Heat stabilisation: past and present

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Bentonite not the first clay for wine

Spanish clay from Lebrija has long been used for fining sherry wines, and was subsequently used in many other countries. Kaolin was trialed in France for protein removal shortly before bentonite was discovered in the USA. Spanish clay and kaolin were much less effective protein removers than bentonite. Use of kaolin in fining wines has also been mentioned in much earlier texts such as Geoponica, the 10th century Byzantine Greek farming manual.

Most common bentonite used

Using in-line dosing


Alternative adsorbents

Many alternative adsorbents have been trialed, but none adopted. Reasons include:

- High price (bentonite is cheap)
- High dose requirements
- Small particle size (higher doses and price could be partly counteracted by using them in regenerable packed beds, but small particle size can create other issues like high pressures/low flow rates)
- Preparation difficulties
- Sensory impacts (some bentonites can remove vanilla/orange flavors and there are debates about whether this is practically significant or not).

Protases

Protases that break up proteins responsible for haze were first investigated in the 1960s, but found to require the use of elevated temperatures. In 1982, at the International Conference on Wine Enological Research in Ophir, Montana, an acceptance from wine producers indicated interest about possible sensory impacts and the food industry requirements.

Proteases

- Zirconia
- Calcium bentonite

German calcium bentonite

In 1948, German-owned Geolastmener Erde calcium bentonite with a low calcium solubility began to be sold and became popular in Germany.

Sodium-calcium granulated blends

In 1969 the Erblsöh wine division (a division created based on the popularity of Geolastmener Erde) released NaCalit. This was a blend of sodium and calcium bentonites that sought to achieve the greater adsorption properties of sodium bentonite with the lower lees volumes of calcium bentonite. This product was also granulated from finer powder, making it easier to prepare without clumping.

Lees compaction during removal or juice/wine recovery with cross-flow filtration

One of the biggest issues with bentonite is the large lees volumes it causes and this process is typically recovered by in-line drum vacuum filtration, during which it is cooled and dried with water. Use of centrifuges for bentonite separation and cross-flow filtration for lees recovery almost completely counters this.

Heat unstable unclarified wine

Wine without macromolecules

The alternatives

The alternatives

- Zirconia
- Calcium bentonite
- Montmorillonite

Carageenan

Polyacrylate from red algae commonly used as a thickener and stabiliser of dairy products, and also as a beer fining agent (sometimes in unpasteurised forms - e.g. Irish moss).

Single-stage ultrafiltration

Ultrafiltration was trialed in the 1980s at laboratory scale and as part of early industrial-scale investigations of cross-flow filtration as a means of clarifying juice or wine and simultaneously removing proteins. Unfortunately, ~10 kDa membranes were not effective, requiring larger molecular weight polyacrylates important to wine quality and experiencing some bleed-through of protein. Negative experiences with single-stage cross-flow ultrafiltration likely contributed to early wine industry negativity towards cross-flow filtration.

Cross-flow ultrafiltration is a process that would not need additional processing aids and that could be integrated as additional stages in automated cross-flow microfiltration equipment. This approach could address all of the concerns of macromolecule stripping experienced with single-stage ultrafiltration in the 1980s. Key questions remain on what membrane materials would be found with suitable rejection and pore sizes that would consistently achieve the protein removal.