Environmental conditions can modulate the production of volatile sulfur compounds (VSC) during wine fermentation

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Environmental conditions can modulate the production of volatile sulfur compounds (VSC) during wine fermentation

In the increasingly competitive worldwide market of wines, a current challenge is to offer products with style and character to meet the consumer’s expectations. In this context, controlling the production of volatile compounds during the fermentation, which may have a positive or negative incidence on the wine aroma, is essential. This project focuses on the understanding of the formation of volatile sulfur compounds (VSCs) deriving from yeast metabolism and described as unpleasant aromas in wines. The yeast metabolic network underlying the synthesis of these molecules remains until now poorly elucidated as well as the incidence on the activity of many environmental and technological parameters including pH, sugars, sugar concentration, nitrogen resource composition and availability or SO₂ addition.

**Materials and Methods**

**Screening of 40 different strains on the basis of VSCs production**

- 22 Saccharomyces
- 18 Non Saccharomyces

**Fermentation using synthetic must (Beley et al. 1998)**

**VSCs analysis by GC-MS (headspace injection method):**

- 15 different compounds analysed

**Selection of strains displaying a high capacity to produce VSCs**

**Incidence of environmental parameters**

- 3 levels: Sugar (g/L), pH, SO₂ (mg/L)

**Box-Behnken design:**

- 15 fermentations with central point in triplicate

**Selection of strains displaying a high capacity to produce VSCs**

**Impact of SO₂ addition**

- Overall, increase in VSC production by adding of 45 mg/l SO₂
- Extent of the response to SO₂ addition depending on both the strain and the nature of the compound

**Combined impact of SO₂, sugar and pH**

- Interaction between pH and SO₂ in the production of MTHTP by the strain MTHTP14
- Positive SO₂ effect of at high pH
- Negative SO₂ effect at low pH

- One parameter is fixed, the others two are represented on x and y axis
- The studied aroma is represented on the z axis

**Summary table**

- Diversity of the response depending of the strain and the compound concentration
- Sugars, pH, and SO₂ act in a complex way on VSCs production (quadratic effect – interaction effect)

**Examples of surface responses**

- Strain MTHTP14
- Strain ECAS
- Strain MTHTP14

Exploring the profile of VSCs formation within a collection of 40 yeasts (Saccharomyces and non Saccharomyces species) commonly encountered in wine environment revealed an important variability between strains in their abilities to produce VSCs. Furthermore, using a Box-Behnken experimental design, we were able to show pH, sugar, and SO₂ concentrations modulate in combination the production of VSCs, with a strain-dependent response.