



Global Market Scenario, Novel Technologies in Processing of Wine and Its Nutritional Significance

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Abstract

Enology is the science deals with wine and winemaking that focuses on grapes after they have been harvested. Wine geography has captivated mankind from ancient civilizations to the current globe. Ancient Egyptians, Greeks, Romans and other early traditions had a keen appreciation of the influence of geography upon the characteristics of wine produced within an area. In addition to winemaking, grapes have been grown for the production of raisins and table purpose. Grape production relayed upon agricultural practices like fertilizing, irrigation, canopy management, monitoring fruit development and characteristics, deciding when to harvest and vine pruning during the winter months, monitoring and controlling pests and diseases. Leaves have venotonic, vasoprotective, astringent and diuretic effects. The berries are vitaminics, tonics, anticancer, hepatoprotective, promote hair growth and prevent ischemic processes, while seed oil have hypolipidemic, prevents increase in vascular permeability, hence grape plant have tremendous medicinal importance since ancient time.

Keywords: Ageing, Enology, Viticulture, *Vitis vinifera* L.

Introduction

Viticulture is the broad term comprises the cultivation, protection and harvest of grapes and these all are confined to outdoor operations; whereas, enology is the science dealing with wine and winemaking, including the fermentation of grapes into wine, which is mostly confined to the indoor operation. A vineyard is a plantation of grape-bearing vines grown for winemaking, raisins, table grapes, and nonalcoholic grape juice. Viticulture introduced by Persian traders 4th millennia BC. During 16th century Portuguese colony introduced port-style wine. Indian wines were showcased during 1883 at Calcutta international exhibition. Indian wine industries started in Maharashtra during 1980-1990. The Nasik city of Maharashtra is called as “*Wine Capital of India*”. Wine is an undistilled alcoholic beverage typically made up from the fermented grapes or fruit juice, produced by fermenting crushed fruits using various types of yeasts mainly ‘*Saccharomyces cerevisiae* var. *ellipsoideus*.’ and various steps for grape processing are briefed in figure 3. Viticulture experienced one of the highest growths among Agri-Horticultural commodities in terms of acreage as well as value over the past 30 years and is now a global

multibillion-dollar enterprise (Table 1). This growth is related to factors such as increased international trade, improved global incomes, changing policies, technological innovations in production, storage, and transportation, by-product processing and utilization leading to development of novel and healthy products, and greater awareness of the health benefits of foods rich in antioxidants like grapes (Table 2).

Biochemicals Responsible for Aroma

- The perception of wine flavor and aroma is the result of a multitude of interactions between a large number of chemical compounds and sensory receptors.
- Factors: the de novo synthesis of many flavor active primary (e.g., ethanol, glycerol, acetic acid and acetaldehyde) and Secondary metabolites (e.g., esters, higher alcohols, fatty acids).

Types of Wine

Sharma *et al.* (2010) has classified the wines into based on colour and usage of grapes.

1. White Wine.
2. Red Wine.

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Table 1: Top 10 Wine-producing and consuming countries in the World 2021 (Anonymous, 2021)

	Wine-producing countries in the World (Million-hectare litres)		Wine consuming countries in world per capita (litres)		Wine-Exporting Countries in the World (% of Global Wine Exports)	
1	United States	33.0	Portugal	51.9	France	29.2
2	France	24.7	Italy	46.6	Italy	21.1
3	Italy	24.5	France	46.0	Spain	9.0
4	Germany	19.8	Switzerland	35.7	Australia	6.2
5	United Kingdom	13.3	Austria	29.9	Chile	5.4
6	China	12.4	Australia	27.8	United States	3.8
7	Russia	10.3	Argentina	27.6	New Zealand	3.0
8	Spain	9.6	Germany	27.5	Germany	2.8
9	Argentina	9.4	Sweden	27.0	Portugal	2.3
10	Australia	5.7	Netherlands	24.2	Argentina	2.0

- 3. Pink/ Rose.
- 4. Sparkling Wine (contain considerable amount of carbon dioxide).
- 5. Fortified wines (Contain added alcohol/ Alcohol content of fortified wines is 19-21%).
- 6. Table Wines (Low alcohol content and little or no sugar).
- 7. Dessert Wines (These are fortified sweet wines).

Red Wine Grape Varieties

1. Pinot noir: This variety used for superior red wines preparation.

Table 2: Nutritional significance of grape wine

Components	Percentage (%)
Water	86.0
Sugar (fructose, glucose and sucrose)	0.3
Alcohol (ethanol)	11.2
Organic acids (tartaric acid, mallic and lactic)	0.6
Minerals (K, Ca, Mg and Fe)	0.5
Phenols (flavonoids, non flavonides)	0.3
Nitrogenous compounds	0.1
Flavor compounds	Trace

2. Rubyred: New variety from released from H.P. Olmo during 1958. Wines from Rubired are opaque with a very intense deep-red colour.

3. Syrah: This variety majorly cultivated in Hermitage area of the Rhone Valley in France, it also known as Syrah.

4. Cabernet sauvignon: Cultivated in Bordeaux region of France, the wines are deep purple in colour and have high tannins.

5. Merlot: Is the principal black variety of the Bordeaux area. It has good colour with a plummy flavor related to that of the Cabernets.

6. Zinfandel: Majorly cultivated in Californian. It is the third most widely planted red wine grape after Cabernet

Sauvignon and Merlot Zinfandel.

7. Tempranillo: This variety is cultivated in Spain. It is having good color intensity and a slightly blue hue.

These briefed red wine varieties are shown in figure 1.

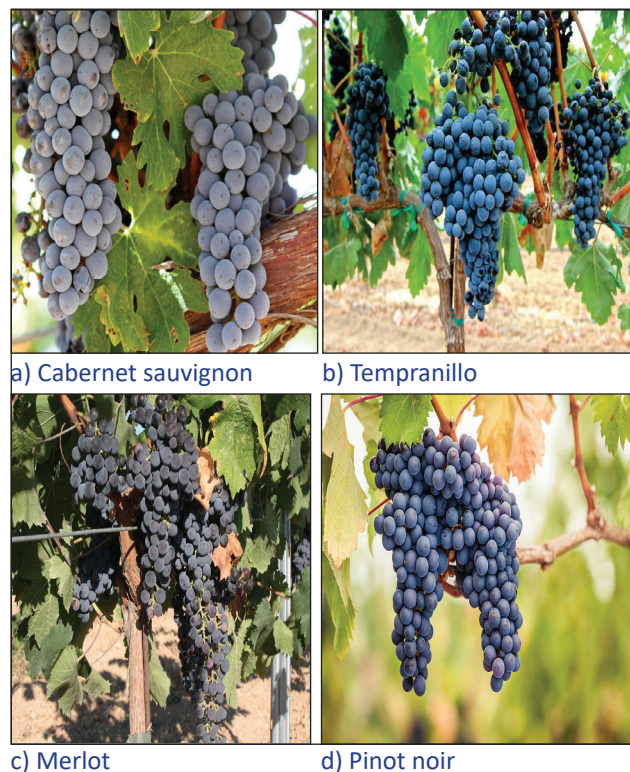


Figure 1: Global red wine varieties

White Wine Grape Varieties

1. Sauvignon Blanc: This variety ranks first among the white wine grape.

2. Grown in France: Successfully cultivated in South Africa and California.

3. Sultana: Is primarily a drying grape but in some seasons, in Australia, more sultanas are crushed for white wine than grapes of any other single variety.

4. Melon: Melon is the official French name, for this white

grape variety and is used in Burgundy.

5. Chardonnay: Majorly cultivated in Burgundy and Champagne regions of France. The varieties were used for champagne purposes.

6. Muscadelle: Is a white grape variety of the Bordeaux region.

These briefed red wine varieties are shown in figure 2.

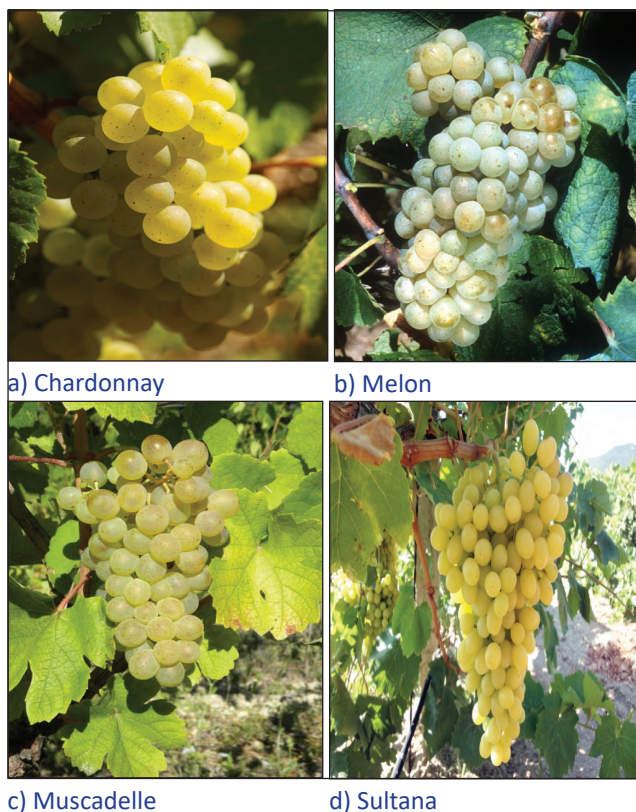


Figure 2: Global white wine varieties

Procédures Involved in Wine-Making

1. Viticulture: Warm sunny day with cool night with rainfall of 400-600 mm, day temperature 28-32 °C and night temperature 15-18 °C with dry weather helps in accumulation of sugar, tartaric acid and color pigments in grapes while light requirement 700-1100 micro molar unit.

2. Harvesting: Grappes are picked up by hand or mechanically, discisions of harvest informed by level of sugar and acid.

3. Stemming: Stemming is the process of separation of beeries from the stems.

4. Crushing: A horizontal press squeezes the broken grapes, separating the fresh juice (must) from the skins.

5. Fermentation: Sugar and acids that naturally react with wild yeasts, vineyard adding their own yeasts and fermentation can take from 10 to 30 days to convert natural sugar to alcohol.

6. Draining: Liquid wine is drained from the vat without being pressed and filled into the barrels. The remaining pulp retains about 20% of the wine.

7. Pressing: The remained pulp after draining then it will squeezed out. The press wine tends to be dark, harsh and unpalatable and is mixed with free-run wine.

8. Mixing: The free-run wine and press wine are always from the same source and are mixed together in appropriate ratios to obtain the desired balance.

9. Clarification: Clarification is the step of stabilization of fermentation. During clarification all remaining solids are removed from the fermented liquid.

Clarification done in numerous ways:

- Fining, a process that calls for the addition of substances that causes the solids in the liquid to adhere to one another and sink to the bottom of the vat.
- Running the liquid through coarse and fine filters.
- Siphoning the liquid off the top of the fermenting vats after the solids have settled to the bottom.

10. Aging: At this point, the clarified wine is transferred into either wooden barrels or metal vats in which the wine is allowed to further mature and develop flavors. If a winemaker chooses to age the wine in wooden casks, then only allowing the wine to pick up flavors from the wood, adding greater depth to its flavors. We have to keep in mind that the “woody” flavor isn’t suited to all types of wine, hence the use of metal vats.

11. Bottling: A dose of sulfite is added to help preserve the wine and prevent unwanted fermentation in the bottle. The wine bottles then are mechanically sealed with a cork, although alternative wine closure such as synthetic corks and screwcaps, which are less subject to cork taint, are becoming increasingly popular.

Advance Technologies in Process of Wine Preparation

1. VitiCanopy

Bei *et al.* (2016) developed an app as “VitiCanopy” at University of Adelaide. Mainly developed to help grape growers by monitoring the growth of the vineyard “canopy”. Users can take a picture of the vine using their smartphone, which then returns a reading or measure of the “vigour” of the canopy. Help farmers to make decisions about the balance between leaf and fruit growth.

2. GPS Sensors

Rogiers *et al.* (2022) developed this technology. “Shiraz is really sensitive to berry shrivel (rate of berry shrivel in Australia is 30%). Because of high temperature during ripening of berry leads to degradation of enzymes and colour. Higher concentration of sugar yields high alcohol. According to Professor “Sigfredo Fuentes” a senior lecturer in wine science at the University of Melbourne, The Sensor technology - Thermal and GPS sensors mounted to drones or “multicopters” - collect data on all aspects of grapevine physiology, from vine growth to water and nutrient status. Data from thermal maps can help stamp out problems such as berry shrivel and assist in controlling the alcohol content in wines.

3. Sap-Flow Sensors

Siqueira *et al.* (2020) used the Sap-flow sensors system this technology measures the effects of irrigation on the vine. Sap-flow sensors measures how much water is flowing

through it. Powered by solar energy, the sensors transmit data in equal intervals, every few minutes. The system sounds an alert if irrigation is required.

4. Measuring Wine Style

The PinotG Style Spectrum - a scale used on labels of Pinot Gris and Pinot Grigio wines, it is a fully-developed example of the application of spectral fingerprinting technology and it is used to inform consumers of the style of wine in the bottle at point of sale in a simple, graphical way.

Impact and Significance of Yeast Breeding

Yeast influence wine aroma and flavor profiles in multiple ways. In addition to the formation of ethanol, yeast can directly produce both positive and negative aroma impact compounds, such as esters, higher alcohols, higher aldehydes and sulfur-volatile compounds. Many can modify varietal aroma through enzymatic and chemical mechanisms. Yeast mannoproteins and polysaccharides may also affect wine stability.

Yeast Assimilable Nitrogen (YAN)

Nitrogen is a critical grape nutrient for yeast growth and

fermentation activity, affects the rate and completion of fermentation, fermentation bouquet and style of wine. YAN analysis provides information on the nitrogen status of grapes, musts and juices; specifically, the amount of nitrogen available for yeast to utilize during fermentation. Early detection of nitrogen deficiency in grapes and juice can enable winemakers to make decisions regarding nitrogen additions using inorganic nitrogen (di-ammonium phosphate; DAP) or organic nitrogen. Nitrogen supplements can reduce the risk of slow or stuck fermentations, affect the development of undesirable sensory characters such as hydrogen sulfide.

Wine Policy

- Concept introduced in 1970 by Shaw Wallace and The UB group.
- During 2007-2008 budget Karnataka government announced the “Karnataka grape processing and wine policy 2007.”

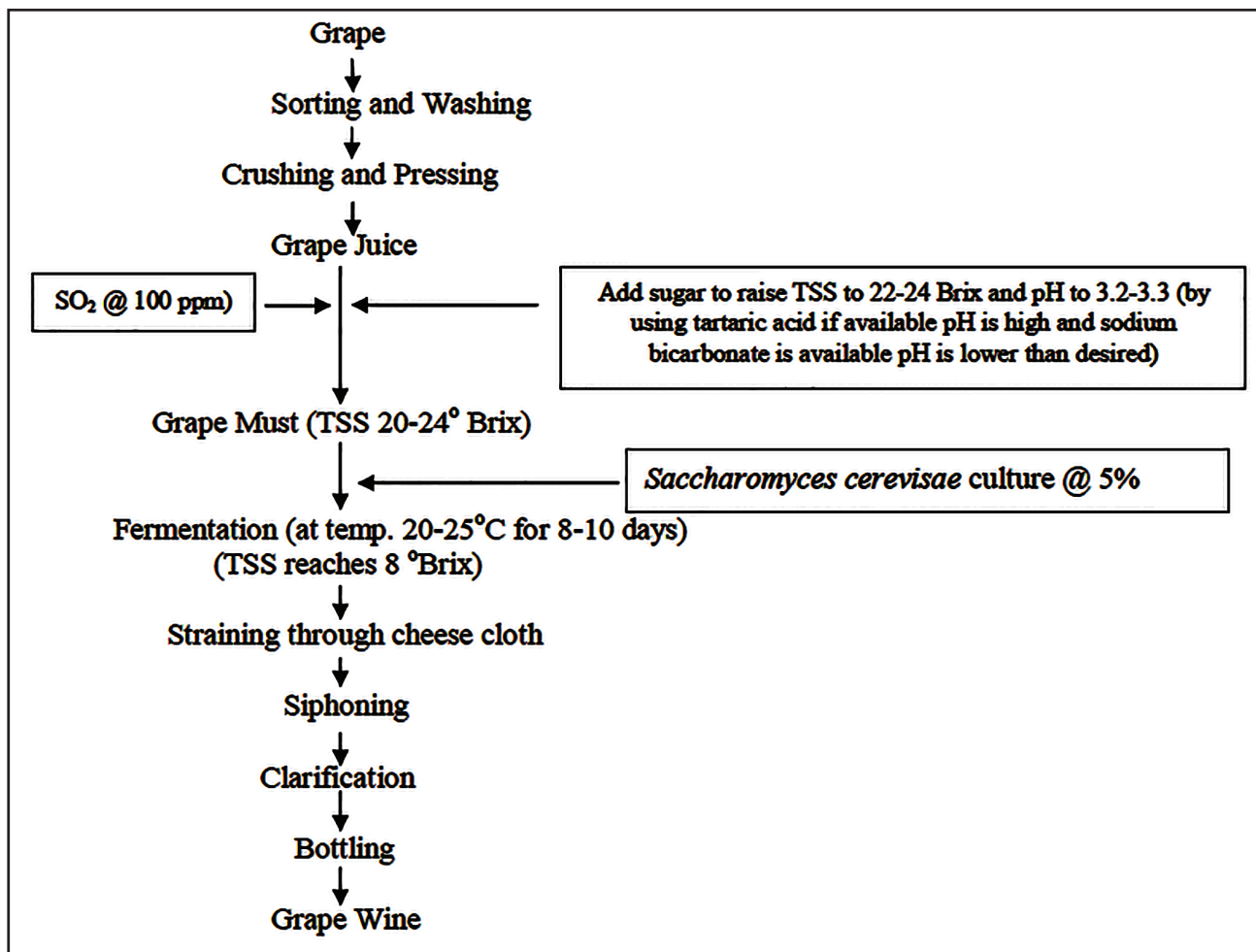


Figure 3: Steps involved in wine making process

Conclusion

Wine is an important un-distilled alcoholic beverage made up of fermented fruit juice. There are many benefits of wine

consumption mainly prevents heart and circulatory diseases, fight against obesity, anti-ageing, provides greater longevity of life, regulates bone density, prevent Alzheimer’s disease,

antidepressant, healthier skin, prevent obesity, boost defenses, strengthens the bones protect teeth against dental plaque and improve our eyesight. It has made a large impact in many historical ways, as well as many economical ways.

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