Production of alcoholic
&
soft beverages

Module- 29
Lec- 29

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Beverages

• Alcoholic Beverages
  – Beer
  – Wine
  – Spirits
  – Flavoured beverages
  – Hot Drinks
  – Coffee
  – Tea
  – Other drinks
    • Chocolate based

• Soft Drinks
  – Carbonated beverages
  – Fruit/vegetable juices
  – Bottled water
  – Functional Drinks
  – Ready-to-drink concentrates
  – Ready-to-drink teas

Production of alcoholic

Production of Beer
Wort production in a classical brewhouse:

1. malt grinding, 2. mash vessels (decoction mashing), 3. wort filtration in a filter vessel, 4. wort boiling, 5. wort clarification in a Whirlpool, 6. wort cooling (heat exchanger).
Malt Milling

- By milling malt, the starchy endosperm will become better accessible for the malt enzymes and this will improve the extraction process. The selected milling technique depends on the methods of mashing and separation that are used. Milling should be performed in conditions that preserve the structure of the husks when a lauter or mash tun is used, as in this case the husks are needed to build up the filtration bed. The husks are more elastic and will be less damaged during milling when they are more humid. Therefore, the malt is usually made humid (called “conditioned” or “wet” milling) before it is milled. Dry or wet milling is performed in a roller mill. When modern thin-bed mash filters are used, filtration is performed using a filter cloth and intact husks are not needed. For this case, malt is milled very finely using a hammer mill. In modern mills, the milling is performed in the presence of de-aerated water to avoid oxygen take-up, using a disc or rotor–stator system.

Type of Milling

- Dry milling
- Wet milling
- Milling with Conditioning

Dry milling

- Dry milling is the most popular milling technique. The degree of malt modification, the position and the type of roll surface (smooth or fluted) determine the particle distribution. Roller and hammer mills can be used for dry grinding. Rolling mills operate by passing the malt through the narrow gap between pairs of closely spaced rotating rolls. Various roll arrangements are possible: 2, 3, 4, 5, or 6 rolls. Most designs have 2 or 3 pairs with an intermediate separation stage or stages.
This enables the fine material, which does not need further milling, and the husks to be separated from coarser material, which does need further milling. Oscillating (frequency of 6–12 Hz) sieves perform the separation steps. The sieves are equipped with a large number of rubber balls or other proprietary sieve cleaners. The mill with 6 rolls gives the best results and is used most frequently.

**Wet milling**

- The moisture content of the husks can be raised to 20% by keeping the endosperm nearly dry in a hot water conditioning mill. This process is referred to “hot water conditioning” (Anon. 1999). In this case, the endosperm is squeezed from the husk through a single pair of rolls. After milling, mashing water is immediately added. The quantity of conditioning water depends on the malt quality, degree of modification, and achieved steeping degree.
- In the “steep conditioning” process, the moisture content is raised to a much greater extent and becomes part of the mashing process. Typically, steeping lasts between 10 and 30 min at a temperature between 30 and 50 °C. The temperature and duration depend on the modification and the moisture content of the incoming malt. The moisture content of the malt increases to 25–30%. The total milling and mashing-in time is in the range 30–45 min.

**Milling with Conditioning**

- In this process, the malt is moisturized with cold or hot water, or steam. Moist husks are more pliable and will be less damaged in a roll mill. The temperature inside the kernel may not exceed 40 °C to avoid damage to the enzymes. The total water content increases by about 0.7%. This corresponds to an increase in water content of the husks of 1.5–1.7% and 0.3–0.5% of the endosperm. The effect of the conditioning results in an increase of the husk volume of about 10–20%, an easier separation of the grist and husks fraction, an increase in filtration rate in a lautertun, an increased yield and attenuation, and a faster starch degradation. Conditioning can be performed using a conditioning screw where the malt is wetted when it passes through a screw conveyor.
Mashing

- Mashing starts with mixing the grist and brewing water (called “mashing-in”). Hydration enables the malt enzymes to become active. Today, mashing-in is part of the milling process, where it is performed in the milling equipment. Formerly, a “premasher” (“foremasher” or “grist hydrator”) mixed the grist and the water on their way into the mash vessel. Deaerated water is used to minimize oxygen uptake. Typically, 2–4 hL water is used for 100 kg malt, depending on the selected brewing method and density of the produced beer. During mashing, the malt content is solubilized by making use of the enzymes of the malt and the extract is obtained. By manipulating the temperature profile and the duration of rest periods at specific temperatures, the brewer is able to influence the composition and efficiency with which the malt is extracted. The mashing operation will influence the alcohol content of the beer, the concentration of unfermented sugars in the beer, the peptide and amino acid profiles of the wort, the yeast nutrient concentration, the buffering capacity and pH of the wort and beer, the β-glucan content of the beer, and some beer physical properties such as foam, color, and clarity.

Mashing Methods

- Mashing is performed in a mashing vessel (also called mashing tun, mash mixer, or mash converter). Nowadays, it is constructed in stainless steel and heated with steam through semicircular pipes welded on the tun bottom and body. An agitator is used to ensure efficient and homogeneous mixing during mashing. Possible rest periods, which are chosen at the temperature optima of the enzymes, are at the following temperatures:

  - 45–50° C for proteolysis and β-glucan degradation;
  - 62–65° C for maltose production (β-amylase);
  - 70–75° C for saccharification (α-amylase); and
78° C as the final mash temperature to inactivate the carbohydrate enzymes and fix the amount of fermentable sugars

- Infusion Method
- Decoction Method

**Infusion Method.**

- In infusion processes, the entire mash is heated up (with appropriate rest periods) to the final mashing temperature. Infusion methods can be classified as increasing temperature (German infusion method) and decreasing temperature (English infusion method) infusion processes (Fig. 20.3 shows some examples). A classical German infusion method starts with a rest period at 45–50 °C (proteolysis) for 30 min. Next, the temperature is raised to 62–65 °C and kept at this temperature for 30–45 min (b-amylase). The next rest period is at 70–75 °C until complete saccharification (a-amylase). The process ends at 78 °C. In the English infusion method, the temperature is initially raised by adding hot water to the mash. This method requires well-modified malt, because a part of the active enzymes are destroyed by the addition of hot water. An alternative English method is to perform the conversion processes at a single temperature, usually 63–65 °C (“isothermal infusion mashing”). These English infusion methods are used for the production of ales (top fermentation), where both mashing and wort separation take place in the same vessel (O’Rourke 1996). The advantages of the infusion method are that this process can be easily automated and controlled, and energy consumption is 20–30% lower than for the decoction method (Kunze 1999). Disadvantages are the rather worse iodine reaction and the possibly rather lower brewhouse yield

**Decoction Method**

- In decoction processes, the temperature is increased by moving part of the mash from the mash converter to the mash cooker where it is boiled (possibly also with carbohydrate rest periods in the mash cooker). By pumping it back to the remainder of the mash in the
mash converter, the temperature of the total mash is increased to the next higher rest temperature. The decoction method is traditionally used in Germany for the production of lager beer.

Depending on the number of boiled mashes, decoction methods can be classified as single-, two-, and three-mash processes. Today, only the single- or two-mash processes are used. The three-mash process consumes a lot of energy and is only used for the production of some special beers.

The removal and boiling of the boiled mashes have the following effects:

• Less protein breakdown in the boiled mash because of more rapid heating;
• More extensive gelatinization and saccharification of the starch;
• Increased extraction of the husks;
• Increased formation of melanoidins (Maillard reaction);
• Increased removal of dimethyl sulfide (DMS);
• Reduced amounts of active enzymes in the total mash; and
• Possibly a higher brewhouse yield

Mashing schemes

• Increasing infusion mashing
Decreasing infusion mashing

Two mash decoction process.

Enzymatic Degradation Processes

- Starch Degradation
- Cell Wall Degradation
- Protein Degradation
Starch Degradation

- Starch is degradated by α- and β-amylase, limit dextrinase, maltase, and saccharine. Gelatinized starch is needed for β-amylase in order to degrade starch efficiently. Barley starch gelatinizes in the presence of amylases at 60°C. Rice starch gelatinizes at 80–85°C and thus needs to be gelatinized before it is added to the mash. Pregelatinization is performed in an adjunct cooker. The action of the α-amylases will result in a decreased viscosity of the gelatinized starch (“liquefaction”).

The complete degradation of starch to maltose and dextrines by amylases is called saccharification. Starch breakdown must be monitored because residues of undegraded starch and dextrins cause starch hazes in beer. Starch degradation can be easily monitored by checking the color of a mixture of a mash sample and an iodine solution (iodine test): a positive starch is indicated by a blue/black color. α-Amylase is active during malting (5–10% starch degradation), but is much more active on gelatinized starch. It needs Ca²⁺ as a cofactor, and does not produce maltose during degradation. β-Amylase is present during malting, but is not active. It produces maltose, β-dextrins, glucose, and maltotriose from amylose and amylopectin. Limit dextrinase breaks the 1,6-bonds in small, branched dextrins. Its presence in malt is limited. Maltase hydrolyses maltose into glucose molecules. However, it is not active above 40°C.

- Cell Wall Degradation
  Cell walls are essentially composed of β-glucan and hemicellulose. Cell wall degradation starts during malting and continues during mashing by endo-β-glucanases, β-glucansolubilase, and endo-xylanase. An insufficient degradation of highMWβ-glucan molecules results in a high viscosity and can give problems during wort and beer filtration. The extent of the problems can be diminished by the extent of malt modification or adding commercialβ-glucanase preparations. An insufficient degradation of pentosans (hemicellulose) can result in filtration and haze problems (CootePentosans (also called arabinoxylans) can be degraded to arabinose and xylose by xylansolubilase, endo- and exo-xylanase, arabinosidase, and xylobiase.
Protein Degradation

- Protein degradation products influence fermentation and beer flavor (lower molecular weight (MW) degradation products), palate fullness (amino acids and higher MW degradation products), color (Maillard reaction), and beer foam (higher MW degradation products). A too extensive proteolysis gives bad foam, too dark color, poor palate fullness, but a good colloidal stability. During malting and mashing, 35–40% of the total protein content is degraded. During malting 60% of the amino acids are produced, the rest during mashing. Carboxypeptidases play an important role in the production of amino acids, due to their optimal pH and temperature conditions. The enzymatic breakdown of proteins occurs predominantly at 45–55 °C, but does not stop even at higher temperatures. With a rest period at 45 °C, lower MW products are formed. It is necessary to supply yeast with sufficient amino acids for growth and metabolism. The \( \alpha \)-amino nitrogen concentration must be at least 20 mg/100 ml wort (Kunze 1999). Worts from normally modified malts always contain sufficient \( \alpha \)-amino acids. At 55°C, more high-MW compounds are produced. When mashing with well-modified malts, the extent of proteolysis is much less than that derived from the malting process (Lew is and others 1992). A long rest at 50 °C always results in a poor foam.

Wort Separation (Lautering)

- During the lautering process (also called “wort separation” or “mash separation”) the undissolved substances are separated from the wort. The insoluble part (spent grains) consists of the husks, the seedlings, and other insoluble material. Wort separation is a filtration process. As much of the extract as possible should be recovered during lautering. The extraction efficiency is measured as “extract yield”, which is the ratio of the mass of extract to the mass of malt or malt and adjunct. The filtration can be performed in a lautertun or a mash filter. Developments in wort separation, which have been introduced over the last 15–20 years
Possibilities of energy recuperation with atmospheric or pressure boiling

Pressurewort copper with vapor condenser (pressureless); energy storage system and wort heating
1. wort collecting vessel, 2. wort kettle, 3. wort heater, 4. vapor condenser, 5. energy storage tank
Process layout including wort stripping
1. wort kettle, 2. sedimentation tank (wort clarification), 3. wort stripper (packed with Cascade Rings from Glitsch), 4. wort cooler.

Schematic of a brew house featuring Merlin and whirlpool with energy storage

**Beer Fermentation Technology**

- Batch Fermentation Technology
- Beer Fermentation Using Immobilized Cell Technology

**Production of Whisky**

- One of the world’s greatest alcoholic drinks is whisky (whiskey). The term “whisky (whiskey)” was derived from the Gaelic “uisgebeatha”, equivalent to the Latin term “aqua vitae”, meaning “water of life”. It was invented by accident by alchemists before the eleventh century and they gave the drink this name (Gavin 1997).

**SCOTTISH WHISKY**

- The word “Scotch” is, of course, a contraction of “Scottish whisky” and was first used in the mid-nineteenth century (Benitah 2002). Scotch malt whisky was well established in Scotland by the end of the fifteenth century, and approximately 700,000 kiloliters (kL) is produced per year. It is consumed in over 200 countries worldwide (Tsuchiya 2006a).

There are three types of whisky in Scotland:

- Malt whisky,
- Grain whisky, and
- Blended whisky

**Malt Whisky**
Scottish malt whisky is produced by using barley, water, and peat as the raw materials. Barley locally grown in the northeast of the country was originally used. However, some of the greatest Highland distilleries today also use imported barley. Large grain two-row barley, with high starch and low protein content, is preferred.

Process

- Malting
- Mashing
- Fermentation
- Distillation
- Maturation
- Bottling

Malting

- Malting is the first step in making whisky. Malt is barley that has been persuaded to germinate by soaking in water and has then been dried by the application of heat. The “Steeping” or soaking period in the tank is usually 2 to 3 days. The water is drained off and the grain spread out to a depth of 20–30 cm on a concrete or tiled floor in the malting house. The water content of the barley rises to approximately 43% by this soaking or steeping process. Barley begins to germinate on the malting floor and generates energy that raises the temperature. The barley is turned with rakes and wooden shovels by maltmen every 4 or 6 h in order to maintain approximately 168°C temperature and to prevent growing roots tangling each other. After 7 to 10 days, the growing stem of the barley becomes one-half to five-eighths of the length of the seed. To stop the germination, green malt is transferred to the drying kiln, which has a unique chimney. The floor of the kiln is a drain board made of perforated iron or wire mesh. The green malt is spread on this floor at a depth of 70 cm to 1 m, depending on the Design of the kiln, and dried in smoke rising from a peat fire below the floor. Besides peat, coal and coke are often used as fuel and the barley is dried for 40–55 h until the moisture content
becomes 3–4%. The peat smoke gives a special smoky flavor to the green malt and to the final product: mature whisky. A growing number of distilleries no longer do their own malting, but buy their malt ready-made from maltsters, peated to the desired degree. The kiln building is only kept as a symbol of such distilleries.

The dried malt is moved to the malt mill and ground to fine grist consisting of husk, grits, and flour in the ratio 2 : 7 : 1. The malt grist is placed in a container known as mash tun and hot water is added. The shape and size of mash tuns vary and they are made from stainless steel, copper, or cast iron, usually with a lid. Mashing or extraction of the malt is carried out three or sometimes four times with hot water, each time at a different temperature, ranging from about 60 °C for the first process to 100 °C for the last. Mashing with hot water dissolves the starch from the malt and also activates the amylase that decomposes the starch to maltose. Wort (the resultant liquid) is drawn off from the base of the mash tun through the finely slotted bottom, cooled to around 20 °C, and passed into fermentation vessels, or washbacks. The residual solids (draff) are removed from the floor of the mash tun and used as cattle feed.

**Fermentation**

The washback is made of wood or stainless steel and has a lid that incorporates a rotating blade that prevents foaming over the sides. When the washback is two-thirds full, yeast is added in liquid or solid form to the wort and fermentation takes place at 17–35 °C for 48 h (on average). The inoculated yeast converts maltose into glucose, and then alcohol and carbon dioxide (CO2) are produced from glucose. Yeast also produce small amounts of other compounds such as a wide range of esters, aldehydes, acids, and higher alcohols. Many of these are flavor elements. The fermented wort (wash) is a sweet peaty beer-like liquid with an alcoholic content of 7–8%.

**Distillation**

Distillation, is what actually produces the whisky. Scottish malt whisky has been traditionally distilled in onion-shaped stills (pot stills), which are large copper kettles with narrow necks called lyne arms or lyne pipes that curve and enter the condenser, often
located in the open air outside the still house. The shape and size of the pot still affect the quality of the whisky produced. Stills come in three basic designs, the “onion” being the most common, and the “boil-ball” and “lantern” shape. The way these designs are interpreted – as to capacity, height, method of heating, angle of the lyne arm, and so on – differs from one distillery to another, and varies the quantity of volatiles that will end up in the spirits. Traditional direct firing either by coal or gas to heat up the pot still is retained by many distilleries. However, a large number of distilleries have now switched to heating the stills by means of internal steam exchangers. The direct-fired wash stills have “rummagers” (revolving arms) to prevent solids in the wash sticking to the bottom of the still and scorching. The area of copper that comes into contact with the wash and low wines is another consideration in still design. Copper dissolves easily and has a decisive influence on the quality of the spirit, as it removes sulfury or vegetable aromas by a chemical reaction.

**Maturation**

The immature spirit, called new pot or new spirit, is piped to the filling station, where it is diluted with water until its strength is reduced to 63.5% by volume of alcohol. This diluted spirit is stored in casks made either from American white oak (Quercus alba) or European oak (Quercus robur) for maturation. Oakwood is thought to be desirable for maturing whisky because of its chemical complexity. The casks are secondhand, in that they have been used to store either sherry or bourbon, and in rare cases port or other wines. Maturation of new spirits is conducted in casks stored in warehouses called “dunnage” warehouses for at least three years undisturbed. After that they can be legally called scotch whisky.

**Bottling**

Before bottling, whisky is further diluted with water until its strength is reduced to 40–60% by volume of alcohol. Soft water, free from organic and mineral impurity, is preferred for whisky production. Whisky is usually filtrated through a cellulose filter to remove fatty
particles at a temperature between 4 and 10 °C prior to being run into bottles. Once run into the bottles, whisky does not further mature, but some chemical changes will occur. Single malt whisky is the product of a single distillery.

When bottled, the single malt may include whisky from several years’ production from the same distillery. The age shown on the bottle label means the length of the youngest whisky’s maturation period. A malt whisky that is bottled from an individual cask is called single cask whisky. A vatted malt whisky is a product that is “married” together with various malt whiskies from several distilleries.

A vatted malt whisky is labeled “pure malt” or “scotch malt whisky”. It is impossible to determine the optimum age for whisky in general terms; so much depends on the individual case.

**Grain Whisky**

In Scotland, when whisky is produced largely from maize with a small amount of malted barley that is not dried over peat fires, it is called Scottish grain whisky. In some cases, unmalted barley is also used with the maize. The unmalted cereal is crushed and then pressure-cooked in batch cookers to gelatinize the starch so that it can be released and solubilized. Wet ground malted barley is added in an amount one-fifth of the amount of unmalted cereal, followed by hot water, and the mixture is stirred.

Amylase from malted barley converts the starch to fermentable sugars, maltose. Although many distillers retain this system, there is an increasing use of continuous operation for the cooking and conversion process. Fermentation of the wort is carried out in the same way, by the action of inoculated yeast, as in the case of making malt whisky. The fermented wort, wash, is pumped into the patent still or Coffey still, which distillates wins a different system from distillation using a pot still. The patent still was first invented by Robert Stein in 1826 and was improved by Aeneas Coffey in 1831.
With the invention of the patent still, making whisky has become quicker, cheaper, and occurs in greater volumes. The product has no peaty flavor, for the malt had not been dried over peat fires.

The patent still basically consists of two linked copper columns, 12–15 m high; these are called the analyzer and the rectifier. Each is divided horizontally into tens of chambers by perforated copper plates. Steam is led into the analyzer and proceeds up the analyzer and then through the linking pipe into the rectifier. The wash is continuously pumped into the rectifier, traveling down in a coiled copper pipe and then via the connecting wash pipe into the top of the analyzer. The heated wash moves down, chamber by chamber in the analyzer, and all the alcohol contained is vaporized before the wash reaches the base of the analyzer.

The steam and alcohol vapors, which rise up through the analyzer, travel down the connecting vapor pipe (which emerges from the top of the analyzer) into the base of the rectifier. As the alcohol vapor and the steam rise up to the rectifier, chamber by chamber, the new incoming wash, coming down the rectifier in the winding pipe, is then cooled, and condensation takes place. Around 95% alcohol can be obtained when the vapor is drawn off through a cooling worm to the stainless steel spirit receivers. Alcohol strength for making whisky is regulated below 94.8% by the law of Scotland. The spirit is then diluted with water to around 70% by volume of alcohol, prior to being run into secondhand oak casks that were previously used for the maturation of malt whisky. The spirit-filled casks are left undisturbed in the warehouse for at least three years, the same as malt whisky.

The grainwhisky, being nearer to a neutral spirit than pot-still maltwhisky, takes less time to mature and changes less in the maturing process. There are two types of grain whisky; one 21.2 SCOTTISH WHISKY 515 is a single-grain whisky produced in one distillery, and the other is that produced by vatting whiskies distilled in several distilleries. The age shown on the bottle label indicates the length of the youngest whisky’s maturation period. Only eight grain distilleries are in operation; seven of these are located in Lowland Scotland.
Blended Whisky

A blended whisky is created from both single malts and grain whisky. Andrew Usher, of Edinburgh, pioneered blending in the early 1860s (Tsuchiya 2000). Blends are central to the Scotch whisky market, outselling malt whiskies at a ratio of around nine to one. Blending can involve combining around 20 to 50 different malt whiskies with two to five grain whiskies to produce mild whisky with a well-balanced flavor.

It provides the distiller with an opportunity to create a product with unique and recognizable flavor attributes. It also enables product consistency. The proportion is 60% grain to 40% malt. The proportion of grain has risen since the early days of blending, when the ratio was more likely to be 50:50. Deluxe blended whiskies generally contain a higher ratio of malt to grain than standard blends.

The blended whisky is left undisturbed in oak casks (generally plain oak) for 6 to 12 months in order to optimize the product quality. Some blenders “marry” the malts and the grains separately and bring them together only in bottling. Prior to bottling, the whisky is usually diluted to market strength, caramel is added to ensure continuity of coloring, and finally the spirit is filtered to prevent cloudiness from developing when water is added by the consumer. As for blends, the age (if any) stated on the label is the age of the youngest whisky in the blend.

CONCLUSIONS

Whisky is the world’s most consistently successful and popular alcoholic drink.

According to documentary records, it was first commerced in Scotland in 1494. Scotland, Ireland, the United States, Canada, and Japan are now the five major whisky-producing countries.
- Each country has developed its own style of whisky into something approaching a fine art. Each country’s particular style will remain essentially unchanged and be eternally inherited by successive generations.
- Recently, “light” whiskies that have a lighter flavor, color, and body have been promoted.

Production of soft beverages

Production of Cold Drink
Introduction

The concept for the soft drink system depends on the corresponding requirements to the system. In addition to a large variety of products, the degree of automation, the required flexibility during product planning, the way of providing the beverage ingredients and the required quality management system are important criteria for selecting the optimum process equipment.

Supply of Ingredients

- Crystalline sugar is stored in silos.
- Manual or automated design.
- Variants depending on volume and consistency of the basic materials: Big Bag station for processing large packs (of 200 – 1000 kg) Bag emptying station for bags up to 50 kg Barrel emptying station for frozen fruit juice concentrates, or concentrates capable of flowing, with 50 bis 78° Brix, and viscosities up to 20.000mPas
Sugar Dissolving Process

- Continuous sugar dissolving process, as hot dissolving process at a temperature of 85 °C or cold dissolving process at a temperature of 35 – 45 °C.
- Sugar processing in a batch system, in a hot or cold dissolving process.
- Filtration for decolourisation and cleaning, using individually designed filtration processes (candle filters, sheet filters, activated-charcoal filters, and others) depending on the raw material quality.
- Afterwards, syrup pasteurization in the plate heat exchanger

Concentrate Station and Powder Dissolving Station

- Processing of ready-made concentrates and essences.
- Dissolving systems for crystalline aromatic acids and powdered additives, such as caffeine

Heating System

Thermal product treatment is an essential process step between manufacture and filling of the product. In the sterile area, there are mainly components meeting most stringent hygienic requirements. All lines are based on the well-proven principle of product heating, using a heat exchanger, and a defined heat retention section. The pasteurization systems are fully suitable for CIP cleaning and built according to the rules of hygienic design. Reliable and flexible with a maximum of microbiological safety!

Multiblend Mixer

- Connection of the ingredient tank to a dosing tube and to mixing tanks.
- Ingredient dosing using a flow meter.
- Blending of the ingredients in the mixing tank using the pump-over method
Process Automation

- Option to integrate a recipe manager.
- Fully automatic control of all process areas including all product and cleaning paths.
- Documentation of all process steps using production data Acquisition.
- Integration of the line automation into a comprehensive control system

Batch Operation

- Mixing of basic ingredients in batches according to individual recipes.
- Flexible system connected to a variable number of basic ingredient components.
- Automatic production with manual feeding of the basic ingredients.

Inline Operation

- In-line blending of the soft drink products.
- Syrup variations can individually be produced from the various ingredients available in the basic ingredient dosing system.
- Fully automatic production of the individual syrup ingredients.

General Aspects

- System for processing ready-made ingredients.
- Application with a low variety of products consisting of only few basic ingredients, and for the production of large batches.
- Frequent type change-over and small batch sizes.
- Mainly manually oriented production processes.
- Cleaning concept.
- Space requirements / space provided.
- Adaptation to existing production systems.
- Completely new investment.
- Line speed.
Concepts for Soft Drink Processing
Ice Tea

Process Flow:

1) Ice Tea Extraction:

✔ Water

Hot Water

∧ Boiler

↓

Cooking & Extraction → Filtration → Storage → Separation →

2) Ice Tea Blending & Flavoring:

Sugar Syrup  Flavors  Pure Water

∧  ↓  ✔

→ Storage → Blending → Filtration → Sterilizing →

3) Bottling & Capping:

Bottle Making

↓

Unscramber → Air Conveyor  Cap

↓  ↓

→ (3-1) washing, filling & capping machine → Turnover Sterilizing → Hot & Cold Sterilizing → Blowing Dry → Inspection → Labeling → Inject Printer → Carton → Carton Packing → Palletizing → Warehouse
Coffee Drink Production

Introduction

Drink coffee is part of life of human being, but cooking coffee or coffee shop is a big job to the busy society. Therefore, Asian is popular in can cooked coffee in hot/ice, which we can enjoy anywhere anytime of living. The concept of canned coffee is coming from the icetea, which are organizing from coffee bean baking, grinding and extraction as juice in canning process. Therefore, cooked coffee can be service anywhere anytime either one / out of work period, which will provide the best convenience to the consumers,

Flow Chart of Canned Coffee Drinks:

Raw Coffee Bean
↓
De-Shelling
↓
Coffee Bean Baking
↓
Coffee Bean Crushing
↓
Coffee Juice Extracting
↓
Mixing
↓
Can Filling and Capping
↓
Sterilizing
↓
Finished Product in Can
↓
Carton Packing
↓
Palletizing
↓
Warehousing

Papaya Juice
Introduction

The papaya is the fruit of plant. It is native to the tropics of the Americas, and was cultivated in Mexico several centuries before the emergence of the Mesoamerican classic cultures. It is sometimes called "big melon" or "pay paw," but the North American pawpaw is a different species, in the genus Asimina.

The fruit is ripe when it feels soft (like a ripe avocado or a bit softer) and its skin has attained amber to orange hue. The fruit's taste is vaguely similar to pineapple and peach, although much milder without the tartness.

General Process as follows

1. De-Skin:

   Peeling off the papaya skin should be necessary, which will be upgraded the juice quality and production yield.

2. Manual Peeling Skin:
Skin peeling will be operated by manual rather than automation, since different sizes of papaya will make machine automation getting trouble, also damage the fruit.

3. **Fruit Pretreatment:**

   a. Manual skin peeling and seed cleaning will be arranged beside the conveyor table GHC-05 in two side workers. The papaya fruits will be fixed by fixture for easy cut and peeling.

   b. Waste of skin will be drop from conveyor table to the underneath conveyor for waste disposable storage, then the fruit pulp will feed into, the GHI-03 crushing.

   c. The fruit pulp will be passing through juicer GHC-07, and then the juice will be pumping into the storage tank to wait for further PH flavoring, pasteurizing and cold storage.

   d. The container of 20 liter tin can will be durability from 0.5

**Processing Flow Chart**

I. **Fruit Pretreatment Section:**

```
Papaya Fruits
↓
Cutting & Peeling conveyor table GHC-05
↓
Bucket Elevator
↓
Fruit Crusher GHJ-03
↓
Fruit de-juice GHJ-07
↓
```
Several Storage Tanks
   ↓
Sanitary Pump
   ↓
Homogenizer GHJ-9
   ↓
Pasteurizer GHJ-11
   ↓
Weight Filler GHJ-15
   ↓
Juice concentrated Can – 20 liters
   ↓
Storage in warehouse life time 1/2~ 1 year

2. Packaging Plant

Storage Tanks
   ↓
Pump
   ↓
Filtration
   ↓
Plate Heat Exchanger cooling
   ↓
Product tanks
Pump GHJ-0413

Can filling & Seaming

Tunnel Pasteurizing

Date Coding / Labeling

Cartoon Packaging

Warehousing
References

- http://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=5&cad=rja&ved=0CEwQFjAE&url=http%3A%2F%2Fncbe.ac.uk%2Fncbe%2Fprotocols%2FPDF%2FFerment.pdf&ei=6ybzUsCnFMWNrgfKtIHYBQ&usg=AFQjCNGGtTxzix9bd5W5EQEINDRrSXwTIJ8A&sig2=aE0g9UsURqL0-c84evhqQ
- http://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=9&cad=rja&ved=0CGwQFjAI&url=http%3A%2F%2Fchangelabsolutions.org%2Fsites%2Fdefault%2Ffiles%2FChangeLab-Beverage_Industry_Report-FINAL_%28CLS-20120530%29_201109.pdf&ei=6ybzUsCnFMWNrgfKtIHYBQ&usg=AFQjCNFk0Jqqw e0MnThbO91X8P0r5btSug&sig2=LuoDd_M_MB8Qge22r97t7A