

Yeast Health and Fermentation

- Topics to be covered
 - Ways to healthier yeast
 - Methods of reusing yeast
 - Different gateways to fermentation
 - Important nutrients
 - How to harvest yeasts



Overview of what happens to yeast once you pitch

- Under normal wort conditions, Yeast will have two phases- a growth stage and then fermentation
- The growth phase is often referred to as the lag phase
- During this phase yeast will multiply and build up their reserves for fermentation
- This is a critical time for the proper nutrients to be in the wort



Overview of what happens to the yeast once you pitch

- Once the lag phase is over, yeast will go into fermentation
- With an incomplete lag phase you will get an incomplete fermentation
- Incomplete fermentation will cause multiple off flavors and residual sugars being left in higher concentrations

Lag phase

- The lag phase occurs in the presence of O_2
- Without the presence of O_2 the lag phase will not occur or will be greatly diminished
- During this phase yeast also build up their cell walls
- The building of the cell walls is extremely important to allow the yeast to take in the larger sugar chains (maltose and maltriotose)



Important Nutrients and their roles

- **Nitrogen-** makes up 10% of the composition of yeast
- **Biotin-** This is the most important Vitamin and is involved in all yeast compositions and reactions
- **Phosphorous-** Is used by the yeast in DNA replication
- **Minerals (Ca, K, Mg)-** used in making cell walls and allow the intake of materials during fermentation
- **Zinc-** used in reproduction and is very important in Alcohol conversion.



Yeast Reproduction

- Yeast reproduces asexually (cells split)
- Yeast will only reproduce in the presence of oxygen
- Yeast will only reproduce in the presence of the nutrients they require
- Yeast will only reproduce a limited amount of times due to sexually budding



Incomplete lag phases and its effects

- An incomplete lag phases will cause two detriments to fermentation
 - Can cause a lowered yeast cell count
 - This will increase off flavors
 - Yeast will not complete fermentation
 - Yeast will not produce proper sterols
 - Yeast cells will not take in maltose and maltotriose



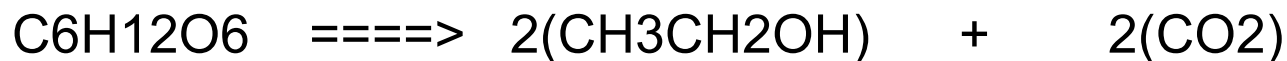
Chemical Equation

- Maltose and Maltotriose are converted into glucose molecules
- Maltose is converted into 2 glucose molecules



Maltose Glucose Glucose

- **Alcohol fermentation**



Sugar Alcohol + Carbon dioxide gas

(Glucose) (Ethyl alcohol)

Reasons for incomplete fermentation

- Sterols not properly produced during lag phase
 - Yeast will not be able to properly take in larger molecules (maltose and maltotriose)
- Incomplete multiplication during lag phase
 - Due to numerous reasons
 - Lack of nutrients
 - Osmotic pressure too high
 - Mutations
 - Old cells

Reasons for incomplete fermentation

- Lack of oxygen
 - Lag phase only occurs in the presence of oxygen
- Initial cell count too small
 - Ideal cell count= 0.75 million cells per ml of wort
- Temperature too high
 - Results in higher fusel alcohol production and more esters
 - Cells die off quicker

Effects of incomplete fermentation

- Yeast cells will not finish taking all maltose leaving a very sweet beer
- Yeast will not clean up byproducts of fermentation
 - Acetaldehyde
 - Diacetyl
 - DMSO
- Allows chance of infections by other bacteria

Effects of incomplete fermentation

- Mutations
 - Yeast will mutate under stressful conditions and off flavors will occur
 - Common off flavors to include medicinal and metallic

Ways to improve yeast health

- Making starters
 - Starters should have a gravity of 1.030 to 1.040 maximum
 - Extremely well aerated
 - Heavily nutrientated
 - Kept at 60-70F for all yeast types
 - Low osmotic pressure
 - Step up starters for any large increase in size
 - One yeast cell will not grow up correctly in 1 liter

Ways to improve yeast health

- Well aerate wort
 - Especially important for harvesting after fermentation
- Add nutrients to wort
- Do not overpitch
- Slightly underpitch
- Temperatures should be well regulated (decrease amount of fluctuations in wort/beer)
- Sanitization

Ways to harvest yeast

- Collect yeast from bottom of fermenter
 - Problems
 - Low viability
 - Increased mutation
 - Decrease in cell count
- Harvest from a bottle
 - Problems
 - Yeast highly stressed
 - Do not know particular strain
 - Unknown yeast health

Ways to harvest Yeast

- Grow up on plate/ slant
 - Problems
 - Hard to get slants/plates
 - Need good sanitization/ sterile technique
 - Very technique driven
- From yeast pack
 - Best way
 - Problems
 - Cost

Freezing yeast

- Yeast should be frozen in a solution of 1/3 glycerine (glycerol) to 2/3 yeast starter
- May also use a solution of 80% water, 10% skim milk, and either 10% honey or 10% sugar (I have never heard of this before)
- Place yeast in cooler in freezer to minimize freezer fluctuations