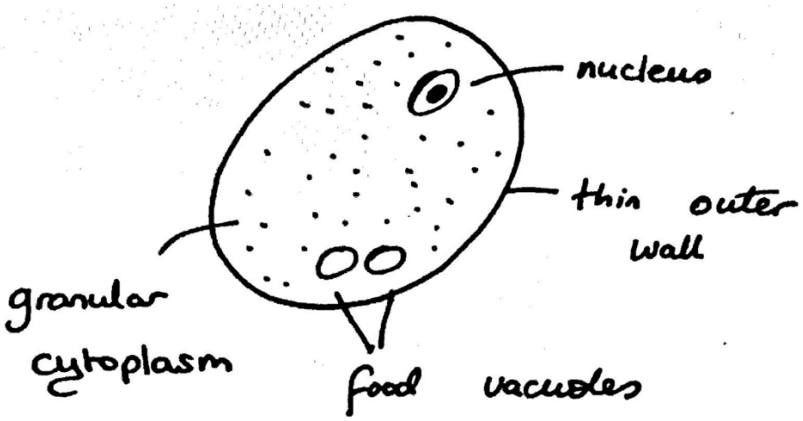
YEAST (SACCHAROMYCETES) - 1.3.8

- Yeast (single celled fungi).
- Oval in shape.
- Saprophytes : Live off dead matter, Secrete enzymes into food (ie) : maltase, invertase, zymase.
- Mainly found on acid/sweet foods (eg) : jam.
- **NOTE** : Yeast cultivated for brewing/breadmaking = Saccharomyces Cerevisiae.

CLASSIFICATION OF YEAST

(A) WILD YEAST	○ **'Bloom' on grapes.**
(B) BREWER'S YEAST 	○ Also called baker's yeast or fresh yeast. ○ Compressed yeast. ○ Beige colour. ○ Putty like texture. ○ "Beery smell". ○ Keep covered in a fridge. ○ Lasts 4-7 days.
(C) DRIED YEAST 	○ Dehydrated active yeast (dormant yeast). ○ Available in granulated form. ○ Keeps for up to 6 months in an airtight container/sealed sachet.
(D) FAST ACTION DRIED YEAST 	○ Dried yeast + improvers (enzymes and Vitamin C. ○ Improvers speed up fermentation (eg) : "Mc Dougalls"

STRUCTURE OF YEAST



- Single celled (unicellular).
- Oval shape.
- Thin outer wall.
- Cell is filled with fluid called cytoplasm, a nucleus that controls activity of cell and food vacuoles (store food).

REQUIREMENTS FOR GROWTH

- **FOOD** : dead matter (saprophyte) (eg) : sugar starch.
- **MOISTURE** : liquid (eg) : water, milk.
- **ACID pH** : 4.5 – 6.5, sugar is acidic.
- **FACULTATIVE** : can live with or without O_2 (prefers anaerobic environment).
- **WARMTH** : Ideal temperature (26°C - 28°C)
  - **Example** : 600ml tepid liquid.
  - (A) : 400ml cold.
  - (B) : 200ml boiling.
  - Destroyed above 60°C, destruction begins at 44°C.

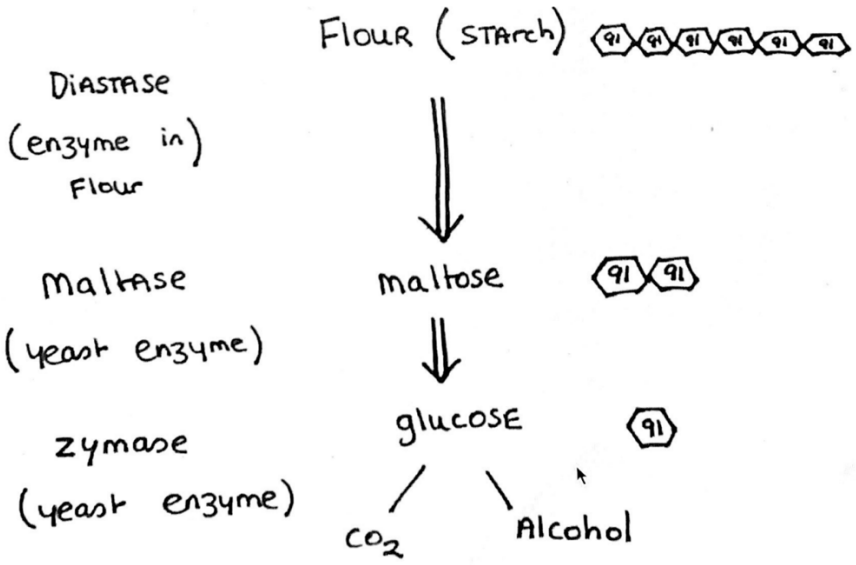
ACTION OF ENZYMES DURING FERMENTATION

- Once yeast cells have obtained nutrition (ie) : feed off of the sugar and starch), yeast cells reproduce.
- Reproduction is by means of 'Budding'.
- Yeast cells need favourable conditions.

Yeast cells secrete enzymes into dead matter to obtain nutrition, they feed off of the nutrients and produce CO_2 and C_2H_5OH.		
FOOD SOURCE	**ENZYMES**	**PRODUCTS**
(A) FLOUR : (containing polysaccharide starch)	There is an enzyme in flour called **Diastase**. Once moisturized with liquid, **Diastase** is active.	**Diastase** breaks down (hydrolysis) **Starch** into the disaccharide **Maltose**.
	Yeast cells secrete the enzyme **Maltase**.	**Maltase** breaks down **Maltose** into **Glucose** (monosaccharide)
	Yeast cells secrete the enzyme **Zymase**.	**Zymase** converts monosaccharides **Glucose** to **CO_2** (carbon dioxide) and **C_2H_5OH** (ethanol)
(B) SUGAR : (made up of disaccharide sucrose)	Yeast cells secrete the enzyme **Invertase**.	**Invertase** breaks down **Sucrose** to **Glucose** and **Fructose**.
	Yeast cells secrete more **Zymase**.	**Zymase** converts **Glucose** and **Fructose** to **CO_2** (carbon dioxide) and **C_2H_5OH** (ethanol)

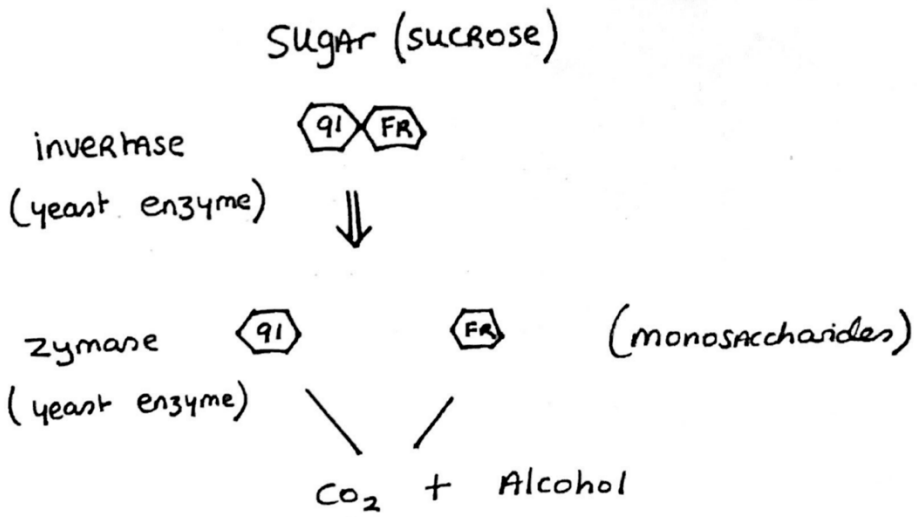
- In order to grow yeast cells, you must obtain a source of nutrition.
- Yeast cells are saprophytic.
- They secrete enzymes into the flour and sugar, feed off the nutrients of these foods and produce CO_2 (carbon dioxide) and ethyl alcohol.
- This process is called **Fermentation**.

(A) :



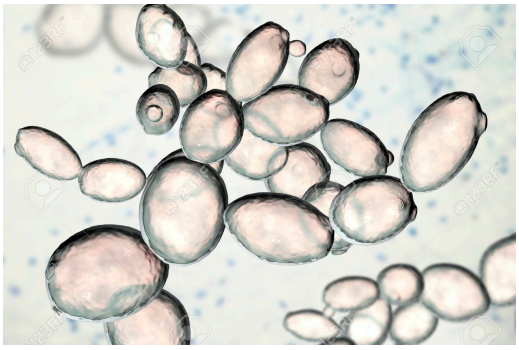
- Diastase in flour ($+H_2O$) hydrolysis breaks the starch into maltose.
- Maltase (yeast enzyme) breaks down maltose to glucose.
- Zymase (yeast enzyme) breaks down glucose into CO_2 + Alcohol.

(B) :



- Invertase breaks sucrose into the monosaccharides glucose and fructose.
- Zymase (yeast enzyme) breaks down monosaccharides into CO_2 + Alcohol.

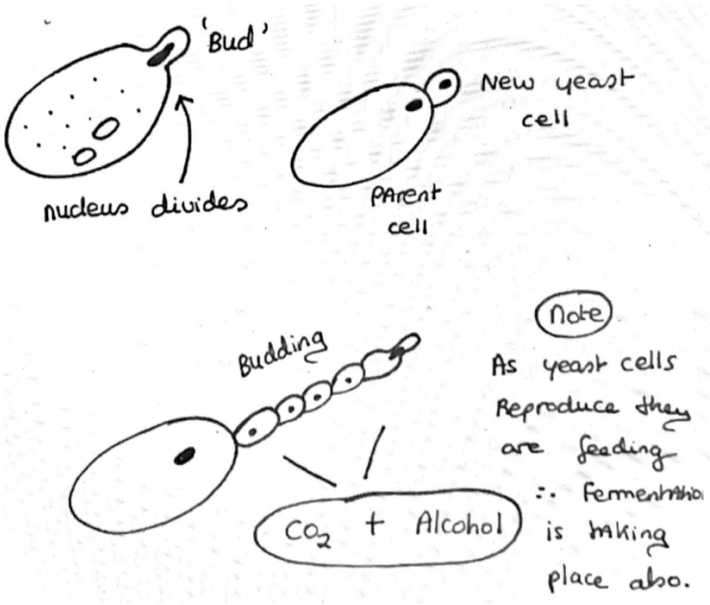
- **NOTE** : CO2 causes the dough to rise. Alcohol will evaporate @ 78°C when the dough is placed in the oven.



Budding Yeast (ie) : Saccharomyces Cerevisiae

REPRODUCTION (IE) : GROWTH OF YEAST

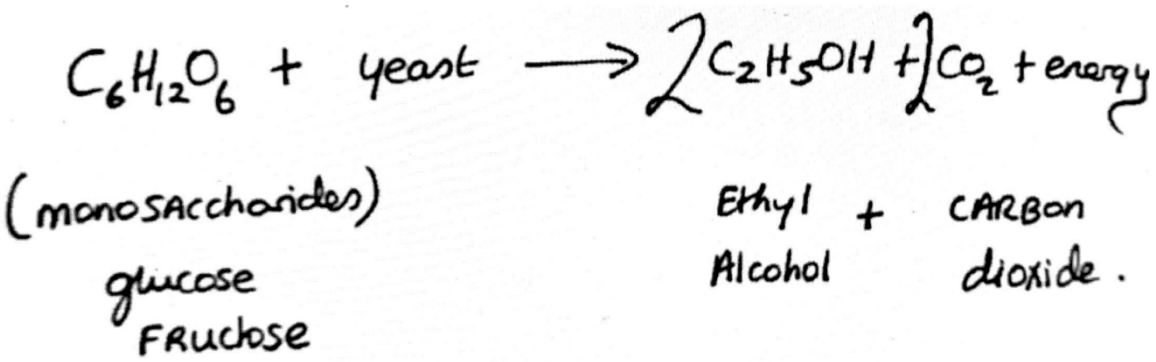
- Once yeast cells have obtained nutrition (ie) : feed off of the sugar and starch), yeast cells reproduce.
- Reproduction is by means of "budding".
- Yeast cells need favourable conditions.
- A small bulge or 'bud' develops at the side of the cell.
- The nucleus moves towards the bulge and the nucleus divides.
- The 'bud' grows, and a wall develops and separates new cell 'bud' from parent cell.
- New buds develop before previous cell is fully grown.
- Reproduction is taking place so quickly that there is a chain of new yeast cells attached to the parent cell.



FERMENTATION

- During feeding (see enzyme action) yeasts break down starch and sugar into CO_2 and C_2H_5OH.
- Called fermentation.
- Used in breadmaking :
  - CO_2 raises bread (outside of the oven).
  - Alcohol is given off (biological raising agent).
  - **NOTE** : CO_2 causes the dough to rise. Alcohol will evaporate @ 78°C when the dough is placed in the oven.
- Used in brewing and wine making.
  - Alcohol is retained (beverage)
  - Still wine/beer - CO_2 given off.
  - Champagne - CO_2 is kept (fizzy effect).

EQUATION FOR FERMENTATION



- **NOTE** : If you are asked to write a note on fermentation structure your answer under the following headings :
  - **(I) Definition**.
  - **(II) Action of enzymes during fermentation**.
  - **(III) Chemical equation**.
  - **(IV) Chorleywood Process**.

CHORLEYWOOD PROCESS

- The addition of Vitamin C (ascorbic acid) speeds up the fermentation process.
- Vitamin C acts as an improver thus 'strengthening' the gluten in the flour (making it more elastic).
- NOTE : Fast Action Dried Yeast contains dried yeast + improvers (ie) : extra enzymes + Vitamin C.

FERMENTED FOODS

- Fermentation is a process that can sometimes be used in food processing. It is a process of converting carbohydrates to alcohol or organic acids using microorganisms like yeast or bacteria. The science of fermentation is known as zymology.

A: YEAST FERMENTATION

- Enzymes (maltase, invertase and zymase) are secreted by yeast cells into carbohydrates (starch and sugar).
- The carbohydrates are broken down into monosaccharides and the yeast enzyme breaks monosaccharides (glucose and fructose) to CO_2, ethyl alcohol (ethanol) and C_2H_5OH.
- Used in food processing :
  - Brewing alcohol – beer, wine etc.
  - Bread making/pizza.
  - Stage 1 of the production of vinegar.

B: LACTIC ACID FERMENTATION

- This is a process where glucose (monosaccharide) or other sugars (disaccharides) (eg) : sucrose and lactose, are converted to lactic acid by bacteria (ideally in an anaerobic environment).
- Used in food production :
  - Yoghurt – Lactobacillus Bulgaricus.
  - Cheese (eg) : Cheddar – Lactobacillus Casei.
  - Sourdough bread.
  - Kimchi – fermented Chinese cabbage, radishes, red pepper, garlic and ginger (Korean).
  - Kefir – fermented milk made using Kefir grains (Russian).
  - **NOTE** : The bacteria are naturally present on the raw ingredients.
  - **NOTE** : Kefir grains contain bacteria/yeast mixture clumped together with casein.

Kimchi

Sourdough Bread

Kefir

RULES FOR BAKING WITH YEAST AT HOME

- USE STRONG FLOUR (BAKERS FLOUR) Which has a 12% gluten content in comparison to plain flour (9% gluten content). This results in a more elastic dough that stretch easily as the bubbles of carbon dioxide are produced during fermentation.
- MAKE SURE THE LIQUID IS TEPID WHEN ADDING TO THE FLOUR MIXTURE, IDEALLY 26-28 DEGREES CELSIUS – This can be achieved by using 1/3 boiling liquid and 2/3 cold liquid. It ensure the yeast cells are activated so fermentation can take place. If liquid is too hot, yeast cells will die.
- ADD SALT TO ONE SIDE OF THE BOWL FLOUR, ADD DRIED YEAST CELLS TO THE OTHER SIDE OF THE BOWL, salt can kill yeast cells if in direct contact which would prevent fermentation taking place.
- KNEAD DOUGH FOR AT LEAST 10 MINUTES, this will strengthen gluten to make it more elastic. As a result the dough will stretch a lot proving, giving greater volume to the bread.
- KEEP THE DOUGH IN WARM PLACE DURING PROVING TO ENSURE THE FERMENTATION PROCESS CONTINUES. If the environment is too cool, the yeast cells will not work efficiently as normal, less carbon dioxide will be produced. Therefore resulting in a flatter bread.