Factsheet
Ethyl Carbamate

ETHYL CARBAMATE

Ethyl carbamate is a chemical that forms during the fermentation process. Therefore, it could be detected in all fermented alcoholic beverages. It has been classified as "probably carcinogenic to humans" by the International Agency for Research on Cancer (IARC). Health Canada has stated it may pose a health risk to the consumer and has established limits on the level of it permitted in alcoholic beverages.

Ethyl carbamate is formed from a reaction of urea and ethanol. During fermentation, yeast create many different by-products. Depending on the amino acids that it metabolizes, yeast can create urea in excess amounts. Urea is a chemical compound formed when yeast metabolize arginine, an amino acid present in raw materials. Urea will then spontaneously react with the alcohol (ethanol) present and form ethyl carbamate. In the case of winemaking and cidermaking, urea can also be produced by lactic acid bacteria during malolactic fermentation. Moreover, some lactic acid bacteria are capable of excreting citrulline, which is another precursor of ethyl carbamate after urea. In distilled spirits, cyanide is another precursor of ethyl carbamate.

FACTORS INFLUENCING ETHYL CARBAMATE LEVELS

- Excessive fertilization with urea and nitrogen fertilizers on grape crops
- The cooling time during the fermentation process
- Temperature and exposure to UV light during storage
- The type of yeast being used for fermentation
- Carrying out malolactic fermentation in winemaking and cidermaking
- Old, aged wines tend to show higher levels of ethyl carbamate, as ethyl carbamate forms slowly during aging
- The type of distillation equipment used

ETHYL CARBAMATE LIMITS

The following limits for ethyl carbamate have been established by the NSLC:

PRODUCT TYPE		Ethyl Carbamate Limit (µg/L)
Beer	Under 8.5% ABV	Less than 15
	Over 8.5% ABV	Less than 30
Cider		Less than 30
Ready to Drink	Non-dairy based	Less than 15
	Dairy based	Less than 100
Spirits	Non-fruit	Less than 150
	Fruit	Less than 400
Wine	Table wine	Less than 30
	Fortified wine	Less than 100

CONTROLLING ETHYL CARBAMATE LEVELS

To help avoid being over the limits one should be mindful of the factors that can lead to increased levels.

For all agricultural raw materials, it is important to be aware of the soil and crop nitrogen status and to not use urea as a fertilizer or over fertilize the crops with nitrogen-based fertilizers.

For winemaking and cidermaking, it is important to analyze the nitrogen status of the juice before fermentation and to not over supplement with any nitrogen supplements or use urea as a nitrogen supplement. It is important to be aware of the nutrient demand of the yeast that is used in the production and apply only the required amount of nitrogen supplement. Read the technical data sheet of the nitrogen supplements provided by the manufacturer and follow the directions of use and recommendations of dosage.

For beer and spirits, cooling to fermentation temperatures at a quicker rate rather than letting it cool naturally may help decrease the amount of ethyl carbamate formed since high temperatures for extended periods increase the production of ethyl carbamate. During production, the use of a chiller will help achieve fermentation temperatures quicker.

For all final products, exposing them to higher temperatures and light can increase the production of ethyl carbamate. During storage, it is important that products are not subjected to higher temperatures and are protected from light exposure for extended periods.

For all products, it is important to be aware of the type of yeast strains being used in fermentation and know if those strains produce high levels of urea. This can be discussed with the yeast suppliers or be tested.

For winemaking and cidermaking, alternative techniques for malolactic fermentation can be considered to avoid ethyl carbamate formation via bacteria metabolism. If malolactic fermentation cannot be opted out for the type of product sought, another option is to use selected lactic acid bacteria that cannot excrete citrulline, which is another precursor of ethyl carbamate after urea.

For distilled spirits, consider the type of distillation equipment used. Copper ions can promote the formation of ethyl carbamate in the distillate.

For ready to drink products and spirits, it is important to be aware of the source of the alcohol being used. Alcohol must be sourced from an approved, trusted supplier, and not have high ethyl carbamate levels.

If fermenting with stone fruits, the pits can contribute precursors to the development of ethyl carbamate. It is recommended to remove the pits of all fruit before using in the fermentation process.

REFERENCES

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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**