October 2018

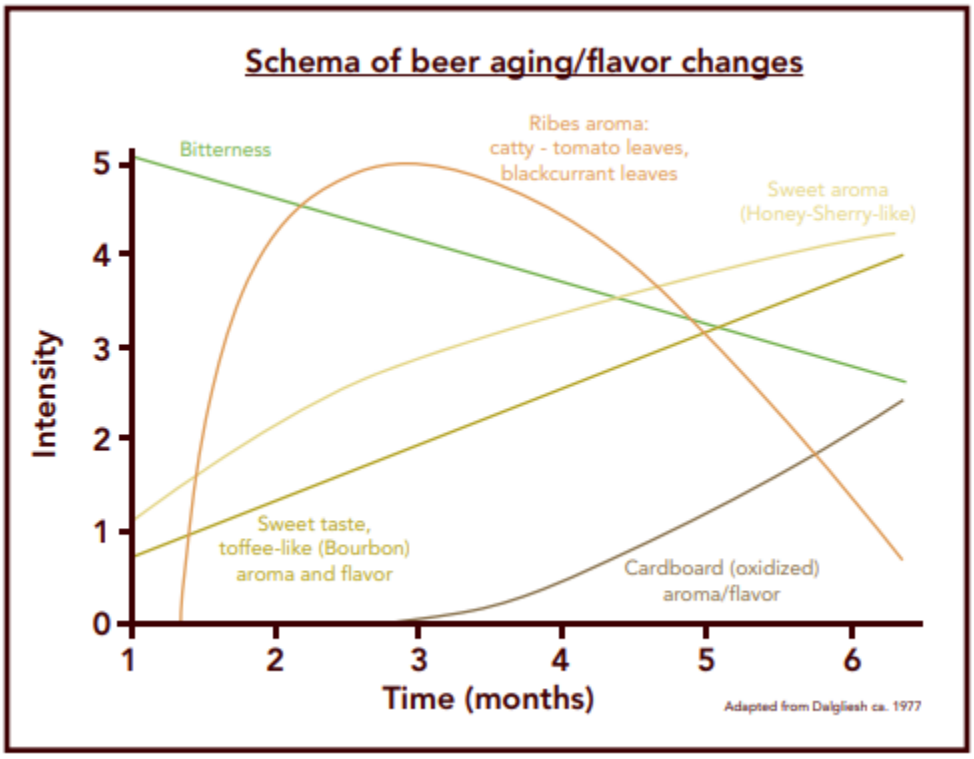
Quality Control during Beer Refrigeration, Storage and Shipping

By: Douglas Wright, President

Temperature monitoring and control once again becomes an essential practice in ensuring your customers and partners are receiving your beer in the same condition as when the batch was brewed. Our extensive line of dataloggers and sensors can give you the control to maintain freshness during storage, track the temperature of your beer during shipping, avoid spoilage and troubleshoot any logistical issues.

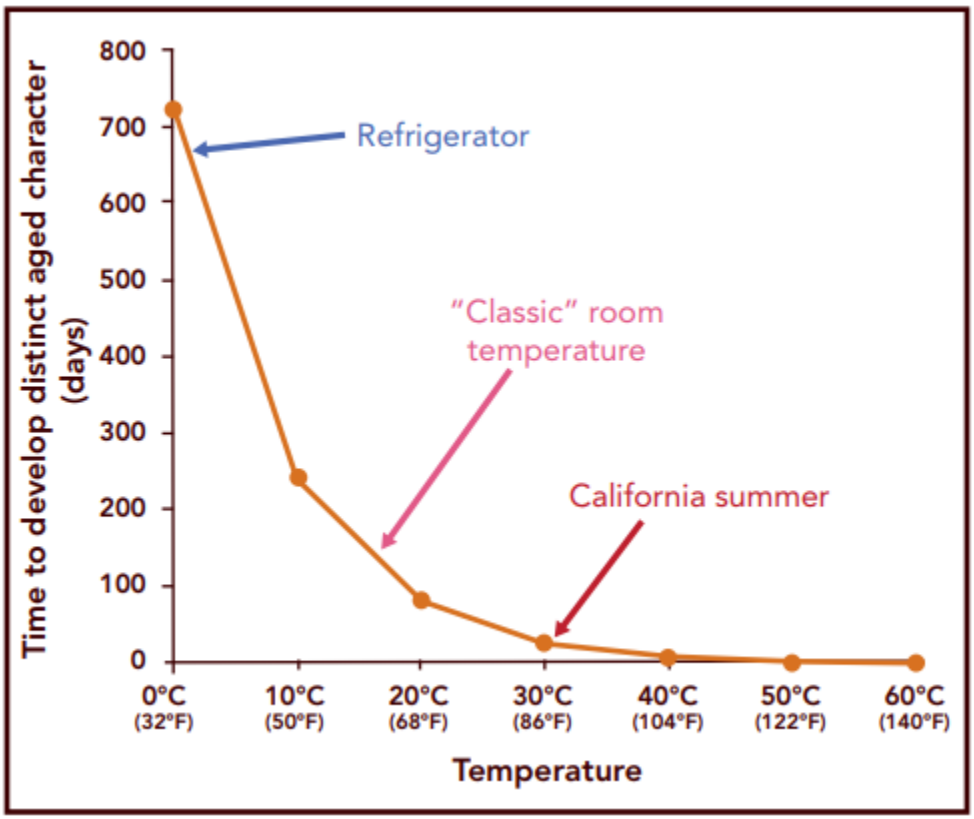
Dataloggers
Wireless Systems

Packaging and distribution are very important to beer quality and flavor. Also, in most cases, the temperature during distribution is beyond the control of the producer. As beer ages, different flavors can be imparted. Some of these flavors are good and some are bad. Beer that is too old or has gotten warm is often described as stale or cardboard like. Bitterness tends to decrease, whereas sweet honey or toffee notes increase over time. Other flavors also change with time (shown in Figure 1 below). Aging a beer may be a way to maximize its potential. However if temperature is not controlled this could go bad quickly.



As beer is being packaged, transported, stored in warehouses, or waiting for purchase in a store, it is aging. In order for your beer to be as close to the product shipped out as it is when you test it for consistency, it should be kept as cold as possible without freezing. Regardless of whether the beer will get better with age it should be kept cold to ensure product consistency. Increased temperature speeds

up all of the chemical processes that cause beer to age and eventually spoil. In Figure 1.5 below it can be seen that the life of a beer increases dramatically as temperature decreases.



It is difficult, if not impossible; to control the temperature of a beer while a different company is in charge of shipping it. While there may be contracts in place to ensure the beer does not reach certain temperatures, it is still possible that these conditions are not met. How is a brewer to know? What if there was a system to continuously monitor the temperature of a finished beer from packaging to the store or pub at which it is sold?

At Scigiene we have multiple solutions depending on how much details you want.
Adhesive thermal indicator labels will tell you if the agreed up limits have been exceeded but not for how long.

For more detail study we have single use or reusable dataloggers. These can be downloaded for detailed graphs. The LCD display will tell the receiver if the product has been abused in transit. If you are having shipping troubles these graphs can tell you who, when and for how long!

If the beer being produced is to be aged, then there are some simple guidelines illustrated below for what temperature to hold them at as they age. Of course these are not hard and fast and may require some experimentation. Aging is not required but can be used as a way to bring out desired flavor changes in certain beers. Temperatures higher than those recommended in the table will shorten the lifespan of your beer. Temperatures lower than that may induce chill hazing. Some beers simply age better than others; this may be something to consider when deciding how to store beer for aging.
In these instances reusable/multi use datalogger or a wireless system will be ideal. The wireless system could be integrated with other portions of your quality control.

Recommended Temperatures for Aging Beer:
Strong beers Barley wines, Tripels, Dark Ales, etc. Room temperature 13-19°C 55-65°F
Standard ales Bitters, IPAs, Dopplebocks, Lambics, Stouts, etc. Cellar temperature 10-13°C 55-55°F
Light beers Lagers, Pilsners, Wheat beers, Milds, etc. Refrigerated temperature 7-10°C 45-50°F

Conclusion:
Controlling temperature when making beer is paramount in every step, from mashing and all the way to distribution and aging. Temperature can affect the flavor, foam quality, consistency, and longevity of beer. Fortunately it is also something that, in most steps, is easy to monitor and control.

Oxygen in the headspace of a bottle can, or any other beer container post-fermentation is arguably the most critical problem when controlling oxygen. This is because the beer tends to stay in contact with this oxygen for extended periods of time. By exposing the finished beer to oxygen many flavor changes occur. The most notable is formation of the stale tasting aldehydes mentioned during the section on mashing, especially in lighter beers. Often bread-like flavors develop along with metallic notes and a butter-like taste from evolved dimethyl sulfide. Dark beers suffer in that they lose flavors, most notably malty flavors, and become bland. Acetic acid can also be created which in low concentrations adds sherry notes which can be enjoyable in some beers. In high concentrations though acetic acid will cause beer to become sour and vinegary.

Headspace air is controlled during the filling of vessels for some packaging, especially kegs, the vessel is flushed with CO2 which displaces O2. Commercial bottle filling equipment allows as little as 0.2 mL of headspace air per 1/3 L of beer. Headspace air can easily be monitored. Instruments exist specifically designed to find the concentration of oxygen and nitrogen in the headspace of beverage bottles. The device punctures the cap of the beer and pressure from dissolved CO2 pushes the air in the headspace of the bottle through a solution that eliminates CO2. Oxygen and nitrogen are then the only gasses remaining and the volume of these gasses is measured. These devices cost about $900 and are well worth the investment for even the smallest commercial brewer. This measurement should occur as soon as possible after filling to ensure that as little oxygen as possible has dissolved into the beer.

The effect of headspace air on the stability of beer is immense. Also important is the temperature at which the beer is stored. Warmer temperature speed up oxidation. The table below illustrates beer stability relative to headspace air and storage temperature.

Table II: Effect of Thermal Abuse and Headspace Air on Staling		
	Days to Staling	
Headspace air (mL per 1/3 L)	Storage at 86 °F (30 °C)	Storage at 43 °F (6 °C)
0.5	60	120
1.0	40	100
1.5	20	80
2.0	5	70
Data obtained from test brews that were carefully controlled with respect to HSA and other forms of CSA (5).		

Conclusion:

Control of oxygen (C02) is important in many stages of brewing and storage. It affects yeasty health and productivity as well as the oxidative formation and degradation of flavor compounds. Careful monitoring as well as measures to control oxygen levels is essential to quality control during beer production.

Scigiene
1295 Morningside Ave Units 16, 17, & 18
Toronto ON M1B 4Z4 Canada
Telephone: 416-261-4865 Fax: 416-261-7879
www.scigiene.com