



Application Report

Influence of Oxygen on Beer Foam Stability — Monitoring with Hach Analytical Solutions



Introduction

Beer foam quality is a key indicator of product freshness and consumer appeal. A dense, stable foam is not just visually appealing—it's a reflection of high process control and product integrity. One of the most critical factors affecting foam stability is the presence of dissolved oxygen (DO) at various stages of the brewing process.

Even trace amounts of oxygen can:

- Oxidize foam-positive proteins and hop resins
- Encourage microbial activity
- Generate aldehydes that negatively impact aroma and taste
- Significantly reduce foam stability and shelf life

To monitor and minimize oxygen pickup effectively, Hach offers a range of precise, brewery-grade instruments specifically designed for inline and at-line oxygen measurement throughout the production chain.



How Oxygen Affects Beer Foam

Mechanisms of Foam Degradation Due to Oxygen:

- **Lipid Oxidation:** Leads to the formation of surface-active agents that collapse foam
- **Protein Breakdown:** Loss of foam-stabilizing polypeptides
- **Hop Resin Degradation:** Reduces bitterness and foam-enhancing properties
- **Microbial Contamination:** Promotes spoilage organisms that produce foam-negative byproducts

These reactions can occur within days or weeks and severely compromise the visual and sensory profile of the final product.

Critical Control Points & Recommended DO Thresholds

The table below outlines the typical stages in the brewing process and the **recommended maximum levels of dissolved oxygen**, based on best practices in brewing science (e.g., EBC, MEBAK, industry standards):

Process Stage	Recommended DO Limit	Purpose
After wort cooling	< 100 ppb	Support yeast health without excessive oxidation
After primary fermentation	< 50 ppb	Prevent oxidation of sensitive compounds
After filtration	< 30 ppb	Ensure sensory and foam stability
Prior to packaging	< 20 ppb	Preserve foam quality and flavor
In final package (TPO)	< 100 ppb (ideal < 50 ppb)	Shelf stability and export-quality assurance
After CIP before product flow	< 20 ppb	Ensure oxygen-free conditions in clean pipelines

Monitoring Solutions from Hach

Inline Oxygen Monitoring Orbisphere M1100 Sensors



Product: Hach Orbisphere M1100 Optical DO Sensors

Technology: Luminescence-based optical measurement with temperature compensation

Range: 0–2.000 ppb (resolution < 1 ppb)

Advantages:

- Accurate in CO₂-rich environments
- Low maintenance, long calibration intervals
- Ideal for CIP/SIP environments

Applications:

→ Installed after wort cooling, before/after filtration, in storage tanks, or for CIP validation.

Total Package Oxygen (TPO) Orbisphere 6110



Product: Hach Orbisphere 6110 TPO Analyzer

Technology: Simultaneous headspace and liquid oxygen measurement

Range: Determine TPO (Total Package Oxygen) for bottles and cans

Advantages:

- High precision; detects oxygen ingress from fillers and closures
- Ideal for line optimization and QA monitoring

Applications:

→ Routine checks during packaging runs, monitoring filler performance, QA release testing.

Central Control & Data Management Orbisphere 410/510 Controllers



Product: Hach Orbisphere 410/510 Controllers

Features:

- Multi-channel support for DO, CO₂, O₃ and more
- Intuitive touchscreen interface
- Integrated data logging, Ethernet for SCADA integration

Applications:

→ Brewery-wide DO management, alarm thresholds, batch tracking, reporting for audits

Case Study:**Real-World Implementation**

Brewery Example – 150,000 hL annual output

Situation:

- Foam stability issues in kegs, especially after prolonged storage
- Customer complaints regarding “flat” appearance and off-flavors
- No oxygen monitoring during filtration or packaging

Action Plan:

- ☑ Installed **Orbisphere M1100** inline after filtration
- ☑ Added **Orbisphere 6110** at packaging line for TPO
- ☑ Implemented **DO validation** before filling after CIP

Results After 3 Months:

Reduced DO after filtration
~70 ppb to <20 ppb



TPO levels decreased
~140 ppb to <50 ppb



Customer complaints
decreased 60%



Sensory panel showed
+35% increase in foam retention



Shelf-life prediction
improved by ~3 months
(export beer)



Reliable, precise, and user-friendly tools to **detect and eliminate oxygen problems before they impact the final product.**

Conclusion

Oxygen management is critical to ensuring beer foam quality, flavor stability, and overall product consistency. Even low levels of DO can compromise premium beers—especially those destined for long shelf life or international markets.

Hach's Orbisphere instruments provide breweries with reliable, precise, and user-friendly tools to detect and eliminate oxygen problems before they impact the final product.

Whether for **inline control, packaging QA, or process optimization**, Hach solutions support breweries of all sizes in achieving higher product quality and longer shelf life—with consistent foam that consumers love.



Recommended Products at a Glance

Product	Use Case	Highlights
Orbisphere M1100	Inline DO monitoring	CIP/SIP resistant, optical sensor, low drift
Orbisphere 6110	TPO in bottles & cans	Highly accurate, detects O ₂ ingress
Orbisphere 3100	Portable O ₂ -Logger	Robust portable logger, optical sensor

