



GETTING TECHNICAL WITH BEER

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The Fundamentals of Oxygen in Brewing

Oxygen is the key component for respiration of organic compounds in plants and animals. The amount of oxygen in the air we breathe remains remarkably stable at about 20.95% and is vital in sustaining life. The respiration function allows the removal of carbon dioxide and other waste gases for organisms with or without lungs.

Yeast Metabolism

Proper oxygenation of wort in preparation for fermentation is an important process. Oxygen is used up during the start of respiration by yeast cells to synthesize sterols and unsaturated fatty acids, two components essential for healthy cell membrane structure and stability. The use of oxygen in the beginning is known as the "aerobic" phase. Once oxygen is absent in wort, the yeast enter the "anaerobic" fermentation phase.

Did you know?
Yeast is the only living organism that can change from respiration phase to fermentation phase

During fermentation, yeast use carbohydrate sugars to create alcohol and oxygen to produce lipid compounds. A lack of lipid compounds can cause poor fermentation quality issues, which can lead to slow or stuck fermentations, off-flavors, poor yeast quality, and lack of yeast growth.

Oxygenating Wort

Wort should be oxygenated only after it has been cooled to fermentation temperature levels. Although oxygen is more readily mixed at warmer temperatures, the risk of oxidized off-flavors is too great. There are several options homebrewers can use to oxygenate wort, and each has varied results. Yeast requires around 8-15 ppm of oxygen in solution. The chart shows the most popular aeration methods in homebrewing. Use a 0.2-micron air filter in line between the aera-

tor stone and air source when using a pump or oxygen can.

Oxidation Control

Brewhouse—Avoid oxygenation in the brewing process prior to fermentation. Oxidation is directly proportional to temperature, therefore oxygen introduction during mashing, sparging, and boiling should be avoided. The introduction of oxygen at this point can cause off-flavors, premature aging, and increased beer color.

Fermentation—Introduce oxygen to the fermentation vessel directly after pitching yeast is quickly assimilated for a fully fermented beer free from oxygen. Avoid introducing oxygen during subsequent racking after primary fermentation. Purge secondary and/or lagering vessels with CO₂ prior to racking.

Packaging (Bottling and Kegging)—Oxygen introduced at packaging can cause oxidized flavors and premature aging. Avoid splashing beer during the racking process. Purge bottles and kegs with CO₂ prior to filling to minimize the introduction of oxygen. Natural conditioned beer has enough active yeast in the final package to use up any additional oxygen introduced during filling.

Fine tuning both the brewing and fermentation process to control oxygen will help you achieve better quality beer. Now, let's get brewing!

Wort Oxygenation Method	Dissolved Oxygen (ppm)	Time (sec)
Siphon Spray	4	0
Splashing & Shaking	8	40
Aquarium Pump	8	300
Pure Oxygen w/Stone	8, 15, 22	20, 80, 120

Greg Doss - Wyeast Laboratories



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About the Author

John Lundy has been home brewing for 14 years. He is 2006 president of the Treasure Coast BrewMasters (www.tcbrewmasters.org) and manages Home Brew Unlimited, a Web site chronicling his home brew experience and rating breweries and brew pubs around the country. Log on to www.homebrewunlimited.com.

