Grapes 101

This is fine: Wine additives, just passing through

By Anna Katharine Mansfield

Figure 1. Fining trials of three to five different concentrations should be performed to fine-tune addition rate prior to fining a wine tank. This trial was performed in 100mL graduated cylinders, and shows an exaggerated amount of gelatin fining. Photo by Anna Katharine Mansfield.

Each time nutritional labeling is considered for wine bottles, winemakers creep into corners, furtively whispering to one another: “So...do we have to put fining agents on the label?” Fining agents may the secret agents of the wine world, because while they’re certainly added to the wine, they’re also removed before the wine is bottled- and if they’re not in the bottle, they shouldn’t be on the bottle label, right? From a legal point of view, that question remains open- but to understand why it’s even under discussion, let’s review the reasons fining agents are used, what they are, and why some people want them on a label.

**Fining removes selected compounds to improve wine sensory or stability.** Fining agents are added to clear hazes, remove off-odors, modify mouthfeel, or to prevent problems from developing in bottled wines. Fining is always performed to change wine composition, generally with as much selectivity as possible- for example, to remove the harsh astringent edge of tannins without affecting wine color. Depending on the compounds used, the issue addressed, and the skill of the winemaker, fining can create very subtle or quite pronounced changes in wine sensory characteristics.

**Fining can be used to remove hazes that resist settling.** Small, insoluble colloids that occur naturally in wine (like proteins, tannins, and polysaccharides) are too light to settle out of solution, and carry weak charges that keep them from getting
too close to other compounds with the same charge. Proteins, for instance, carry a weak positive charge, so in a wine with high natural protein, proteins repel each other with enough force that they remain suspended throughout the liquid, instead of aggregating and falling out of solution. In a bottle of wine, these tiny proteins reflect light, appearing as a haze. Natural wine trends notwithstanding, most wine consumers prefer their wine to be as brilliantly clear as the glass it’s poured in, and consider hazes (however natural) as a quality issue. To solve it, a fining agent with an opposite (and in this case, negative) charge is added, and positively-charged proteins are drawn to the negatively-charged fining agent, coalescing into larger, heavier groups that can either be settled or filtered out of solution.

**Fining clears up compounds that resist, or impede, filtering.** Most wines are filtered prior to bottling to ensure the removal of stray microbes that might run riot and cause spoilage later. Haze-forming colloids range in size from 2-1000nm. Since wines are often finished with filters of 0.45mm (450nm) pore size, smaller colloids can move right through the filter, increasing the potential for haze in the wine bottle. Larger colloids that are too light to settle out of solution quickly clog filters, resulting in lost time and extreme frustration on the part of the bottling crew. Fining agents are used to remove these problematic compounds prior to bottling to save time, expensive filter membranes, and the winemaker’s sanity—because worrying about hazes forming post-bottling is enough to give anyone nightmares.

**When done right, fining agents don’t stay in the wine.** The whole idea of fining is adding a reactive or adsorptive substance, allowing it to react with the compounds to be removed to form larger compounds. Settling and racking (removing liquid from a point in the tank above the shallow layer of settled goo) is almost always part of a fining operation, as the aggregated fining-agent+bound-compound sinks to the bottom of the tank and must be separated from the newly clear wine. Numerous studies have failed to detect fining agents in finished wine; after one or more rounds of settling, racking, and possibly filtration, it’s long gone before the wine hits the bottle. So, should fining agents be on ingredient labels? Why would wine drinkers care, anyway? Because:

**Several traditional fining agents are animal products.** Winemakers have been fining tannins out of red wine for centuries. When wine tannins are underripe, harsh, or just aren’t giving the sensory profile the winemaker is looking for, various fining agents can be used to soften, modify, or remove them. Tannins carry a weak negative charge, so they can be removed with a positive charge—like that carried by proteins. And historically the easiest place to get relatively concentrated proteins is from animal products like eggs, milk, and animal byproducts. One legend about the storied Hungarian wine Egri Bikavér, or “Bull’s Blood,” is that bull’s blood was mixed into the wine to make it more palatable (and while powdered blood products are certainly effective for tannin fining, they haven’t been legal fining agents in the US or EU since the first mad cow scare.) These days, purified and deodorized versions
of casein (from milk), albumen (from eggs), gelatin (from animals or fish) and
isinglass (sturgeon swim bladder) are available, but their use raises concerns for
consumers with allergies or religious or ethical dietary restrictions. Someone with a
severe egg allergy may want to know if albumin was used as a fining agent, even if
no residue can be detected with cutting-edge analytical methods, and to a vegan
consumer, the fact that animal products were used at all is problematic, even if no
trace remains in the wine.

Another common fining agent is literally dirt. Or more accurately, clay. Bentonite
is a phyllosilicate clay, found primarily in Wyoming, that carries a negative charge.
When the powdered clay is hydrated in warm water over several hours, individual
molecules form a unique matrix structure that strongly attracts positively-charged
particles, like proteins. Bentonite fining is very common in white wines, where
excessive grape proteins result in unsightly hazes. If you're been paying attention,
you'll know why protein haze is a problem in white wines but not red wines... red
wines have tannins, which have a negative charge, which react with any positively-
charged proteins during fermentation, effectively self-fining. Consequently,
bentonite is rarely used in red wine production.

Better fining through chemistry. There are several synthetic fining agents that can
be used in combination with more traditional compounds, or which are effective on
their own. The most common is polyvinylpolypyrrolidone, which is shortened to
PVPP for obvious reasons. PVPP and related polymers act like weak proteins,
reacting preferentially with small phenolic compounds (the building blocks of
tannins) to reduce browning in white wines and bitterness in reds and whites.
Synthetic fining agents relieve the ethical questions related to animal protein use,
but may raise other concerns if consumers consider them to not be ‘natural.’

Fining isn’t an exact science. Even if it’s possible to measure the concentration of
whatever component needs to be removed from wine (and it usually isn’t), it’s
impossible to predict how a fining agent and its target compound will react within a
specific wine matrix. In other words, there’s a lot of guesstimation involved, and
since the error rate of guesstimation is high, fining trials are performed to fine-
tune fining additions. Usually, 100mL samples of the wine to be fined is place into
100mL graduated cylinders, and a fining agent is added at the guesstimated rate
and at one or two additional concentrations both above and below that rate, for a
trial of three to five fining levels (Figure 1). After hours or days of reaction time
(depending on the fining agent), the wine samples are inspected physically and/or
analytically to see if the desired result has been achieved.

When fining isn’t fine…and isn’t really fining. In one of those quirks of misnomer
history, outdated enology texts offer the option of ‘copper fining’ to remove sulfur
off-odors, specifically hydrogen sulfide (H2S), from wine. This is problematic for a
few reasons; from the point of view of nomenclature, it’s not really fining, because
the added copper ‘fining’ agent binds with the sulfur stink to form an odorless complex, but doesn't necessarily precipitate out of the wine. More importantly, copper is toxic at high enough concentrations, so the federal government regulates both the amount that can be added at treatment and the residual, making additions tricky. Recent research reveals an even greater problem: copper fining doesn't always work. While studies show that copper addition just after fermentation, but before racking, results in lower H₂S, the later copper additions are made, the more likely the off-odors come back in full force after months or years of bottle aging. In short: wines that have been copper ‘fined’ have to be carefully checked to make sure that no copper complexes remain, and may need further fining operations to remove it.

**It's all fine.** Fining agents have been used in wine for as long as enological ideas have been recorded, and while we're usually adding powdered albumin instead of hand-cracking and separating the whites of tens of dozens of eggs (been there, done that) the basic principles remain the same. Whether the compounds used to keep wines limpid, bright, and not-too-astringent count as ingredients or processing methods is an open debate, but it's abundantly clear that fining continues to be a valuable tool in quality wine production.

*Anna Katharine Mansfield is Associate Professor of Enology at Cornell AgriTech, based in Geneva, NY.*