

Schweizerische Eidgenossenschaft Confédération suisse Confederazione Svizzera Confederaziun svizra Federal Department of Economic Affairs, Education and Research EAER

Agroscope

Ref. 2017-1691 The fate and influence of glutathione additions during alcoholic fermentation

Johannes Rösti, Luis Taveira, Carole Koestel, Fabrice Lorenzini, Ágnes Dienes-Nagy

40th World Congress of Vine and Wine, 31st of May 2017 Sofia

www.agroscope.ch I good food, healthy environment

Sensory characteristics play an important role for the quality and typicality of wine



2017-1691 | 40th World Congress of Vine and Wine Johannes Rösti

Glutathion is a promising molecule against oxidation in must and wine



Role of Glutathione in Winemaking: A Review

Engela C. Kritzinger,[†] Florian F. Bauer,^{†,‡} and Wessel J. du Toit^{*,†}

[†]Department of Viticulture and Oenology and [‡]Institute of Wine Biotechnology, Stellenbosch University, Private Bag X1, Matieland, 7602 Stellenbosch, South Africa

ABSTRACT: Glutathione is an important constituent of grapes, must, and wine. However, to date, no review has provided an integrated view of the role of this compound in wine-related systems. In this review, special emphasis is given to its occurrence in grapes, must, and wine and its role as an antioxidant in wine. The effect of glutathione on both desirable and undesirable aroma compounds is also outlined. Furthermore, the use of glutathione-enriched products in winemaking and the various analytical techniques for the quantification of glutathione in must and wine are discussed. Limitations in existing knowledge are also identified.

KEYWORDS: glutathione, wine, antioxidant

In 2015 OIV has issued a permission for glutathione additions not exceeding 20mg/I

2.2.8. TRAITEMENT DES MOUTS AU GLUTATHION (OENO 445/15)

Définition:

Addition de glutathion au moût.

Objectif:

Limiter l'intensité des phénomènes d'oxydation des moûts grâce à la capacité du glutathion à piéger les quinones et à réduire leur activité oxydative

Prescriptions :

- a) Il est recommandé d'ajouter le glutathion au cours de l'obtention des moûts ou au début de la fermentation alcoolique en veillant préalablement et au cours de la fermentation alcoolique à ce que le niveau en azote assimilable soit suffisant pour éviter la métabolisation du glutathion par la levure,
- b) La dose utilisée ne doit pas dépasser 20 mg/l,
- c) le glutathion doit être sous forme réduite et répondre aux prescriptions du Codex oenologique international.

In 2015 OIV has issued a permission for glutathione additions not exceeding 20mg/l

Prescriptions :

- a) Il est recommandé d'ajouter le glutathion au cours de l'obtention des moûts ou au début de la fermentation alcoolique en veillant préalablement et au cours de la fermentation alcoolique à ce que le niveau en azote assimilable soit suffisant pour éviter la métabolisation du glutathion par la levure,
- b) La dose utilisée ne doit pas dépasser 20 mg/l,
- c) le glutathion doit être sous forme réduite et répondre aux prescriptions du Codex oenologique international.

- Three simple questions from a practical point of view
 - 1. Is 20mg/I of reduced glutathione a sufficient amount during fermentation?
 - 2. When is the right moment to add reduced glutathione to the fermentation?
 - 3. How to avoid metabolisation of glutathione by the yeast?

We conducted micro-fermentations at laboratory scale with different amounts and moments of glutathione addition



2017-1691 | 40th World Congress of Vine and Wine Johannes Rösti

7

Material used for the laboratory scale experiments

<u>Must</u>

- Gamay vintage 2016, pressing w/o maceration, w/o sulphur dioxide addition, frozen for storage and pasteurized before use
- sugar 20.9 Brix, total acidity 7.5 g/l (H2T), pH 3.08
- nitrogen: 60 mg/l NH₃, 120mg/l amino acids

<u>Yeast</u>

CY 3079 Bourgoblanc (Lalvin)

Addition of the legal limit of 20mg/l of reduced glutathione at the start of fermentation is quickly consumed



Addition of 50mg/l or 100mg/l of reduced glutathione at the start of fermentation allows to maintain a higher level until the end



^{2017-1691 | 40&}lt;sup>th</sup> World Congress of Vine and Wine Johannes Rösti

Glutathione stays reduced during fermentation but gets oxidized towards the end



^{2017-1691 | 40&}lt;sup>th</sup> World Congress of Vine and Wine Johannes Rösti

The reductive state of glutathione during fermentation is independent of the amount



^{2017-1691 | 40&}lt;sup>th</sup> World Congress of Vine and Wine Johannes Rösti

Fractionated addition of reduced glutathione during fermentation also allows to maintain a higher level until the end



The state of glutathione might remain more reduced with fractionated addition during fermentation



Agroscope

Different moments of addition might change the amount and reductive state of glutathione during fermentation



^{2017-1691 | 40&}lt;sup>th</sup> World Congress of Vine and Wine Johannes Rösti

Different moments of addition might change the amount and reductive state of glutathione during fermentation



^{2017-1691 | 40&}lt;sup>th</sup> World Congress of Vine and Wine Johannes Rösti

Late additions maintain a higher level of reduced and total glutathione towards the end of fermentation



Agroscope

Addition of reduced glutathione at the start of fermentation slows down the fermentation speed



^{2017-1691 | 40&}lt;sup>th</sup> World Congress of Vine and Wine Johannes Rösti

Addition of reduced glutathione at the start of fermentation slows down the fermentation speed



^{2017-1691 | 40&}lt;sup>th</sup> World Congress of Vine and Wine Johannes Rösti

The fermentation speed remains normal if reduced glutathione is added between the 3rd and 4th day of fermentation



2017-1691 | 40th World Congress of Vine and Wine Johannes Rösti

The fermentation speed remains normal if reduced glutathione is added between the 3rd and 4th day of fermentation



^{2017-1691 | 40&}lt;sup>th</sup> World Congress of Vine and Wine Johannes Rösti

Glutathione might be metabolised by yeast to produce biomass at the start of fermentation



2017-1691 | 40th World Congress of Vine and Wine Johannes Rösti

22

Conclusions

1. Is 20mg/l of reduced glutathione a sufficient amount during fermentation?

→ 20mg/l seems not enough to maintain an enhanced level during fermentation. 40-50mg/l might be more appropriate.

2. When is the right moment to add reduced glutathione to the fermentation?

→ Early addition might lead to yeast metabolisation.
A fractionated addition seems most appropriate to maintain a good level of reduced glutathione throughout fermentation without feeding yeast at the beginning

3. How to avoid metabolisation of glutathione by the yeast?

 \rightarrow Delay addition to 3rd day of fermentation. Adaptation of nitrogen levels of the must needs still to be studied.

Agroscope



Luis Taveira Carole Koestel for conducting the experiments

Ágnes Dienes-Nagy Frédéric Vuichard Fabrice Lorenzini *for the analytics*

Swiss government

for the financial support



















Thank you for your attention

Johannes Rösti johannes.roesti@agroscope.admin.ch

Agroscope good food, healthy environment www.agroscope.admin.ch

























