Fining & Clarifying Agents

A presentation compiled by Terry Rayner
With thanks to Ludvik Furbacher for the use of abstracts from his paper on Wine Finings and Procedures

Fining is the name given to the clarification phase / step of wine & beer making.
The object of fining is to aid in producing a product that is near perfect in terms of taste, colour, bouquet and clarity. The fining method should not take away from any of these characteristics and should allow the clarified condition to be maintained for as long as necessary before the wine is consumed. Any fining treatment preferrably should have little or no effect on the essential aromatic and flavour compounds of the wine.
Fining could be as simple as letting nature takes its course through gravity, but if you'd like to consume the wine a little sooner then you can help nature using an assortment of fining or clarifying agents.

There are basically 2 groups of materials that need to be acted upon including; proteins and polyphenols. There is one other contributing cause of suspended haze that we often overlook being entrained carbon dioxide. Moving the wine into a warmer area from a cold cellar can frequently reduce this contributor.
The array of clarifying agents available include; Activated carbon, Bentonite (wine grade), Casein and caseinates, Diatomaceous earth, Egg albumen, Gelatin (low bloom), Isinglas, Kieselsols, Polyvinylpyrrolidone (PVP), and Sparkalloid. Commercial combinations of some of these are also available.

Fining agents work on the principle that all of the particles responsible for the clouding or haze in a wine or beer have an electrical charge. As an example gelatin has a positive charge meaning that it can attract negatively charged materials. In binding to the negatively charged materials the combined weight increases resulting in settling to occur. In practice it's usually necessary to have finings agents of different charges added sequentially to the wine in order remove the materials of various charges contained in the wine.

Positively Charged	Negatively Charged
Gelatin	Bentonite
Egg albumen	Kieselsol
Isinglas	
Sparkalloid	

Proteins which are not removed during post fermentation settling, fining or filtering are small enough to remain soluble. These have some effect on the wine flavours in terms of perceived body / mouthfeel.

Polyphenols may be considered as much more active over time than proteins. They are susceptible to oxidation and polymerization which will impact the wines aromatic and taste qualities.
Polymerized polyphenols are generally referred to as tannins. The simple flavanoid polyphenols form the precursors or building blocks of tannins. These flavanoid polyphenols can be divided into; anthocyanins, flavones and leucoanthocyanins/catechins.

Anthocyanins (red pigments) undergo colour change with pH shifts. Flavones are yellow polyphenols similar to anthocyanins and can undergo oxidation reactions leading to brown polymeric pigments. The leucoanthocyanins and catechins have a similar structure. In red wines thay may be present at 1-3g/L and a few 10th's of a milligram in white wines. These can vary from colourless, non-astringent molecules up to haze forming, red coloured precipitates depending on the degree of polymerization.

Pinking is thought to be a side reaction of these leucoanthocyanins due to conversion to flavenes through a slow hydration process. The important part of this is that we can associate color changes and off flavours with polyphenols and clarity problems with insoluble polyphenol-protein complexes and tannins.

The use of the "correct" finings agent is generally arrived at through experimentation. The degree of clarity required depending on your intended use and its appearance after course filtration. Fining of red wines is a concern due to suspected removal of flavour components, in this case gravity may be the best fining agent. Experience may be the best teacher but trial and error can produce some less than desirable consequences such as completely stripped wines. It is often more practical to do nothing rather then fine a wine with an inappropriate material or a matter of practice.

As shown above there are a lot of materials that can be used and have been used over time to clarify a wine. The Romans experimented using sea water to help clarity their wine.
Listed below we'll review a number of the conventional clarifiers with regard to their functionality, uses and restrictions.

Bentonite / Bentogran *(proteins)*

AKA: Montmorillonite clay. Naturally occurring hydrated aluminosilicate of sodium, calcium, magnesium, and iron. Kaolin clays are used as fillers in many commercially available products but have a lower surface area and efficiency of use. The name Bentonite comes from the place where it was originally mined Fort Benton, Montana.

Methodology: Bentonites negative charge attracts positively charged particles, such as protein, to its surface and gradually carries them down due to the forces of gravity. Bentonite absorbs a large quantity of water, which increases its surface area and aids in deproteinizing. The alkaline/basic nature of bentonite results in a rapid reaction in the acidic wine resulting in simultaneous combination with proteins & other positively charged particles. Bentonite is relatively non-specific, absorbing all proteins.

Effects: Benign in flavour retention. Best for protein stability. Doesn't affect tannin levels. Polyphenols, and colour loss with red wines while sodium, calcium, ash and alkalinity are increased. The colour loss in reds is generally the insoluble / unstable colouring materials. Can inhibit completion of fermentation and has bulky lees (easily disturbed)

Uses: Fining agent that acts as a protein remover. Also useful when added to a clear juice must at the beginning of a fermentation to provide yeast nucleation sites and speed the onset of fermentation. Use 1/2 g per litre of wine or a 5% slurry. Dissolve by blending into water (for every gram of bentonite use about 25 ml of water: (If added during fermentation use 0.8-1.3 g / L, if added after fermentation use 0.25-0.375 g/L). Allow to stand for 24 hours and stir thoroughly into wine. The newer KWK Agglomerated Bentonite may be used after 1-2 hrs hydration time. Wait two weeks and then rack wine from sediment. 5 ml (one teaspoon) = approximately 3g. When used in conjunction with kieselsol and gelatin there seems to be a difference of opinion as to whether to add the bentonite prior to the kieselsol or after the gelatin.

Optimum Temperature: 10°C to 25°C. Best performance in the upper part of the range.

Contra-indications: Using more than the recommended amount can strip anthocyanins / melanoidins (colour and flavour compounds) from a wine.

Storage: Cool and dry.

Hazard Classification: Very low. Prolonged breathing of dust can cause respiratory disease.

Gelatin / Enolophin pH / Gelsol *(proteins & higher polyphenols)*

AKA: Liquid gelatin finings or dried form. Gelatine Extra No.1, Gecoll Supra 95, Gelarom, Gelaffort, Gecoll and Gecoll No.5. Davis unflavoured gelatine.

Composition: 100% animal-derived gelatin. Composed of aminoacids primarily glycine, proline and hrydroxproline. Produced from cooking / controlled partial hydrolysis of fibrous insoluble protein collagen found in bone, tendons, skin and connective tissue. pH of a 1% solution ranges from 4.5-6.5. Gelatin is characterized by bloom value which refers to the size of the gelatin molecule and consists of proteins of various natures and in variable proportions. In the wine industry low bloom values of 70-200 are used and when used in conjunction with keiselsol bloom values of 70-130 are preferred. The choice of gelatin can have an impact on its effectiveness.

Methodology: Gelatin is colloidal in nature and primarily has a positive charge. Gelatin requires tannin to flocculate which limits its to use primarily red wines. It attracts tannins which are primarily negatively charged. Once this neutralization has occurred the turbid particles tend to agglomerate which in turn causes them to settle out. Acts on both proteins and tannins. Gelatin can also be used to preserve clarity, and improve the sensory qualities, soften the wine and balance the composition.

Effects: reduces astringency in red wines by lowering tannin levels. Tends to remove more higher M.W. tannins than lower M.W. ones. (The former are perceived as astringent, the latter as bitter). Improves and removes colour.

Uses: Positively charged fining agent for wine and beer. Can be used alone or in conjunction with Enolophin 700 / Neosol. The most powerful of the organic finings, gelatin will also remove excess tannins (polyphenolics) and colouring particles (melanoidins) from wine. For Enolophin 700 use .66 ml per litre (about 15 ml per 23 litres). For non-flavoured gelatin powder use 1 g / 20ml solution and 18ml of solution per 19 L carboy. Use a syringe for accurate measurement. Place gelatin container in hot water to soften contents. Stir into wine or beer thoroughly. Wait two weeks and rack from sediment.

Preparation: dissolve the gelatin in warm/hot not boiling water. Always add the gelatin to the water not water to the gelatin. Don’t dissolve gelatin in the presence of acids or juices. Use is typicallly in the range of 0.1-0.2 g gelatin / L wine (less for white more for reds). Make up a dilute solution as above and add the desired amount with a syringe.

Optimum Temperature: 10°C to 25°C. Works best at the lower end of the range.

Contra-indications: Using more than the recommended amount will remove too much of the colour and flavour compounds from wine and some of the body from beer. In older wines where the tannins

have had a chance to polymerize gelatin can strip these astringent tannins leaving fewer to mask the bitter tannins. Gelatin provides proteins that fix onto the tannin, however , if used in excess means that a major quantity of protein will be in the wine leaving a haze (i.e. in white wines that are low in tannin).

Storage: Keep refrigerated.

Enolophin 700 / Neosol *(proteins)*

AKA: Kieselsol. Baykisol. Sihasol. Silicon dioxide. Silica. Silica Sol. The other part of Enolophin 2 part finings. (diatomaceous earth)

Composition: Solution of about 30% silicon dioxide in water suspension. Colloidal solutions of high molecular weight, high surface area polymers of silicic acid. PH 9.8-9.9. Negatively charged.

Methodology: Strong protein reactants. Characterized by increased floc sizes which result in more rapid sedimentation. These should be used in conjunction with gelatin but added prior to the gelatin. More specific for higher molecular weight proteins.

Uses: Fining agent for beer or wine. Should be used in conjunction with gelatin. For Enolophin 700 use 2.2 ml per Litre of wine or beer (about 50 ml per 23 litre batch). For Neosol the suppliers suggested use level are; must (0.5-1 ml/L), wine (0.3-1 ml/L). Ludvik's suggestion is 0.44 ml/ Litre of wine (8.4 mls per 19L carboy). Use a syringe for accurate measurement. Stir thoroughly. Wait two weeks and rack off sediment.

Storage: Unlimited when kept in the orignal container at above 6°C. Do not freeze or refrigerate. Seal tightly when not in use.

Egg Whites *(higher polyphenols)*

AKA: Egg white, dried powder, frozen egg whites, dried albumen

Composition: Proteinaceous; contains albumen and globulin (dried is 84-87% protein)

Methodology: Albumen is colloidal in nature with a positive charge on its surface. It attracts tannins (negatively charged). Once this neutralization occurs the turbid particles agglomerate and settle out due to gravity.

Uses: Positively charged fining for wine. Works similar to gelatin, removing tannins and some colour. Separate the egg white completely from the yolks. Dosage is 1/5 to 1/2 egg white per 23 litres. Gently beat white with 500 ml of wine and a pinch of salt (aids in solution of the globulin), remove any foam/froth from the surface, then stir immediately into the wine. (Do not beat stiff, just loosen up the white so it will mix into the wine). Wait two weeks and rack. This is the only fining agent used on the great red wines of Burgundy. If using dried albumen use 8 to 15 grams per hectolitre. (Note: 1 Kg of dried albumen ~ = 280 eggs)

Advantages: Changes the tannin structure in reds favourably, making them more supple, but not thin.

Optimum Temperature: 10°C to 25°C. Works best in the lower part of the range.

Contra-indications: Tannins are attracted to the albumen because their surface electrical charge has been removed. The wine becomes temporarily cloudy while the flocculates agglomerate then settle. There is loss of colour. Not suitable for white wines.

Isinglass *(polyphenols)*

AKA: Glue. Fish glue. Made up of collagen fibres derived from the air bladders of certain fish.

Composition: Shredded, freeze dried, powdered swim bladder of sturgeon dissolved in liquid suspension.

Methodology: Like gelatin this is positively charged but unlike gelatin it does not require the presence of tannins to act on the wine, making it a preferred clarifier for white wines. A less efficient / more gentle fining agent than gelatin.

Uses: Positively charged fining agent. Traditionally used for beer but can also be used for wine. Extremely gentle. Use 1 ml per litre of beer or wine. Dissolve into 250 ml of water and stir thoroughly into beer or wine. Wait two weeks and rack off sediment.

Contra-indications: Not as strong as any other fining; may fail to clear completely. Avoid over fining.

Advanatges: The addition of proteins resulting from the use of Isinglas lends a brillance to the colour and mouth feel.

Storage: Tightly sealed.

Polyclar *(low M.W. polyphenols)*

AKA: Polyvinylpolypyrrolidone food grade. Polyclar AT /10. Polyamide

Composition: a high molecular weight crosslinked polyvinylpyrrolidone supplied as a white powder (similar to nylon but with a more compact structure – more hydrogen bonding)

Methodology: appears to be through the formation of hydrogen bonds between the carbonyl groups of the Polyclar and the phenolic hydrogens of the polyphenols. Remarkable ability to complex with a wide variety of materials. It attracts the low molecular weight polyphenols rather than the condensed tannins and leucanthocyanins that are removed by gelatin.
Polyphenols can be divided into catechins, flavanols and anthocyanogens, plus phenolic compounds and polymeric polyphenols or tannins.

Uses: Stabilising additive for wine or beer. Removes polyphenolic compounds and oxidised melanoidins. This means that when used in beer it will remove haze-causing husk tannins and oxidized compounds that contribute to off flavours. When used in a finished wine it can help to remove haze-causing proteins. More importantly, it can remove oxidized flavour and aroma compounds, making the wine taste fresher while improving and enhancing the aroma. Also able to gently reduce tannins.
Use 1/2 g per litre of wine or beer. Typical range is 0.25-0.75g/L. May be directly added or dissolve powder in 500 ml of the wine or beer. Stir into larger amount, mixing very well. Wait for one week and rack from sediment. May cause gushing and foaming when added; when in doubt, add to wine

or beer in a container with 25% larger volume than the liquid inside. 5 ml (one teaspoon) = approximately 1.1 g. Note: contact time is important. A minimum of 24 hrs is required, longer exposure should have no harmful effects.

Optimum Temperature: 10-25oC preferrably at the lower end of the range.

Advantages: the reduction in polyphenols does not adversey affect the flavour. Easily removed by filtration. Can stabilize the colour in white and rose wines. Removes the polyphenols and protein-tannin complexes. Lowers bitterness in wines.

Contra-indications: Although Polyclar will remove haze it is not primarily a fining agent. Using more than the recommended amount can strip melanoidins (colour and flavour compounds) from a wine. Polyclar is highly selective, it can adsorb up to 4 times as much polyphenols as nylon. Wine should be filtered after use.

Storage: Room temperature.

Hazard Classification: Low. Inhaled dust irritant to lungs.

Sparkolloid *(proteins / metal ions)*

AKA: Celite. Calcined diatomaceous earth. Kieselguhr. Siliceous rock.

Composition: Crystalline Silica, quartz aluminasilicate, cristobalite. It contains colloidal compounds which make it gel, and the silica is derived from the preserved skeletons of marine animals found in dry seabeds. Complex of various polysaccharides and diatomaceous earth. The diatom is a microscopic organism in colonial algae that has a silicified skeleton.

Methodology: attracts negatively charged particles and removes the surface charges which allow agglomeration of the colloidal particles then settling due to gravity.

Effects: Clarifies a broad pectrum of hazes. Good at removing hazes left from using other fining agents and in removing cations such as copper. Little effect on flavour or colour. Most wines are easier to filter. Noted for working when other fining agents have failed. Also provides a compact sediment bed, pressing down other fining agents and increasing yield. Used as a coating medium for filter pads, to decrease porosity.

Uses: Positively charged fining agent for beer and wine. To use, stir 25 g of Sparkolloid into 1 litre of briskly boiling water. (Use 40ml of water per gram of Sparkalloid.) Boil for three minutes, stirring well to completely dissolve. All of the translucent globules must be dissolved and the mixture should be smooth and creamy. Use 12.5 ml of the prepared solution for every litre of wine (about 300 ml for 23 litres). This equates to a dry solids basis of 0.13 to 0.4 grams / Litre. Stir thoroughly into wine, leave for 2 weeks, then rack off sediment. Store remaining solution in tightly sealed bottle. Will keep for 6 months or more. 5 ml (one teaspoon) = approximately 1.2 g. The solution is best added to the wine while hot.

Optimum Temperature: 10-25°C. Does better in the lower end of the range.

Contra-indications: Preparation for use is not straight forward. Should be filtered after use. In the U.S. the wine must be filtered to be sold as commercial wines after use of Sparkalloid. Cold mix Sparkalloid is not as effect as the hot mixed version. Do not use in conjunction with gelatin.

Storage: Keep dry, Seal tightly when not in use.

Hazard Classification: Low. Prolonged exposure to dust can cause lung irritation.

Activated carbon (polyphenols)

AKA: Norit. Carbogran.

Composition: pure form of carbon

Effects: an excellent adsorbant of benzenoid compounds. Acts to remove / partially remove all classes of polyphenols and is fairly non-specific. Used to decolorize and deodorize juices and wines.

Uses: add the carbon as a slurry to a portion of the juice or wine to be treated. The most optimum time to add the carbon is a soon as possible after fermentation but before bentonite addition. Carbon added by itself is difficult to remove by filtration and should be followed by additional fining such as bentonite or sparkaloid to assist in settling of the carbon. Carbon should be removed from the wine as soon as possible.

Advantages: can be used to assist precipitation during fermentation, clarify wine, remove excess colour in white wine, remove excess colour in dry sherry's, reduce colour in red wines such as for blush wines, reduce the varietal character in late harvest wines.

Contra-indications: overuse can strip flavour, colour and aroma. Generally used as a last resort.

Casein

Casein is sodium or potassium caseinate which is the primary protein in milk.
Both are obtained through the precipitating action of acid on milk. The caseinates exert a binding action on the haze particles and reduce unwanted polyphenol contents such as tannins. The acidity of the wine causes the alkali casein to lose its counterion, making it less soluble, resulting in turbidity and the gumming action of haze removal.
In addition the proteinaceous nature of casein allows it to from complexes with tannin.
It is can be used to remove metal salts from the wine. Egg albumen works similar to casein in being able to remove astringency in reds through higher tannin removal. Skim milk powder is a source of the caseinates. When used in conjunction with PVP can adsorb stale flavours and reduce discoloring due to ageing. Casein has to be specially prepared in a high pH solution and added very quickly to the wine because it precipitates almost instantly. Most of the effects are better handled with Polyclar or gelatin.

New Combinations: Colloidal Silica and Chitosan

This combination is reported to replace isinglas for white wines and gelatin or red wines.
The colloidal silica binds to the smaller proteins and pulls them together (agglomerates them).
Chitosan being derived from the shells of shellfish and crustaceans acts as an all encompassing flocculating agent that removes all solids, including the larger proteins brought together by the colloidal silica.

There are other fining agents that have traditionally been used, including blood, agar-agar, and occasionally milk. Blood is tough to get and to keep fresh. Agar-agar is a good fining agent, but can be very expensive. Gelatin works just as well and is cheap. Milk is mentioned in some wine-making books under the heading of casein, which is the protein compound responsible for the fining action.