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Dairy Foods Science Notes

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Light-Induced Flavor Defects in Milk

Good quality milk should have a pleasantly sweet and clean flavor with no distinct aftertaste. Milk, however, is a delicate food that is often mishandled in a manner that can result in off-flavors. Excessive exposure to light is one manner of mishandling that can result in a serious flavor defect known as **light-induced or light-oxidized**. Light-oxidized milk is characterized as having a burnt protein (e.g., burnt feathers or hair), medicinal or plastic-like flavor. A more severe light-induced defect may be perceived as a flavor similar to old vegetable oil that results from the oxidation of milk fat. Depending on the intensity of the light-oxidized flavor, consumers may vary in their ability to detect this defect; some may find the milk objectionable while others detect no specific off-taste.

How does a light-oxidized defect develop in milk?

Light-oxidized defect develops in milk as a result of its exposure to sunlight or to fluorescent lighting common in store dairy cases (especially bulbs with wavelengths below 620 nm). Light initiates a chemical reaction in milk that modifies specific components of proteins and fats, resulting in the characteristic off-flavors. Certain vitamins are also susceptible to light-induced degradation in a similar manner (i.e., riboflavin and vitamin A). Exposure to sunlight for as little as 10-15 minutes (as short as 5 minutes on a very clear day with intense sunlight) is sufficient to cause the defect, while longer exposure times are generally required for fluorescent lighting. The closer the milk is to the fluorescent light source or the more intense the light, the quicker the development of the off-flavor (within 1-2 hours in some cases). In general, the defect is more common in milk packaged in transparent plastic or glass, although it can also occur in milk in more opaque containers with very intense light and sufficient exposure time.

How can light-oxidized defects be prevented?

Preventing light-oxidized defects in milk simply involves protecting the milk from light, especially sunlight, and especially milk packaged in transparent plastic or glass. A few minutes exposure to the sun on a loading dock or during consumer transport may be all it takes. Recommendations for dairy plants and stores include:

- Milk receiving and handling areas, storage coolers, and display cases should be designed for minimum direct light exposure to packaged milk and to facilitate product rotation. Milk crates in storage should not be stacked in a manner that results in close proximity to over-head lighting, or a cover should be used. Display cases in stores should be set up such that no light bulbs are in close proximity to the product.
- Fluorescent light bulbs used for display cases and coolers should be the “warm white” variety, which generally have less harmful energy in the critical wavelengths than the “cool white” variety.
- Yellow shielding (e.g., over or in front of fluorescent bulbs) may be used to reduce the intensity of light.
- Unnecessary lighting in coolers and display cases should be turned off during times of the day when milk turnover rate is slow (e.g., night shift or when store is closed).
- Light block additives or over-wraps may be used for some packaging material to help protect the milk. These materials may not offer 100% protection, so protection from light is still warranted.

Though the convenience of plastic containers is attractive to most consumers, light-oxidized defect is more common in this type of packaging when compared to paperboard, so extra care is needed during transport and storage. Plastics containing light blocking agents or coloring (e.g., yellow) are currently used by some companies to protect their products from light-activated off-flavors and vitamin degradation. Lastly, protecting milk from light should not end at the store. Consumers should also be aware that milk needs to be protected from light during transport (e.g., offer a brown paper bag), storage and use.

MILK - BUY IT FRESH, KEEP IT COLD, & PROTECT IT FROM LIGHT

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