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Instructions Pressing Under Inert Gas

Instructions
Pressing Under Inert Gas

The objective of this technical guideline is to help you optimize your Bucher Inertys Press and your wine production, especially for white and rosé wines. We have gathered data to facilitate the process of pressing under inert gas. On no account, is it supposed to replace your own know-how or of your wine consultant.

Content

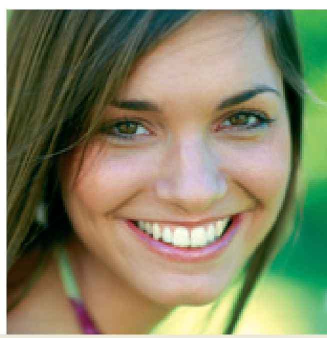
*words with an asterisk have their own definition in the glossary.

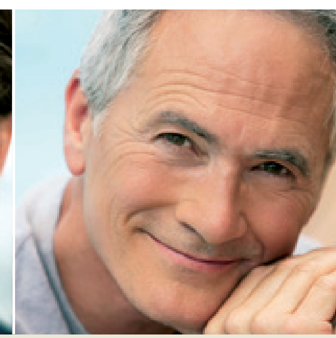
New consumers seek pleasurable wines that are fresh, fruity, aromatic...

The greater the wine’s aromatic intensity, the greater the consumer’s appreciation...

It is necessary then to produce easy-to-drink, fruit-forward “seductive” wines. For white and rosé wines, this quality depends on the winemaking process during which the pressing operation is determined. This phase is essential as it corresponds to the extraction of grape juices when oxidation processes are most likely to occur.

In order to produce qualitative wines with better aroma stability and thus meet the consumers’ tasting expectations, it is essential **to control the pressing, one key phase in winemaking**.





Pressing: a key phase

The composition of the grape berry determines the future quality of wine. It results from a complex process in which a large number of elements interacts such as the vineyard settings, type of soil, climate, farming techniques,...

Various studies and publications have widely contributed to provide a better knowledge of the composition of grape berries. The conclusions of the research reveals the elements that have a good influence on quality and also those having a bad influence.

In white and rosé winemaking, **pressing has various functions**:
- extract juices from the berry while encouraging some compounds of the skin to spread inside the must, especially fruit aromas and their aromatic potential.
- and at the same time, limit the desolving of bitter-flavored compounds and prevent the extraction of phenolic compounds that could have a negative impact on the future wine stability.

Physical actions made on grapes during the pressing process influence the quality of musts.

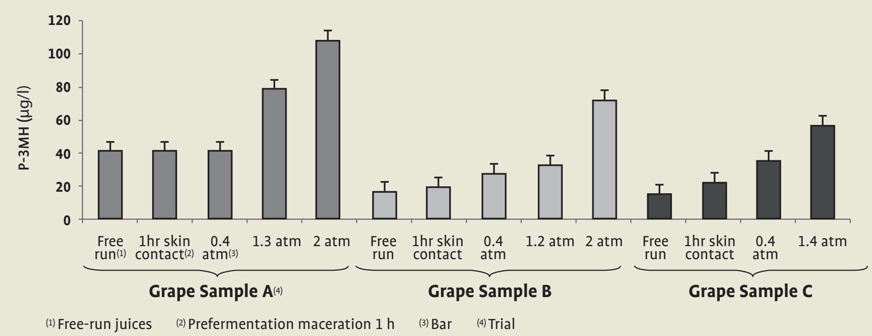
During the pressing process, **cells are fragmented** in a gradual chronology, first pulp cells then skin cells.
These two zones have a very distinct chemical composition, especially when considering the criteria of acidity, content in polyphenols* and aromatic potential* (Chart 1).

	P-4MMP	P-3MH
Juice	1,65	5,72
Skin	1,93	41,31

Chart 1 - Distribution of thiol-aroma precursors contained in grapes equivalent thiols/g of material (source Peyrot des Gachons et al. 2002).

Generally speaking, skin compounds such as **aromatic potential* and polyphenols* are extracted as** the pressing operation proceeds (Graph 1).

A higher content in aromatic potential* at the end of a pressing cycle could imply that wines coming from those juices are of high quality... whereas, in the case of a traditional pressing, it is the opposite.
Wines coming from musts at the end of a pressing cycle are less aromatic than those coming from the beginning of a pressing cycle, despite a higher aromatic potential than the one coming from free-run musts.



Graph 1 - Concentration of P-3MH precursor during a pressing cycle over 3 batches of 15 T of various Sauvignon grape varieties, named here Grape Sample (source Manu Maggu et al. 2007).

Why musts coming from the end of a pressing cycle give less aromatic wines?

Oxidation of polyphenols*

Although polyphenols* are known for their organoleptic qualities (fat, volume, bitterness), their oxidation is one of the causes of this aromatic loss.

During pre fermentation operations, oxygen dissolves very fast in musts and impacts a number of oxidations that modifies somehow the phenolic composition of must.

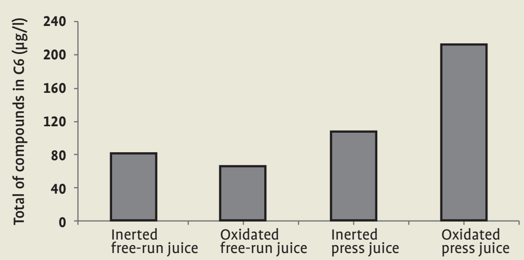
Must browning at the end of a pressing cycle is the most widely known consequence. This reaction is due to the oxidation of polyphenols* into quinones through the phenoloxidase enzyme. Aromas are easily trapped by the quinones, the latest works have demonstrated this phenomenon (Nikolantonaki, 2010). This mechanism related to the reaction of quinones (oxidized flavanols) with volatile thiols found during fermentation partly explains the differences observed between free-run wines and wines from the end of a pressing cycle.

This last point is most important as it proves that **part of oxidized polyphenols (quinones) during the pre fermentation phase remains in must and their state doesn't change**. Alcoholic fermentation, being carried out in a reductive environment, does not modify the state of the existing quinones and therefore they keep their ability to fix volatile thiols emerging during this phase.

Development of herbaceous taste

However, the absence of typical characteristics in press wines is not only related to a loss in volatile thiols. Other enzymatic reactions occur during pressing such as **the oxidation of fatty acids**. This oxidation allows the development of compounds in C6 that contribute to the vegetal nuance in wine. The vegetal characteristic can be very well detected on press musts coming from a traditional pressing process (Graph 2).

Must oxidation and extraction of polyphenols are essential parameters for the quality of wines.



Graph 2 – Impact of the degree of oxidation of press musts on the composition of C6 compounds of young wines from various appellations (source Nikolantonaki, 2010).

Before pressing
especially before pressing under neutral gas

To control the action of oxygen over musts implies limiting grape grinding and free juices before pressing and to limit oxygen supply during phases of transfer. It is therefore essential **to install a coherent reception line** that is respectful of grapes.

- Harvesting machinery must be correctly set.
- Harvesting at night in order to work at a lower temperature and thus reduce mechanisms of oxidation.
- Selection of a vibrating trailer to carry the grapes with a juice separation device (rather than a screw bin).
- Selection of a vibrating hopper (rather than a screw hopper) for the reception of grapes.
- Grape transfer through gravity, belt table or helical pump (with variable speed drive and large outlet section) or peristaltic pump (mechanic harvesting).
- Use of a destemmer that respects the grape berry and stems (by keeping them as intact as possible).

Press filling

The filling phase has inevitably an impact on the quality of extracted juices due to the risk of grinding and thus the extraction of polyphenols*.

Instructions to be respected

- **Press filling must not be superior to 80% of the press tank** (keep a spare space of 30 to 40 cm between the grapes and the top of the tank).

- **Axial filling**: spread the grapes homogeneously thanks to the TA/TB function that corresponds, for a Bucher press, to a back-and-forth tank rocking control between filling "A" position and pressing "B" position, far more efficient than a complete 360-degree revolving of the tank.

- **Door filling**: spread the grapes homogeneously with the tank rocking control on "Rocking" mode, from one end to the other end of the filling position on Bucher presses.

Is inerting necessary when filling the press tank?

While filling the press tank, inerting reduces dissolving and oxygen action on must compounds and especially to preserve free juices antioxidants (such as glutathione).

- **Hand-picked grapes**: inerting when filling is **not essential**. The grape is intact and therefore is preserved from oxygen. However, it is important to note that, at the beginning of a cycle, first juices will be oxidized.
  When pressing under inert gas with full grapes and before starting the pressing cycle, it is recommended to carry out a first sequence at 400 – 600 mb in order to extract the whole oxygen from the press tank and break the grape skin.

- **Mechanical harvesting**: inerting while filling is **strongly recommended** in order to prevent free-run juices from being in contact with oxygen and browning phenomena to occur.

CO_2 or N_2 gas selection can have an impact. As a matter of fact, carbon dioxide characteristically dissolves in must and thus limits oxygen dissolving. It ensures then a better protection though its higher consumption.

Is sulfering necessary when filling the press tank?

Generally speaking, the use of **sulfur dioxide*** on grapes should be as low as possible and be limited to some cases only (for example: on mechanical harvesting with lots of free juices and when transportation of grapes is long).

Though it is widely used, the main inconvenience of sulfur dioxide is the "perforation" of cell walls of the skin, which thus facilitate the extraction of polyphenols*, especially the catechins* (Corona, 2010).
Previous studies (Dubernet, 1974) and more recent ones (Nikolantonaki, 2010) try to minimize the antioxidasic activity of SO_2*. Considering the dosing commonly used when filling the tank, only an inhibition of the enzymatic activity can be observed but never an immediate stop (see paragraph "When can juices be sulfidized").

Pressing under inert gas

The only way to settle down the action of oxygen is **grapes inerting during pre fermentation phases and especially during the pressing operation**.

From a technical point of view, this means the control of various flows (juice flow and gas flow) as well as the various phases inside the press (solid phase, liquid phase and gas phase). Considering the number of flow transfers and the time it takes (crumbling phases), it is difficult, even **impossible to carry out this operation with a lost gas supply system** (bottles, gas regulator, tapping) without a risk of letting oxygen in.

To solve those obligations of flow control, the **Bucher Vaslin solution is based on the supply of a flexible chamber** acting like a "lung" that enables **a free gas transfer** between the chamber and the press.

Today, this patented **Bucher Inertys process** is well-known across the world and has been approved many times by national and international technical centers.

Pressure rising phase - Bucher Inertys

Decompression phase - Bucher Inertys

How to conduct a pressing operation?

Pressing is necessarily a succession of mechanical actions and in that way, it represents **a major qualitative risk**. The objective is to extract a maximum of juices while limiting mechanical actions on grapes, especially when grape skins are rich in polyphenols*.
The major qualitative risk of pressing comes from the **number and intensity of crumbling operations** followed by pressure rising.
With **the Bucher closed tank and draining channels with a specific shape** (Bucher patent), there are no front pressing, which prevents clogging and facilitate juice extraction.
Bucher draining channels are known for their efficiency thanks to their triangular shape. As a matter of fact, the slotted, 45-degree inclined surface opposite to the pressure direction allows an easy juice draining and self-cleaning of draining channels.
In addition, they make crumbling operations easier: they allow the number of tank revolving to be reduced significantly and consequently to minimize the production of juice lees.
Two types of Bucher programming, “Automatic” and “Sequential”, are available **to extract a maximum of juices with a minimum of pressure and a small amount of crumbling operations**.

“Sequential” programming

This programming limits the extraction of polyphenols* from the skin. This type of programming should be used preferably with grape varieties rich in polyphenols* such as Pinot Blanc, Sauvignon Blanc, Chardonnay, Grenache Blanc, Gros Manseng, Muscadet, Riesling, ...
The user sets the pressure rising through successive steps with or without crumbling operation between each step. The number of crumbling is minimized.

“Automatic” programming

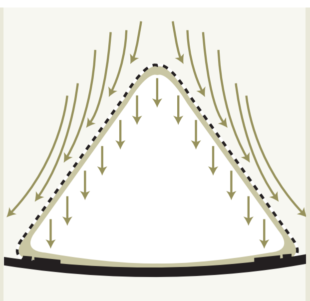
This type of pressing has the main advantage to be fast but can also generate a higher extraction of compounds from the skin. It can thus be used with grape varieties poor in polyphenols* such as Colombard, Picpoul, Clairette, Chasselas, ...

The operator chooses a simple, complete and performing “Automatic” program based on a succession of complete cycles: pressure rising, pressure holding, decompression, tank rotation(s).

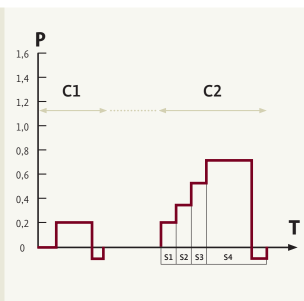
Is it a good thing to select juices at the end of a pressing?

The composition of must changes while the pressing cycle proceeds, the first extracted juices come from the pulp and then those from the skin. Depending on the type of grape variety and type of soil, the phenolic composition of juices coming from the skin can be very different from the one coming from pulp juices.

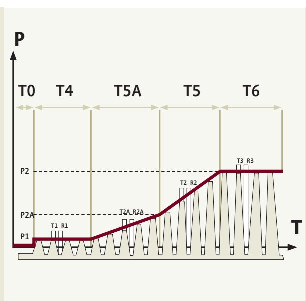
When pressing under inert gas, it is important to consider the phenolic content of the last press juices, in other words juices coming from the skin. Wines coming from last press juices (from 1.5 bar) contain more catechines* and epicatechines, which implies a risk for the aromatic stability of the future wine (Nikolantonaki, 2010).
Thus, it is recommended to separate the last fraction of press juices, especially when grapes are rich in polyphenols*. This fraction of juices will be treated specifically in order to reduce its phenolic content (see paragraph “How to reduce the content of polyphenols* in press juices”). The volume of last press juices represents approximately a maximum of 5 to 10% of the total extracted volume.



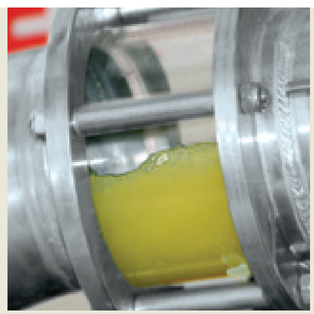
Juice draining channels



“Sequential” programming
Examples of successions of cycles



“Automatic” programming



Must coming from Bucher Inertys pressing

Pomace at the end of a Bucher Inertys pressing

Before wine fermentation

When can juices be sulfered?

Is sulfering possible during a pressing cycle?

Sulfur dioxide acts on must as a reducing agent. As a matter of fact, the most visible effect occurs when sulfering is made on oxidized must, then the brown color of juice becomes yellow, this result is well-known by operators. This additive is today the most widely used method to block an enzymatic activity.
Studies by Dubernet (1974) and Kovac (1979) have perfectly demonstrated it (Chart 2 and Graph 3), a 4 g/hl dosing reduces by **89% the enzymatic* activity after 33 minutes**.
The latest studies by Nikolantonaki (2010) have shown that **blocking the enzymatic* activity through sulfering is not sufficient** to block the mechanism of polyphenols* oxidation and especially the one of catechines*. The mechanism of oxidation during pre fermentation is still going on despite sulfering.

Data supplied by literature on lost gas pressing systems in association with a SO_2 injection between each crumbling operation confirm the fact: **the decrease of glutathione proves the non-inhibition of the mechanism of oxidation in the sense that sulfur dioxide* reduces only the speed of oxygen consumption**.

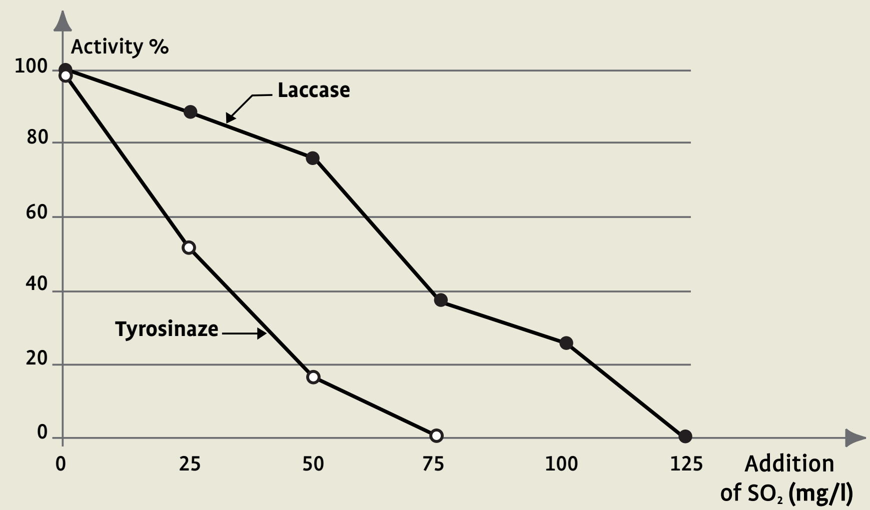
Latest knowledge on mechanisms of must oxidation minimizes the SO_2 action as the action on colour is just an "illusion" regarding those mechanisms. Only a dosing superior to 10 g/hl can have an impact on those enzymatic reactions though they can involve a high production of reduced compounds during fermentation.
In addition, sulfur dioxide* acts on grape skin by perforating them and thus facilitates the extraction of polyphenols*. Considering those scientific data, **this practice (excessive sulfering) is thus nonsense when pressing white grapes**.

Is sufering possible after a pressing cycle?

Extracted musts have to be sulfured as soon as possible after the pressing cycle with a dosing allowing the **inhibition of the fermentation activity and anti-oxidative activity while inerting is maintained**.
If not, the degradation of glutathione* and oxidation mechanisms keep going by dissolving oxygen during pumping, juice lees clearing and any other phases.

SO_2 dosing (mg/l)	Decrease of tyrosinase activity after 30 mn (%)
0	0
5	-24
20	-62
40	-89
80	-98

Chart 2 – Anti-oxidasic action of $S0_2$ (Dubernet, 1974).



Graph 3 – Anti-oxidasic action of $S0_2$ (Kovac, 1979).

When can oxygen be added to allow yeasts to grow during fermentation?

Oxygen must be added three days after the fermentation process started (when 1/3 of must density has been reduced) as environmental conditions are then most suitable:
- yeast content is then sufficient to consume oxygen,
- the environment is a reducing agent due to the fact that fermentation has started,
- the activity of oxidizing enzymes is reduced.

How can the content of polyphenols* in press juices be reduced?

Two solutions are possible to reduce the content of polyphenols* in musts:
- **fining made of PVPP*** (Polyvinylpolypyrrolidone) – pressing with or without inert gas
  This kind of treatment is efficient. Time for the polyphenols* to be adsorbed on the PVPP can be long (several days).
- **controlled oxidation** – non sulfering pressing under inert gas
  The principle relies on a controlled oxidation of polyphenols*, which generates a precipitation of the latter. This process is efficient. It gives fat and aromatic stability. However, the aromatic element is different for wines coming from pressing under inert gas.

After wine fermentation

For a complete winemaking process under reducing conditions, it is recommended to keep as long as possible wines on lees in a reducing environment or under inert gas. During the very first months of breeding, it is recommended to maintain wine with a sufficient free SO_2* dosing.

Glossary

Polyphenols found in grape skins are essentially composed of:
- **tannins** (also called **catechines**) that influence chemical oxidation mechanisms. Their content depends on the grape variety and type of soil. Must browning originates mostly from an extensive oxidation of catechines,
- **anthocyanins** found in red grapes only. They give the color to red wines. Their oxidation is very fast and is responsible for the immediate change of the red color into yellow. This change in color is in fact a very good index of oxidation during grape and wine working phases.

Glutathione is one of the antioxidants of grapes. It acts as a protective agent of aromatic compounds against oxygen.
- As it is naturally part of the grape, its content varies depending on grape varieties, climate and farming techniques.
- As the very first component to fix oxygen, its role is essential for the aromatic stability of wine by preserving aromatic oxidizable compounds (thiols).

Enzymes (also called **oxidases**) are mainly located in the grape skin.
- They play a role in mechanisms of oxidation in must.
- **Tyrosinase** is an enzyme mostly found in grape skin. Its extraction is connected to grape grinding (during transportation, destemming and pressing phases).
- **Lipoxygenase** is responsible for the oxidation of unsaturated fatty acids of the skin and of the production of herbaceous aromas.
- **Laccase** is the Botritys Cinerea enzyme.

3MH and 4MMP volatile thiols: they are sulfurized, highly oxidizable compounds. Those molecules come from **P-3MH and P-4MMP** aromatic precursors found in the grape pulp and especially in the skin as they metabolize during alcoholic fermentation. They are characterized by typical notes of box, blackcurrant, exotic fruits and citrus fruits.

Unsaturated fatty acids: found on the grape skin, their oxidation through lipoxygenase is responsible for the development of “herbaceous taste” (hexanol).

Sulfur dioxide is known for its various actions:
- Anti-microbial (inhibits the development of yeasts and bacteria),
- Anti-oxidasic (inhibits oxidases activity),
- Anti-oxidant (capacity to consume oxygen dissolved in juices very slowly).

PVPP (Polyvinylpolypyrrolidone) allows the rate of oxidized or oxidizable polyphenols to be reduced.

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