

Thoughts concerning the winemaking process

History

Wine has been made for thousand of years. Initially, in classic time, wine was fermented in pots made of burnt clay. The size of such pots was not more than 1 to 2 hl, and all processes could be handled by hand, such as stirring, transfer from pots, filtration and "bottling".

Slowly, the volume of the pots - the process vessels - grew larger, but still all the processes from pressing to bottling were done by feet or hand. Only in the last part of the 19th century, transfer pumps were introduced. In the same period it was realized that cooling of the fermenting must has a beneficial influence on the quality of the wine.

Cooling of fermentation vessels, however, was nearly impossible since the tanks were mostly made of wood or concrete. The cooling problem therefore put a limitation to the size of the fermentation vessels, and only when the first metal tank, properly lined, early in the 20th century came into use, it became possible to cool the tanks by simply spraying them with cold water. This made the construction of larger vessels possible, since it then was possible to "extract" the heat from the fermentation and to control the temperature to some degree.

The further processes like filtration and particularly ageing were still done in smaller vessels, because the necessary agitation (batonage) and "oxygenation" could only be handled in relatively smaller vessels/barrels, which for all practical purposes were made in oak wood.

Only as late as in the middle of the 20th century it became possible to construct the fermentation tanks in stainless steel. By adding external cooling jackets to such stainless steel tanks it became technically possible to increase the size of the tanks from the previous maximum of 100-200 hl up to 300-600 hl, since the oenologist could now adjust and control the temperature to a much higher degree, particularly in white and rosé fermentation. There is, however, a limit to how large you can make such jacketed tanks, since the heat removed is proportional to the wall area of the fermentor, while the heat generated is proportional to the volume. Therefore the limit is, when the tank surfaces are totally covered with jackets.

Present technology

Basically, both beer and winemaking are relatively simple anaerobic biotech processes. One of the most important parameters in all such biotech processes is to keep the tank content homogeneous both what concerns temperature and chemical compositions. As mentioned before, keeping temperature low and homogeneous is important. This requires agitation. However, up until now the winemaker has relied on the natural convection established either by the CO₂ generation or by temperature gradients along the cold tank wall. Such agitation, however, is not very efficient.

Similarly, keeping compositions homogeneous have also relied on the CO₂ generation and/or temperature gradients. As mentioned before, this is not very effective way to ensure such homogeneity, particularly when a uniform temperature is to be preferred.

Homogeneity in composition over the entire tank volume, as well as the necessary time needed to achieve it, is of key importance in a number of situations, right from

1. Inoccoluation
2. Enzyme addition
3. Ingredient addition both before and during fermentation
4. Keeping yeast in suspension
5. Keeping malolactic bacterias in suspension,

up until the end of the winemaking process where good mixing of wines before bottling and adjustment of the CO₂ is of utmost importance for obtaining the desired quality. Also in connection with micro-oxidation it is extremely important, that the minute amounts of oxygen is added and dispersed in such a way, that all parts of the tank volume is treated in a fast, consistent and homogeneous way.

Future possibilities

With the development of the ISO-MIX rotary jet heads (RJH), mixing technology, a door has been opened to an entirely new era in the winemaking process. Applying this technology not only makes the overall process systems less costly, but gives the winemaker a new possibility to actively control and influence the processes where he until now to a large extent has been left to rely on reactive ways of response. The ISO-MIX system consists very simply of a pump, a recirculation loop, and an ISO-MIX RJH mixer installed under the liquid surface. The

must/wine is pumped from the bottom of the tank – possibly over a heat exchanger – to the ISO-MIX blender. It is the rotary jet effect which ensures the surprisingly fast blending and homogenization of the entire tank content.

Applications of ISO-MIX

The ISO-MIX RJH process system gives the oenologist a number of tools which individually are superior to any existing comparable tools available to him today.

The ISO-MIX RJH mixer very effectively may be used for:

1. Blending of wines (mixing of large volumes into large volumes)
2. In-mixing of ingredients (mixing of small volumes into large volumes)
3. Gas dispersion
4. Powder dispersion
5. Crystal dissolution
6. Cleaning of tanks

The following comments may be added to the above "tools" or applications.

Re. 1. The blending of wines from the ordinary table wine to the finest champagne is a common job which with an ISO-MIX RJH can be done in minutes rather than hours. The potential negative influence of the mixing process on the wine is thereby reduced proportionally.

To ensure tank homogeneity during fermentation in terms of sugar, yeast and temperature is done fast and effective. If a plate heat exchanger is installed in the recirculation loop, an extremely efficient heat extraction system may be established. In such a system 20-30% of the cooling capacity will not be lost to the outside of the tank being the case for typical jacketed tanks. The total tank system at the same time will be less costly.

Re. 2. In-mixing of enzymes, nitrogen compounds and other micro-ingredients can be done in few minutes and with a homogeneity which it will today take hours to establish.

- Re. 3. The ISO-MIX RJH system has proven to surpass all other comparable gas dispersion systems in terms of dispersing gas into liquids or removing one gas with another gas from a liquid. In the wine industry, this "tool" may be used for adjusting the CO₂ content, downward by blowing in N₂. For both macro oxidation as well as for micro oxidation this technology may prove to be very efficient for addition of oxygen.
- Re. 4. Any powder may be added either directly to the tank or more efficiently to the loop on the suction side of the recirculation pump.
- Re. 5. The agitation effect of the jets will dissolve any crystals normally used in the wine industry fast and effectively.
- Re. 6. At the end of the process, the ISO-MIX RJH may be used as an extremely fast and effective tank cleaner, which automated will clean the tank in matters of minutes and without having people to enter the tank. Since the impingement of the jets on long distance is very effective, the tank cleaning may be performed not only in a much shorter time, but also with 50-75% less water and chemicals than normally used in less advanced cleaning systems.

Conclusions

All in all, the wine industry with the ISO-MIX RJH system has now got a new and extremely powerful set of tools added to its toolbox. A piece of technology which has already proven itself in other demanding areas, and which may add an entirely new meaning to process predictability in the wine industry, irrespective of whether the size of the winery is producing 250,000 bottles or more than 25 million bottles per year.