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CLARIFICATION OF WINES, JUICES AND VINEGAR

In the food processing industry, cloudiness that creates an adverse consumer reaction must be removed. The cloudiness, and its removal, has been an important problem in this industry for centuries. Volclay KWK Food Grade and Volclay KWK Krystal Klear, mineral colloids, can be effectively used as a solution to this problem.

Cloudiness is introduced as part of the processing and consists of three distinct phases:

1. Coarse grained, poorly suspended solids that settle rapidly or can be removed with simple cloth filtration.
2. Finely divided suspended solids that pass through some filter cloths but can be removed with a supplementary filter aid.
3. Macromolecular solids, generally positively charged, which create a colloidal suspension and pass readily through filter cloths and filter aids and remain in the final product. These tend to coalesce with age, creating definite evidence of sediment after the product has been stored.

The first two types of solids are relatively simple to remove. The third type, the positively charged colloid, is difficult to remove because it is a colloid and follows basic colloidal chemistry laws. Colloids are unusual. They are particles of matter so small that they resist filtration. They are truly suspended solids, and exhibit behavior similar to magnetic repulsion. Colloids that are positively charged on all exterior surfaces tend to repulse each other and may remain in permanent suspension for months and even years.

Colloidal impurities are usually detected in a clarified liquid by beaming a thin ray of light through the solution. True solutions do not distort the light; it appears to pass through in a straight line. Colloids, no matter how fine, disperse the light, and the degree of diffraction or scattering is a measure of the degree of impurity in the colloidal suspension.

Undesirable suspended proteins can create difficulties. They are colloids and obey colloidal laws. Therefore, one excellent approach is to attack them with equally strong colloids, of a different type.

Volclay is a true mineral colloid, negatively charged, available at low cost. When Volclay is completely dispersed in water, the particle size of the product is measured in fractions of microns, and the surface area in square miles per pound.

Dispersed Volclay forms a plate structure too tiny to be seen by even the most powerful conventional microscope, with the longest dimension approximately 1/25,000 of an inch. The width is slightly smaller, and the platelets have almost no thickness.

To test the clarification power of Volclay KWK in the laboratory, prepare a suspension of 2 grams of Volclay KWK – the free flowing, readily mixing granular form of Volclay bentonite – in enough raw wine to make 100 cm^3 total. Stir this

mixture until smooth and free of clots. Then pipette portions of the base mix into 100 cm^3 graduated cylinders, shake or stir the solution by hand, and allow to stand for the normal sedimentation period.

The cylinder that shows the greatest degree of clarity with the minimum amount of Volclay is the level of Volclay to be used.

This chart, based on a 2% suspension of Volclay KWK added to 100 cm^3 portions of raw wine, indicates a proposed testing program that translates laboratory results into plant calculations.

2% KWK Suspension	Percent by weight	Pounds per 1,000 Gals.
0.5 cm^3	0.01%	0.8
1.0	0.02%	1.6
2.0	0.04%	3.2
2.5	0.05%	4.2
5.0	0.10%	8.3
10.0	0.20%	16.7

PLANT PRACTICE

The normal approach for mixing Volclay with wine for clarification follows these simple steps:

1. Prepare a base suspension of ½ pound or up to 1 pound of Volclay KWK per gallon in raw wine in a separate vessel. This is simply prepared by sprinkling Volclay KWK into the wine, allowing it to swell, then agitating.

2. Hydrate the Volclay KWK completely by recirculation through a pump, or by agitation with a propeller type mixer until smooth and uniform.

3. Slowly add the base Volclay suspension, proportions determined by experience or laboratory test, to the full vat of the wine.

4. Circulate or stir until clarification is completed.

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When samples indicate the flocculation is essentially completed, circulation is halted, and the particles settle to the bottom of the tank. For simple sedimentation, the time necessary for settling depends upon the height through which the particles must fall. In some cases, it is measured in hours. In other cases, as much as ten days may be required for tall slender storage tanks.

Dispersed particles of Volclay have a uniform negative surface charge, thus, attract, weld to and solidly hold the positively charged protein colloids in suspension. The two colloids neutralize each other, forming a precipitate. The precipitate settles or can be filtered without difficulty, entraining the course, charge-less suspended solids within its precipitating structure.

The actual process for food liquids is relatively simple:

1. Disperse the Volclay uniformly in a small portion of water or of the raw, unclarified liquid.

2. After a smooth, creamy suspension results, pump the Volclay suspension into the main vat and circulate. The negatively charged Volclay contacting the positively charged macromolecules forms a precipitate which is then settled, centrifuged, or filtered out.

These are general directions. Actual in-plant industrial techniques follow these general directions but with minor changes depending upon the liquid to be processed.

APPLE JUICE

A typical process that renders apple juice polished to a sparkling clarity follows these simple steps:

1. Flash heat to 200°F, flash cool to approximately 60°F. This halts enzymatic action and precipitates materials coagulated by heat.

2. Approximately 8 ounces of Volclay KWK pre-dispersed in about 1 gallon of apple juice is then added to 100 gallons chilled juice and circulated by stirring.

3. The coagulation is completed with slow stirring 20 to 30 minutes after the Volclay KWK addition. At this point, one ounce of diatomite filter aid per gallon of juice is added and the juice is filtered through fabric.

4. The clarified juice was flash sterilized and canned. Twelve months of storage at room temperature yielded no cloud, and no sediment. The Volclay processed juice had retained its original clarity.

WINES

Wines are highly variable in the amount of Volclay to achieve permanent clarity. In some instances, two pounds or less per 1,000 gallons are required; in other instances, 10 or 12 pounds per 1,000 gallons may be needed. The requirement varies with the type, age and cloudiness of the vine. The exact amount can be determined with laboratory tests.

The volume occupied by the sludge represents 3% to 5% of the total volume of wine processed at room temperature, 5 to 12% of the wine processed hot. The wine in the sediment may be removed by direct filtration or centrifuging. It will be found to filter slowly, even using filter aids. Residual alcohol in the final wash can be recovered by rinsing and distilling.

The action of Volclay will be more rapid when added to hot wine. If possible, wines should be processed at a temperature between 120 to 140°F. If chilling to remove tartrates is planned, the Volclay can remain in the wine during the natural cooling and chilling states, eliminating one filtration step. Some users report greater effectiveness by adding minor amount of gelatin or ammonium casein, prior to the addition of Volclay KWK.

TARTRATE RECOVERY

Some wineries convert by-product wine lees, still slop, grape pomace and wine stones into recoverable tartrates, usually calcium tartrate.

A typical program involves adding water to dissolve the tartrates, unless a solution is used as the source, settling the insoluble matter from the water, then precipitating the tartrate with calcium chloride.

A small amount of Volclay, on the order of 5 to 10 pounds per 1,000 gallons of liquid, accelerates the settling of impurities, speeding the clarification step.

The same method outlined under laboratory methods for clarifying wine is used for clarifying tartrate-bearing liquids.

CIDERS

Follow the directions for “wine clarification”, except the Volclay KWK should be dispersed in water rather than in raw cider.

Laboratory testing, plant production methods and the like are similar to that of wine.

VINEGARS

The mechanics of vinegar clarification are similar to those of wine clarification. The amount of Volclay is usually much higher, 10 to 15 pounds of Volclay per thousand gallons of vinegar. In addition, the acid that is the vital ingredient in vinegar helps the flocculation. It is possible to use too much Volclay thereby increasing the volume of the precipitate. Too little Volclay, similar to wine processing will give incomplete clarification.

Vinegar should be clarified while hot, and the KWK added as a suspension prepared in fresh water, rather than Vinegar. The acid present in vinegar reduces the separation of the tiny Volclay platelets, and improved performance is obtained with fresh water prehydrated Volclay.

For laboratory determinations use the chart under “wine clarification”; 8 to 10 pounds per 1,000 gallons is a good starting point, with the Volclay prehydrated in distilled water before laboratory testing. The optimum amount of Volclay is that which gives clarity without excessive sediment.

In plant production, Volclay is pumped in slurry form to the heated vinegar, which is then stirred, recirculated or mixed until flocculation commences. Sedimentation, followed by filtering, yields the finished product.

Some users report successes with a combination of ammoniated casein and Volclay, in the general ratio of 4 to 5 pounds of ammonium casein to 1,000 gallons of vinegar, plus the usual amount of Volclay. Purification takes place in two steps, casein treatment, followed by sedimentation, followed by bentonite treatment and final filtering.

As printed in **“The Technology of Wine Making”** Fourth Edition by M.A. Amerine, Ph.D., H.W. Berg, M.S., R.E. Kunkee, Ph.D., C.S. Ough, M.S., D.Sc., V.L. Singleton, Ph.D., A.D. Webb, Ph.