

Chemical processes in winemaking



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Produce one bottle (750ml) of high quality wine by the controlled fermentation of the fruits of the Marula (*Schleracarya birrea*) tree. Name of wine produced by myself, Thomas Hulett, Jarryd Putter and Duncan Roberson was Chateau de Soleil. The name means the “ Place of the sun”. Since Mpumalanga means place of the rising sun, we thought it would be an appropriate name of our wine. Since we were also planning on selling our wine world wide, Chateau de Soleil, would suit our targeted market better.

Chemical process of Fermentation

Fermentation in basic terms is when yeast consumes sugar and converts it into approximately half alcohol and half CO₂ gas (carbonation) depending on weight. The breakdown of alcohol verses gas would not necessarily be half and half yet it would be very close. Variances due occur due to external factors such as the amount of air available, nutrients as well as the type of yeast used.

Fermentation can be broken up into two distinct stages primary and secondary. This is also described as aerobic and anaerobic fermentations.

Primary Fermentation normally lasts for the first four to seven days. During this time 70 percent of the fermentation activity will take place. In most case a noticeable amount of foam will form during this rapid fermentation.

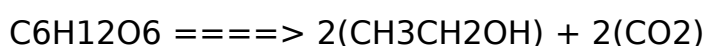
Primary fermentation also called aerobic fermentation because the fermentation vessels are allowed to be opened to the air. Air plays large role in the multiplication of yeast cells. The little pack of yeast used in a wine recipe typically multiplies up to 100 to 200 times during the few days of primary/aerobic fermentation. Without air this multiplying stage is hindered.

Alcohol will be produced in primary fermentation yet a significant portion of the yeast's energy is being devoted to reproducing itself.

Secondary fermentation phase is when the remaining 30 percent of the fermentation activity will take place. Secondary phase may last anywhere from two to three weeks depending on the amount of nutrient and sugars still available. It is therefore clear that the secondary phase is much slower and there is less activity at any given time. You should notice activity becoming slower by each passing day. The secondary phase is anaerobic fermentation which means the air exposure is to be kept to a minimum. It is this reduction in air exposure during the secondary phase that entices the yeast to forget about multiplying and start giving it energy completely to making alcohol.

During the fermentation process you will need to transfer wine off the sediment into a clean container. This process is referred to as “ racking”. You should “ rack” your wine at the end of primary fermentation, secondary fermentation and just before bottling.

“ The overall process of fermentation is to convert glucose sugar (C₆H₁₂O₆) to alcohol (CH₃CH₂OH) and carbon dioxide gas (CO₂). The reactions within the yeast to make this happen are very complex but the overall process is as follows:”



Sugar \implies Alcohol + Carbon dioxide gas

(Glucose) (Ethyl alcohol)

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<http://www.eckraus.com/wine-making-101.html>

<http://www.yobrew.co.uk/fermentation.php>

Procedural Design

First step is to sterilize all the apparatus which is going to be used besides the fruit, sugar etc. We did this to prevent contamination.

Take plus/minus 5kg of marula fruit and wash in Luke warm water. We selected our fruit by dropping the fruit into the water and the fruit that sank we used. By doing this we removed the water and selected ripe fruit.

Remove skin of the fruit. Since we were unable to remove the pip from the actual marula fruit we decided to boil the fruit in a pot and let it soak overnight in small amount of water. We then tried again to remove pip yet we were unsuccessful, so we decided to leave the fruit the way it was.

Removed the skin to get to the pulp of the fruit which is rich in sugars.

Take 5 litre bottle with a wide screw on top. Then add the boiled fruit with the small amount of water into the bottle. Add some skins for extra flavour.

Add 1 litre of distilled water and 500g of sugar into the 5 litre bottle. Sugar will later cause fermentation.

Dissolve 10ml dry yeast in three quarter cup distilled water. Add further half a teaspoon of sugar. Leave for an hour to activate. Yeast accelerates the fermentation process.

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Drill/bore a 6mm hole into the lid of the plastic bottle. Push a 6mm pipe, plus/minus 150mm in length through the hole. Pipe will be used to allow gases to pass out bottle. Make sure that prestik or some sort of agent is used to prevent oxygen from entering through the gap between the pipe and bottle cap.

Add the yeast sugar and marula mixtures into the bottle and screw the cap on tightly. So no other gases may enter.

Attach a 100-200ml bottle, filled with water, alongside to the large bottle (5 litre) by push the plastic pipe which is already connected to the 5 litre bottle into the bottle of water (100-200ml) alongside so that the tip is just submerged in the water. The reason for doing this is so as fermentation takes place the gases can escape from the 5 litre bottle and no surrounding air may enter.

The yeast fermentation will now commence. The gas released by the fermentation will be released into the small bottle of water alongside resulting in no air entering the marula mixture preventing it turning into vinegar. This process is known as anaerobic fermentation. The yeast in the 5 litre bottle ferments with the fruit and sugar causing the formation of gas. This gas is forced through the pipe into the smaller bottle. Gas bubbles in the mixture should be seen after 1-2 days.

The process will gradually slow down and fewer gases will be pushed into the smaller bottle alongside.

Add another 500g of sugar to the marula mixture to continue the fermentation process.

Repeat the adding of sugar until the fermentation stops.

The more sugar added the more alcohol is formed. Leave for 2-3 days.

After fermentation is complete sieve the marula mixture through a clean piece of gauze into a clean bottle. This will remove large particles of fruit and the by-products of fermentation.

The wine will mature better in the bottle the longer it stands, thus improving the quality.

Apparatus

“ Jik solution” to sterilise equipment.

5 litre large capped bottle.

Small bottle, 100-200ml.

6mm Pipe.

Marulas, yeast and sugar.

Teaspoon, Measuring flask(s), scale and small mixing bowl.

Stove and large pot to boil marulas in.

From research we found it was best to store the wine at a temp of 70-90 degrees Fahrenheit. The reasoning for choosing this method was that

Jarryd's next door neighbour had previously made marula wine and she was able to give us advice on how to make a good time. Temperature plays an extremely vital role in the fermentation process. If the fermentation temperature is too cool, the yeast may not be invigorated enough to ferment. It will simply remain in the juice, dormant. If the fermentation temperature is too warm, the yeast may

ferment fine, but the flavor of the wine will usually suffer. This is because of the increased production of unwanted enzymes by the yeast and the possible growth of micro-organisms that

thrive in warmer temperatures. The optimum temperature for a fermentation is 72 degrees, but anywhere between 70 and 75 will do fine.

Diagram of Setup Apparatus

Sealed cap (prestik)

Gas

Water

5 litre bottle

Sugar+Yeast

Pipe

Marulas

Water

Results of Wine-Tasting

Marks achieved on 5 assessed criteria

Analysis of results

From the wine tasting evening the results we received in the 5 assessed criteria were, Colour 5, Clarity 5, Bouquet 5, Taste 3 and Presentation 7.

From the marks it was clear that the wine we produced was not of high quality/standards. The colour of our wine was of intense attractiveness hence we received a 5. The reason for this could of been the fruit that we used was not of quality and was not perfectly ripe. The colour also could have been affected by our filtration process. In order to improve the colour of our wine we should make sure the fruit we choose/pick is perfectly ripe. We could ask someone with a professional background in marulas to help us. Also consider changing our process.

Clarity of our wine was not excellent yet it was acceptable as there was no sediment present. The clarity of our wine could only be linked to the filtration process we choose. In order to improve the clarity of our wine we would have to investigate a better filtration process.

The mark we achieved for the bouquet of the wine was also acceptable. The bouquet of wine has to do with the aging process. As the wine ages chemical reactions among acids, sugar, alcohols and phenolic compounds create smells which become known as the wines bouquet. So in order to improve our bouquet of our wine we should have made and bottled the wine sooner and given it time to age.

Taste was the lowest mark we achieved. We understood from the comments made that our wine was quite sour and sharp. Yet all white wine drinkers enjoyed our wine and told us it was a nice white wine. Therefore from the analysis of the individuals who tasted our wine the better option would be to make a sweet/dry wine. In order to improve on our taste we could have add more sugar to sweeten the taste of our wine. Since people found our wine to taste little bit like vinegar too much oxygen must have been present in the process of making our wine. The only way to improve on this is to make sure no oxygen can enter into the fermenting bottle. We should have double checked that the bottle was securely fastened and no oxygen could enter through rim of the pipe. By doing this I believe our taste of our wine could have been improved.

Then our highest mark achieved was presentation, we received a 7. This was due to tasty treats and original African design topped off by our one of a kind bottle.

Conclusion

That we made an acceptable wine which was little bit more pleasing to the eye and nose and not so much to the taste buds. Yet by changing few things in our procedural design as mention in the analysis our wine would definitely receive high marks.

Uses of Alcohol in our Society

Alcohol has been a major factor in society for millions of years now.

Misconceptions created are that alcohol is only used in beverages which are

sold for the public's consumption. Alcohol is not just used (and miss used) in society for social purposes or enjoyment. In many faiths and traditions alcohol has been used for medicinal purposes and in religious ceremonies. Libations and the religious mysteries of Dionysus used wine as a sacramental entheogen to induce a mind-altering state. Wine (alcohol) is also form an integral part of the Jewish laws and traditions. Wine (alcohol) is recited over by Kiddush, which is a blessing, and then it is used to sanctify the Shabbat. On Pesach, Passover, it is seen as a rabbinic obligation for women and men to drink 4 cups of wine. In Christianity wine is used in a sacred rite called Eucharist. This originates from the last supper in which Jesus shared bread and wine with his disciples. Various socials traditions and activities are linked to alcohol (mainly beer). Social games which are associated with beer drinking are games such as playing cards, darts, bags or other pub games. Then there are the common drinking games linked to beer such as beer pong, flip cup and quarters.

Alcohols are also used as source of energy. Methanol and ethanol are alternatives to fossil fuels and they burn very cleanly and only produce carbon dioxide and water. We even wear alcohols in today's modern society. Alcohols (ethanol, as it is the least toxic) are added to perfumes to prevent the plant and animal extracts from going off. Alcohols are even included in cosmetics and vegetable essences such as vanilla extracts. Then there is methylated spirits which contains methanol and is used for cleaning (mostly cleaning of paint brushes). Isopropyl alcohol is widely used in industries as a solvent for paints and chemical processes. Glycerol is an alcohol with three carbon atoms and three hydroxyl groups in its molecules. Glycerol possesses

many moisturizing properties so 50% of glycerol produced goes into foods and cosmetics.

Alcohol is also a very good disinfectant, Surgical spirits for example which is used to clean wounds. Another form of disinfectant is alcohol swabs which are also used in the cleaning of wounds.

These are only a few uses of alcohol in today's modern society. With all the modern developments in sciences and engineer there must be a tremendous amount of uses for alcohols arising each day.

http://en.wikipedia.org/wiki/Wine#Religious_uses

<http://www.alcoholandyou.org.uk/facts/uses.html>

<http://science.jrank.org/pages/187/Alcohol-Names-properties-uses.html>

Abuses of Alcohol in our Society

Alcohol abuse in today's modern society is major growing concern. Alcohol abuse is the use of alcoholic beverages in excess, either on individual occasions ("binge drinking") or as a regular practice. Alcohol abuse is extremely dangerous if it gets out of hand. Some individuals drink to the point of losing their health, their family and their jobs.

A growing concern at the moment in the U. K. is how businesses are suffering from poor performance and increased absenteeism by employees due to their alcohol consumption. It's not only a few businesses which have to deal with this problem over 79 percent of business in U. K. reported increased problems linked to alcohol abuse. The problem with alcohol abuse

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in businesses it that it leads to poor productivity meaning the company will not be able to make the intended profit. This decreases the chance of economic growth as it's not just happening in one company but 79% of businesses in U. K.

Another major concern is alcohol abuse in rural areas and amongst pregnant women. Since the wages received by rural workers is not high at all, when drinking becomes a problem and there is a family to support, major turmoil is created. The individual whom abuses alcohol would squander the money and then there would be no money for education for children and most importantly food. This would lead to conflict within the family and in some cases abuse. Drinking while pregnant in certain developed nations is illegal although in developing nations this is not known. Alcohol abuse amounts pregnant woman is another major problem. These female individuals do not know the damage they causing their child (brain damage, mental instability). In some cases the child is born an alcoholic.

Alcohol abuse is not only a concern in rural areas. It up market urban areas alcohol buses figures are raising. Alcohol abuse leads to drunken driving which endangers not only the abuser but many innocent individuals around them. Statistics show Two thirds of the deaths seen at hospital trauma centres are due to car accidents, and for over 20 years, alcohol has caused 40 to 50 percent of those wrecks.

Alcohol abuse has a negative effect on the health of your body. The consumption of large amounts of alcohol regularly can and most probably will lead to permanent liver damage and in some cases death. Alcohol

poisoning will most likely be caused by alcohol abuse. Alcohol abuse leads to misjudgement which in some cases leads to violence.

This violence in the form of fights in bars, on streets even at soccer/rugby games is totally unnecessary and can lead to death or permanent damage.

<http://www.sahealthinfo.org/admodule/alcohol.htm>

<http://www.cmaj.ca/cgi/reprint/160/5/675.pdf>

<http://www.medterms.com/script/main/art.asp?articlekey=10925>