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(54) **METHOD AND COMPOSITIONS FOR PRESERVING WINE**

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(57) **ABSTRACT**

Resveratrol and/or pterostilbene are added to wines to preserve the wine from oxidation, bacteria and fungi. The resveratrol and/or pterostilbene can be added to grape must prior to fermentation and/or to fermented wine prior to bottling.

METHOD AND COMPOSITIONS FOR PRESERVING WINE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from provisional application Ser. No. 61/019,745, filed Jan. 8, 2008, the entire contents of which are hereby incorporated by reference.

FIELD OF THE INVENTION

[0002] The present application relates to a method and compositions for preserving wine.

BACKGROUND OF THE INVENTION

[0003] Wine is traditionally defined as an alcoholic beverage produced when fruit undergoes primary fermentation in which yeast converts the sugar in fruit to alcohol. When the sugar supply is exhausted, the yeast dies off, leaving the alcohol produced to blend with, or attach to, other components.

[0004] Almost all wine improves with aging. However, peak flavor and bouquet may require years to develop in wines with high concentrations of tannins, and many wines deteriorate not long after reaching their peak. Chemical reactions during the aging process are extremely complex and well documented. The desirable characteristics of wine result from a long term blending of the components in the wine.

[0005] The traditional wine aging process is simple, well known, and well understood. Oxidation is among the greatest problems with which a winemaker deals during the making and aging process for wine. Oxidation can adversely affect the fruity flavor and freshness of wine. In order to prevent oxidation of the wine, sulfur dioxide (as potassium metabisulfite or sodium metabisulfite) is frequently added to grape must before fermentation to inhibit or kill all unwanted bacteria prior to the point at which the alcohol production commences after fermentation begins. The metabisulfite salts are converted to sulfur dioxide, which is the so-called "free sulfite" of wine. After fermentation produces some alcohol, the sterilizing effects of alcohol assist in killing the unwanted bacteria.

[0006] In some wines, particularly those of the Sauternes type, a considerable quantity of naturally-occurring sulfur dioxide is retained in the wine until the wine is bottled. In red wines and in some white wines, sulfur dioxide is added to prevent the wine from becoming unsound.

[0007] When sulfur dioxide is first added in the Free State, it rapidly combines with other substances in the wine, so that sometimes in a few minutes, and, in other cases, in as much as thirty minutes, the amount of free sulfur dioxide is halved. Over a period of weeks or months, the exact rate of disappearance depends upon many factors, such as temperature and amount of aeration, whereby the total sulfur dioxide content of the wine falls.

[0008] During the normal aging process for wine, the conditioners and preservatives, such as sulfur dioxide, are dispersed throughout the liquid. Changes in the wine following bottling are subtle and difficult to establish, since there are no measurements other than taste and smell that are used to determine when the aging process is complete and when the wine invariably begins its decline. Further, the ingredients used vary among wines and winemakers, and each ingredient may affect the aging process differently.

[0009] There is a direct relation between the amount of sulfite added and the inhibition of bacterial growth in wine. As such, large scale wine producers, whose risks are high, may use a higher concentration of additives such as sulfite to avoid spoilage. However, with the addition of large amounts of sulfites, the wine can be adversely affected, irrespective of the lack of bacterial deterioration.

[0010] Some smaller wine producers advertise that they do not use sulfite. This is important to many consumers, as some consumers complain of headaches which are attributed to the presence of sulfite in wines, even though all wines contain a small amount of naturally occurring sulfites. Although the relationship between sulfites in wine and headaches has not been clinically confirmed, many believe that the link is real. As such, wines not containing added sulfites may command a higher retail price, because manufacturing costs are higher and the risk of losing entire batches of wine to bacterial contamination and/or oxidation is borne by the consumer.

[0011] Although all wines naturally contain some sulfites as a result of the fermentation process, the amounts of these sulfites are not noticeable to most people. However, when sulfites are added to the must, during fermentation and more so after bottling, gaseous hydrogen sulfide develops in the wine. This gas is extremely toxic and, in many cases, may destroy what would otherwise be a good wine. The concept of decanting the wine, or letting the wine "breathe", in essence allows the hydrogen sulfide to volatilize out of the wine so that it is then suitable for drinking. There is no nutritional value to the sulfites added to wine, and, in the case of sodium metabisulfite, consumers may wish to avoid additional sodium as well.

SUMMARY OF THE INVENTION

[0012] It has now been discovered that resveratrol; pterostilbene, a natural methoxylated analogue of resveratrol; or a combination of the two compounds, can be used as an antioxidant, fungicide and bactericide in wine. Resveratrol and pterostilbene have no known side effects in humans, and can be used as a replacement for sulfites that are conventionally added to wines as preservatives.

[0013] The resveratrol, pterostilbene, or combination thereof, can be added to the grape must prior to fermentation, during fermentation, and at the time of bottling the wine. Since the yeast during fermentation and the alcohol produced during fermentation do not adversely affect the pterostilbene or resveratrol, the time of addition of these compounds is not critical.

[0014] Grapes, and some other fruits and vegetables such as Vaccinium berries, normally produce resveratrol as a defense mechanism when being attacked by some extraneous fungi, bacteria or insects. However, the amount of resveratrol the fruit or vegetable produces is only sufficient to protect the individual fruit or vegetable, but it is not nearly enough to protect an entire batch of wine produced from grapes (about 5 mg/kg in red wine). Moreover, different grape varieties produce different amounts of resveratrol.

[0015] Resveratrol and/or pterostilbene, whether naturally occurring or synthetic, can be added to wine to act as a preservative. These compounds can be added to wine in amounts ranging from about 10 mg/L to about 10,000 mg/L Ideally, the compounds should be added twice. It is preferable to add pterostilbene during the first step of fermentation because it is less water soluble than resveratrol and thus will create a thin film layer on top of the must, further preventing

contact with oxygen and preventing decomposition of the pterostilbene. Resveratrol, which is more stable than pterostilbene, is then added to finished wine to act as an antioxidant during aging and storage of the wine.

[0016] Resveratrol and pterostilbene have antibacterial and antifungal activity in wine. (Biochem. Pharmacol. Jan. 15, 2002; 63(2) 99-104).

DETAILED DESCRIPTION OF THE INVENTION

[0017] Resveratrol, 3,4'-dihydroxystilbene, also known as 3,4',5-stilbenetriol, is a phytoalexin produced naturally by several plants when under attack by bacteria or fungi. Resveratrol has also been produced synthetically (see Farina et al., *Nat. Prod. Res.* 20(3): 247-252, 2006).

[0018] Pterostilbene is a stilbenoid compound that is an analogue of resveratrol. Other names for pterostilbene are 4-[(E)-2,(3,5-dimethoxyphenyl)ethenyl]phenol; 3',4'-dimethoxy-4-stilbenol; and 3,5-dimethoxy-4'-hydroxy-trans-stilbene.

[0019] In grapes, resveratrol is found in the skin and seeds. The amount found in grape skins varies with the grape cultivar, its geographic origin, and exposure to fungal infection. The amount of time wine spends in contact with grape skins is an important determinant of its resveratrol content. Table 1 illustrates resveratrol content in several types of wines

TABLE 1

Beverage	Total Resveratrol, mg/L
Muscadine wine	14.1-40
Red wines (Global)	1.98-7.13
Red wines (Spanish)	1.92-12.59
Red grape juice (Spanish)	1.1-8.69
Rose wines (Spanish)	0.43-3.52
Pinot noir	0.40-2.0
White wine (Spanish)	0.05-0.80

[0020] As can be seen from Table 1, ordinary non-muscadine red wine contains between 0.4 and 12.59 mg/L of resveratrol, depending upon the grape variety. White wine contains much less resveratrol. This is because red wine is fermented with the skins, allowing the wine to absorb the resveratrol, whereas white wine is fermented after the skins have been removed from the grapes. Additionally, red grape skins have more resveratrol than white grape skins. However, wine grapes that have been sprayed with pesticides that prevent fungal infection contain little, if any, resveratrol, because there is no need for the grapes to protect themselves from fungal infection by producing resveratrol. Wine grapes grown in dry climates have less resveratrol than those grown in humid areas.

[0021] It can readily be seen that the amount of resveratrol in wines is extremely low, so that additional resveratrol or pterostilbene must be added to wines to preserve the sine from oxidation, bacteria and fungi.

[0022] Quantitative studies of resveratrol in plants have found that there are only one to two parts pterostilbene per ten parts of resveratrol. The relationship between the two compounds and their unequal content in plants is unclear, but it remains the subject of ongoing studies. Dark-skinned grapes are likely to contain the most pterostilbene. For reasons that are not clear, pterostilbene is normally not found in wine. This may be because it is unstable in light and air, which makes it less likely to survive the wine making process.

[0023] The following examples are for purposes of illustrating the invention, and are not meant to be limiting in any way,

EXAMPLE 1

[0024] One gram (1000 mg) of resveratrol was dissolved in one liter of 12.5% alcohol non-sulfated Cabernet Sauvignon. While the variety of wine would not make much difference, the alcohol content of the wine might have some effect on spoilage, as a wine having a higher concentration of alcohol would need less resveratrol to control spoilage.

[0025] The resveratrol enriched wine was stored in an open bottle at room temperature. The wine retained its taste and color for more than five months, despite the exposure to atmospheric oxygen and ambient bacteria and fungi. This is in contrast to similar wines to which sulfite has been added which, once exposed to oxygen, begin to deteriorate within a few hours.

EXAMPLE 2

[0026] Volunteers were given 8 ounce glasses of red wine fortified with 1 gram/L of resveratrol. The volunteers drank three eight ounce glasses of the wine. In a separate experiment, as a comparison of resveratrol absorption, the volunteers drank eight ounce glasses of the same red wine fortified with 2 g/L resveratrol and 3 f/L of resveratrol. In each test, the volunteers were instructed to sip the wine slowly and retain it in the mouth for a long period of time (up to 60 seconds) before swallowing.

[0027] In all cases, that is, drinking wine fortified with 1, 2, or 3 grams/liter of resveratrol, the effect was the same. The level of free (unconjugated) resveratrol in the serum of the individual volunteers was directly proportional to the amount of resveratrol that was consumed. Because the volunteers retained the wine in their mouths for a long period of time, much of the resveratrol in the wine was absorbed through the mucous membranes of the mouth directly into the bloodstream. Therefore, the amount of free resveratrol was greater than if the resveratrol had been administered orally. In addition, there was no perceptible difference in tests of these wines treated with three different amounts of resveratrol. When the wine is retained in the mouth it is absorbed via the oral mucosa straight to the blood and thus by passing the hepatic immediate conjugation to glucuronic acid a thus it does not looses its biological activity.

EXAMPLE 2

[0028] Studies were conducted at the Israeli Wine Institute under the supervision of Mr. Shlomo Cohen, The CEO of the Institute.

[0029] Wines were evaluated to determine if resveratrol was effective in preventing oxidation and other degradation of both red and white wines. The red wines were cabernet sauvignon and shiraz. The white wines were chardonnay and Muscat.

[0030] The study ran 12 batches for each kind of wine: 3 control, with no additives; 3 with 100 ppm SO_2, the accepted industry standard; 3 with low dose resveratrol, 300 ppm; and 3 with high dose resveratrol, 3000 ppm. The resveratrol was added in about 1:1 stoichiometric ratio and 10 times the stoichiometric ratio of the sulfite used.

[0031] The following parameters were compared:

[0032] 1. pH

[0033] 2. Density.

[0034] 3. Brix

[0035] 4. Browning (indication of oxidation) in different waves lengths: 280 nm, 420 nm 520 nm and 62 nm.

All the different studies indicates that resveratrol can replace SO_2 in the preservation of wine

[0036] The foregoing description of the specific embodiments will so fully reveal the general nature of the invention that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without undue experimentation and without departing from the generic concept and, therefore, such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments.

What is claimed is:

1. A method for preserving wine comprising introducing into wine an effective amount of a preservative selected form the group consisting of resveratrol, pterostilbene, and mixtures thereof.

2. The method according to claim **1** wherein the preservative is present in amounts ranging from about 1 gram/L to about 10 grams/L.

3. A method for producing wine that is resistant to oxidation comprising:

a. introducing an effective amount of a preservative selected from the group consisting of resveratrol, pterostilbene and mixtures thereof into grape must prior to fermentation; and

b. fermenting the wine.

4. The method according to claim **3** wherein an additional amount of preservative is introduced into the wine after fermentation and prior to bottling the wine.

5. The method according to claim **3** wherein the preservative is pterostilbene.

6. The method according to claim **4** wherein the additional amount of preservative is resveratrol.

7. The method according to claim **3** wherein the preservative introduced into the grape must is pterostilbene, and the preservative introduced into the wine after fermentation is resveratrol.

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