# Bee Product Processing -Level-II

Based on October 2019, Version 2 Occupational standards

## Module Title: Operating a Mead Maturation Process

**LG Code:** IND BPP2 M14 LO (1-5) LG (46-50)

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Educational, Scientific and
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**Instruction sheet**

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Confirming maturation requirements
- Confirming clarification requirements as specifications
- Confirming materials availability
- Confirming Services
- Checking maturation equipment
- Setting the maturation process

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Confirm maturation requirements
- Confirm clarification requirements as specifications
- Confirm materials availability
- Confirm Services
- Check maturation equipment
- Set the maturation process

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets”
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

## Information Sheet 1- Confirming maturation requirements

In order to implement mead maturation process, confirming the requirements for the operation is mandatory. This enables us to carry out the operation successfully.

### Definition of terminologies

**Mead** is an alcoholic beverage made by fermenting a mixture of honey, water and different type of additives.

**Clarification:** is the process of eliminating (removing) or killing (deactivating) of all forms of life and other biological agents such as yeast and bacteria to significant amount to a harmless level for the honey wine stability.

**Filtration:** is a process of separating impurities from mead brewery

### 1.1. Mead maturation requirements

**Nutrients**

Yeast requires nitrogen in the fermentation phase of growth. Because honey is a poor source of nitrogen, mead fermentations without adequate nutrition are notoriously slow. The addition of yeast nutrients (diammonium phosphate), yeast energizer (diammonium phosphate, magnesium sulfate, yeast, folic acid, niacin, sodium pantothenate and thiamin), yeast hulls or yeast extract is very important to promote complete and rapid fermentation. These materials are readily available and their use is encouraged. We have been using both yeast nutrients and yeast energizer at two-fifths tablespoons per gallon (1.1 mL per liter) or two tablespoons (29.6 mL) in a five-gallon (19-liter) batch.

**ACIDS**

Acids have a key role in mead maturation process. The use of acids such as citric, malic, tartaric, acid blend or lemon juice has been widely recommended to balance any residual sweetness in the finished mead. Some sweet-acid balance is desirable but optional. Furthermore, the addition of acids before fermentation can reduce the pH of the honey. Small amounts of acids, such as malic, tartaric and citric acid are added to balance the flavor. Their tartness offsets the sweetness of the honey while combining

with the alcohol to give a degree of stability against spoilage. Some experts recommend an acid blend composed of twenty-five percent citric, thirty percent malic and forty-five percent tartaric acids.

**SULFITES**

Sodium bisulfite or potassium metabisulfite in tablet or powder form are commonly used for sanitation in wine making. The most common preservative used in winemaking is sulfur dioxide (SO2), normally added in one of the following forms: liquid sulfur dioxide, sodium or potassium metabisulphite. Another useful preservative is potassium sorbate.

Sulfur dioxide has two primary actions, firstly it is an anti- microbial agent and secondly an anti-oxidant. In the making of white wine it can be added prior to fermentation and immediately after alcoholic fermentation is complete. If added after alcoholic fermentation it will have the effect of preventing or stopping malolactic fermentation, bacterial spoilage and help protect against the damaging effects of oxygen.

**Potassium sorbate** is effective for the control of fungal growth, including yeast, especially for sweet wines in bottle. However, one potential hazard is the metabolism of sorbate to geraniol which is a potent and unpleasant by-product. The production of geraniol occurs only if sorbic acid is present during malolactic fermentation. To avoid this, either the wine must be sterile bottled or contain enough sulfur dioxide to inhibit the growth of bacteria. Sterile bottling includes the use of filtration.

Some winemakers practice natural wine making where no preservative is added. Once the wine is bottled and corked, the bottles are put into refrigeration with temperatures near 5 °C (41 °F).

**STABALIZERS:** When making still mead, potassium sorbate, or wine stabilizer, can be added at the bottling stage to prevent a second fermentation by killing remaining yeast cells.

**Calcium carbonate ($CaCO_3$)**

Calcium carbonate also has a role in mead maturation process. It is used when the nutrient level in mead becomes low. These low nutrient levels in honey may cause unnecessarily long and slow fermentation, therefore add plenty of yeast nutrients. Poorly buffered honey may result in the pH falling to unacceptable levels during fermentation; therefore the addition of CaCO3 may prevent this pH decrease and accelerate the fermentation.

**Green young mead**

In mead maturation process, presence of green mead or young mead is very important. Green mead is used for maturation process or in which final matured or aged mead is developed from. Thus, before starting the maturation process, checking the presence of younger age of mead very important.

After mead has been prepared, storing green or young mead in appropriate place is very important as to maintain its quality. To store mead, it needs a cool, dry place away from direct sunlight. The storage temperature should ideally stay between 50 to 60 degrees Fahrenheit, with relatively low humidity. Temperature factors into aging, with higher temperatures accelerating the aging process and lower temperature affects the fermentation process.

## 1.2. Mead maturation process

**Monitoring temperature**

Monitoring temperature in mead maturation process is essential to maintain the mead quality. Temperature affects various reactions involved in wine maturation. During fermentation the must should be maintained at a constant temperature of 20° to 25 $^0$C but not exceeding 28 $^0$C. The exact temperature is not absolutely critical since fermentation will also take place at other temperatures but at different speeds. The longer the fermentation, the greater the risk of contamination by other bacteria or yeasts will become. At higher temperatures fermentation will be faster, but will produce less alcohol. At lower temperatures fermentation will become progressively slower and eventually stops.

**Filtration**

Filtration is a process of separating impurities from mead brewery. Filtration activity is very important operation in mead preparation that is implemented before bottling**.** Once mead aging or maturation is completed, then the mead is filtered into the bottling tank and then bottled. The whole process usually takes about 3 months, except for some of other special releases which may age in barrels for nearly a year.

Filtration in winemaking is used to accomplish two objectives, clarification and microbial stabilization. In clarification, large particles that affect the visual appearance of the wine are removed. In microbial stabilization, organisms that affect the stability of the wine are removed therefore reducing the likelihood of re-fermentation or spoilage.

**Conditioning**

Just like long-term wine or beer storage, the best temperature for mead storage is about 70 degrees, so room temperature for most people. However, just as with storing wine for long periods, extreme fluctuations in temperature should be avoided, as temperatures above 70 degrees can negatively impact the mead. As a result, you want to store your mead in a dark, dry location that is neither too hot nor too cool. A cabinet indoors is a good idea; better still is one temperature controlled, just like for wine storage. Excessive temperature swings and excessive oxidation by sunlight can cause mead to skunk, just as the same can occur with fine wines and ales. If you plan to store mead for long periods (nothing wrong with drinking it as soon as possible, though!) then some sort of planned storage is a good idea.

**Production quality checks**

Many reactions occur during the maturing and aging phases which lead to significant changes in the composition of the wine. Many of these changes are subtle and, in some cases, so small that their impact on the sensory properties of wine is not noticeable. On the other hand, certain reactions have a noticeable effect on the various physical attributes of wine, and they play a significant role in wine maturation and aging. Generally, during the process of maturation and aging, the most obvious change occurs in the color of the wine. In white wine, the color becomes golden, and later, can turn to brown if the wine is aged too long. In red wine, the purple and violet tints are progressively replaced by orange and brick red colors. The honey-derived aromas fade,

and more complex and pleasing aromas develop. The taste of the wine also changes. Astringent and harsh tastes are replaced by smoother, rounder tastes. The various taste and aroma components integrate, yielding complex, rich, and delicious wines. The quality parameter of mead is determined by using organoleptic methods (color, taste and mouth feel, aroma) and laboratory analysis of chemical compositions.

**Transferring matured mead to bright mead tanks**

After fermentation is complete, the mead is stabilized and fined. Then it is transferred either into oak barrels, or stainless steel tanks for aging. During the aging process, the mead maker takes samples to determine how it is progressing. The mead must be released once it has matured enough, not based on a time-table or formula. This is the art of mead making.


**Figure 1:** Transferring matured mead to bright mead tanks

| Self-check 1 | Written test |
|---|---|

Name…… ID…… Date…….

**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

1. What are the most important additives and agents used in mead maturation process (6 point)

You can ask you teacher for the copy of the correct answers.

***Note:*** **Satisfactory rating - 4 points** **Unsatisfactory - below 4 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short answer questions**

1. _____

_____

_____

## Information Sheet 2: Confirming clarification requirements as specifications

Clarification is an important activity in mead maturation process. This activity requires appropriate equipments, different additives and agents for the operation as required specification.

### 2.1. Clarification requirements

The process of clarification is concerned with the removal of particles; those larger than 5–10 millimetres (0.20–0.39 in) for coarse polishing, particles larger than 1–4 micrometres for clarifying or polishing. Microbial stabilization requires a filtration of at least 0.65 micrometres for yeast retention and 0.45 µm for bacteria retention. However, filtration at this level may lighten a wine's colour and body. Microbial stabilization does not imply sterility, i.e. eliminating (removing) or killing (deactivating) of all forms of life and other biological agents. It simply means that a significant amount of yeast and bacteria has been removed to a harmless level for the honey wine stability.

Clarification of the honey-wine can take place naturally by putting the honey-wine or mead into refrigeration at 35 °F (2 °C). The wine takes about a month to settle and it is clear. No chemicals are needed.

**Specification of additives and agents**

**ACIDS**

Honey, despite its low pH, has low acidity, about 2-3 gallons per liter (g/L), and less than 1g/L after dilution with water. It usually will benefit from some level of acidulation, especially if there is considerable residual sugar. As noted earlier, acid additions are better made after fermentation. Acids such as tartaric, malic, citric or a blend of these three are generally used.

Small amounts of acids, such as malic, tartaric and citric acid are added to balance the flavor. Their tartness offsets the sweetness of the honey while combining with the alcohol to give a degree of stability against spoilage. Some experts recommend an acid blend composed of twenty-five percent citric, thirty percent malic and forty-five percent

tartaric acids. The acids are responsible for much of the sharp taste of wine, and it contributes to both the biological stability and the longevity of wine.

**Table 1:** Amount of acids required per litter in mead maturation process

| Common acid Type | Quantity (grams/liter) |
|---|---|
| Tartaric | 1 - 5 |
| Malic | 1 - 4 |
| Succinic | 0.4 - 1 |
| Lactic | 0.1 - 0.4 |
| Citric | 0.04 - 0.7 |
| Acetic | 0.05- 0.5 |

**SULFITES**

Sodium bisulfite or potassium metabisulfite in tablet or powder form are commonly used for sanitation in mead making. The most common preservative used in winemaking is sulfur dioxide ($SO_2$), normally added in one of the following forms: liquid sulfur dioxide, sodium or potassium metabisulphite. Another useful preservative is potassium sorbate. Sulfur dioxide has two primary actions, firstly it is an anti- microbial agent and secondly an anti-oxidant. In the making of white wine it can be added prior to fermentation and immediately after alcoholic fermentation is complete.

When added to honey mead, sodium or potassium metabisulfite releases sulfur dioxide ($SO_2$), which is the active ingredient responsible for stunning wild yeasts and microorganisms. The pH of the mead affects the amount of free $SO_2$ present and should therefore be taken into account. Table 1 shows the recommended levels of $SO_2$ to treat honey-wine and these values may be directly substituted in mead. Although these values represent the optimal levels of sulfite required to release an appropriate dose of $SO_2$. When the pH of the mead drops 3.2, the yeast activities are inhibited. The addition amount of sulfite depends on the pH of the mead.

**Table 2:** Required amount of $SO_2$ as pH condition of the mead

| PH of the mead | Required ppm free SO2 |
|---|---|
| 3.0 | 40 |
| 3.2 | 60 |
| 3.4 | 70 |
| 3.6 | 80 |
| 3.8 | 120 |

**Potassium sorbate** or stabilizer Crystals is used in winemaking to 'stabilize' a wine and prevent a renewed fermentation (especially when sweetening a wine prior to bottling. Potassium sorbate does not kill yeast cells but instead inhibits the yeast cell from being able to multiply, grow and begin a new fermentation.

Some winemakers practice natural wine making where no preservative is added. Once the wine is bottled and corked, the bottles are put into refrigeration with temperatures near 5 °C (41 °F).

**Potassium sorbate** is effective for the control of fungal growth, including yeast, especially for sweet wines in bottle. In honey mead production, sometimes, the pH of the mead drops during fermentation. Fermentation can quickly drop the pH to a level below which the yeast are inhibited (Below a pH of 3.2, most wine yeasts start to struggle). In order to support a healthy fermentation your must should have at least 300 ppm potassium. Although you could supplement the mead with potassium by adding any potassium salt and separately adjust the pH with calcium carbonate or sodium bicarbonate with 3.4 grams per gallon will effectively reduce acidity by 0.1%.

**STABALIZERS:** When making still mead, potassium sorbate, or wine stabilizer, can be added at the bottling stage to prevent a second fermentation by killing remaining yeast cells.

| Self-check 2 | Written test |
|---|---|

Name…… ID…… Date…….

**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

1. What are the important acids added in mead during maturation? (6 point)
2. What are the important stabilizers in mead maturation? (4pts)

You can ask you teacher for the copy of the correct answers

***Note:*** **Satisfactory rating – 6 points** **Unsatisfactory – below 6 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short answer questions**

1. _____
   _____
   _____
2. _____
   _____
   _____

## Information Sheet 3: Confirming materials availability

In mead maturation process, confirming the availability of material (clarifying and fining agent) is very important. Since, it is impossible to carryout mead maturation process without the availability of materials. Materials have a key role in maintaining the quality of the mead through preserving and keeping the flavor of the mead.

**Clarifying agents**

Clarifiers help the coagulation of proteins created by the hot break. Irish moss and whirfloc are both commonly used by home brewers for the clarification of their wort.

Irish moss is a species of red algae composed of an abundance of carrageenan. The carrageenan, in hot wort, helps to coagulate, or clump together, proteins. Coagulated proteins drop out of suspension much more readily, and help prevent chill haze down the line. Common dosage is ½ teaspoon per 5 gallons, and is added 15 minutes from the end of the boil.

Whirlfloc is a very similar product. It is made from irish moss, processed into an easy-to-use tablet form. Dosage is 1 tablet per 5 gallons, added at 15 minutes from the end of the boil.

## Finings

**What is the purpose of using a fining agent?**

The purpose of adding a fining agent to wine is to soften or reduce its acidity and/or bitterness; remove proteins capable of haze formation; or reduce Colour by the adsorption and precipitation of polymeric phenols and tannins. The fining agent reacts with wine components either chemically or physically, to form a new complex that can separate from the wine.

**What is the best way to apply fining agents?**

Fining should be carried out only when necessary and using lower rather than higher addition rates, as it is possible to remove positive flavor characteristics. It is important, however, that sufficient fining agent is added when the prime purpose of fining is to achieve stability and/or to remove undesirable sensory characters. It is essential that

identical components used in the cellar for the finished wine is replicated in the laboratory trials. A control, where no addition is made, should always be set up so that the sensory effect of the addition can be assessed.

**What are some of the most commonly-used fining agents?**

Some of the most commonly-used and permitted fining agents for wine are:

**Gelatine**

Gelatine is added to honey wine, and particularly pressings, to aid clarification and to reduce the level of phenolic compounds associated with bitterness, astringency and browning. It is added to red honey wine to reduce the level of phenolic compounds associated with excessive bitterness and astringency and might also remove some colour. Gelatine interacts mainly with larger polyphenolic compounds and sometimes it is added in conjunction with tannin to provide better clarification.

**Application methods:** The temperature of the wine should be about 10°C. The liquid form of Gelatine can be added directly to the wine. Accurately measure out the required volume. Add the liquid to the wine slowly and with thorough but gentle mixing. Allow a few days for settling, then rack or earth filter.

**Bentonite**

Bentonite is a type of very fine clay made of aluminum-silicate. It is distinct from other clays in that it is formed from volcanic ash. Bentonite is principally used to remove proteins from honey wine and juice, as it is a negatively charged clay colloid and reacts with positively charged proteins, precipitating them from the honey wine. Use of bentonite in red honey wines should be limited because of its ability to reduce Colour by adsorption of anthocyanins.

**Application methods:** prepare a 5 % w/v solution by weighing out the required amount of bentonite and slowly adding, with stirring, to an adequate volume of water which has been heated to about 60°C. The suspension is left to stand overnight and used the next day. Mix well before addition. It is important that the bentonite is thoroughly dispersed in the slurry. If the suspension settles out or forms lumps, break up the lumps, reheat and stir vigorously to re-suspend the bentonite. To reiterate, it is important that the same

batch of bentonite is used in both the laboratory trials and in the cellar. Additionally, the bentonite suspension should be prepared under conditions as similar as possible to those existing in the cellar; with respect to water, water temperature, composition, and time of rehydration before use.

**Carbon**

Carbon can be used to remove off-flavors and odors from wine, to decrease browning or pinking in white wines and to remove colour from red wines. There are two forms of carbon: ‘decolorizing’ carbon normally marked KBB and ‘deodorizing’, normally marked AAA. Carbon works well in combination with PVPP in both tasks. The compounds to be removed are physically adsorbed to the large surface area of the carbon particles. The adsorption rate on the carbon surface is typically very fast. Carbon is regarded as a severe and relatively non-specific fining agent and therefore should be used with care. Special care should be taken to avoid exposure to carbon: use eye protection in combination with breathing protection.

**Application methods:** Weigh out the required amount of carbon. It can be added to the wine by direct addition of the powder or as slurry, with thorough mixing. Allow a few days for settling, then earth or pad filter.

**Polyvinylpolypyrrolidone (PVPP)**

PVPP is a synthetic polymer used to reduce the level of phenolic compounds associated with browning and astringency in white honey wine. It can also be used to remove pink colour and pinking precursor compounds in white honey wines. PVPP is practically insoluble in honey wine and absorbs the low molecular weight phenolic, especially anthocyanins and catechins. PVPP is a gentle fining agent which preserves wine aroma, unlike some other fining agents. When used for colour reduction in white honey wines, combining with carbon is more effective in many cases, as it helps with clarification of the carbon particles. PVPP is not commonly used in red honey wines; however, it can reduce bitterness and brighten the colour. In many cases PVPP can also reduce certain off-flavors and bitterness.

**Application methods:** Accurately weigh out the required amount of PVPP and make slurry with minimal volume of distilled water. Add the slurry slowly with mixing to the wine, allow a few days for settling, then earth or pad filter.

**Table 3:** Comparison of fining agents and their different capabilities

| **Comparison of Fining Agents** | | | |
|---|---|---|---|
| **Colour removal** | **Tannin removal** | **Tendency to over fine** | **Clarity and stability** |
| Carbon | Gelatine | Carbon | Bentonite |
| Gelatine | Egg white | Gelatine | Carbon |
| Casein | Isinglass | Egg white | Isinglass |
| Egg white | Casein | Isinglass | Casein |
| Isinglass | Bentonite | Casein | Gelatine |
| Bentonite | Carbon | | Egg white |

**Table 4:** Typical rates of additions of fining agents in honey wine

| Fining agents | Typical doses used (mg/L) | Characteristics |
|---|---|---|
| Gelatine | 15 – 120 | Good clarity. Effective in reducing bitter after-taste. |
| Isinglass | 10 – 100 | Good clarity. Intensifies yellow colour. Light flakes, bulky, settles slowly. |
| Casein | 50 – 250 | Good clarification. Treats and prevents oxidation. No over fining. |
| Bentonite | 200 – 1000 | Average clarification. Treats and prevents protein instability and reduces the likelihood of copper cases. Facilitates settling. Avoids over fining. |
| Carbon | 50 – 2000 | Removes off-odours. Effective in colour reduction (browning and pinking). |
| PVPP | 100 – 800 | Effective in colour reduction (browning and pinking). Reduces bitterness. At high rates can result in colour and flavor stripping. |

## Hop extracts

**Hops** are the female flower clusters or seed cones of the hop vine humulus lupulus, which are used as a flavoring and preservative agent in nearly all beer made recently.

### What is hop extract?

The hops are what make beer taste like honey wine, beer, and they have long been known to inhibit bacteria growth as the brew ferments. Acids in the hops, called humulones and lupulones, have been shown to kill cancer cells and block leukemia cells from clinging to bone in petri dish experiments

Hop extract is a product developed from the extraction of the hop components that are important to brewers. These are the alpha-acids and essential oils that contribute to beer bitterness, aroma, head retention, and stability. This is different than using pellets or whole leaf hops, as hop resin extract eliminates a great deal of the inert materials that come with pellets and leaf hops, which means less trub in the bottom of the brew kettle.

### Types of Hop Extracts

$CO_2$ extraction is a method for extracting and preserving the alpha acids along with many of the hop oils in a concentrated form that can be used much like the original hops. You can think of $CO_2$ extract as simply concentrated hops. They are most often used in the boil, and behave much like hops would in the boil except they are concentrated to a level of 35-70% alpha acid.

### a) $CO_2$ extract

$CO_2$ extraction is a method for extracting and preserving the alpha acids along with many of the hop oils in a concentrated form that can be used much like the original hops. You can think of $CO_2$ extract as simply concentrated hops. They are most often used in the boil, and behave much like hops would in the boil except they are concentrated to a level of 35-70% alpha acid.

### b) Isomerized extract or ISO-extract

Isomerized extract (often called Isomerized Kettle Extract or IKE) also contains alpha acids but these have already gone through the transformation that takes place when we boil hops called isomerization. You can think have these almost like pre-boiled hop extract. The isomerized alpha acids add bitterness directly to the beer, so you can add these at any stage in the brewing process. Isomerized alpha acids are most often used after fermentation to adjust the bitterness of a finished beer. You can even add them at bottling time “to taste” to get the flavour you want. These too are highly concentrated often containing 50-70% alpha acid.

**C) Hop Aroma**

There are also hop extracts that add aroma. Rather than select hop varieties high in a particular molecule, you can purchase concentrated aromatics. Unfortunately there aren’t many available in homebrew-scale packaging at this time, but they have slowly been gaining popularity with craft brewers to augment traditional hopping

## Carbon Dioxide

Carbon Dioxide is a gas produced by yeast during fermentation and creates the “fizz” or “condition” characteristic of honey wine. In the anaerobic fermentation process, yeast converts the sugars in the wort to, primarily, alcohol and $CO_2$. Surplus $CO_2$ is often collected and used later for boosting the level of $CO_2$ in the finished beer. $CO_2$ will dissolve quite readily in honey wine, with solubility increasing with decreasing temperature. The content of $CO_2$ in a beer is often expressed in terms of volumes of gas at standard temperature and pressure per volume of beer or in grams of $CO_2$ per liter of beer. As an approximation, one volume of $CO_2$ is equivalent to two grams of $CO_2$ per liter. Cask-conditioned beers have $CO_2$ levels of around 1.2 vols, whereas keg beers range typically from 2–2.6 vols and bottled and canned honey wine slightly higher. Knowledge of the precise level of $CO_2$ in a keg beer is important in that gas pressure in the dispense line from keg to tap needs to be adjusted to the level of the beer in the container to prevent excessive foaming (“fobbing”) of the beer as it is delivered into the glass.

| Self-check 3 | Written test |
|---|---|

Name…… ID…… Date…….

**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

1. List out the fining agents for white and red honey wine with their function? (6 point)

You can ask you teacher for the copy of the correct answers

***Note:*** **Satisfactory rating – 4 points** **Unsatisfactory – below 4 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short answer questions**

1. _____
   _____
   _____

.

## Information Sheet 4: Confirming services availability

### 4.1. Services availability

In order to undertake mead maturation process there must be an accessibility of infrastructures to undertake the maturation process successfully. Before conducting the task confirming the availability and functionality of different services is very important. Since operating the mead maturation process without available services is difficult. Among different services, the most frequently required services are electrical power, water accessibility, gas, steam, compressed air and refrigerator. These services are very critical to carryout mead maturation process and to maintain the quality of mead or honey-wine. Therefore, identifying and confirming the availability of these services before conducting the operation is mandatory as to maintain the quality of the product (honey-wine).

**Electrical accessibility (Power)**

Electrical accessibility is very critical in mead maturation process specifically controlling the temperature of the mead, conditioning, clarification, fining the product. In general to carryout mead maturation process, electrical power accessibility is very important.

**Accessibility of water**

Accessibility of water is also very important and critical for dissolving, cooling and for different cleaning activities in mead maturation process. Thus, water must be freely accessible in the workplace area.

**Compressed air**

Air compressor is also the most important equipment in mead maturation process. At the start of each process, air compressors pull air in from the surrounding atmosphere, creating the pressure that is key in nearly every process moving forward. The next part of the process involves pushing liquid from one tank through piping while maintaining ideal conditions along the way.

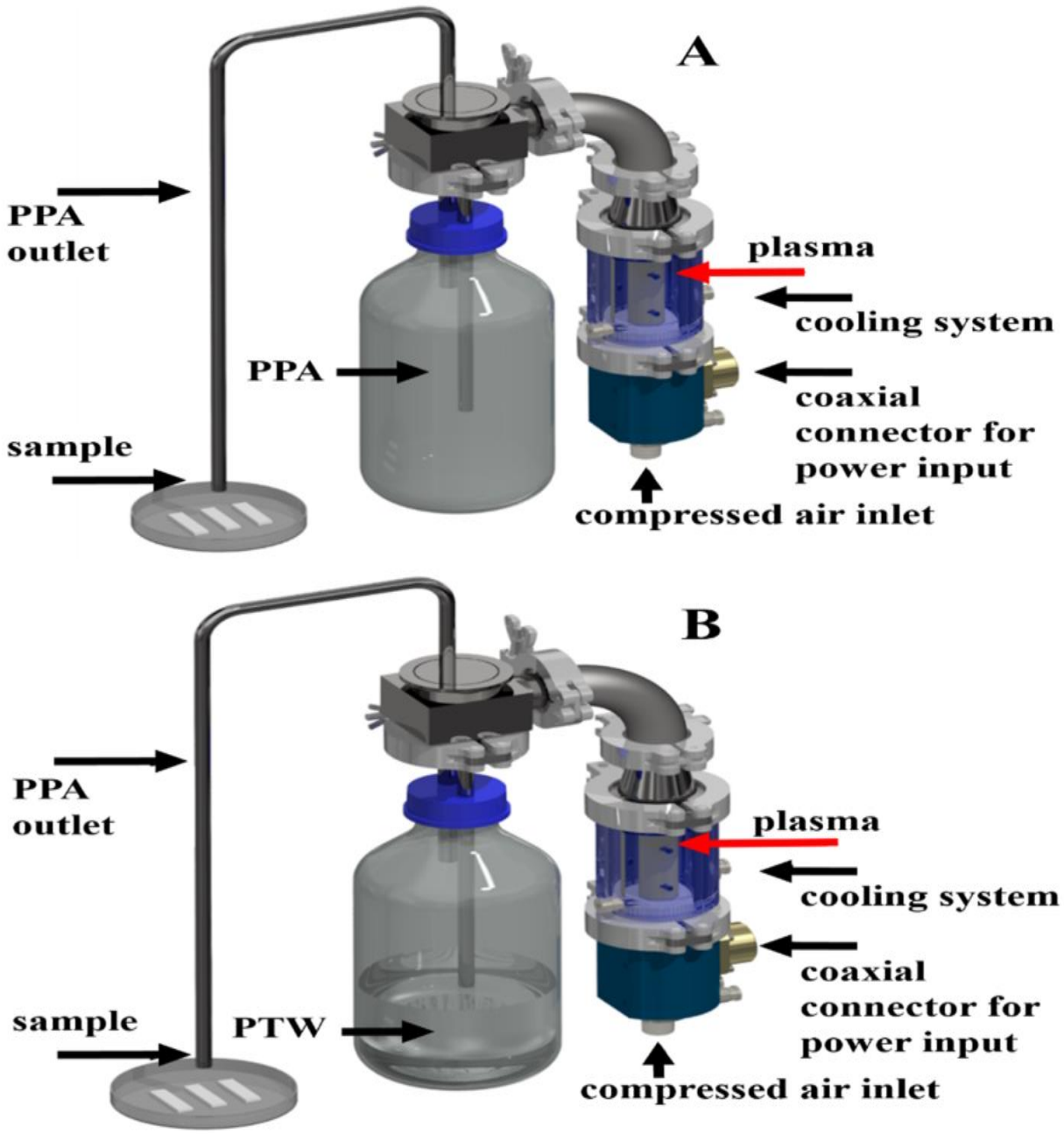


**Figure 2**: Air Compressor

**Inert gas:** is one of the best solutions for controlling oxygen exposure to aging wine. It protects the wine from oxygen and keeps the wine freshness, sherry-like aromas and flavors, and volatile acidity production.

**Figure 3:** Inert gas system

## Steam

Steam is an efficient and effective energy medium which is widely used in brewery industry for wine or mead maturation process. Steam heat plays an integral role in mead maturation process.

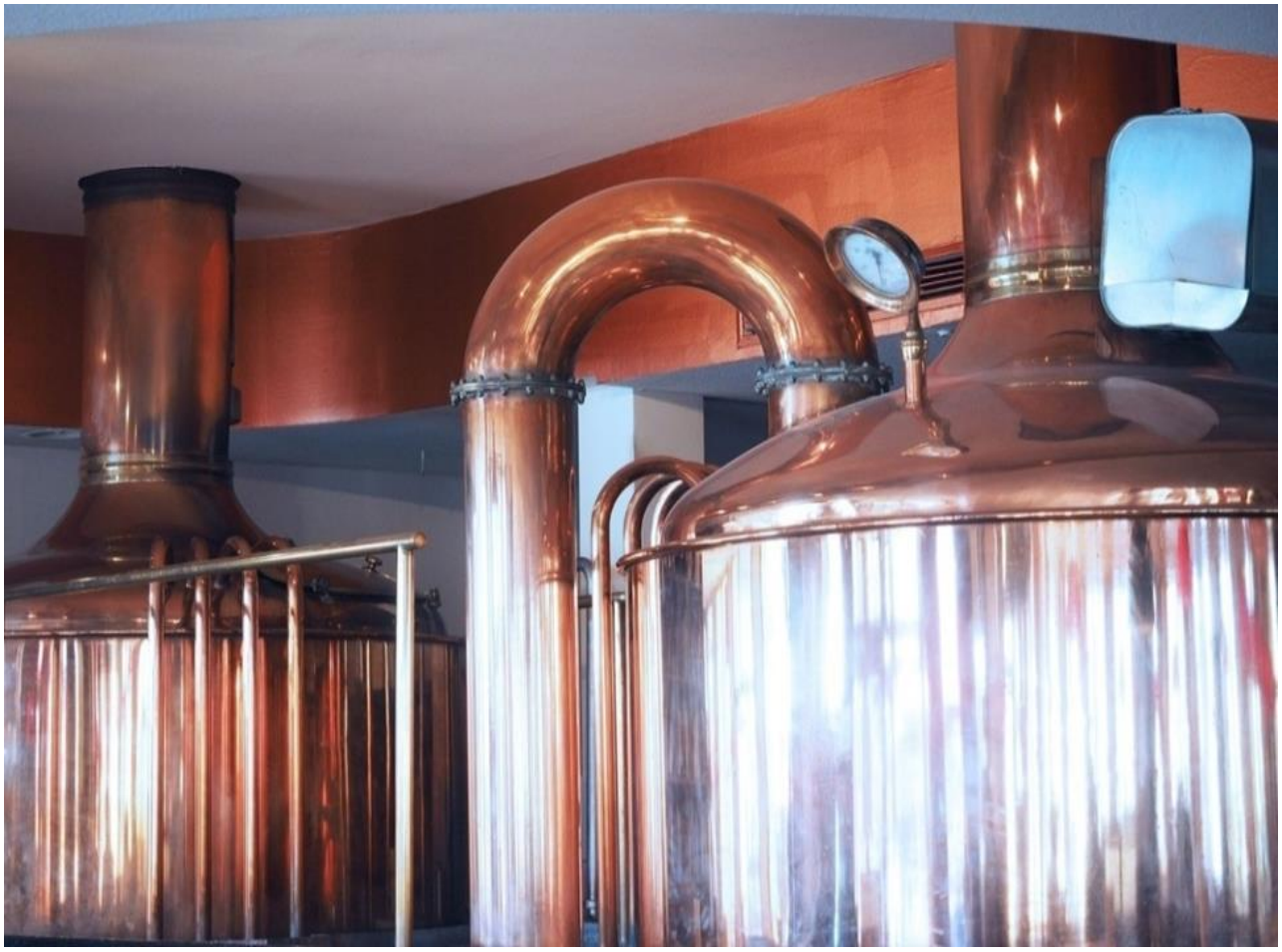

**Figure 4**: steam machine

**Refrigerator**

Refrigerator is very important for maturation process of the mead or to carry out the fermentation process indoor the chamber of the refrigerator. It's also used as storage of honey wine. However, just as with storing wine for long periods, extreme fluctuations in temperature should be avoided, as temperatures above recommended level can negatively impact the mead. Excessive temperature swings and excessive oxidation by sunlight can cause mead to skunk. Therefore, to maintain the quality of mead during maturation process using a temperature-controlled refrigerator or a cabinet indoors is a good ideal.

**Figure 5:** French door refrigerator

| Self-check 4 | Written test |
|---|---|

Name…… ID…… Date…….

**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

1. What is the importance of using air compressor in mead maturation prepara? (6 point)
2. What is the importance of inert gas in mead maturation? (6pts)

You can ask you teacher for the copy of the correct answers.

***Note:*** **Satisfactory rating –7 points** **Unsatisfactory – below 7 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short answer questions**

1. _____

   _____

   _____

2. _____

   _____

   _____

## Information Sheet 5: Checking maturation equipment

In mead maturation process, checking the maturation equipment is critical. During maturation the operational equipment must be carefully inspected for their functionality. Incident of malfunctioning of equipment in mead maturation process may result into deterioration of the final mead quality. Therefore, daily follow up, inspection and checking of maturation equipment during operating the activity is very important.

### 5.1. Importance of checking maturation equipment

The purpose of an inspection is to identify whether work equipment can be operated, adjusted and maintained safely with any deterioration detected and remedied before it results in a health and safety risk. The need for inspection and inspection frequencies should be determined through risk assessment. This checking and equipments is very important as to identify and confirm that hygiene and sanitation standards, safety standards and pre-start requirements are met and that equipment is operational. Similarly, it enables us to check the operation and calibration status of measuring instrumentation.

Check each component of the equipments properly to confirm:

- The used equipment are mending to the specification
- The used equipment are installed according to manufacturer's specification
- The input and the outputs are connected according to manufacturer's specification
- The calibration of the equipment are correct
- The sanitation standard of the equipment according to workplace procedures
- The overall functionality of the equipment

## 5.2. Maturation equipments

Maturation equipments are very important in mead maturation process. In process, different maturation equipments are required to operate the process. Among these, the common maturation equipments are discussed as below.

### Filters

In order to have clean, sediment and haze free product at the end, it is critical to filter out the protein molecules, waxes, pollen and any other particles in the honey water mixture. Ultrafiltration (UF) removes most particles from 0.1 microns down to 0.01 microns.

Filtering is an extremely common practice among commercial brewers, but considerably less so for home brewers. The two main advantages of filtering are time savings, and consistency. Filtering can clear that all up nearly instantly, as well as guaranteeing that any particles larger than the filter size will be removed. The filter size is not small enough (<1 micron). Thus, before conducting check the filters for its function and its suitability for the required operation.

**Figure 6:** Filters

**Valves:** Valves are a mechanical device that controls the flow and pressure within a system or process. They are essential components of a piping system that conveys liquids, gases, vapours, slurries etc. Some **valves** are self-operated while others manually or with an actuator or pneumatic or hydraulic is operated.

**Pumps:** pump is one the mead maturation equipment part that is used when transferring your worth and recirculating the mash is more convenient and faster. And also used when your beer has finished fermenting, use the pump to move the finished product from the fermenter to the keg for the carbonation process.

**There are three main types of brewing pumps used by home brewers**. These are:

- **Peristaltic:** Peristaltic pumps work by creating a squeezing action to allow the liquid to pass through the tube.
- **Diaphragm:** Diaphragm pumps work by increasing and decreasing the pressure in the pump to allow water movement and prevent backflow problems
- **Centrifugal pumps:** Is the most common type of brewing pumps and work using outward action so that the hose can take the liquid and transferred it to another container.

**Tanks or cellars**: is stainless steel equipment used for fermentation tanks primarily used as a holding tank while the wort ferments.

**Figure 7:** Fermentation tank

**Mixing or blending equipment:** It is equipments that are used for mixing the honey with water and different additives as to make homogenous in mead maturation process.

**Figure 8:** mixing or blending equipments

**Heat exchangers/chiller:** A chiller is a machine that removes heat from a liquid via a vapor-compression, Adsorption refrigeration, or absorption refrigeration cycles. This liquid can then be circulated through a heat exchanger to cool equipment, or another process stream (such as air or process water).


**Figure 9:** chiller equipment

**Cleaning equipment:** Cleaning equipment is equipment used for different cleaning activities including tools and equipment in mead maturation process. It has potent chemicals to kill microscopic organisms that are infectious. These chemicals also clean dirt efficiently which harbour these micro-organisms. They will go a long way to make sure a place is clean and healthy to maintain a favourable working environment for the employees and clients. The cleaning reagents must be odourless and tasteless.


**Figure 10:** Cleaning equipments

### 5.3. Monitoring and chemical analysis instruments

The monitoring and chemical analysis instruments are the special instruments frequently used in mead maturation process. These instruments are used for monitoring the progress of the mead in the stages of maturation process as to maintain the quality of the final honey wine. The common monitoring equipments for these activities are discussed as below.

**Hydrometer**: This instrument measures the density (gravity) of liquid and can be used to tell us how much sugar is in our mead. This can then tell us how much alcohol will be in the finished mead

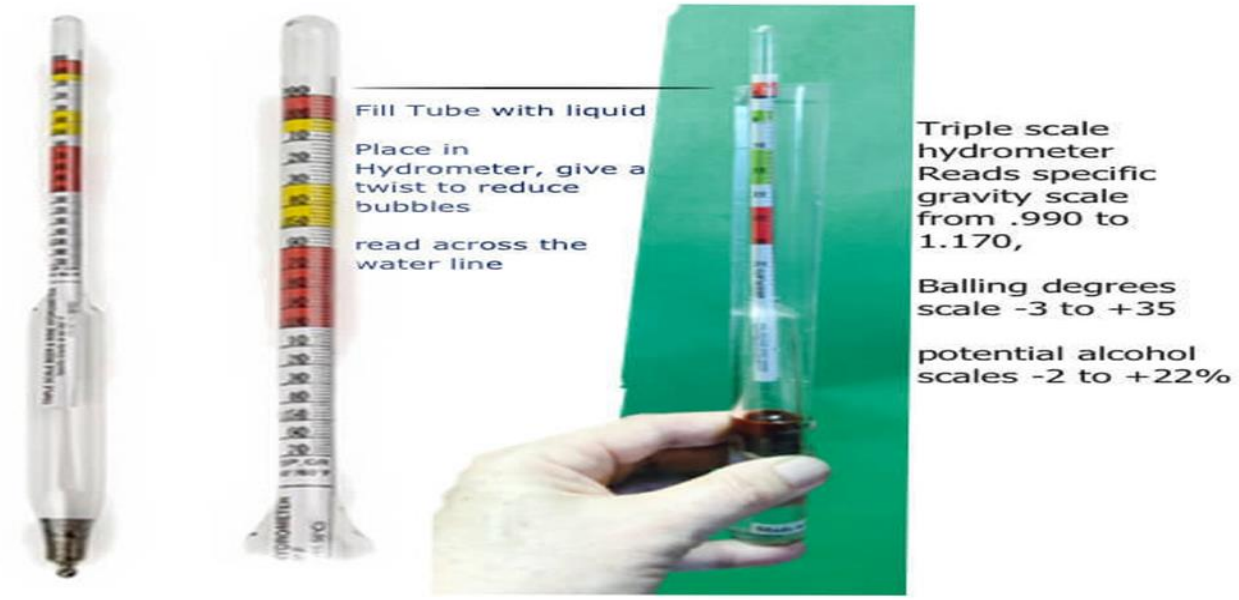


**Figure 11:** Hydrometer

**Pfund scale:** an instrument used to measure the colour of the mead in millimeter. The liquid solution of mead is immersed on to the sensory of the pfund scale.


**Figure 12:** pfund scale

**pH meter:** is an instrument used to measure acidity or alkalinity of a solution


**Figure 13:** pH meter

**Oxygen meter: is** an instrument is a measure or determine the oxygen content in mead maturation process.


**Figure 14:** Oxygen meter

**Carbon dioxide meter:** is an instrument used to measure the amount of carbon dioxide in mead maturation process


**Figure 15:** Carbon dioxide meter

| Self-check 5 | Written test |
|---|---|

Name…… ID…… Date…….

**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

1. List out the important maturation equipment? (6 point)
2. List out the mead maturation monitoring and chemical analysis instruments (6pts)

You can ask you teacher for the copy of the correct answers.

***Note:*** **Satisfactory rating –7 points** **Unsatisfactory – below 7 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short answer questions**

1. _____

   _____

   _____

2. _____

   _____

   _____

## Information Sheet 6: Setting the maturation process

### Setting mead maturation process

Mead maturation process requires the pre-preparation activities including confirming maturation requirements, confirming clarification requirements as specifications, confirming materials availability, confirming service availability and checking the availability and functionality of maturation equipment. After all these pre-requisite activities identified, checked and confirmed for their functionality, sanitation and suitability for the process, collecting to the workplace area and make them ready the process. The mead maturation process should be undertaken with respect to its procedures or workplace procedures and guidelines.

| Self-check 6 | Written test |
|---|---|

Name…… ID…… Date…….

**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

1. What activities to be ready for the maturation process? (12 point)

***Note:*** **Satisfactory rating –7 points** **Unsatisfactory – below 7 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short answer questions**

1. _____
   _____
   _____

| LG #47 | LO #2- Operate and monitor mead maturation equipment |
|---|---|

## Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Starting up equipment
- Monitoring control points
- Making system and sub-system outputs
- Monitoring equipment
- Identifying, rectifying and reporting defected product and equipment
- Completing size and product changeovers
- Recording workplace information for the mead maturation process

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, **you will be able to**:

- Startup equipment
- Monitor control points
- Make system and sub-system outputs
- Monitor equipment
- Identify, rectify and report defected product and equipment
- Complete size and product changeovers
- Record workplace information for the mead maturation process

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets

7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

## Information Sheet 1- Starting up equipment

All the pre-identified, checked and confirmed equipments required for the process of mead maturation should be bringing online from an in operative condition such that normal mead maturation process are being carried out.

The racking equipment should be ready for transferring mead from one fermentation vessel to another, leaving behind the solids that fell to the bottom (i.e. racking) is sometimes enough to clear a mead. Racking should also be performed after clarifying and fining, especially if the mead will be filtered before bottling.

And then all maturation equipments including filters, pumps, tanks, mixing or blending equipment, cellars, heat exchangers/chiller, cleaning equipment, equipment accessories, monitoring and chemical analysis instruments (oxygen, carbon dioxide, starch, gravity, acidity, colour and bitterness) and transfer systems with all its accessories must be transported to on-line from an in operative condition such that different normal mead maturation process are being implemented. Accordingly, the mead maturation processes are undertaken by using appropriate maturation equipment as the workplace procedures and environmental guidelines.

.

| Self-Check – 1 | Written test |
|---|---|

Name…… ID…… Date…….

**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

1. What is the importance of starting up equipment?(10pts)

You can ask you teacher for the copy of the correct answers.

***Note:*** **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short answer questions**

1. _____
   _____
   _____

## Information Sheet 2- Monitoring control points

Monitoring is a plan which includes observations or measurements to assess whether the CCP is being met. It provides a record of the "flow of food" through the establishment. If monitoring indicates that the critical limits are not being met, then an action must be taken to bring the process back into control.

### 2.1. Importance of monitoring CCP

The Critical Control Point (CCP) retains a special and important place in the monitoring and control of food safety. It is the output of an assessment relating to a specific food process and ensures significant hazards requiring management are effectively monitored and controlled when a deviation is detected.

### 2.2. Determine the Critical Control Points

Critical control points (CCPs) are steps at which essential control measures designed to prevent or eliminate a food safety hazard or to reduce it to an acceptable level are applied. In other words, they are specific production stages where the implementation of appropriate control measures will ensure the elimination or minimization and avoiding of a specific hazard. Accordingly, in order to maintain the quality of must for final good mead production, identifying the Critical control points (CCPs) with their critical limits for each control measures is mandatory. Thus, must preparation, the critical control points and critical limits for each control measures that must be followed are identified and described as below.

**Oxygen Management:** Because of its impact on fermentative performance, oxygen is an important control point. Yeast produces membrane lipids only when grown aerobically. In the initial growth phase, proper oxygen management leads to production and storage of sterols in the yeast cell, which can be shared with daughter cells during subsequent anaerobic budding. Yeast ethanol tolerance may be enhanced by promoting synthesis of sterols, via addition of oxygen in the starter and intermittently during fermentation. Additionally, some yeast-derived commercial products aid in sterol synthesis.

Post-fermentation, yeast lees deplete the oxygen content and can impact the redox potential and formation of Sulfur like odor. Oxygen management involves an understanding of the following:

- Optimum 8-10 mg/L oxygen during the initial growth phase (starter preparation).
- Oxidative stress may be a primary cause of early yeast mortality.
- Lees are potent oxygen consumers, even after yeast cell death.
- Lack of oxygen can contribute to Sulfur like odor
- Oxygen additions may allow yeast to produce more glutathione, an important white wine antioxidant.
- Optimum 50-100ml/L oxygen best for maturing typical wine.

**Carbon Dioxide:** Although carbon dioxide is a normal byproduct of alcoholic fermentation, at high concentrations it is inhibitory (toxic) to yeast. Mixing during fermentation (regardless of the size and shape of the vessel) not only helps keep the yeast in suspension, but also drives carbon dioxide out of solution. Some addition products contain inert compounds like micro-crystalline cellulose, which help release carbon dioxide, thereby reducing its toxic impact.

**Temperature:** Temperature affects various reactions involved in wine maturation. Since many reactions are physiochemical in nature, they are accelerated at elevated temperatures. To prevent rapid aging and loss of quality, fresh, fruity and young white wines should be stored at a cooler (<10ºC) cellar temperature. To accelerate aging in certain styles of wine, high temperature storage under anaerobic conditions has been tried. Such a maturing practice may be useful for certain wines, but its wide scale application seems doubtful.

**Light:** Light exposure has been known to affect wine aging. Particularly, wine exposure in the ultraviolet radiation range can initiate an oxidative reaction. A light-struck aroma is a good example of the type of reaction mentioned above

| Self-Check – 2 | Written test |
|---|---|

Name…… ID…… Date…….

**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

1. Why is CCP monitoring important?(10pts)
2. What are the CCPs in mead maturation process?(10pts)

***Note:*** **Satisfactory rating - 11 points** **Unsatisfactory - below 11 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short answer questions**

1. _____
   _____
   _____
2. _____
   _____
   _____

## Information Sheet 3- Making system and sub-system outputs

At the industry level, mead maturation process involves different systems and subsystems. This systems and subsystems play a vital role in mead maturation process and producing a good flavor honey wine depending on the input raw materials, additives and agents.

Mead maturation process at industry level involves several system and subsystem as produce the required specification of honey wine depending on the desired flavor and required physico-chemical compositions. Accordingly, the output of the product (honey wine) specification should be determined based on its physico-chemical composition which approves the quality of honey wine.

**FINING**

Fining is an optional step that clarifies mead, using agents such as bentonite, isinglass, egg white, gelatin, and casein. A commercial product called Sparkolloid is also available. Fining agents combine with charged particles in suspension, such as protein, and precipitate them. The result is clear mead that has a sparkle. The drawbacks to fining are the amount of mead left in the residue and the potential for decolorizing the mead.

Fining is usually done before racking or when mead fails to clear. After racking, attach the air lock. Fermentation will begin in several hours or may take several days. Mead is best fermented at temperatures between 70 °F and 80 °F. Fermenting at lower temperatures will not harm the mead flavor; it will just take longer to complete. During fermentation, rack the mead into a new container as sediment develops. If the mead sits on the sediment too long, the yeast will begin to feed on the sediment (autolysis) and result in an unpleasant flavor. Fermentation is complete when air bubbles are no longer visible

**RACKING**

Racking involves siphoning off the clear mead into a second sanitized fermenter, leaving the sediment behind in the first. This step is repeated as many times as is necessary to achieve the desired level of clarity, usually at three-month intervals. Strict sanitation practices must be observed to prevent contamination. (If sulfating agents are

used as a disinfectant, they need to be added at each racking to ensure the desired level of 50 ppm sulfur dioxide.) Care must also be taken to not incorporate oxygen during racking after the onset of fermentation. Excess exposure to oxygen once the process has begun, can cause spoilage. When filling the carboy, headspace should be limited to approximately one inch to minimize the available oxygen.

**Filtration**

Filtration is a process of separating impurities from mead brewery. Filtration activity is very important operation in mead preparation that is implemented before bottling**.** Once mead aging or maturation is completed, then the mead is filtered into the bottling tank and then bottled. The whole process usually takes about 3 months, except for some of other special releases which may age in barrels for nearly a year. Filtration in winemaking is used to accomplish two objectives, clarification and microbial stabilization. In clarification, large particles that affect the visual appearance of the wine are removed. In microbial stabilization, organisms that affect the stability of the wine are removed therefore reducing the likelihood of re-fermentation or spoilage.

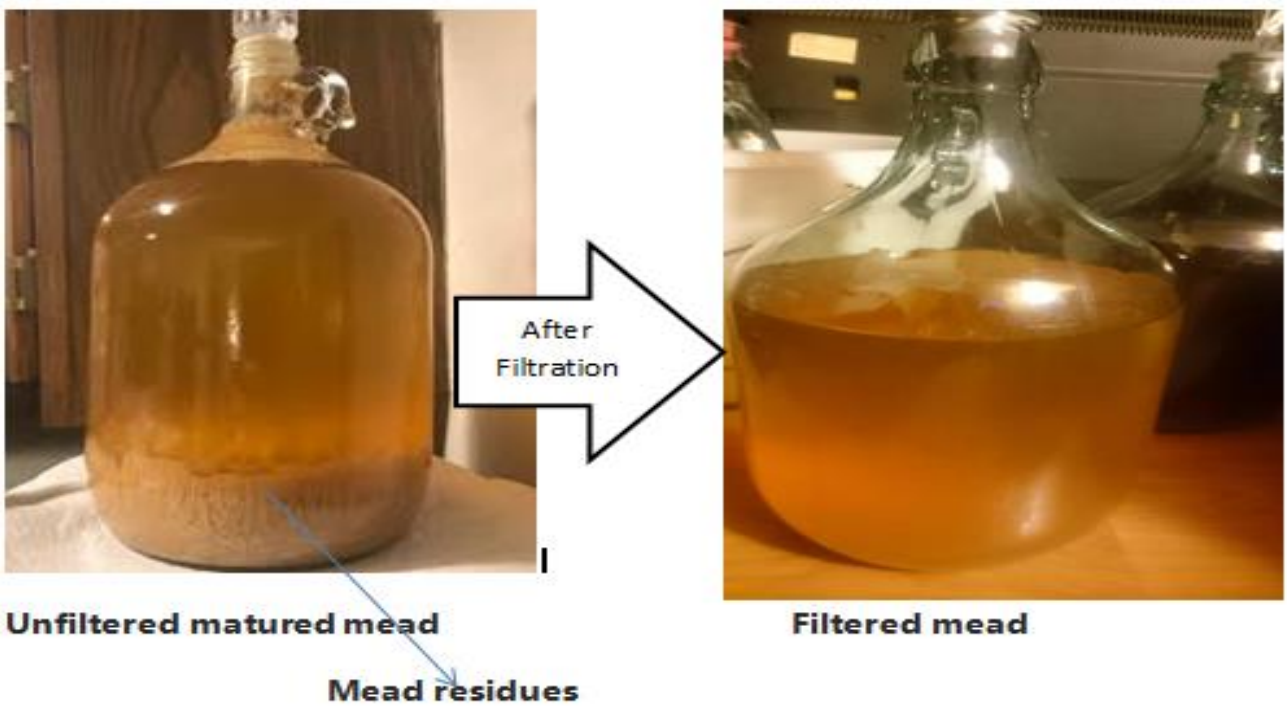


**Figure 1:** Filtration process

**AGING**

Aging requires the most patience. During this step, the mead clears and develops its flavor. Usually, it moves from a harsh, acidic, unpleasant taste to a smooth, mellow beverage with a nice bouquet and fragrance. As the dead yeast cells continue to settle, it is important to continue racking the mead. A steady temperature below 70 °F (preferably around 60 °F) is recommended through the aging process. The length of aging can take months or years, depending on a number of factors. In general, lighter meads will be ready sooner while darker, sweet meads and those with higher alcohol content will need more time to fully develop. Ultimately, the taste preference of the mead maker will determine when it has aged enough.

**Bottling**

The last step is bottling and capping. As with all the steps, good sanitation practices are essential and aeration during the transfer should be avoided. Standard caps or corks can be used. Bottles with corks need to be stored on their sides or the corks need to be dipped in melted paraffin to keep them from drying out. Headspace should be approximately one-half to three-quarters of an inch to limit exposure to oxygen. Making sparkling mead requires a second fermentation using a new yeast culture and priming sugar. The concentration of sugar to mead should be 60 grams or 2 ounces for each gallon of must or three-fourths to one cup per five gallons. The second fermentation occurs in capped bottles, thus trapping the carbon dioxide gas until the bottle is opened. Typically, sparkling mead has higher alcohol content. Additional sediment settles in the bottom of the bottle. The finished sparkling mead should be decanted off the sediment. Overall, careful handling of sparkling mead is required to prevent premature release of the carbon dioxide gas and exploding bottles.

**Figure 2:** Honey wine bottling

Overall, careful handling of sparkling mead is required to prevent premature release of the carbon dioxide gas and exploding bottles. Throughout the mead-making process, it is important to test various parameters. Sugar levels of the honey, fruit juices, and mead are measured in brix or specific gravity, using a hydrometer. Acid levels are determined by measuring pH using acid test kits that are readily available in brewing supply stores. A good thermometer is necessary to monitor room and brew temperatures throughout process.

| Self-Check – 3 | Written test |
|---|---|

Name…… ID…… Date…….

**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

1. What are the activities to be carried out in mead maturation?(10pts)

***Note:*** **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short answer questions**

1. _____
   _____
   _____

## Information Sheet 4- Monitoring equipment

### Monitoring of equipments

Monitoring of equipments is very important to maintain the quality of mead during maturation process as to achieve the desired production of mead with good flavor. All the maturation equipment including filters, valves, pumps, tanks mixing or blending equipment, cellars, heat exchangers/chillers, cleaning equipment, equipment accessories, monitoring and chemical analysis instruments (oxygen, carbon dioxide, starch, gravity, acidity, colour and bitterness) and transfer systems must be monitored before, during and after carrying out mead maturation processes.

Similarly monitoring of equipment is used to identify the defected equipments which have a negative impact on mead maturation and suggested for maintenance. Monitoring involves the regular measurement of parameters such as functionality, vibration, temperature and sound in and around machines and equipment. The equipment component defects are recognized at an early stage for maintenance or purchasing new and the remaining runtimes of bearings, shafts, etc.

| Self-Check – 4 | Written test |
|---|---|

Name…… ID…… Date…….

**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

1. What is the importance of monitoring equipments ?(10pts)

***Note:*** **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short answer questions**

_____

_____

_____

**Information Sheet 5- Identifying, rectifying and reporting defected products and equipment**

## 4.1. Identifying defected products and equipment

Equipment procedures and maintenance guidelines should be kept in a central location for quick reference when needed. If missing, request complimentary copies from manufacturer or maintenance contractor. Malfunctions, faults, wear or damage to equipment are identified and reported in line with enterprise requirements. Since factors vary among installation sites, equipment users must work closely with each of their suppliers to ensure that proper data is being collected, that the data is being provided to the correct supplier, and that the resulting solutions are feasible.

All events (failures) that occur during inspections and tests should be reported through an established procedure that includes collecting and recording corrective maintenance information. The data included in these reports should be verified and then the data should be submitted on simple, easy-to-use forms that failures are tailored to the respective equipment or software.

Then check and report to your supervisor how much of the materials he/she provided in the list are functional and how much of them are faulty. Then are the functional tools and equipment's sufficient enough to the mead maturation process with the available labour power. Then after reporting the faulty and functional materials your supervisor will guide you what to do if there is insufficiency of material for that particular poultry production activity.

## 4.2. Defected honey wine (mead)

### Flavor defects

A Honey wine fault or defect is caused by the chemical change of organic matter in honey wine due to the wrong production process and storage mode and leads to mead deterioration. The chemicals that cause flavor defects in honey wine have been produced. For example, the aldehydes such as dactyl organic acids, lipids and sulfur compounds in mead influence the taste of mead. When the concentration of one or more elements exceeds the standard threshold, the flavor characteristics of beer will change and form the flavor defect of mead. In particular, fermentation byproducts, even

small fluctuations of just over 1% above the threshold can have an impact on the flavor of the mead

Meaderys need to be familiar with the taste of every mead that has gone bad to judge the quality of their brew. The precision of controlling materials and processes is reflected in whether the taste of mead is defective. Meaders also need to find a solution to the flavor defect by tasting different types of honey wine.

The change of the external environment and the wrong production process are also the reasons of wine flavor defects. The lack of wine is due to the turn of the external environment caused by the chemical changes in the composition of the wine, such as the poor sanitary conditions of the winery, dirty wine, excessive use and oak cork rot, and the influence of temperature fluctuations of the wine flavor defects which leads to the loss of honey wine flavour. Any chemical composition change against specification is considered as defects.

### 4.3. Reporting defected products and equipment

A damage defect report is a report that summarizes the overall findings of damage that has occurred to a property, vehicle or equipment. It helps understand the background to a claim and also documents information regarding details of the accident and the extent of the damage.

This is essential as to identify defected equipments that need routine maintenance and complex maintenance. Those materials that need simple maintenance should be rectified without any delay with technician or instructor having knowhow about maintenance if not report. Accordingly, the equipments needs complex maintenance should be reported to the supervisors with reporting format.

| Self-Check -5 | Written Test |
|---|---|

**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Why reporting of fault equipment required to supervisor? (2pts)
2. List out the defects to happen in mead maturation process? (3pts)

***Note:*** **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short Answer Questions**

**1.** _____

_____

_____

_____

**2.** _____

_____

_____

_____

## Information Sheet 6- Completing size and product changeovers

Every production process has periods of time where equipment is unavailable due to tooling changes, material changes, part changes, program changes, or any other changes to production that must be performed while equipment is stopped. Collectively, these events are referred to as “changeovers”, or alternately as “setup”, “make ready” or “planned down time”.

**Complete size:** The production size should consider the production capacity of the equipment or producing machine. Additionally, overproduction of any product is resulted in to waste production and finally resulted into loss of production and malfunctioning of the production machine. Thus, in any production process, avoiding Mura is mandatory.

**Product changeovers**

The changeover process is a disruption of your normal way of working. It could also call unevenness production levels (or Mura). Finally it resulted into loss of production. In any production process, changeover can be divided into the three. These are:

**Clean-up:** Clean-up product, materials and components from the line. It may range from minor, if only the label of a package is being changed.

**Set-up**: Set-up is the process of actually converting the equipment. This may be achieved by adjusting the equipment to correspond to the next product or by changing non-adjustable "change parts" to accommodate the product. Typically it will be a combination of both.

**Start-up**: Start-up is the time spent fine tuning the equipment after it has been restarted. It is characterized by frequent stoppages, jams, quality defects and other problems. It is generally caused by variability in the clean-up and set-up or by variability in the product or its components.

**Loss of Production**

The image below shows the overview of these phases. Please note that not all processes and not all changeovers go through all of these phases. Please also note that it simplified the ramp down and ramp up as a linear change, whereas in reality the line may be more curved or even have erratic peaks and valleys.

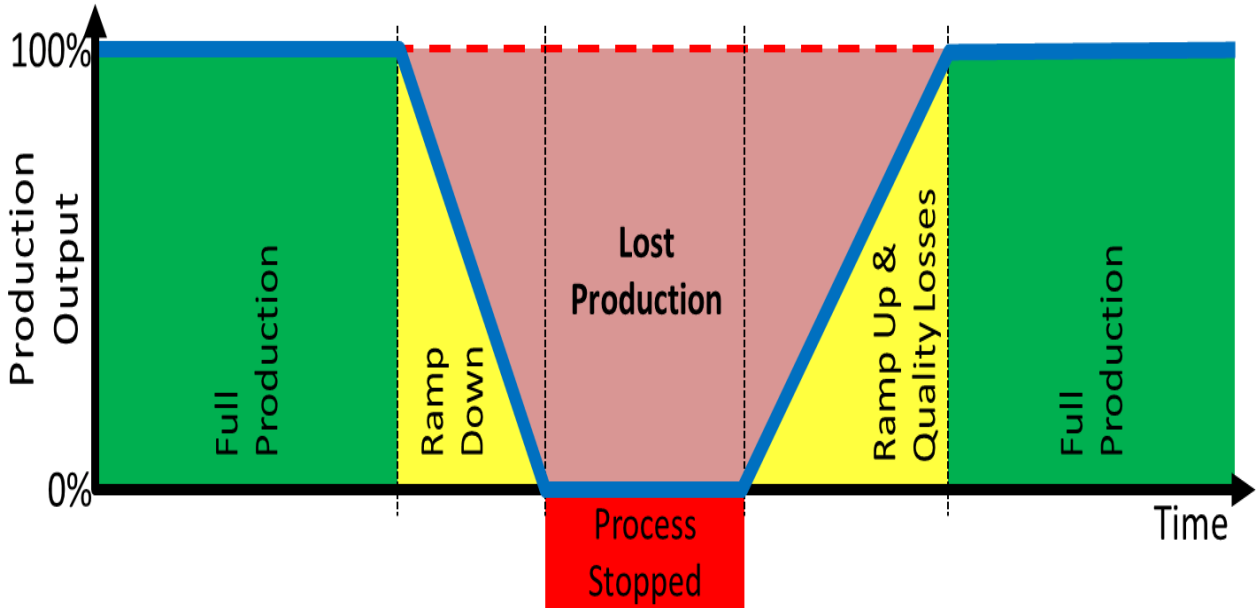


**Figure 2:** Product changeover

**Ramp Down**

Initially, the process is running at full speed and quality. Depending on the details of the process, the changeover could start with a ramp down of the process. In most cases this will go rather quick. However, there are also situations where it could take more time. It is possible that the production rate decreases slowly. It is also possible that the quality problems may go up during the ramp down because the process is no longer operating at full capacity.

Examples are found in processing industries, where the process may run slower while emptying material. The produced goods may also be of inferior quality compared to normal production. It depends heavily on the process if there is actually a ramp down, how long it takes, and its impact on quality.

**Stopped**

The main part of the changeover is the time when the process is actually stopped. During this time, nothing is produced.

**Ramp Up**

The ramp up is more common than the ramp down. It often will take some time before the process produces good parts at full speed again. This may be for a number of different reasons

| Self-Check -6 | Written Test |
|---|---|

**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

3. What is product change over mean? (2pts)
4. What does complete size mean? (3pts)

***Note:*** **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short Answer Questions**

1. _____
   _____
   _____
   _____
2. _____
   _____
   _____
   _____

## Information Sheet 7- Recording workplace information for mead maturation process

This is a very important part of the brewing process as it can not only help you reproduce a good Mead, but it can identify what might have gone wrong if a batch turns out bad. Keep very good notes describing exactly how everything was done, and continue adding to the notes as the mead matures, right up to the point where it is ready to drink. The notes should include the mead, the process used, any observations (such as the time it took to start fermenting, or how long fermentation took to completion), how the Mead looks and smells, any problems encountered, and how it tasted after aging.

**Points should be recorded in respecting to mead maturation may include but not limited to:**

- Brew Date
- Batch number
- Volume of the mead
- Racking date
- Clarification date
- Fining date
- Temperature
- pH or acidity levels
- Hazards at the workplace area

**Ingredients**:

- ✓ Amount of fining agents added to mead
- ✓ Amount of stabilizer used
- ✓ Other ingredients used

| Self-Check -7 | Written Test |
|---|---|

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What records to be taken during mead maturation process? (10pts)

***Note:*** **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
   _____
   _____

## Operation Sheet 1: Making system and sub-system outputs

| | |
|---|---|
| Operational title: | Racking fermented mead for maturation process |
| Purpose | To acquire and develop the knowledge, ability and right attitude to perform racking of fermented mead in accordance with operational standards |
| Equipment, tools, products and materials | fermented mead, empty carboy, hose, sanitizing and cleaning agents, sulfite and funnel |
| Conditions or situations for the operation: | The mead filtration process should be conducted at appropriate room to control aeration |
| Procedures | 1. wear appropriate PPE<br>2. identify all appropriate materials tools, products and equipments<br>3. clean and sanitize tools and the equipments<br>4. Arrange all products, tools and equipments as suit to work<br>5. open the cover of aged mead container and empty a carboy<br>6. insert the hose one side into mead holding carboy and the other side into empty carboy<br>7. Racking<br>8. Add sulfite to racked product<br>9. covering the carboy or airlock<br>10. cleaning<br>11. taking record |
| Precautions | ▪ Care must also be taken to not incorporate oxygen during racking after the onset of fermentation.<br>▪ Excess exposure to oxygen once the process has begun, can cause spoilage.<br>▪ When filling the carboy, headspace should be limited to approximately one inch to minimize the available oxygen |
| Quality criteria: | ▪ Aroma: refined aroma<br>▪ Color: clear, diamond bright<br>▪ Residue: no residues<br>▪ Using sulfite agents as a disinfectant<br>▪ Absence of spoilage<br>▪ Absence of contamination |

## Operation Sheet 2: Making system and sub-system outputs

| | |
|---|---|
| Operational title: | Filtering fermented mead for maturation process |
| Purpose | To acquire and develop the knowledge, ability and right attitude to perform filtering of fermented mead in accordance with operational standards |
| Equipment, tools, products and materials | fermented mead, empty carboy, filter with all accessories, sanitizer, cleaner, fining agents and stabilizing agents |
| Conditions or situations for the operation: | The mead filtration process should be conducted at appropriate room with electrical power accessibility |
| Procedures | 1. wear appropriate PPE<br>2. identify all appropriate materials tools, products and equipments<br>3. Disassemble the filter<br>4. clean and sanitize tools and all parts of the equipments<br>5. Assemble the filter<br>6. Fining the mead<br>7. stabilizing the mead<br>8. inserting the hose of the filter in to the container of the mead to be filtered<br>9. inserting the other hose of the filter in to receiving carboy<br>10. insert the cable of the filter into electric power and press the switch on<br>11. Filtering<br>12. taking record |
| Precautions | ▪ The all equipments and tools used for filtration must be cleaned and rinsed in to sanitizer<br>▪ The amount of fining and stabilizing agents must be used as recommended level |
| **Quality criteria:** | **Aroma:** refined aroma<br>**Color:** clear, diamond bright<br>**Residue:** no residues |

## Operation Sheet 3: Making system and sub-system outputs

| **Operational title:** | **Bottling fermented mead for maturation process** |
|---|---|
| Purpose | To acquire and develop the knowledge, ability and right attitude to perform bottling of fermented mead in accordance with operational standards |
| Equipment, tools, products and materials | Empty Bottles, cleaning and sanitizing agents, Corks, Corking machine, racking cane and hose |
| Conditions or situations for the operation: | The mead filtration process should be conducted at appropriate room with electrical power accessibility |
| Procedures | 1. wear appropriate PPE<br>**2.** identify all equipment, tools, products and materials<br>3. clean and sanitize tools and all parts of the equipments<br>4. Arrange all necessary tools, product and equipment<br>5. Insert one side of pump transfer into matured mead container and the other side into bottles<br>6. start transferring of the honey wine liquid from carboy into bottle<br>7. fill them from the bottom up<br>8. leaving a small amount of headspace<br>9. Capping of the bottle using corking machine<br>**10.** Taking record |
| Precautions | ▪ good sanitation practices are essential<br>▪ aeration during the transfer should be avoided<br>▪ The corks need to be dipped in melted paraffin to keep them from drying out.<br>▪ Headspace should be approximately one-half to three-quarters of an inch to limit exposure to oxygen<br>▪ careful handling of sparkling mead to prevent premature release of the carbon dioxide gas and exploding bottles |
| **Quality criteria:** | ▪ Aroma: refined aroma<br>▪ Color: clear, diamond bright<br>▪ Residue**:** no residues<br>▪ Recommended level of physco-chemical composition |

| LAP TEST | Performance Test |
|---|---|

Name……. ID……..

Date…….

Time started: _____ Time finished: _____

**Instructions:** Given necessary templates, tools and materials you are required to perform the following tasks within **6** hour. The project is expected from each student to do it.

**Task-1:** perform racking of fermented mead

**Task-2:** Perform filtering of matured mead or honey wine

**Task 3:** Perform bottling of matured mead or honey wine

| LG #48 | LO #3- Shut down the dissolving process |
|---|---|

## Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Shutting down the system
- Cleaning and maintaining equipment
- Collecting, treating and disposing wastes

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, **you will be able to**:

- Shut down the system
- Clean and maintain equipment
- Collect, treat and dispose wastes

**Learning Instructions:**

**(1)** Read the specific objectives of this Learning Guide.

**(2)** Follow the instructions described below.

**(3)** Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.

**(4)** Accomplish the “Self-checks” which are placed following all information sheets.

**(5)** Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

**(6)** If you earned a satisfactory evaluation proceed to “Operation sheets

**(7)** Perform “the Learning activity performance test” which is placed following “Operation sheets” ,

**(8)** If your performance is satisfactory proceed to the next learning guide,

**(9)** If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

## Information Sheet 1- Shutting down the process

Mead maturation process involves several processes which including operation of different mead maturation equipments for different specific purposes. This equipment includes filters, valves, pumps, tanks mixing or blending equipment, cellars, heat exchangers/chiller, cleaning equipment, equipment accessories for racking, clarifying, filtering, fining and settling of the mead.

In mead maturation process, monitoring and chemical analysis instruments (oxygen, carbon dioxide, starch, gravity, acidity, colour and bitterness) and transfer systems are used to check the mead maturation progress as to maintain the honey-wine quality.

After finalizing the mead maturation process the final honey wine must be bottled and stored in appropriate storage containers. All the materials, tools and equipment's used for the process must be dismantled, cleaned, sanitized thoroughly and stored in appropriate place for the next use.

| Self-Check -1 | Written Test |
|---|---|

**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is shutting down of the process means? (6pts)

***Note:*** **Satisfactory rating - 4 points** **Unsatisfactory - below 4 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short Answer Questions**

1. _____
   _____
   _____
   _____

## Information Sheet 2- Cleaning and maintaining equipment

Before and after every mead maturation process, cleaning and maintaining of equipment is very important as to maintain the quality of the mead and workplace health and safety.

### 2.1. Clean and Sanitize Mead Brewing Equipment

Cleaning is the removal of dirt and organic substances from surfaces of tools and equipment. Through the cleaning procedures, high numbers of microorganisms (90% and more) present on the mentioned objects will be removed. However, many microorganisms stick very firmly to surfaces, in particular in tiny almost invisible layers of organic materials and will not entirely be removed even by profound cleaning but persist and continue multiplying. Inactivation of those microorganisms requires antimicrobial treatments, carried out through hot water or steam or through the application of disinfectants.

Cleaning and sanitizing your brewing equipment is an important step in preventing your creations from getting infected and spoiling your end product. After all that effort and patience, you wouldn't want to suddenly find your brew to have a funky, foul taste. The process of brewing is all about fostering the growth and prosperity of certain microscopic organisms. But they have some nasty rivals that like to grow in similar environments. In order to hinder that little nastiness, it is critical that you take proper precautions in caring for your brewing gear. You should do this both before you begin using, and after you've finished with the tools.

Always wash your equipment first. This will remove any large contaminants that could harbor microorganisms in its nooks and crannies.



**Figure 1:** sanitizing and cleaning agents

## 2.2. Mead Brewing equipment maintenance

The technical meaning of maintenance involves functional checks, servicing, repairing or replacing of necessary devices, equipment, machinery, building infrastructure, and supporting utilities in industrial, business, governmental, and residential installations. Over time, this has come to include multiple wordings that describe various cost-effective practices to keep equipment operational; these activities take place either before or after a failure. Maintenance can be considered as a combination of actions carried out in order to replace, repair, service, modify the components, or some identifiable group of components, of a workshop, so that it will continue to operate to a specified availability or a specified time. Maintenance is the totality of all measures directed towards control (preservation and restoration) of the workshop performance. Maintenance is an auxiliary process in a production process directed towards a high effectiveness of the main process.

**Purpose of maintenance**

- To keep equipment/system operative.
- Attempt to maximize performance of production equipment efficiently and regularly

- Prevent breakdown or failures
- Minimize production loss from failures
- Increase reliability of the operating systems
- To keep operation safe
- To prevent leakages/losses

### 2.2.1. Types of maintenance

There are three types of equipment maintenances. These maintenance types are discussed as below.

#### a) Preventive Maintenance

Preventive maintenance means all actions carried out on a planned, periodic, and specific schedule to keep an item/equipment in stated working condition through the process of checking and reconditioning. These actions are precautionary steps undertaken to forestall or lower the probability of failures or an unacceptable level of degradation in later service, rather than correcting them after they occur.

#### b) Corrective Maintenance

Corrective maintenance is required when an item has failed or worn out to bring it back to working order. The two types of corrective maintenance are the following:

- ✓ Planned Maintenance is a scheduled service visit carried out by a competent and suitable agent, to ensure that an item of equipment is operating correctly and avoid any unscheduled breakdown and downtime. It is preplanned, and can be date based on equipment running hours, or on distance travelled.
- ✓ Unplanned Maintenance the action which is carried out without any scheduled for thoughts or prior planning called unplanned

Breakdown Maintenance and Process the breakdown maintenance is a type of maintenance that involves using a machine until it completely breaks down and then repairing it to working order.

#### c) Breakdown Maintenance

Breakdown Maintenance is referred to repair and maintenance work performed on a machine, production workshop or component, be it mechanical or electrical after it has

failed or broken-down unexpectedly. It is also referred to as maintenance or engineering work related to unexpected plant breakdowns. It is not a planned event and other expenses such as out of budget maintenance costs including overtime, technician call outs and urgent delivery fees for spare parts or support. Maintenance breakdowns can have many causes, some being the result of improper preventive and long term maintenance planning, lack of maintenance inspections, lack or incorrect evaluation of stresses and load cycles on machinery, faulty design and materials and in some cases neglect.

| Self-Check -2 | Written Test |
|---|---|

**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What and discuss the three types of maintenance? (6pts)
2. What is the importance of cleaning equipments? (4pts)

***Note:*** **Satisfactory rating - 6 points** **Unsatisfactory – below 6 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short Answer Questions**

(1) _____

_____

_____

_____

(2) _____

_____

_____

_____

## Information Sheet 3- Collecting, treating and disposing wastes

In mead maturation process, waste generated in the process of racking, clarification, filtration, fining and settling process must be collected, treated and disposed of, or recycled according to workplace procedures. In this process, there might be a production of solid and liquid wastes.

### 3.1. **Liquid wastes and its disposal**

The wastes water produced at home level (small scale) and industrial level from sanitary sewage is said to be liquid waste. The waste water or sewage that is generated from a mead maturation process at industry level or home based level must be collected in appropriate temporary storage container properly in respecting with environmental guideline.

Waste water is one of the major wastes produced in the process of mead maturation. This waste can be produced from cleaning of the different equipments used in the process. This sanitary liquid wastes discharged from industry might be resulted into environmental pollution if not managed properly. Since, Liquid waste can quickly seep into the earth and resulted into contamination of drinking water and disrupting aquatic ecosystems.

Thus, to minimize the environmental pollution, the liquid waste produced in this process must be handled, managed and disposed properly according to workplace procedures.

**Figure 2:** liquid waste trash bin

### 3.2. Solid waste and its disposal

In mead maturation process, the solid wastes to be produced might include plastic materials, remaining of floating wax and other residues. These solid waste materials should be handled, managed and disposed properly to minimize its environmental pollution according to workplace procedures.

**Figure 3:** Solid waste trash bin

| Self-Check -3 | Written Test |
|---|---|

**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the types of wastes produced in mead maturation process? (10pts)

***Note:*** **Satisfactory rating - 6 points** **Unsatisfactory – below 6 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short Answer Questions**

1._____

_____

_____

_____

| LG #49 | LO #4- Contribute to continuous improvement of the system |
|---|---|

## Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Assessing quality or process outputs
- Identifying and investigating opportunities
- Developing and implementing proposals

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, **you will be able to**:

- Assess quality or process outputs
- Identify and investigating opportunities
- Develop and implement proposals

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

## Information Sheet 1- Assessing quality or process outputs

Assessing the quality of the matured honey wine is one of the most important aspects in mead production systems. Accordingly the quality of the final matured honey wine is determined physical and chemical composition against specifications.

### 1.1. Assessing Honey wine quality

The quality of matured honey wine is evaluated against the pre desired specification as below.

**a) Physical assessment (organoleptic)**

**Color**

Color is one of the most appealing properties of a mead or wine. Mostly the color of wine or mead is light yellow. During maturation, when the wine is exposed to air, the color becomes darker, and with over-aeration, becomes brown. Several phenolic compounds are involved in oxidative reactions. To minimize oxidation and browning, white wines are generally treated with minimum oxygen exposure. Besides phenolic oxidation, other reactions such as the Millard reaction and sugar caramelization may also contribute to color in white wine.

In red mead or wines, the bright red (with purple tint) color is due to monomeric anthocyanin pigments which are extracted from the skin during fermentation. During maturation, these pigments are progressively replaced by the polymeric form, which results from the combination of anthocyanin pigments with tannin. Monomeric anthocyanins occur in various forms, such as the red colored flavylium cation, quinoidal base (blue), carbinol pseudo-base (colorless), chalcone (nearly colorless), and as a bisulfite addition compound (colorless). The various forms of anthocyanins are present in equilibrium, which is influenced by pH and other factors. An important point to note is that monomeric anthocyanins are susceptible to bleaching by S02 and with a lowering of pH, the equilibrium shifts from the colorless to colored form.

During maturation, the wine is exposed to air. Oxygen (from air) plays an important role in the condensation reaction between anthocyanins and tannins, which results in the

gradual loss of free anthocyanins and the formation of stable polymeric (anthocyanin tannin) pigments. It has been observed that the polymeric pigments account for 50% of the color density in one-year-old wine. As the wine matures and more polymeric pigments are formed, the color shifts from red to orange and brick red.

Color is often determined from optical density measurements using a spectrophotometer. The intensity of the color is measured by adding absorption values at 520 nm and 420 nm. The tint of color is measured by determining the ratio between absorption at 420/520 nm. In young reds, the absorption maximum occurs at 520 nm, the red color region. As mead become mature, maximum absorption decreases at 520 nm and increases at 420 nm in the yellow color region. This explains the shift in well-aged wine from a red to an orange hue, and brick red color. The condensation reaction between anthocyanins and tannins is accelerated by oxidation. If condensation continues (due to oxidation), precipitation of coloring matter occurs.

**Taste and mouth feel**

With proper maturation and aging, the wine becomes mellower and smoother, and acquires a richer mouth feel. Many compositional changes contribute to the improved taste. The important changes include polymerization of phenolic compounds and reduction in acidity. Phenolic compounds play an important role in the taste and flavor of wine. White wines contain mostly non-flavonoid phenols; whereas, in red wines, flavonoid phenols dominate. Bitterness and astringency is primarily attributed to flavonoid phenols. The monomeric flavonoids are more bitter than astringent. As flavonoid phenols polymerize, they become less bitter and more astringent. With further polymerization, the molecules become too large, and finally precipitate. This leads to a reduction in phenolic compounds and also in astringency. During maturation, oxidative and non-oxidative polymerization and precipitation of phenolic compounds (of larger molecules) occurs. This results in a wine with reduced astringency and a smoother, softer taste. Maturation, therefore, plays a key role in improving wine's sensory appeal.

Another factor contributing to improved taste is loss of acidity. This occurs due to acid precipitation and ester formation. Acidity enhances the astringency and loss of acidity makes wine taste less astringent and mellower.

**Aroma**

Significant changes in wine aroma occur during maturation and aging. These include the loss of certain grape or yeasty aromas, retention of the varietal aroma, formation of new aromas, and above all, integration of all flavors to produce a harmonious and pleasing fragrance. Many esters and higher alcohols formed by the yeast's metabolic activity contribute to the fermentation aroma. During wine storage, the esters are hydrolyzed and the fresh and fruity aroma is lost. Concurrent with the degradation of esters, a synthesis of new esters occurs. For example, the formation of isoamyl acetate and diethyl succinate.

In wines with strong varietal flavor, both qualitative and quantitative changes in aroma take place. For example, in muscat varieties, terpenes are the main odorous compounds. During maturation and aging, the concentration of monoterpene alcohol declines and monoterpene oxides are formed. This leads to the loss and alteration of floral aroma. In Riesling, linalool is found in significant amounts. This terpene compound gives a floral aroma to the wine. The oxide terpene derivatives, such as alpha terpineol, have a pine like odor; whereas, its precursor linalool, as indicated earlier, has a floral fragrance.

It should be noted that terpene compounds also occur in a bound form. In an acidic medium, such as wine, the bound terpenes are slowly converted to free volatile terpenes over time. When these reactions occur, the fruity aroma of a wine is enhanced during maturation.

**b) Chemical composition assessment (Laboratory testing method)**

Besides to physical determination of matured honey, laboratory analysis of chemical composition is the paramount parameter to determine the quality of matured honey wine. These chemical compositions are discussed as below.

**Table 2:** Honey wine chemical composition parameters under the standard

| **Analytical Parameter** | **Minimum** | **Maximum** |
|---|---|---|
| Alcohol (%) | 4.5 | 22 |
| Ash (%) | 0.046 | 0.52 |
| Sodium (%) | 1.24 | 14.02 |
| Potassium (%) | 8.62 | 74.19 |
| Phosphorus | | 400 mg/L |
| Calcium (%) | 0.41 | 5.11 |
| Magnesium (%) | 0.43 | 2.03 |
| Volatile Acidity(g/l) | 0.14g/l | 1.5 g/L |
| Cyanides(mg/L) | | 0.1 mg/L |
| pH | 2.9 | 3.75 |
| Total acidity (g/L) | 2.20 | 7.08 |
| Residual sugar (%) | 2.5 | 27.8 |
| Acetaldehyde (mg/L) | 18.2 | 125.5 |
| Water | | 70 ml/L |

| Self-Check- 1 | Written test |
|---|---|

Name…… ID…… Date…….

**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

1. List the methods used for determining honey wine quality? (10pts)

***Note:*** **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short Answer Questions**

1. _____

_____

_____

_____

## Information Sheet 2- Identifying and investigating opportunities for improvements

### 2.1. How Organizations Can Identify Areas for Improvement?

Typically, organizations will identify a problem and then work to identify the root cause of the problem to come up with a solution for implementation. But what if there are several, few, or no problems in the organization, but you would like to improve your organization? How do you go about identifying areas for improvement? One of the best ways that I know how an organization can identify areas for improvement is to use a Lean assessment methodology.

The Lean assessment helps an organization identify potential opportunities for improvement at a high level and provides an understanding of the process before change occurs. It is a methodical evaluation that documents the current state of the business and what can be expected in the future state. Typical areas that are evaluated through a Lean assessment include the company's current culture, market expectations, customer satisfaction, employee skills requirements, readiness to change, and other areas that may be identified by management: Ultimately, any area can be evaluated.

Here are the steps to performing a Lean assessment in your organization:

- Meetings: Meet with key and controlling stakeholders to determine expectations and timeline for the Lean assessment.
- Determine the project scope. Write a project charter to contain the project.
- Conduct interviews with customer and staff to gather answers to specific questions. What are the perceived levels of empowerment in the business? There is value in speaking to as many staff as possible to identify the strengths, weaknesses, opportunities and threats to the business. Also include other situational topics specific to your business.
- Develop benchmarking for several areas in your organization. For example, include strategic and operational planning in your review, workplace organization, IT systems, human resources development, current accounting practices, operational performance, sales and marketing, and other areas that you feel could or should be included in the assessment.

- Prepare summary and detailed reports of your findings and include specific areas for initial improvement, reasons, and possible solutions. Estimate amount of internal and external resources and provide high level recommendations resulting from your findings.
- Meet with the key and controlling stakeholders to present your findings and recommendations and determine steps forward.

But what should an industry do now that you have all this information? At the beginning starts with minimally intrusive area such as corporate culture or readiness for change. Then get stakeholder buy-in for change in that area. Your initial efforts should include a full-scale investigation in the area that you have chosen as well as extensive benchmarking as you establish your go-forward plan.

Whatever area you choose and however you choose to implement it, a crucial ingredient is and will be people. Include as many people from your organization as possible in the project. And remember to include them early in the planning stage, so that ideas are captured and heard. There is nothing worse than initiating a project and implementing it on your own in an effort to not make waves for staff. You need to make waves. You need to get staff involved. The more involved they are, the more accepting they will be of the change. And during the project, it will be much easier to implement the changes.

Ultimately, identifying areas for improvement in an organization is really dependent on what areas you choose to study and evaluate and what areas stakeholders agree to be priority those areas that, once improved, will markedly improve the organization's performance and bottom line.

And don't forget any matter how you proceed, document your lessons learned, so that subsequent projects can be conducted even better.

## 2.2. Identifying opportunities for improvements

In mead production to be successful entrepreneurs, we need to be continually innovating and looking for opportunities to grow our startups. But how do you find new opportunities to take your startup to new markets and growth levels?

**Here are four ways to identify business opportunities**

### a) Listen to your potential clients and past leads

When you're targeting potential customers listen to their needs, wants, challenges and frustrations with your mead industry. Have they used similar products and services before? What did they like and dislike? Why did they come to you? What are their objections to your products or services? This will help you to find opportunities to develop more costumer based products and services, enhance your target market and identify and overcome common complaints.

### b) Listen to your customers

When you're talking to your customers listen to what they saying about your industry, products and services. What are their frequently asked questions including experiences frustrations, feedback and complaints. This valuable customer information will help you identify key business opportunities to expand and develop your current products and services.

### c) Look at your competitors

Do a little competitive analysis (don't let it lead to competitive paralysis though) to see what other startups are doing, and more importantly, not doing. Where are they falling down? What are they doing right? What makes customers go to them over you?

Analyzing your competitors will help you identify key business opportunities to expand your market reach and develop your products and services.

**d) Look at industry trends and insights**

Subscribe to industry publications, join relevant associations, set Google alerts for key industry terms and news and follow other industry experts on social media. Absorb yourself in your industry and continually educate yourself on the latest techniques and trends.

| Self-Check- 2 | Written test |
|---|---|

Name…… ID…… Date…….

**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

1. How an organization can identify areas for improvements? (10pts)
2. List out the four ways to identify more business opportunities(10pts)

***Note:*** **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short Answer Questions**

1. _____
   _____
   _____
2. _____
   _____
   _____

## Information Sheet 3- Developing and implementing proposals for improvements

In mead production developing and implementing the proposal for improvements and further enhancement is very important. The development of proposal shall be depending on the gaps of customers demand and existing production problems within the industry or complaints from the product user internally or externally. Thus, depending on the problems or willingness of the industry for further enhancement, a feasible proposal should be developed for improvement of the production.

A proposal consists of a smart objective to be implemented. The developed proposal must answer the following questions Who? What? When? Where? Why?
A complete proposal should answer a similar set of questions

- What is being proposed? # Concept"
- Where will the proposal be implemented? # Setting
- Who will champion the proposal and see it to completion, and who else must be involved? # Team"
- How will the proposal be implemented? # Plan
- Why is the proposal important and why should it be supported? # Expectations
- What if things do not go as planned? # Contingencies
- To who is the proposal addressed? # customer

A proposal that addresses these questions will usually meet the customers demand

In proposal developments, the seven Question Building Block Approach to preparing proposals are:
**Organizing Principle:** A well-prepared proposal should answer the following questions in a complete and balanced manner:

- What?
- Where?
- Who?
- How?
- Why?
- What If?
- To Whom?

| | |
|---|---|
| **What?**<br>▪ Product or service to be offered<br>▪ Technology to deliver product or service<br>▪ Client group to be provided with the product or service<br>▪ Appropriateness of product, service and technology to the client group<br>▪ Resources being requested | **Who?**<br>▪ Hotels<br>▪ Individuals<br>▪ Customers<br>▪ Government<br>▪ Employees and staff<br>▪ Contractors and supplier<br>▪ Stakeholders<br>▪ Mead industry |
| **Where?**<br>▪ Physical location and characteristics where the proposal<br>▪ Town<br>▪ Rural areas<br><br>**Why?**<br>▪ Financial expectations<br>▪ Social and development impacts<br>▪ Environmental benefits<br>▪ Growth potential<br>▪ Reliability potential<br>▪ Other benefits<br>▪ Customer satisfaction<br>▪ Income generation | **How?**<br>▪ Current status<br>▪ Steps and schedule to completion of planning<br>▪ Steps from completion of planning to final authorization<br>▪ Steps from final authorization to beginning of construction (or roll-out of pre-operation stages)<br>▪ Steps from beginning of construction / pre-operations to completion of construction and commencement of operations<br>▪ Operations, maintenance, management, accounting and reporting plans<br>▪ Monitoring and evaluation plan<br>▪ Key contract relationships<br>▪ Financial structure |
| **Why?**<br>▪ Financial expectations<br>▪ Social and development impacts<br>▪ Environmental benefits<br>▪ Growth potential<br>▪ Replicability potential<br>▪ Other benefits | **What If?**<br>▪ Schedule disruptions<br>▪ Cost and revenue variances<br>▪ Output performance changes<br>▪ Key person changes<br>▪ Changes in law or regulation<br>▪ Owner, lender, investor, sponsor changes<br>▪ Staffing disruptions<br>**To Whom?**<br>▪ Customers: households, businesses<br>▪ Donors: charitable institutions<br>▪ Government<br>▪ development institutions<br>▪ Investors: partners, suppliers,<br>▪ Mead industry |

**How to implement proposal?**

Having a process defined and documented is only the start. Most companies struggle to get their process implemented.

**Make it easier to follow the process than it is to do the proposal without it:** With or without a process, it's not easy to do a proposal. A well designed process, by eliminating the need to reinvent the wheel, will expedite things and make it easier to follow the process than to improvise. A more complex process, requiring more effort and training to follow it, reduces the advantage to the user, increases the perception that the process requires work over and above what is required to do the proposal, and increases resistance to the process. If you find yourself asking people to invest in following the process for an intangible future benefit, your process is too difficult. The process should show people how to do the things they will have to do anyway, and make it easier than coming up with their own solutions.

**Prime the pump (work towards success):** Whenever possible, customize process templates and fill-in forms in advance. This lowers the effort to execute the process. Every time someone faces a blank page, the outcome is unpredictable. It also raises the level of frustration and resistance. Set things up so that all contributors have to do is to provide content.

**Build training into the process and make it constant:** Training should not be a separate once a year or even once a proposal event. Thirty-six five-minute sessions delivered at the moment of need are better than one three-hour session. Each task should come with guidance built in. If you have identified what you want reviewers to validate, then you have the criteria you need to enable contributors to self-review. Think of every instruction paragraph, checklist, or process document as a training tool. Build it into the process so that they don't have to go looking for it. Surround the participants with guidance.

**Set expectations:** Communicate clear roles and responsibilities at every step to ensure that participants know what they are getting into. No one should ever stop work or feel frustration as a result of not knowing what is expected of them. Process cooperation

and acceptance starts with a clear dialog regarding expectations. The process should provide opportunities to raise issues with expectations early and frequently to anticipate and mitigate potential problems.

**Ensure participants are capable of fulfilling their assignments:** Even if the process defines roles and responsibilities, communicates expectations, and provides guidance, it will fail if participants are not capable of fulfilling their assignments or not are available to fulfill them. When staffs are assigned who cannot fulfill their assignments, you are doomed to failure. They need to be helped or replaced as quickly as possible. To ensure the success of your process implementation, you should anticipate that this will happen occasionally and address it during resource identification and shortly after assignment tasking.

| LG #50 | LO #5- Recording information |
|---|---|

## Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Recording workplace information
- Identifying, rectifying and reporting defects

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, **you will be able to**:

- Record workplace information
- Identify, rectify and report defects

**Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

## Information Sheet 1- Recording workplace information

### 1.1. Collecting workplace information

Each workplace relies on the exchange of information to carry out its daily business. Information is passed from employee to employee, customer to employee, supervisor to team member, supplier to customer, and so on. Dealing effectively with information and records is necessary and important for all organizations. The quantity and variety of information kept by an organization can be huge. Information needs to be sorted into related groups so that it can be stored easily and found when needed. An organization's success depends largely on how well it manages its information. You need to be familiar with the type of information used in your job and the way records are organized so you can collect, file, store and find information quickly and easily. Finding and using information is a large part of many jobs, so knowing how to deal with it is an important workplace skill. Being confident and efficient in this skill helps you and your organization succeed.

**Types of information**

The types of records held by an organization vary depending on the business.

**Product information**

- Brew Date
- Batch number
- Volume of the mead
- Racking date
- Clarification date
- Fining date
- Temperature
- pH or acid levels
- Hazards at the workplace area

**Ingredients**:

- ✓ Amount of fining agents added to mead
- ✓ Amount of stabilizer used
- ✓ Other ingredients used

**Other workplace information includes**:

- Messages such as telephone and email
- Correspondence such as letters, memos, faxes and email
- Computer files such as reports and research
- Sales records such as monthly forecasts, targets achieved and sales reports
- Product information such as price lists, catalogues and brochures of our product
- Forms such as claim forms, membership forms, order forms and leave forms
- Electronic databases such as customer records, financial records and library catalogues
- Accounts records such as invoices, credit notes and statements (from suppliers and to customers)
- Personnel records such as employee details, salary rates and annual leave
- minutes of meetings
- Cash handling such as petty cash receipts, cash takings and register readings

**Ways of dealing with information**

There are different ways to deal with information. Each business will have a system that suits its needs. For instance, a large company might have a centralized, electronic system that allows its workers to access information from any location throughout the world. A small company may have a specialized system that integrates different types of information into the way staff works (for example, paper-based filing systems and databases). Every organization is different. The most important thing is to know how your workplace operates.

**Types of recording**

The following are the most common ways of information recording methods

**a) Paper-based records**

Examples of paper-based records include:

- Reports
- Magazines, journals and newspapers
- Project files
- Production data
- Minutes of meetings
- Business letters
- email messages and memos
- Faxes
- Forms
- Production out put

**Figure 1:** File cabinet system

**b) Electronic based records**

Many organizations store records and information electronically. Storing information electronically can save space and paper. Examples of electronic records include:

- Computer databases such as production catalog
- Customer records, sales records and financial records
- Electronic correspondence such as email and faxes computer files of letters, memos and other documents.

Information can be easier to access if it is stored electronically. You can search through records and copy information easily into other documents or files. The information in electronic records can also be updated, deleted or changed more easily than hard copy records.

**Figure 2:** Electronic records

**What will be the frequency of information record?**

- Daily
- Weekly
- Periodically, etc.

| Self-Check- 1 | Written test |
|---|---|

Name…… ID…… Date…….

**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

**Test I: Short Answer Questions**

**1.** Lit and discuss the types of information recording? (10pts)

***Note:*** **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short Answer Questions**

1. _____

_____

_____

_____

## Information Sheet 2- Identifying, rectifying and reporting defects

### 2.1. Equipment defects

Equipment procedures and maintenance guidelines should be kept in a central location for quick reference when needed. If missing, request complimentary copies from manufacturer or maintenance contractor. Malfunctions, faults, wear or damage to equipment are identified and reported in line with enterprise requirements. Since factors vary among installation sites, equipment users must work closely with each of their suppliers to ensure that proper data is being collected, that the data is being provided to the correct supplier, and that the resulting solutions are feasible.

All events (failures) that occur during inspections and tests should be reported through an established procedure that includes collecting and recording corrective maintenance information. The data included in these reports should be verified and then the data should be submitted on simple, easy-to-use forms that failures are tailored to the respective equipment or software. The detail of identification, rectification and reporting defects of product and equipments is discussed in LG #47 information sheet #5).

### 2.2. Defected of product (honey wine)

**Flavor defects**

A Honey wine fault or defect is caused by the chemical change of organic matter in honey wine due to the wrong production process and storage mode and leads to mead deterioration. The chemicals that cause flavor defects in honey wine have been produced. For example, the aldehydes such as dactyl organic acids, lipids and sulfur compounds in mead influence the taste of mead. When the concentration of one or more elements exceeds the standard threshold, the flavor characteristics of beer will change and form the flavor defect of mead. In particular, fermentation byproducts, even small fluctuations of just over 1% above the threshold can have an impact on the flavor of the mead. The detail of identification, rectification and reporting defects of product is discussed in LG #47 information sheet #5).

## 2.3. **Reporting defected products and equipment**

A damage defect report is a report that summarizes the overall findings of damage that has occurred to a property, vehicle or equipment. It helps understand the background to a claim and also documents information regarding details of the accident and the extent of the damage. The detail reporting of defects of product and equipments is discussed in LG #47 information sheet #5).

| Self-Check -2 | Written Test |
|---|---|

**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Why reporting of fault equipment required to supervisor? (2pts)
2. List out the defects to happen in mead maturation process? (3pts)

***Note:*** **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

**Answer Sheet**

Score = _____

Rating: _____

Name: _____ Date: _____

**Short Answer Questions**

1. _____
   _____
   _____
   _____
2. _____
   _____
   _____
   _____

## REFERENCES

Einstein, A., B. Podolsky, and N. Rosen, 1935, "Can quantum-mechanical description of physical reality be considered complete?", Phys. Rev. **47**, 777-780.

Einstein, A., B. Podolsky, and N. Rosen, 1935, "Can quantum-mechanical description of physical reality be considered complete?", Phys. Rev. **47**, 777-780.

Food and chemical toxicology: an international journal published for the British Industrial Biological Research Association 47(8):2057-63

Iglesias, A., Pascoal, A., Choupina, A. B., Carvalho, C. A., Feás, X., & Estevinho, L. M. (2014). Developments in the fermentation process and quality improvement strategies for mead production. *Molecules*, *19*(8), 12577-12590.

### Websites

Mead-Lover's Digest, an online distribution of articles from readers. Subscribe by e-mail sent to mead-request@talisman.com with the word "subscribe" in the subject line.
http://www.talisman.com/mead. Web site for Mead Lover's Digest and other material.
http://www.best.com/davep/mme, The "Mead Made Easy" book by Dave Polaschek in electronic format.
http://www.brewery.org/brewery/Mhall.html, collection of links to mead-related pages.
http://www.brewery.org/brewery/library/beeslees, collection of mead recipes, formulas and tables.
http://www.solorb.com/gfc/mead/mead.html, Mead Maker's Page on mead basics and terminology
http://www.gotmead.com/, Web site with mead-making basics and links.
https://winesvinesanalytics.com/features/article,Commercial-Mead-Production

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