

Wine - dealcoholisation

Spinning Cone Column Application Bulletin 1-03-2308



The Spinning Cone Column (SCC) is an efficient and versatile stripping column that can be used for a variety of wine-making applications (see Bulletin 1-01-1306). One such commercially successful application is that of alcohol adjustment while retaining all the desired and valuable flavour of the wine.

When using modern wine making techniques, there are several reasons the adjustment of alcohol may be considered desirable. Two specific applications where the SCC has made dramatic differences in commercial wineries are:

- Adjustment of the ratio of flavour to alcohol in order to improve the quality of full strength wines.
- Production of a range of reduced alcohol wines.

In both of these applications a two stage process is used whereby the heat-sensitive, delicate wine aroma is first removed from a portion of the wine using the SCC. The second stage involves the removal of the alcohol from the de-flavoured wine to the desired level. The flavour together with the dealcoholised portion of wine is backblended with the bulk original wine to produce the finished product at the desired alcohol level.

Key benefits of the Spinning Cone Column are:

- Delicate, varietal wine flavours are

recovered intact – without damage to characteristic top-notes.

- Precise control over operating parameters allows the profile of the flavour recovered to be controlled and adjusted.
- Production of high quality spirit during alcohol reduction stage.
- Flexibility of SCC technology allowing several winery applications in addition to alcohol adjustment processes.
- Hygienic design with Clean In Place (CIP).

The number of wineries using Spinning Cone Column technology for alcohol adjustment for full strength wines has grown dramatically as the demand for full, “fruity” wines has escalated, not only in home markets but also in key high-value export markets.

In California alone, some 500 wineries have utilised SCC technology in the production of high quality wines.

The Spinning Cone Column

The SCC is a uniquely efficient counter-current liquid-gas contacting device, i.e. a distillation or stripping column, that belongs to the same family of mass transfer devices as packed, plate and bubble-cap columns. The SCC is unique in its use of gentle mechanical forces to enhance inter-phase contact. This allows the rapid, efficient and cost-effective separation of volatile compounds such as aroma and alcohol from a thin-film liquid

system. The SCC can process thick, viscous slurries containing high levels of suspended solids just as readily as it can clear liquids without damaging the recovered flavour or the treated product.

Further details regarding the operating principle of the SCC may be found at www.flavourtech.com

Alcohol Adjustment – Full Strength Wines

The ability to improve the characteristics of a wine by a small adjustment in the ratio of flavour to alcohol is based on the physical principles of relative volatility.

Wine aroma is made up of a complex number of volatile compounds that stimulate our olfactory senses. The impact that each compound has is dependant on several factors, notably the concentration at which they exist at in the wine and the relative volatility of the compounds in the wine. If the aroma compounds are not very volatile they will have less impact when we taste a wine than if they are more volatile. In the context of wine the biggest single factor that effects the volatility of the aroma compounds, and therefore the impact they have when a wine is tasted, is the alcohol concentration. Chart 1 shows how the volatility of aroma compounds of interest to winemakers changes with alcohol concentration.

As can be seen from Chart 1, the volatility of key wine flavours increases as the alcohol content is reduced. The area of most interest when considering full strength wines is of course the changes that occur in volatility when a wine is reduced from 14 to 16% ABV down to 12 to 14% ABV.

The SCC can maintain the flavour impact of a fully developed grape whilst removing the alcoholic burn associated with “hot” wines, thus controlling and balancing the body of the wine.

The reduction of alcohol is achieved in a two step process. It is important to note that not all of the wine need be treated. Only a portion of the total wine is processed, depending on the final alcohol content required.

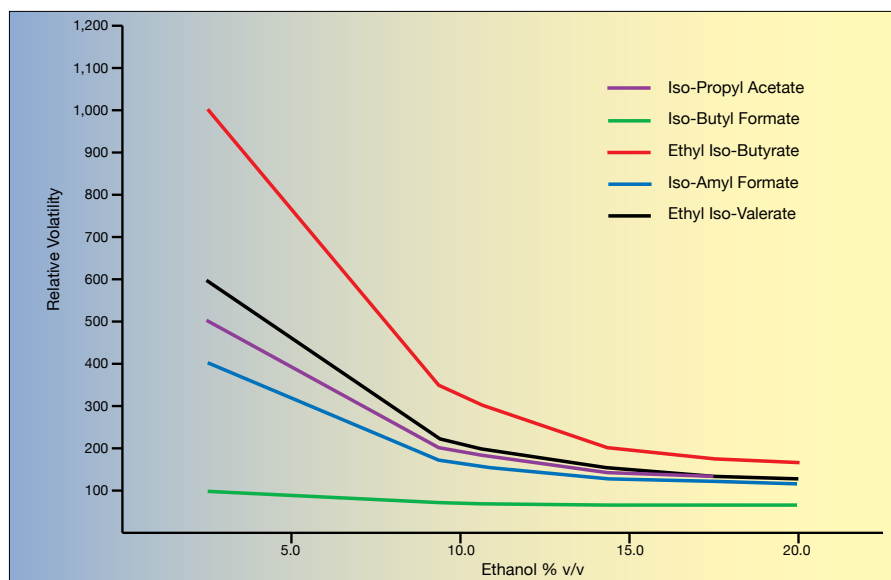


Chart 1 - Volatility versus alcohol concentration

Step 1 - Protecting the Aroma

Before the alcohol level is adjusted, it is vital that all of the flavour and aroma in the wine is removed and protected. The SCC's ability to recover the aroma as a stable, concentrated and alcoholic condensate without damage is unique. This is due to the high separation efficiency combined with a low residence time (about 30 seconds) at low operating temperature (typically 25 to 35°C).

At the end of the aroma recovery step all of the volatile flavour of the wine will be in a volume equivalent to 1 or 2% of the volume processed. Typically the alcoholic strength of the aroma will be 55 to 60% ABV. The alcohol concentration of the de-flavoured wine will therefore have been reduced by about 0.5 to 0.7% ABV. Chart 1 suggests that in aroma with an alcoholic strength of 50 to 60% ABV the compounds are low in volatility and this helps to protect them while they remain separated from the wine base.

Step 2 - Removing Alcohol

While the aroma is safely stored, the de-flavoured wine can be reprocessed on the SCC in a second pass to remove alcohol. Again the gentle processing conditions used in the SCC ensure that the wine is not subjected to excessive heat. The amount of alcohol removed is controllable by simple operating parameters. It is generally considered undesirable to process the whole of a batch of wine to reduce the alcohol from say 16 to 14% ABV. Instead a much higher alcohol removal rate can be used on part of the batch and then blended back with unprocessed wine and the stored alcoholic flavour to give the final alcohol concentration required.

The table below indicates the amount of wine from a 10,000L batch which should be processed given a target alcohol concentration. The initial wine concentration has been assumed as 15% ABV.

Processing volumes for a 10,000 litre batch of 15% alcohol wine	
Final alcohol concentration required (%ABV)	Volume of wine required to be processed (L)
13.9	987
6	6,936
0.5	10,000

Flavourtech is an Australian based company specialising in innovative process technologies including the:

- Spinning Cone Column
- Centritherm® evaporator
- Resin Adsorbing Column
- Integrated Extraction System

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Spirit - A Valuable by Product

The removal of alcohol from wine results in the production of a clean spirit by-product. This spirit is typically recovered at a concentration of 50 to 55% ABV. This low cost yet high quality spirit can be used for fortification or other purposes (subject to approval by regulatory authorities in individual countries). Flavourtech has recently developed a number of wine plant upgrades that allow alcohol output concentrations of above 90%v/v.

The Californian Success Story

The SCC is widely used by winemakers in California for adjusting the ratio of flavour to alcohol in order to produce premium quality finished wines.

Much of the flavour of a wine is determined by the concentration of non-volatile precursors present in the grape immediately prior to harvesting. These precursors are transformed into the delicate, characteristic wine aroma during the fermentation and maturation processes. However it is known that the formation of these precursors occurs later in the grape than the developed sugars. This means that when the weather in any particular region is hot sugar levels rise

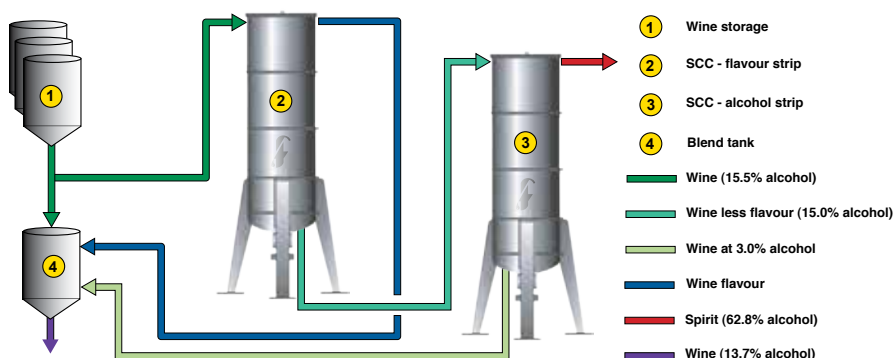
allows the grape to be left on the vine to allow full maturity of the flavour precursors regardless of the sugar content. The resulting wine may be fermented to in excess of 15% ABV in the safe knowledge that all of the flavour will be present and enhanced when the alcohol level in the finished wine is adjusted downwards by 1 or 2% ABV.

A further advantage for some wine producers is that the finished wine strength may be kept below any high alcohol limit that may incur a higher rate of taxation.

Alcohol Adjustment - Reduced Alcohol Wine

For a variety of different reasons markets for several categories of reduced alcohol wines ranging from <0.05% to 10% ABV are increasing. The key to successful growth of these products is in producing such products while retaining the desired flavour of the original full strength wine.

By varying the conditions used in the 2 stage process described above, it is possible to produce wines across a complete final alcohol range that will retain all of the desirable, volatile flavours. Careful selection by the wine maker of the starting wine and the SCC



Alcohol adjustment using the SCC in a two pass process

rapidly to those required to produce wine in the range of 12 to 14.5% ABV before the flavour precursors have fully developed. In the past in order to ensure the alcohol content does not exceed 14.5% the grapes have had to have been picked based on sugar content. As such there is a danger particularly in hot climatic conditions that the flavour of the finished wine will be weak and lacking in fruit character.

The use of the 2 stage alcohol adjustment process described above

operating conditions, ensures a high quality of finished product, previously unattainable, is achieved. Flavourtech's new Resin Adsorbing Column (RAC) technology can also be implemented for the production of zero alcohol wine products (<0.05% ABV).

As with the alcohol adjustment process for full strength wines, a quantity of clean wine spirit is produced as a by product of the production of reduced alcohol wines.



Contact details are continually updated at flavourtech.com