

Bottle Overpressure in Liquid Supplements



Executive Summary

A nutraceutical manufacturer producing liquid mineral supplements experienced unexpected bottle overpressure occurring 10–15 days after filling. The issue raised concerns around product safety, stability, and handling but could not be explained using existing test methods.

Gasporox conducted a non-destructive, time-resolved headspace study, monitoring oxygen, carbon dioxide, and internal pressure inside sealed bottles over 44 days. By tracking multiple variables in parallel without opening any packages, the study revealed how internal gas dynamics evolved over time and how these changes correlated with pressure buildup. The results provided the customer with quantitative data to support their root-cause investigation and corrective actions.

Industry Context

- **Industry:** Food and Pharmaceuticals
- **Operations:** Liquid nutraceutical products

Manufacturers of liquid food and pharmaceutical products operate under strict quality and regulatory requirements. Unexpected changes in headspace gas composition or internal pressure can indicate product instability, microbial activity, chemical reactions, or packaging-related effects.

Traditional investigative methods often require destructive testing, which limits the ability to observe how conditions evolve over time in the same package. Non-destructive insight into headspace behavior is therefore critical when investigating delayed failures or stability-related issues.

The Challenge

The customer observed that sealed bottles developed significant internal overpressure approximately 10–15 days after filling. When opened, contents were forcefully expelled, creating concerns related to:

- Product safety and consumer handling
- Stability and shelf life
- Packaging and process robustness

While the timing of the issue was consistent, the customer lacked a method to determine what internal mechanisms were driving the pressure increase. It was unclear whether the root cause was related to product chemistry, microbial activity, oxygen availability, or packaging effects.

The Solution

Gasporox designed and executed a 44-day non-destructive headspace study, enabling repeated measurements on the same sealed bottles over time.

Measured parameters:

- Oxygen (O₂) concentration
- Carbon dioxide (CO₂) concentration
- Internal package pressure

Measurement approach:

- Laser-based spectroscopy
- No bottle opening, puncturing, or sample destruction
- Time-resolved monitoring of multiple variables in parallel

Instruments used:

- GasSpect Flex O₂ for high-resolution oxygen monitoring
- VialArch™ O₂ for parallel oxygen measurements under dynamic conditions
- GasSpect CO₂ for combined CO₂ concentration and internal pressure analysis

This setup allowed Gasporox to observe how headspace gas composition and pressure evolved throughout the entire post-filling period.

The Results

The study provided clear, quantitative insights into internal package behavior:

- Internal overpressure development was detected and characterized without compromising the bottles
- Time-resolved data showed how gas composition changed prior to and during pressure buildup
- A direct correlation was established between changes in O₂, CO₂, and internal pressure
- The sequence of internal events leading up to overpressure was clearly defined

These findings enabled the customer to narrow down potential contributing mechanisms and focus their internal investigation.

Key Takeaways

The non-destructive study enabled the customer to:

- Establish the sequence of internal gas and pressure changes leading to overpressure
- Differentiate between potential root causes, including microbial activity, chemical reactions, and packaging-related effects
- Evaluate product stability over time without destroying samples
- Support internal root-cause analysis and corrective actions with quantitative data

Importantly, all insights were generated without invasive testing, allowing the customer to preserve samples and integrate the findings directly into their quality and stability workflows.

Next Steps

Non-destructive, time-resolved headspace analysis makes it possible to understand what happens inside sealed packages before issues become visible or costly.

If you are investigating delayed overpressure, gas generation, or unexplained package behavior in food, nutraceutical, or pharmaceutical products, Gasporox can support your analysis with quantitative insight without destroying samples.

Contact Gasporox to discuss your application, sample types, or a feasibility study tailored to your process at: sales@gasporox.se