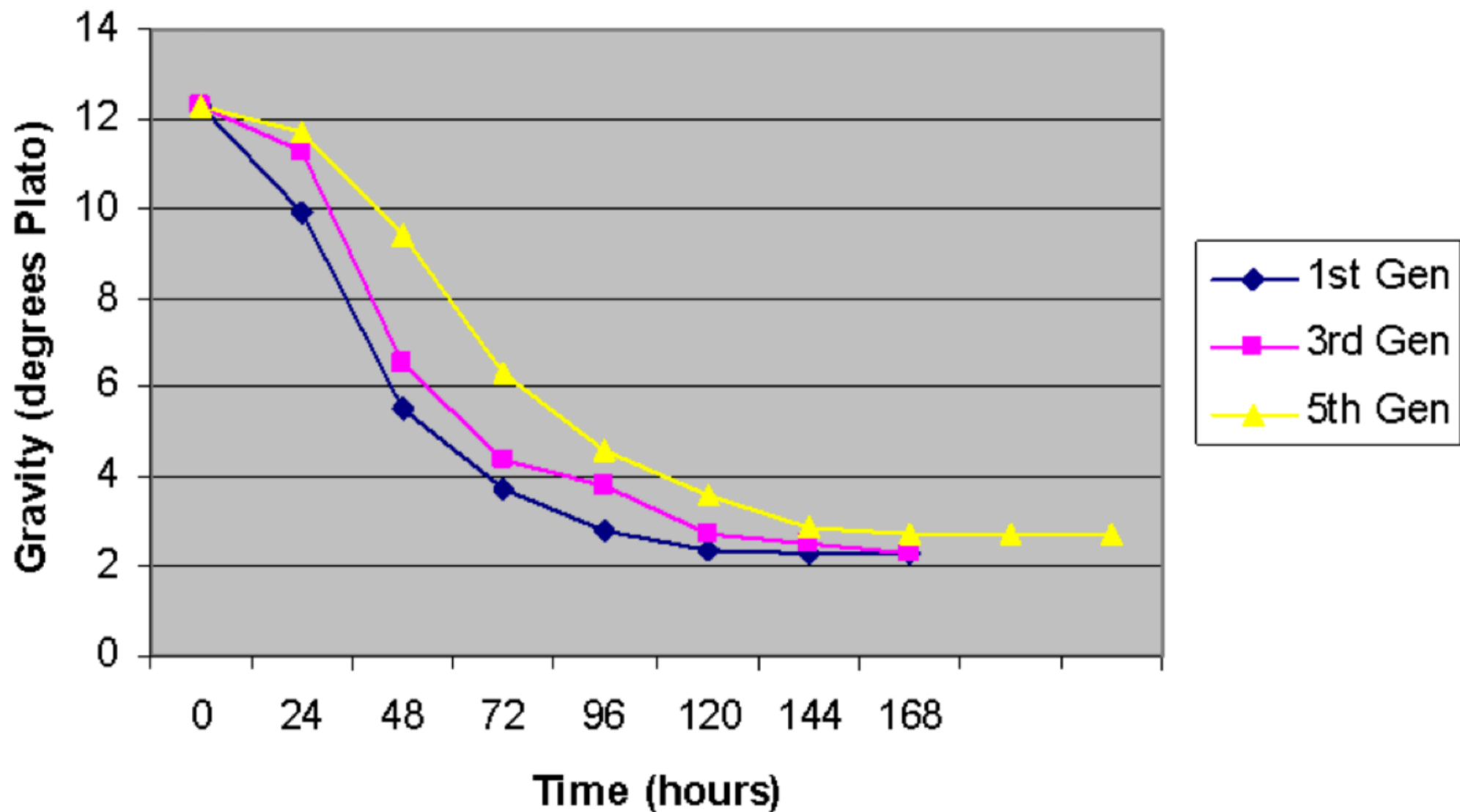


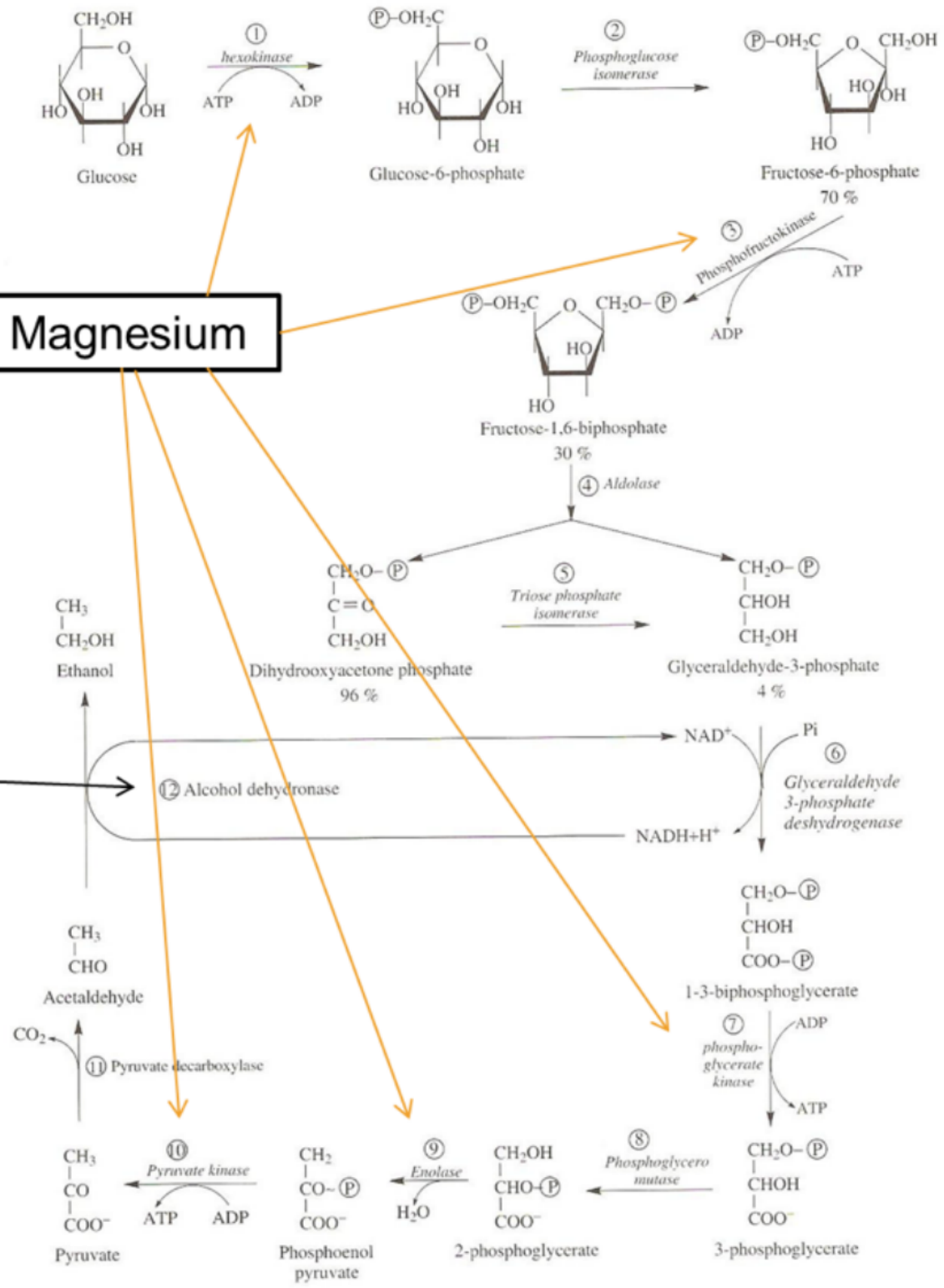
Figure 4. Fermentation performance of worts with various yeast generations with depleted oxygen resources.

Lack of  
Nutrients

- ◆ 1st Gen
- 3rd Gen
- ▲ 5th Gen

# Magnesium

# Zinc





Can more oxygen be added?  
What about more yeast?  
More nutrients?

Step Guide

the time 2

## My Step-by-Step Guide

1. If you can, raise the temp 2 degrees & rouse the yeast
2. Add more oxygen if attenuation is still 50% or less

ing yeast  
is difficult to

If all else fails:

Add more ACTIVELY fermenting yeast

Add more nutrients (but this is difficult to do in a sterile way)

degrees &

2. Add m

is still 5



2. Quick drop

in yeast viability

Poor yeast

collection or

storage

If all else fails:

Add more ACTIVELY fermenting yeast

Add more nutrients (but this is difficult to do in a sterile way)

is still 50% or less

COLLECTION



OR



Conical Fermentors:  
Best practices

- Timing - end of fermentation, depending

Carb  
Best pr

- Timing - end

# Conical Fermentors:

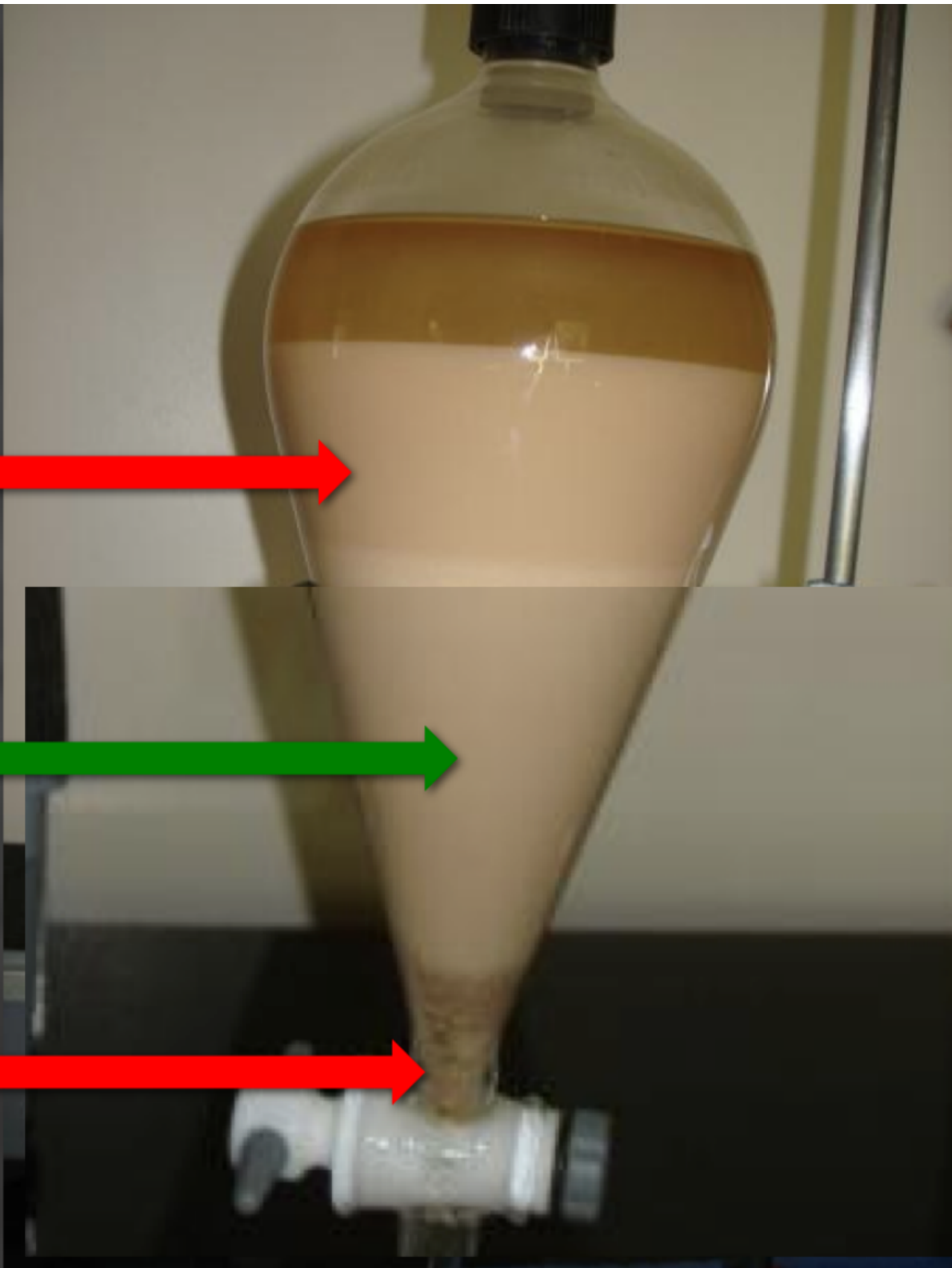
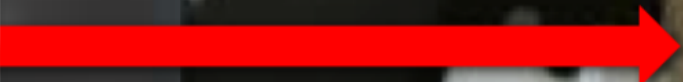
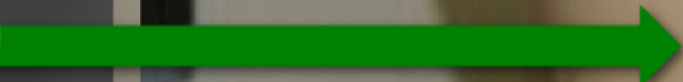
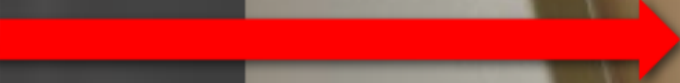
## Best practices

- Timing - end of fermentation, depending on strain
- Remove as soon as possible without risking integrity of beer
- Discard the first runnings
- Use only the middle pack

# Carboys:

## Best practices

- Timing - end of fermentation.
  - But less critical than with conicals
- Transfer beer from carboy, then transfer yeast to a sterile container
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# STORAGE

Objective:

Keep metabolic activity to an absolute minimum in order to preserve viability and vitality

OW?

- Cool the yeast quickly and keep it cold (38-40F)
- Keep air/oxygen contact to an absolute minimum (WHY?)

GLYCOGEN

Energy reserve stored by yeast  
times of starvation

- Store yeast for as short a time as possible



# STORAGE

OBJECTIVE:

Keep metabolic activity low  
in order to preserve viability

HOW?

- Cool the yeast quickly and keep it cold (38-40F)
- Keep air/oxygen contact to an absolute minimum (WHY?)
- Store yeast for as short a time as possible
  - Time results in viability loss due to glycogen depletion

# GLYCOGEN

Energy reserve stored by yeast during  
times of starvation

Presence of oxygen signals metabolism  
of glycogen

## HOW?

- Cool the yeast quickly and keep it cold (38-40F)
- Keep air/oxygen contact to an absolute minimum (WHY?)
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  - Time results in viability loss due to glycogen depletion, ethanol stress, CO<sub>2</sub> stress

Energy

Presence

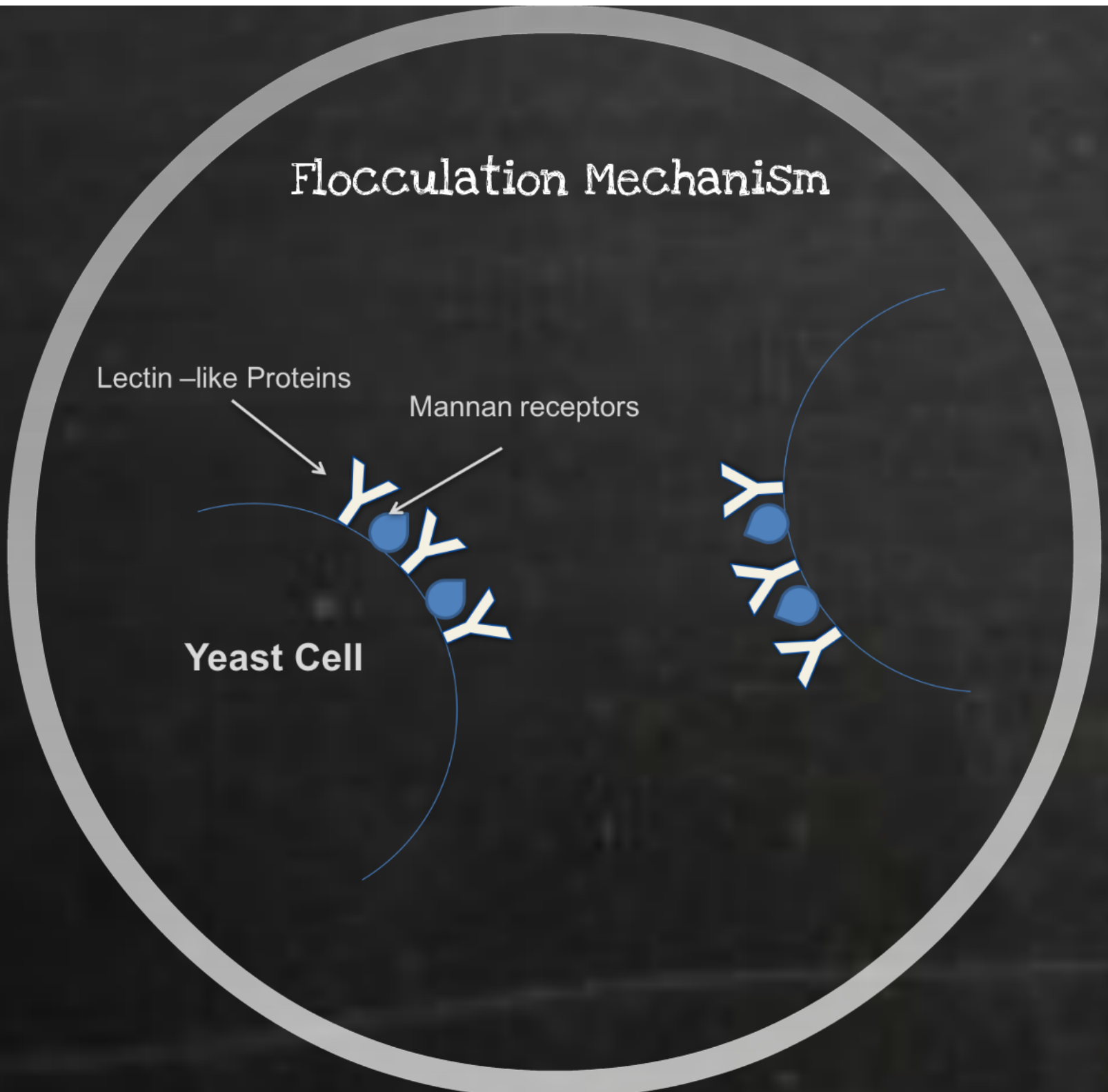
3. Change in  
flocculation

# Flocculation Mechanism

Lectin-like Proteins

Mannan receptors

Yeast Cell



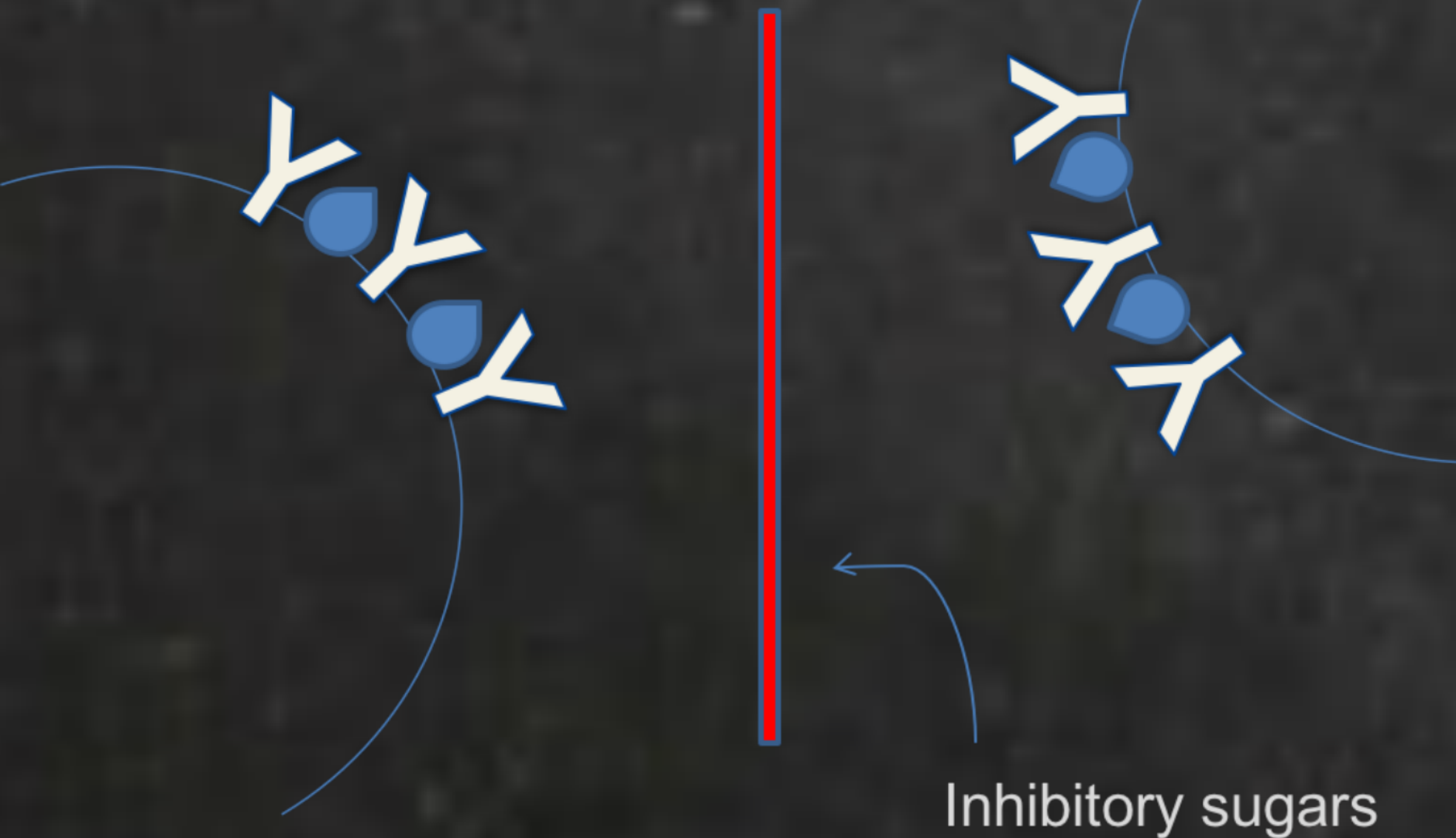
Yeast is not  
flocculating:

Problems with pitching yeast:  
Mutations, older yeast populations





Calcium deficiency



Inhibitory sugars

Flocculation "Blockers"

Yeast is

flocculating too

early:

early:

- Problems with pitching yeast:  
Low viability, vitality, yeast health
- Natural mutations, as with German wheat strains, Belgian strains
- Other factors that inhibit good fermentation performance:  
Low temp, low oxygen, low nutrients

# Poor turbulence in fermentor

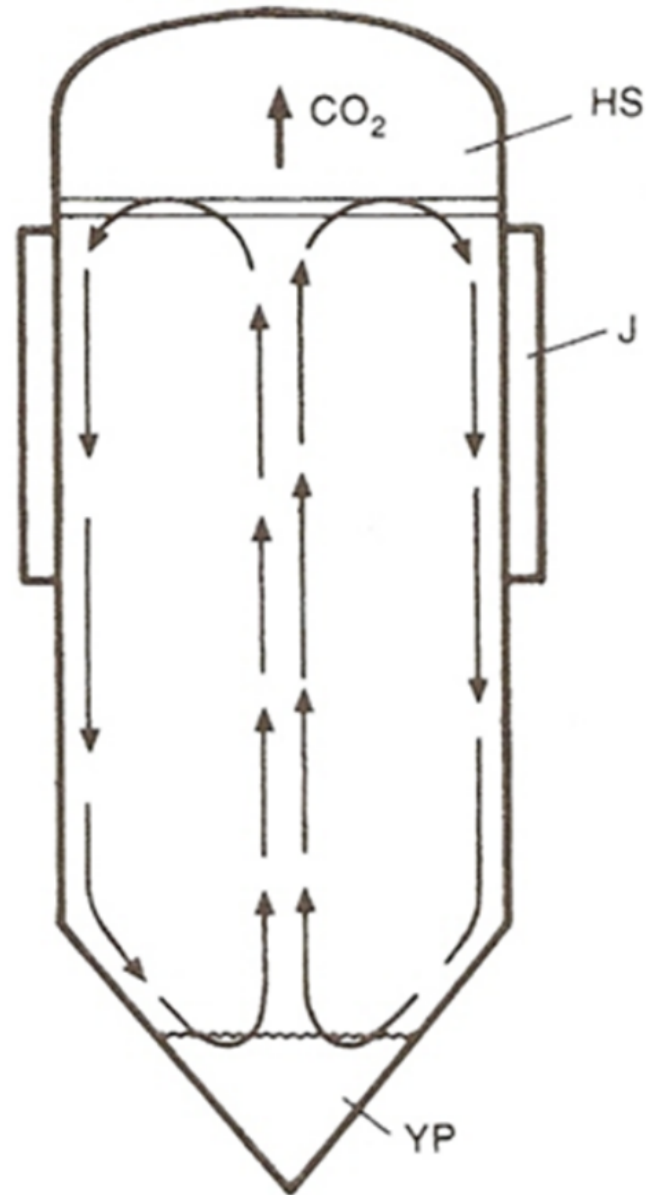


Figure from: *Brewing*,

Michael J. Lewis and Tom W. Young

If possible - resolve the  
issue.

If not, start over with  
fresh yeast

4. Fermentation

off-flavors

# Phenolics

Unintentional clove, spice

Band-aid, plastic



Mutation of yeast due to stress

Cross-contamination

Contamination by wild yeast

# Esters & fusels

Excessive fruit, bubblegum

Excessive "hot" aromas

Insufficient temperature control

Underpitching yeast

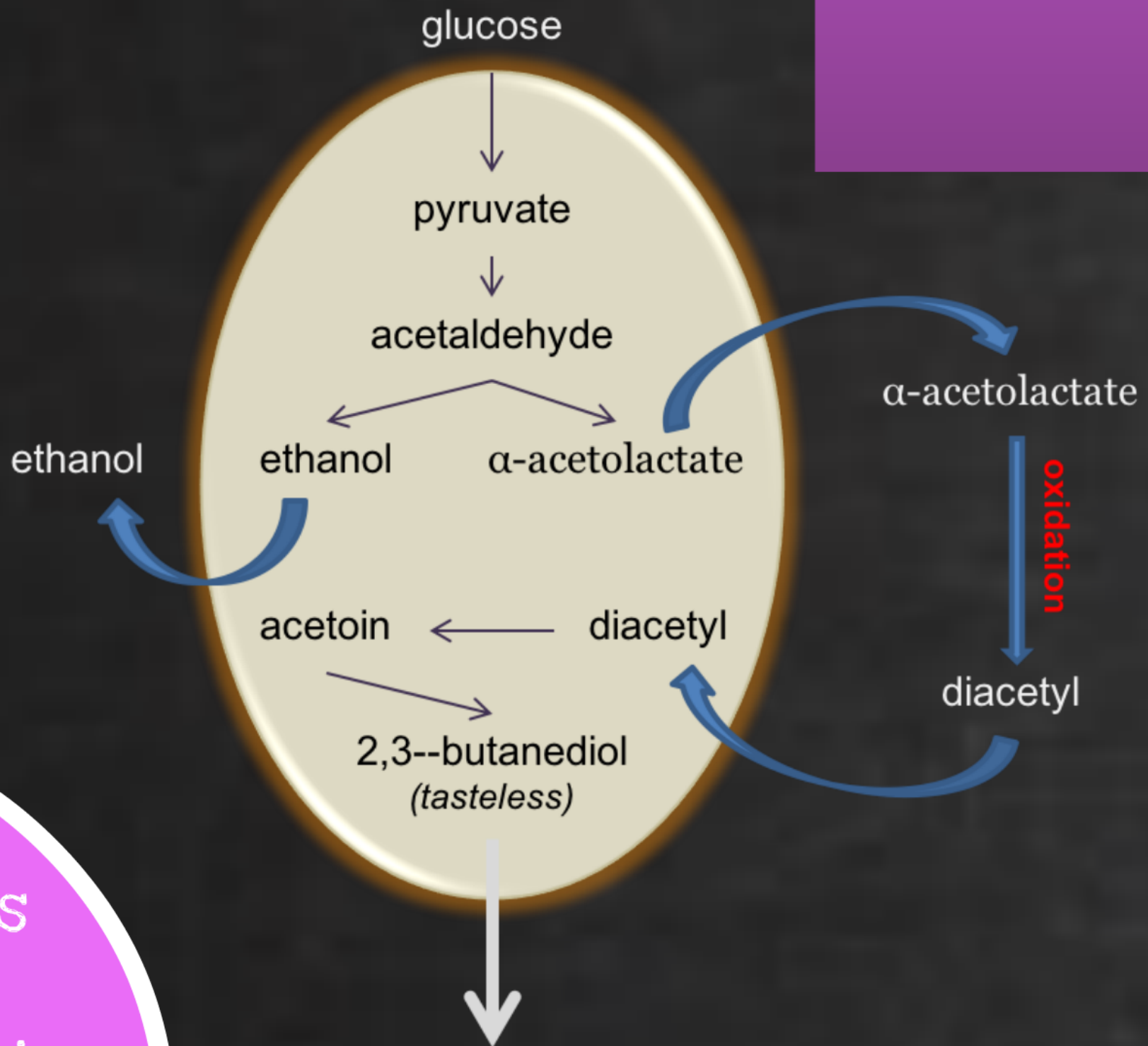
Once these are formed -  
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# Diacetyl

Buttered popcorn

Slick mouthfeel



uptake is  
dependent on:  
time, and

Slow or incomplete fermentation

Yeast flocculating too soon

Removal of yeast from beer too soon

Diacetyl uptake is  
dependent on:  
Activity, time, and  
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Make sure you have  
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Yeast condition affects subsequent fermentations

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