

# BEER PRODUCTION TECHNOLOGY

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Beer - one of the oldest and most complex in the preparation of drinks. To create the final product brewers use the latest technology and very expensive equipment. But, as before, the integral components of beer are 4 ingredients - water, malt, yeast and hops.

## Water

Solutions of various salts give water different characteristics which, in turn, influence the beer. Several varieties of beer are cooked better on hard water (Munich), while others do better on soft water (Pilsner). The difference between these two types of water depends first of all on the concentration of  $\text{Ca}^{++}$  ions and carbonates.

## Malt

Conversion of grain into malt is done via a whole range of biochemical processes. The endosperm of grain contains a large reserve of starch. From this starch a sprout gets its first nutrition. But this occurs only after the grain completes a period of rest. In the course of this period the seed contents are reliably protected so that the nutritional substances are solidly bound chemically with each other and the surrounding environment is kept free of moisture. Sugar, the most important source of energy, exists in the form of starch. Since beer is brewed from barley, brewers need firstly to "turn on" the process which, in normal conditions, occurs in the spring, when grain begins to germinate. This managed process is called malting.

## Hops

Hops give beer its characteristic bitter taste and to a large degree are responsible for the aroma of the beverage. The chemical composition of hops is unique, therefore it cannot be replaced by other additives without a negative impact on the quality of the beer. Hops contain more than 200 flavour substances. The different varieties of hops give beer an aroma or bitterness of variable intensity. Hops also facilitate the formation of a foamy head on beer. When hops are added, the head is more dense and long-lasting. In brewing only hops cones from female plants are used.

## Yeast

Depending on what type of beer they want to get, one of two types of yeast is chosen for the production process: yeast for top fermentation or yeast for bottom fermentation. Top fermentation yeast is used to produce porter, ale, stout and most types of wheat beer. Bottom fermentation yeast is used to prepare lager beer and most Middle European varieties.

Top fermentation yeast is so named because it can form in the final stage of fermentation on the surface of the beer, whereas bottom fermentation yeast descends at the end of the process to the bottom of the fermentation vat. Various types of yeast give beer different tastes.

## Production Process Technology

### Fermented wort

Malt is a basic raw material for producing beer. It is obtained from barley with the help of a process called malting. In order to facilitate the process, the malt is ground and broken up. As a result malt grounds are obtained. These are combined with water in a special kettle or vat. The components break down,

forming soluble extract substances to the greatest extent possible. The mixture so obtained is a mass like jam.

Depending on what variety of beer is being brewed, this mass is then heated to predetermined temperatures over certain periods of time. In the course of the process, starch contained in the malt is turned into soluble substances: fermentable and non-fermentable sugars. The transformation occurs with the help of various enzymes present in the malt.

After this the wort is separated from the barley-corn. The wort is the liquid part of the mass, while the solids consist mainly of the husks of the grain and insoluble proteins. This separation is done in a filtering vat where the jam-like mass is pumped from the kettles.

After filtration, the wort is collected in a special kettle. Here it is then brought to a boil and cooked. During the boiling, hops are added to the wort.

### Fermentation

Conical-cylindrical tanks are used for the fermentation process. The cold wort enters them from below and yeast is injected into the flow. In the fermentation process, yeast converts sugars contained in the wort into ethyl alcohol and carbon dioxide.

It is important that fermentation begin as soon as possible. Otherwise bacteria and wild yeast will multiply rapidly in the rich nutritional substances of the wort and compete with the beer yeast. When fermentation has already begun, the newly formed alcohol and carbon dioxide inhibit growth of most other microorganisms. The fermentation process also produces carbon dioxide. Part of it dissolves in the beer. But after a certain time the beer has absorbed its fill of carbon dioxide. The carbon dioxide which continues to form is eliminated from the tank via a special duct. When nearly all the fermentation sugars contained in the wort have been processed, the fermentation stops.

## Filtration

However, the beer continues to be cloudy and for that reason it undergoes filtration. At first it is passed through a separator, where large particles are removed, and then it goes through a kieselguhr filter and fine particle filter. After these operations, the beer is completely transparent and ready for filling. Prepared beer is stored in cisterns (containers of clarified beer) at low temperature.

## Filling

During the filling process it is essential to protect it from air and contaminants. During filling, beer can be pasteurised. This is done to restrict growth of microorganisms which may be in the beer or, if possible, to destroy them.

## References:

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