

Factsheet

Sulfur Dioxide (SO_2)



SULFUR DIOXIDE (SO₂)

Sulfur dioxide (SO₂) is a food preservative used frequently throughout the food and beverage industry. Its use as a food preservative began towards the end of the 18th century, and yet it is still one of the safest preservatives available when used within the permitted limits.

As a preservative, SO₂ is used in different steps of production. Two of the main characteristics of SO₂ are being an antiseptic and antioxidant. With these characteristics, SO₂ inhibits the development of undesirable microorganisms and prevents chemical oxidations. Moreover, SO₂ inhibits oxidation enzymes, protecting juice from oxidation and oxidasic casse which causes turbidity and darkening. Lastly, by binding with different compounds, SO₂ can protect aromas in alcoholic beverages.

SO₂ is naturally found in fermented alcoholic beverages, such as wine and cider, in certain amounts, as it is produced by yeast during alcoholic fermentation. The amount of SO₂ produced by the yeast changes depending on the yeast strain and fermentation conditions. Levels of SO₂ are generally less than 10 mg/L but can exceed 30 mg/L under certain conditions.

During production, excessive use must be avoided for health reasons. Irritation of the eyes, mucous membranes, skin, and respiratory tract are the main concerns. Moreover, bronchospasm, pulmonary edema, pneumonitis, and acute airway obstruction are the results of direct exposure. Even at concentrations within the limits, SO₂ can cause issues for people who suffer from chronic pulmonary diseases, such as asthma. Along with the health concerns, excessive use of SO₂ has a negative impact on the aroma of the final product.

Free and Total SO₂

SO₂ in a solution (as in the case of alcoholic beverages) exists in different forms depending on the temperature, pH, and other constituents of the solution. Three main forms of SO₂ that are referred to during production are free, bound, and total SO₂. Once SO₂ is added, it binds to different compounds present in the medium. The amount that binds is called bound SO₂, while the rest staying in the free form is called free SO₂. The total amount of free and bound fractions of SO₂ in the medium is called total SO₂.

Free and Total SO₂ Limits

The Food and Drug Regulations Division 2 Alcoholic Beverages has set a limit for sulphurous acid, including salts thereof, as 70 parts per million in the free state, or 350 parts per million in the combined state, calculated as sulphur dioxide in the specified alcoholic beverage categories. The total sulphur dioxide is the sum of the free state and combined state. This corresponds to 70 mg/L free SO₂ and 420 mg/L total SO₂.

The amount of SO₂ needed to achieve the desired microbial and oxidative protection changes depending on the chemical parameters of the product. Among these chemical parameters, is the amount of residual sugar. Therefore, for wine, cider and ready to drink (RTD) beverages, depending on the type and characteristics of the product, free and total SO₂ limits have been established by the NSLC.

PRODUCT	FREE SO ₂ LIMIT		TOTAL SO ₂ LIMIT	
	NSLC (mg/L)	Health Canada (ppm – mg/L)	NSLC (mg/L)	Health Canada (ppm – mg/L)
Wines under 35 g/L sugar	Less than or equal to 50	Greater than 70	Less than or equal to 300	Greater than 420
Wines containing 35 g/L of sugar and over	Less than or equal to 70		Less than or equal to 400	
Ciders under 35 g/L sugar	Less than or equal to 50	Greater than 70	Less than or equal to 300	Greater than 420
Ciders containing 35 g/L of sugar and over	Less than or equal to 70		Less than or equal to 400	
Ready to drink (RTD)	Less than or equal to 30	N/A	Less than or equal to 100	N/A

CONTROLLING SULFUR DIOXIDE LEVELS

The following points should be considered when using sulfur dioxide:

- It is important to understand the application purpose and effects of sulfur dioxide on the product.
- Establish cleaning and sanitation protocols in the production area, including all processing equipment and vessels. The hygienic state of the production area can contribute to decreasing SO₂ usage.
- To determine the amount of SO₂ needed to achieve the desired effect, it is important to consider the alcohol, pH and residual sugar of the product.
 - » A common practice to determine SO₂ dosage is to calculate molecular SO₂, one of the fractions of free SO₂ which is effective for microbial and oxidation protection.
- Read the technical data sheet of the SO₂ product provided by the manufacturer and follow the direction of use and recommendations of dosage.
- It is important to keep track of all the additions to the batch of the product to avoid any mistakes and incorrect applications.
- There are different alternatives to replace or decrease the concentration of SO₂, including different preservatives, production techniques, and bio-protection methods.

REFERENCES

Beech, F. W. (1972). Cider Making and Cider Research: A Review. *Journal of the Institute of Brewing*, 78(6):477-491.

Benito, S. (2019) The Management of Compounds that Influence Human Health in Modern Winemaking from an HACCP Point of View. *Fermentation*, 5(2):33.

Food and Drug Regulations, CRC, c. 870

Freedman, B. J. (1980). Sulphur dioxide in foods and beverages: Its use as a preservative and its effect on asthma. *British Journal of Diseases of the Chest*, 74, 128-134.

Jackson, R. S. (2014) Wine Science: Principles and Applications. Elsevier.

Ribéreau-Gayon, P., Dubourdieu, D., Donèche, B., Lonvaud, A. (2006) Handbook of Enology: The Microbiology of Wine and Vinifications. (2nd ed., Vol. 1). West Sussex: John Wiley & Sons, LTD.

The Australian Wine Research Institute. (n.d.). Wine Flavours, Faults and Taints.

Watrelot, A., Savits, J., Moroney, M., Hannan, J. (2020). Excessive Sulfur Dioxide in Wine Faults Series. *Iowa State University Extension and Outreach*.

FOR MORE INFORMATION

If you have questions about the information found in this factsheet, please contact one of Perennia's specialist at:

Quality and Food Safety

Phone: **902-896-0277**

Email: foodsafety@perennia.ca

or

Food and Beverage Innovation Centre

Phone: **902-896-8782**

Email: innovation@perennia.ca

If you have questions regarding the established limits or product testing, please contact the NSLC at product.testing@mynslc.com