

## Chapter 2 – Beer

### What is Beer?

Beer is brewed and fermented alcoholic beverage, made usually from malted barley water, and yeast and flavoured with hops. With changing time, other cereals like wheat, maize, and rice can be utilized in production of Beer. Beer contains between 4 – 7 percent of alcohol by volume.

### Ingredients used in making of beer are as follows –

- Water
- Barely
- Yeast
- Hops

### Understanding role of each ingredient -

Water –

Out of all the ingredients water makes up 90- 95% Water affects beer in 3 ways,

- It determines the flavour of the wort, which is the liquid which contains sugars and is extracted from the mash in the brewing process.
- pH of the water also impacts the bitterness of the beer.
- Any contaminants or chlorine in the water can result in off tasting beer.

Barley

- It is the preferred cereal to make Beer.
- Easy to malt for brewing.
- Chosen barley should have high starch & low protein with little flavor.



## Yeast

- Yeast is a living organism.
- During fermentation process, the yeast converts the sugar into alcohol and releases carbon dioxide.
- Co<sub>2</sub> determines the amount of the fizz & foam formation in the beer.
- It is also known as Brewer's yeast. *Saccharomyces cerevisiae* (also called top fermenting yeast) and *Saccharomyces carlbergensis* (also called bottom fermenting yeast)



## Hops

- The hop is a climbing vine.
  - Belongs to nettle family
  - **Hops** are the female flower clusters, known as **Humulus Lupulus**.
- Its cone-like blossoms contain a bitter dust called lupulin which has tannins and resins.
- The tannins help clarify, stabilize, and preserve the beer.
- The resins and oils are the principal sources of aroma and dryness.



**Sugar:** - Specially graded and refined sugar is used that aids in fermentation process and also give sweetness to beer. The yeast act on sugar therefore breaking it up into alcohol and carbon di oxide.

## Production / Manufacturing of Beer

### Malting

- It is the first step in production.
- In malting, the starch is converted to soluble sugar.
- Barley is soaked in water for about three days.
- Then it is spread on malting floor which causes germination or sprouting.
- Moisture, warmth, and oxygen are necessary for the growth of shoot and rootlets.
- Insoluble sugars are converted to soluble sugar by enzyme diastase.
- The germinated cereal is called as green malt.
- Green malt is then dried and roasted in a kiln at 204 degree Celsius to stop further germination.
- The temperature and the length of time the cereal is heated dictate the colour and taste of the beer.



### Mashing –

- Crushed malt is called **grist**.
- Water is added to the grist.
- Mash is then mixed & cooked for 1-6 hrs, during which *malt enzyme converts starch in maltose*.
- Temperature – 65 degree Celsius
- The liquid contained in the mash is transferred into another tank called a lauter tun.

- This is accomplished by drawing the liquid out through the bottom layer of mash solids, which acts as a filter.
- Hot water is added to the top of the mash tank to rinse the remaining liquid, now called wort, from the mash.
- The solid remains of the grain are dried and sold by the brewery as animal feed.
- This solution is called as **Wort**
- *Wort=Liquid which has natural sugar.*



### **Brewing-**

- Wort is placed in huge copper or stainless steel kettles, where dried hops and sugar are added.
- The amount of sugar and hops added depend on the style of beer under production.
- Wort is boiled for 1-2 hours, which makes the wort bitter.
- After brewing is complete, the finished wort is filtered again and pumped to the fermentation tanks.

### **Cooling and Pitching**

- The wort is then cooled down to 15 degree Celsius and transferred to fermenting vats.
- The wort should not be at 30 degree Celsius and above.
- Yeast remains active between 5 degree and 30 degree Celsius.

### **Fermentation-**

- There are two types of fermentation
- Top Fermentation
- Bottom Fermentation
- *Saccharomyces cerevisiae* yeast is used for top fermentation
- *Saccharomyces carlsbergensis* is used for bottom fermentation

Top Fermentation	Bottom Fermentation
<b>Type of Yeast-</b> <b>Saccharomyces Cerevisiae</b> Has a tendency to multiply & float on the top.	<b>Type of Yeast-</b> <b>Saccharomyces Carlsbergensis</b> Has a tendency to multiply & settle at the bottom.
Fast & Vigorous process at a high temp (15 - 25 degree Celsius).	Slow process, yeast works slowly at a low temp (5 – 9 degree Celsius).
Produced in few days' .Produces heavy foam at top because the yeast rises to the surface.	Fermentation starts at the bottom by producing the Co2 bubbles that emerge at the top of the beer.
Then it is filtered, bottled & packaged for immediate consumption.	The above process helps to have a smooth & flavor ,mellow beer
Ale, Porter, Stouts	Lager

### Maturing (Aging)

- After the fermentation, the ale is racked into storage tank and stored for 3-21 days.
- The lager is racked into storage tank and matured for 10-24 weeks at a temperature range of 1-3 degree Celsius.
- Lagering helps the beer to mature.
- During the maturation, the yeast settles, harsh flavours mellow, and the beer gets its natural texture and carbonation.

### Pasteurizing

- After aging, the beer can be pasteurized to kill the remaining yeast and prevent further alcohol production.
- This is accomplished by heating the beer above 135°F (57°C).

### Brightening or Clarifying

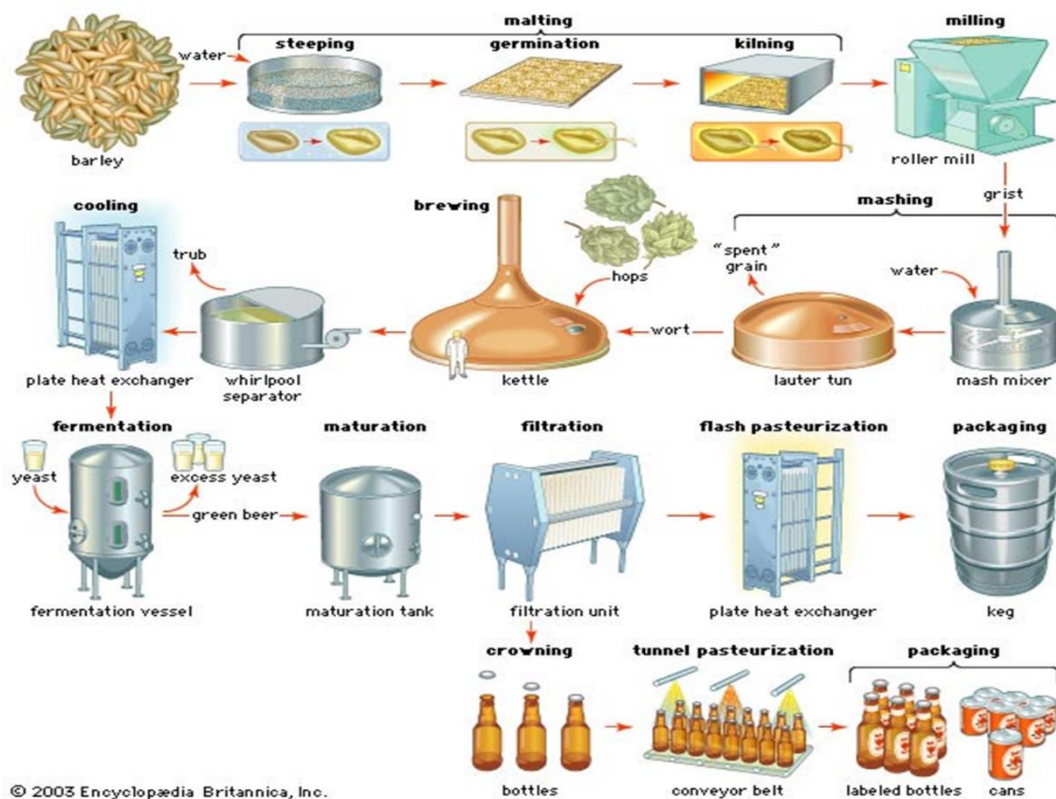
- In this step, the beers are then brightened with the addition of finings.
- It is done to remove tannins, dead yeast cells, and other products.

## Carbonation or conditioning

- Natural process of conditioning will give gas to produce the head.
- Addition of Co<sub>2</sub> to make beer fizzy. If no co<sub>2</sub> is the beer is found the beer is called as Flat.
- Carbonation can be achieved by injecting the co<sub>2</sub> in the neutral containers

## Casking & Packaging

- The beers are packed into sterilized casks, kegs, bottles, and cans.
- The beer is then cooled, labelled, packed and distributed for sales.
- Cans are coated with Lacquer (kind of a sealing wax) to avoid any reaction of brew with the metal can.



## Styles of Beers

**ALE BEER:** - Ale is generic term for top fermented beer. Ale are fermented at higher temperature & takes less time to mature. More pronounced hop flavour, heavy body & in most cases high in alcoholic content.

The various styles are as follow:-

- **Pale Ale** - Whether *American* or *English*, the “pale” was clipped on long ago to distinguish it from the dark colour of Porters. American and English styles differ, but generally they are gold or copper colored and dry with crisp hop flavour. Brand names :- Martin’ Pale Ale, Courage’s Strong Pale Ale etc. (U.K.)
- **India Pale Ale (IPA)** - Pale ale with intense hop flavour and aroma and slightly higher alcohol content. Brand names: - Bass, Charington’s, Goose IPA.
- **Brown Ale** –These distinctively northern English style ales have a strong, malty centre and can be nutty, sweet and very lightly hopped. They are medium bodied and the name matches the colour of the ale. Alcohol content (6-12%). by volume. Brands– Provisie (Belgium), Samuel Smith (U.K)
- **Stout (Guinness and Murphy’s are *dry Irish stouts*)** – Thick, black opaque and rich. Stouts draw their flavour and colour from roasted barley. They often taste of malt and caramel, with little to no hop aroma or flavour.
- **Porter** – Very similar to stout but made from unroasted barley. Sweet and dark brown in colour with hints of chocolate and a sometimes-sharp bitterness.

**WHEAT BEER - Also called** “White beer”. Popular in Germany, Germans take their beer very seriously, so much that it is required by law to use top-fermenting yeast in wheat beer. It must be made from at least 50% wheat malt. Wheat proteins contribute to a hazy, or cloudy appearance and are commonly unfiltered, leaving yeast sediment in the bottle. They are light coloured, full flavoured and the unique yeast strains produce flavours like banana, clove and vanilla.

**LAGER BEER** - Lager yeast sinks to the bottom of the vessel and ferments at a colder temperature than ale yeast, slowing the process down. At a colder temperature, bottom-fermenting yeast produces fewer “esters” (flavour compounds, basically). This creates a mild, crisp and clean tasting beer. Lager is the German word meaning “to store”. *Lagering* softens flavours and texture.

## Different Styles of Lager Beer

- **Amber/Red Lager** – More malt and darker than their lighter lager relatives, usually amber to copper colored. Flavour profiles vary considerably between breweries. Nine times out of ten when a beer label says no more than “Lager” it is an amber. Brand names - Yuengling, Killian’s, Brooklyn Lager.
- **Pilsner** – Conceived in Czechoslovakia, easily the world’s most popular beer style. Pilsners are pale, straw colored and crisp with medium body and more hops than traditional lager, but typically smooth and clean. Brand names - Beck’s, Labatt Blue, Warsteiner, Pilsner Urquell.
- **Bock** – Of German origin, brewed in the fall to be enjoyed in the winter or spring. A stronger lager with heavy malt, medium to full bodied, lightly hopped and dark amber to brown in colour. Brand name - Sam Adams Winter Lager.
- **Doppelbock** – “double” bock is stronger and darker than bock, sweeter with more malt and a little higher in alcohol content.
- **Oktoberfest** – Indicates the Vienna style of “Marzen” beer, the German word for “March”. These are brewed in the spring and stored to serve in autumn. They have a toasted quality with a sweet tinge, robust malt flavours, and a deep amber hue.

**DRAUGHT BEER** - Draught beer, also spelt draft, is beer served from a cask or keg rather than from a bottle or can. Draught beer served from a pressurised keg is also known as keg beer.



**CRAFT BEER** - A beer made in a traditional or non-mechanized way by a small brewery. Colorado defines 'craft beer' as beer made by a brewer that is small, independent, and traditional. They are also known as Freshly Brewed beers. Microbreweries produced freshly brewed beers. Examples of breweries – Independence Brewery, Pune, Effingut



**FLAVOURED BEERS** - Flavoured beers obtain flavours from different ingredients apart from hops. Flavours can be from spices and fruits. Examples – Coffee, Chocolate, Bubble-gum, Cloves

### Other Brewed and Fermented Beverages

**Cider** - Cider is an alcoholic drink obtained by fermenting the juice of cider apples. It is also legally permitted to make cider from the mixture of apple juice and pear juice. Proportion – 75% Apple juice and 25% Pear juice. Countries popular – United Kingdom & France. Alcoholic strength – 1.2% to 8.5 %



Types of cider –

1. Draught Cider
2. Keg Cider
3. Bottled Cider

**Perry** - Perry is an alcoholic drink obtained by fermenting the juice of pear. Proportion – 75% Pear juice and 25% Apple juice. Perry is carbonated either by tank method or direct impregnation method. Alcoholic Strength – 2% - 8.5

**Sake** - It is brewed and fermented drink made from rice in Japan. It is served warmed and so a special flask is used to serve it called 'Tokkuri'. It is served in small cup called 'Sakazuki'. The alcoholic strength is around 17% ABV.



**Mead** - Mead is an alcoholic beverage created by fermenting honey with water, sometimes with various fruits, spices, grains, or hops. The alcoholic content ranges from about 3.5% ABV to more than 20%