

# Effect of the Introduction of Chrysanthemum on the Nutritional and Sensory Properties of Cabernet Sauvignon Red Wine

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**Abstract:** In this paper we propose a new wine technology where dried chrysanthemum is introduced during the process of fermentation of wine. This technology sets an example of a blend between exotic wine culture and traditional Chinese tea culture. The influence on the chemical and sensory properties of wine due to the addition of different amounts of chrysanthemum at different fermentation periods was studied. In all the wine with added chrysanthemum the content of both polyphenols and flavones obviously increased. The wine of T1 and T2 had a higher content of polyphenols and flavones than others, due to thermomaceration, whereas those in the wine of T2 were the highest, due to the technique of squeezing juice. The sensory quality of T3, without the techniques of thermomaceration and squeezing juice, was optimal, with characteristics such as a ruby color, fuller aroma, and a lighter flowery texture. Therefore, T3 was defined as the optimum of chrysanthemum adding procedures. With the increase of chrysanthemum addition, both flavones content and polyphenols content of the obtained wine first increased, and then decreased.

**Keywords:** Red wine, Chrysanthemum, Fermentation.

## Introduction

Chrysanthemum, native to China, is a kind of a representative medicinal and edible herb. Flos Chrysanthemi in Chinese Herbs is the dried flower of *Chrysanthemum morifolium* Ramat., recorded in “Shennong Encyclopedia of Chinese Medicinal Herbs” and “Chinese Pharmacopoeia”. Furthermore, modern medicine has proved that chrysanthemum has effects including dispelling wind, cleaning heat, removing toxic substances and improving eyesight [4, 18]. In addition, chrysanthemum is one of Chinese traditional tea drinks.

Wine is one of the most common beverage products, with various types existing. In China, the ration of wine in beverage products has risen rapidly [15]. With the improving of Chinese

living standard, “nutrition” and “characteristic” have become the theme of wine industry [16]. To enhance the nutrient value of wine products, and to change the situation for a single product on the wine market, Chinese traditional tea culture is bound to integrate with the rising wine culture, and a special healthy wine with Chinese characteristics should be developed. In this paper, the influence of adding chrysanthemum on the chemical and sensory properties of Cabernet Sauvignon dried red wine was investigated.

## Materials and methods

### *Grape and Chrysanthemum*

Grape berries (*Vitis vinifera* cv. Cabernet Sauvignon) were processed from commercial vineyards located in the Huai-Zhuo Basin, Hebei, in the 2011 vintage. The dried chrysanthemum used was White Chrysanthemum of Hangzhou growing in Huailai County, Hebei.

### *Yeast strains*

The yeast (*Saccharomyces cerevisiae*) used for conducting alcoholic fermentation was the commercial dried preparations (LaIVin D254, Lallemand Inc., France).

### *Winemaking experiment*

Grapes were destemmed and crushed into fermenters (20 L capacity). The grape juice was treated by the addition of SO<sub>2</sub> (60 mg/L). Alcoholic fermentation was conducted at 25-30 °C and initiated by inoculation with rehydrated dry yeast. At the completion of alcoholic fermentation, the fermenting juice was pressed off grape skins and subsequently racked off lees. Then, wines were settled, racked into vessels (12 L) without ullage, prepared by the addition of SO<sub>2</sub> (60 mg/L), and stored at 14-16 °C.

Chrysanthemum was added into the grape must, followed by alcoholic fermentation. The different addition procedures were conducted as follows: the crushed must was heated to 70 °C for 2 hours, followed by adding Chrysanthemum, cooling and inoculation (T1); the crushed must was heated to 70 °C for 2 hours, followed by squeezing the juice, adding Chrysanthemum, cooling and inoculation (T2); the chrysanthemum was directly added to the crushed grape juice, followed by inoculation (T3); no chrysanthemum was added (CK). The amounts of chrysanthemum addition were 0.5%, 1.0%, 1.4%, and 1.8% respectively. The experiments were done in duplicate, and the progress of the fermentations was monitored by the total of the juice.

### *Chemical analysis of grape juice and wine*

Total soluble solid (°Brix) was determined for the grape juice and wine by refractometry. Total acidity (TA), pH and SO<sub>2</sub> concentration in the grape juice and wine were determined according to the OIV methods. Alcoholicity was determined by distillation, using an alcoholimeter. Polyhenol was determined by ferrous tartrate colorimetry [17]. Flavone was determined by NaNO<sub>2</sub>-Al(NO<sub>3</sub>)<sub>3</sub> spectrophotometry [5].

### *Sensory evaluation*

Wine was evaluated at the end of fermentation. The tasting panel was composed of 7 trained members with a long experience in wine tasting and aroma evaluation. Scores were given with a full mark of 30, divided into colority, aroma and texture, respectively, and descriptors were recoded. The wine samples were coded and presented randomly to the panel [9].

## Results and discussion

### *Effect of the chrysanthemum adding procedure on the nutritional properties and sensory quality of wine*

Polyphenol compounds are an important variety of antioxidant compounds in wine, with structural and functional diversity [2], which contributes to the color, flavour, astringency, bitterness and clarity of wine [8, 14]. Polyphenol compounds are also the main carrier for the antioxidant effect of wine [1, 3, 10]. The factors relative to the polyphenols in wine include not only grape material (involving such factors as variety, climate, geographical features, and cultivation patten) [11], but also the winemaking techniques [7, 12]. During the winemaking, the nutritional properties of wine changed with regard to the active compounds from the added chrysanthemum. Fig. 1 shows the dynamic of the polyphenolic compounds content in wine during the fermentation under different chrysanthemum adding procedures. The content of polyphenolic compounds for wine in each team rose with the fermentation. The polyphenols content in T2 was obviously higher than those of other treatments and CK, successively followed by T1. In T1 and T2, a higher content of polyphenol in the wine came into being at the beginning of fermentation, followed by somewhat ascending during the fermentation period. However, in T2, in the first 2 days of the fermentation process, the polyphenolic compound in the wine decreased, and got a little higher than that of the grape juice before fermentation. Furthermore, compared to CK, T3 had a similar change trend with regard to the polyphenol content. At the beginning of fermentation there was a little polyphenol compound in the wine for T3 and CK, close to each other, then it sharply increased, followed by a gentle ascending. At the end of the fermentation, the polyphenol compound for T3 was slightly higher than that of CK.

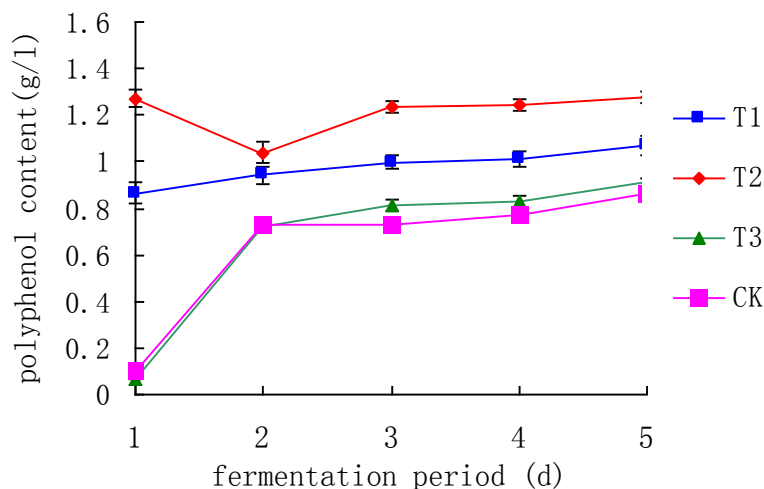


Fig. 1 Effect of different adding procedures of chrysanthemum on the polyphenol content of the wine

Polyphenol has a great variety. Flavone, as a kind of a bioactive compound in fruit and vegetables, providing the bitterness of wine [6], gets more and more concern [13]. Fig. 2 shows the dynamic change of the flavone compounds content in the wine during the fermentation under different chrysanthemum adding procedures. The variation tendency of the flavone compound content in the wine during the fermentation was similar to that of the polyphenol compound. The flavone content in all the wine with chrysanthemum added was clearly higher than that of CK. The flavone content in the wine of T2 was the highest compared with those in all the other treatments, followed by that in T1. Due to the heating treatment, the wine of T1 and T2 had higher contents of flavone at the beginning

of fermentation, while those of CK got higher contents of flavone at the end of fermentation. During the fermentation process, T3 and T1 were getting closer in flavone content.

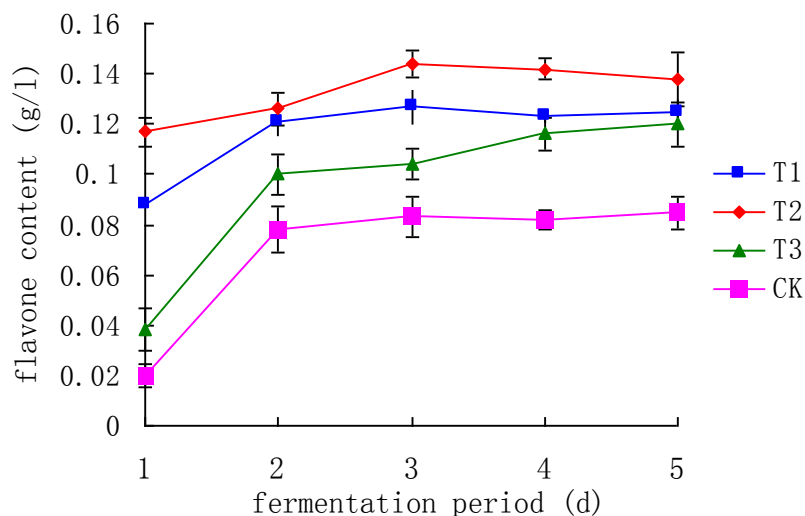


Fig. 2 Effect of different adding procedures of chrysanthemum on the flavone content of the wine

The various sensory properties of the wine with the different chrysanthemum adding procedures are shown in Table 1. The wine with chrysanthemum was bestowed with a light perfume of Chrysanthemum. According to the taste evaluation, the sensory quality of wine in T3 was optimal, with characteristics such as a ruby color, fuller aroma, a lighter flowery texture.

Table1. Effect of the procedure of adding chrysanthemum on the sensory properties of the wine

Treat	Sensory description	Score
1	Clear and onion skin red appearance, a harmonious and round taste, a little bitter after-taste, a fuller scent of chrysanthemum	22
2	Clear and slight dull, dark red, a slight acerbity, a heavy scent of chrysanthemum	18
3	Clear and lustrous appearance, pale ruby red, a full and soft body, sweet and sour moderate, a fresh and fine aroma, a velvety scent of chrysanthemum, a good harmony	28
4	Clear appearance without foreign substance, dark red, an excessive tannin body with an early emergence, weak persistence	20
CK	Clear and typical red wine appearance, pure taste, good bouquet	25

### *Effect of the amount of chrysanthemum addition on the nutritional properties and the sensory quality of wine*

Under the established chrysanthemum adding procedure in winemaking, the effect of the amount of dried chrysanthemum addition on the nutritional properties of wine was also studied. The change in the polyphenols content in the wine resulting from the different amount of chrysanthemum addition is shown in Fig. 3. The polyphenolic compounds of wine first increased, and then decreased with the increasing of the amount of chrysanthemum

addition. At 1.0% of the chrysanthemum addition, the polyphenol content of the wine reached the maximum. All the wine treated with chrysanthemum had significantly higher polyphenol content than CK.

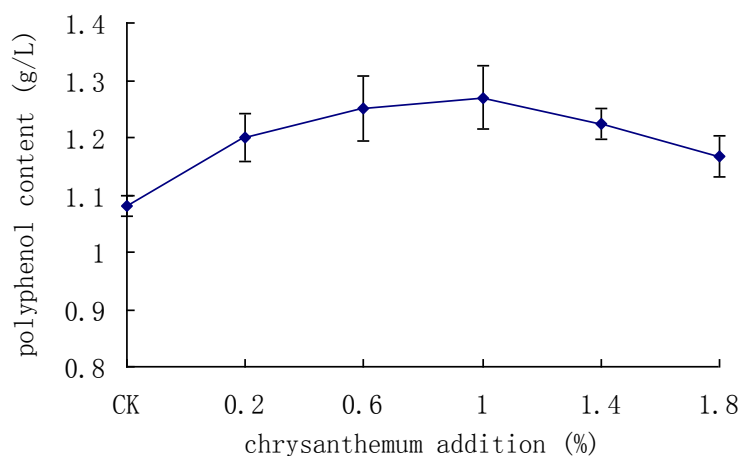


Fig. 3 Effect of the amount of chrysanthemum addition on the polyphenol in the wine

The effect of the amount of dried chrysanthemum addition on the flavone content of the wine is shown in Fig. 4 The flavone compound of the wine also increased first and then gradually decreased with the increasing of chrysanthemum addition. The wine with 1.0% chrysanthemum addition had the highest flavone content. All the wine treated with chrysanthemum had significantly higher flavone content than CK.

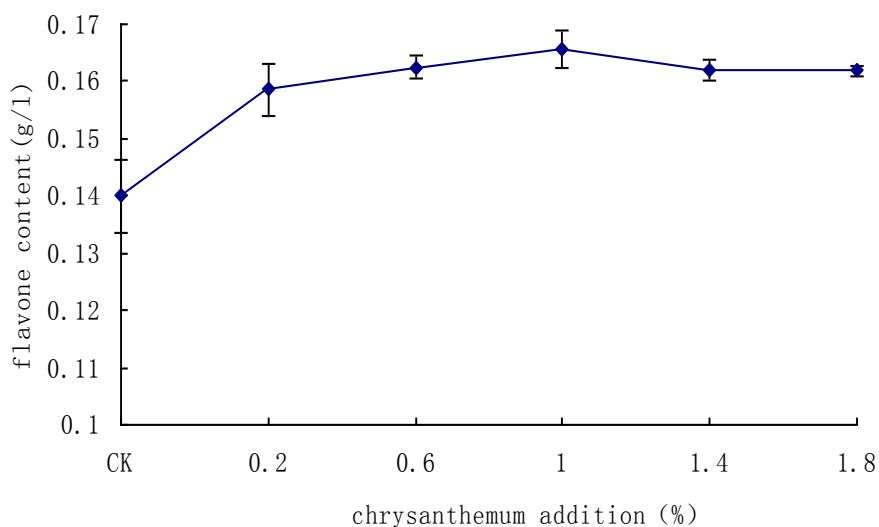


Fig. 4 Effect of the amount of chrysanthemum addition on flavone of wine

Table 2 shows that the sensory property of the obtained wine was also affected by the amount of chrysanthemum addition. According to the taste evaluation, the sensory quality of the wine with 1.0% chrysanthemum addition was optimal, while the excessive chrysanthemum addition brought about a little heavy flowery scent of chrysanthemum and an unbalanced texture.

Table 2. Effect of the different addition of chrysanthemum on the sensory properties of the wine

Treat	Sensory description	Score
1	Clear and lustrous appearance with a purple hue; astringent, strong after-taste, a slight scent of chrysanthemum	20
2	Clear, rose red; a strong solid, apparent scent of chrysanthemum with weak persistence	26
3	Clear and lustrous appearance, pale ruby red, a full and soft body, sweet and sour moderate, a fresh and fine aroma, a velvety and lasting scent of chrysanthemum, a good harmony	28
4	Clear appearance without foreign substance, a dark purple hue, a heavy tannin taste, a spicy after-taste, a sharp scent of chrysanthemum	17
CK	Clear and purple appearance, a slight piquancy, a fresh and sweet after-taste, a little distinct scent of chrysanthemum	18

## Conclusion

To improve the health care of wine, a new kind of wine with Chinese characteristics was developed by combining Chinese traditional tea culture with exotic wine culture. The polyphenolic compounds in wine come mainly from grape berries, and the heating treatment prior to fermentation can advance the transfer of the polyphenolic compounds from berry to juice. Polyphenol is also an important kind of a bioactive compound of chrysanthemum. Fermentation promotes the extraction of polyphenol from grape peel and chrysanthemum. The introduced chrysanthemum can improve the polyphenolic content of wine. A short decline of the polyphenols dynamic curve for T2 at the beginning of fermentation may be due to the test operation or other unknown factors. Moreover, this decline phenomenon was not found in all the flavone dynamic curves. In the procedure of squeezing for T2, the peel and seed of the grape were removed without the formation of a wine “cap”, thus, the chrysanthemum got fully soaked in wine to advance flavones dissolving out.

With an excessive addition of more than 1%, chrysanthemum can impact the sensory quality of wine, hindering the full extraction of the active compounds from chrysanthemum.

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