RESOLUTION OIV-CST 369-2011

OIV CODE OF GOOD VITIVINICULTURAL PRACTICES IN ORDER TO MINIMISE THE PRESENCE OF BIOGENIC AMINES IN VINE-BASED PRODUCTS

The GENERAL ASSEMBLY,

In view of Resolution OENO 4/97, which requires, if necessary, the study of the means required to reduce the biogenic amine content in wines;

In view of the actions K.4 of the 2009-2012 strategic plan of the OIV, which intends in particular to propose the means to detect and limit the presence of contaminants in vine-based products;

Taking into account the principles provided for in Resolution CST 1/2004 on the development of a sustainable viticulture and resolution CST 1/2008 which provides on sustainable vitiviniculture in order to help reach the predefined objectives,

Taking into account the results obtained in recent years further to the studies and research carried out to reduce the content of biogenic amines by viticultural and oenological practices.

DECIDES to adopt, as follows, the code of good vitivinicultural practices in order to minimise the presence of biogenic amines in wines, establishing the actions to be carried out in vineyards and wineries to help reduce the risks related to the presence of biogenic amines in wines.

OIV Code of good vitivinicultural practices in order to minimise the presence of biogenic amines in wines

PREAMBLE

- Biogenic amines are biologically active molecules which may, in high concentration, affect the central nervous and vascular system in animals and humans.
- The biogenic amines are nitrogenous organic bases of low molecular weight caused by the decarboxylation of precursor amino acids by plant and microbial enzymes.

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- The amino acid and biogenic amine content in wines depends upon the incidence of the processes involved in the grape production, wine-making and wine aging.
- The term "biogenic amines" designates non-volatile amines such as histamine, tyramine, tryptamine, cadaverine, putrescine, spermine and spermidine, and volatile amines such as phenethylamine, isoamylamine and ethanolamine.
- The amino acid and biogenic amine content in wines depends upon the incidence of the processes involved in the grape production, wine-making and wine aging.
- Nitrogenous fertilization of the soil, the poor state of health of the grapes combined with mould, a high must pH and the development of certain yeasts during alcoholic fermentation can all favour a moderate level of biogenic amines; thereafter, certain bacteria can, during malolactic fermentation, significantly increase the presence of biogenic amines in wines. Post-fermentative maceration can also favour the formation of biogenic amines.
- The contribution of lactic bacteria to the formation of biogenic amines appears to be much greater than that of yeasts, although that of the latter is not negligible and must be taken into account.
- Healthy grapes do not vary in biogenic amines content irrespective of the sugar concentration.
- The below-mentioned practices are particularly recommended when a wine has high pH levels and is aged with few prior oenological treatments.
- The present recommendations are based on current knowledge and may be updated in accordance with research undertaken.

INTERVENTIONS IN THE VINEYARD

All the recommendations contained in the OIV Guide concerning the guidelines for sustainable vitiviniculture must be adhered to, with particular reference to issues involving fertilization, the ventilation of foliage and grape bunches and the phytochemical protection of the grape (Resolution CST 1/2008). It is recommended that all the preventative measures designed to limit the formation of biogenic amines or their precursors in the agronomic phases are applied in the vineyard. Techniques which favour conservation of the acidity of grapes and prevent an increase in the pH of the must also help to reduce the risk of high biogenic amine contents.

Any viticultural practice (or the lack thereof) deteriorating the sanitary quality of

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grapes and/or high nitrogen content, and/or high pH will increase the risk of formation of biogenic amines.

INTERVENTIONS DURING THE GRAPE HARVEST

Musts with low acidity and/or high pH, increases the risk of the production of biogenic amines.

During the grape harvest the following practices are recommended:

- Harvest should be selective (hand or mechanical) in order to eliminate bunches or parts of bunches that are damaged by fungi, which could increase the formation of biogenic amines in the wine,
- Delays in transport and maceration of the grape before its arrival at the cellar are to be reduced to a minimum.

INTERVENTIONS IN THE CELLAR

Pre-fermentative operations and treatments

- It is recommended to ensure suitable hygiene practices are applied in the cellar,
- It is recommended, if necessary, to continue sorting through the grape in order to eliminate bunches or parts of bunches that are damaged by fungi, which could increase the formation of biogenic amines in the wine.
- In case of spoiled berries the maceration period must be minimized
- In case of maceration, choose a period most suitable to the style of wine sought, given that the maceration period is one of the important factors in the production of biogenic amines, particularly in terms of
    - The enrichment of the must and/or wine in precursor amino acids,
    - The increase in the pH of the wine
    - The activity of indigenous yeast and bacteria which may catalyse spoilage reactions.
- In the event of a must with a high pH, (3.6 – 3.7), which favours the diversity

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and development of the bacteria population, it is recommended:

- before carrying out alcoholic fermentation, to lower the pH using suitable techniques in accordance with the International Code of Oenological Processes of the OIV.
- to avoid triggering spontaneous malolactic fermentation by preventing the proliferation of lactic bacteria before alcoholic fermentation. To do so, taking care not to alter the following conditions of malolactic fermentation, it is possible:

- to add a suitable quantity of sulphur dioxide, taking into account the fact that a high pH decreases the effectiveness of free sulphur dioxide,
- to add adequate quantities of lysozyme[1], which is only effective in controlling a small population of lactic bacteria.
- other techniques which can limit a growth of malo-lactic bacteria can be considered like pasteurization for example.

Fermentation operations

- If improved fermentation capacity of the wine yeasts is required to complete alcoholic fermentation , the addition of ammoniacal nitrogen or inactivated yeasts or yeast cell walls or yeast autolysates should be restricted to minimal concentrations appropriate to the situation, as they are, directly or indirectly, precursors for biogenic amines synthesis.
- Carry out alcoholic fermentation preferably using:
  - yeast stocks of the Saccharomyces type, which have a low predisposition for the formation of amines,

If malolactic fermentation is desired, this should be carried out by inoculation after alcoholic fermentation or by co-inoculation of lactic bacteria during alcoholic fermentation, if possible. During malolactic fermentation it is recommended:

- to inoculate the wine with lactic bacteria after checking, where appropriate, that the effects of the lysozyme has disappeared,

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- to inoculate the wine with selected stocks of lactic bacteria which have no or little carboxy-lyase activity (mainly histidine carboxy-lyase and tyrosine-carboxy-lyase, responsible respectively for the formation of histamine and tyramine). A check should be made to make sure that these characteristics are guaranteed by the producer.
- To ensure malolactic fermentation quickly starts and completely ends by inoculating the wine with sufficient quantities of lactic bacteria, in order to prevent the proliferation of undesirable indigenous bacteria which could increase the levels of biogenic amines.
- After malolactic fermentation, it is recommended to eliminate the micro-organisms by adding sulphur dioxide (to obtain levels greater than 70 mg/l total SO2 and more than 20 mg/l of free SO2) and the existence of residual populations of lactic bacteria is suspected (Oenococcus, Lactobacillus spp., Pediococcus spp., etc.), to eliminate them by an appropriate treatment described in the International Code of Oenological Practices.
- The preventive amounts of sulphur dioxide must be increased even more if the wine has a high pH and is intended for maturing.

Maturing and clarification operations:

As a precaution, it is recommended to carry out a complete microbiological analysis, in particular to determine the population of lactic bacteria with carboxy-lyase activity. This analysis may be renewed as the wine develops, throughout maturing.

- To reduce the risk of the production of biogenic amines, it is recommended to maintain the rules applied after wine making. Clarification can be added in order to:
    - decrease the viable and viable but not cultivatable bacteria population, which uses amino acids in the substrate as a source of energy when the natural substrates such as sugar and malic acid have been consumed,
    - eliminate any protein compounds which have been transferred to the wine and which can act as substrates for the bacteria
- Current clarification products have varying levels of effectiveness in reducing the contents of biogenic amines:

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- Bentonite appears to be the most effective
- The use of fining agents appears to be more effective in musts than in wines

- In risk situations, in particular those diagnosed by a microbiological analysis targeting the lactic bacteria producing amines, the technique of maturing on lees is not recommended, since it can increase the content in precursor amino acids usable by lactic bacteria.

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[1] Depending on the applicable regulations and considering the potentially allergenic nature of lysozyme, its presence might be subject to a special mention on the label in the future.

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