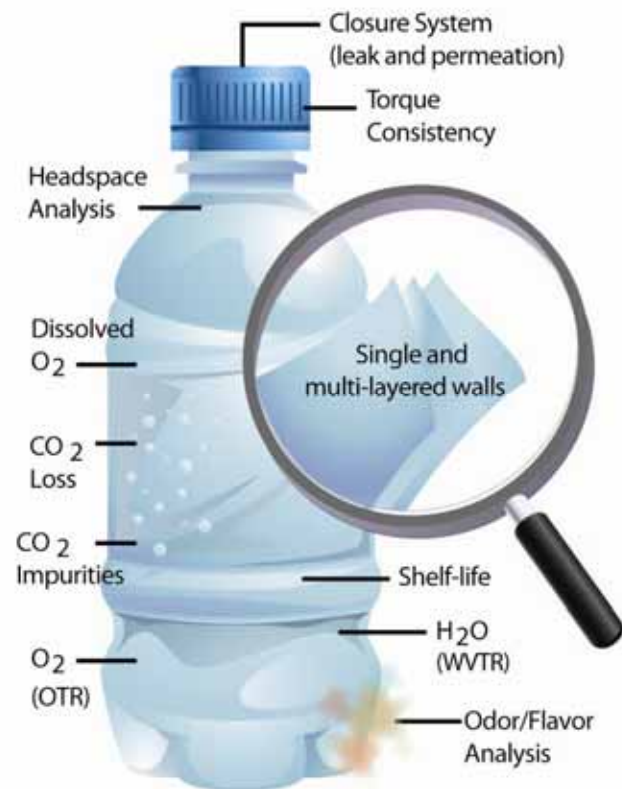


# Advancements in Testing for the Bottle Industry

2009 Webinar Series

Presented by: Joel Fischer



# [ There's a Message in the Bottle ]

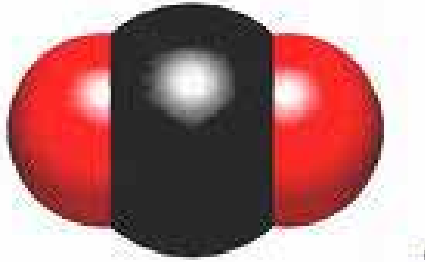
Drinktec 2009



# Three Areas Specific to Carbonated Soft Drinks

- CO<sub>2</sub> Gas Purity
- Impurities that affect Sensory Perception
- Shelf-life (CO<sub>2</sub> Retention)

# Where does CO<sub>2</sub> come from?



- CO<sub>2</sub> exists in the atmosphere (387ppm by volume)
- Commercially, CO<sub>2</sub> is derived from byproducts from industrial processes



# Common Impurities

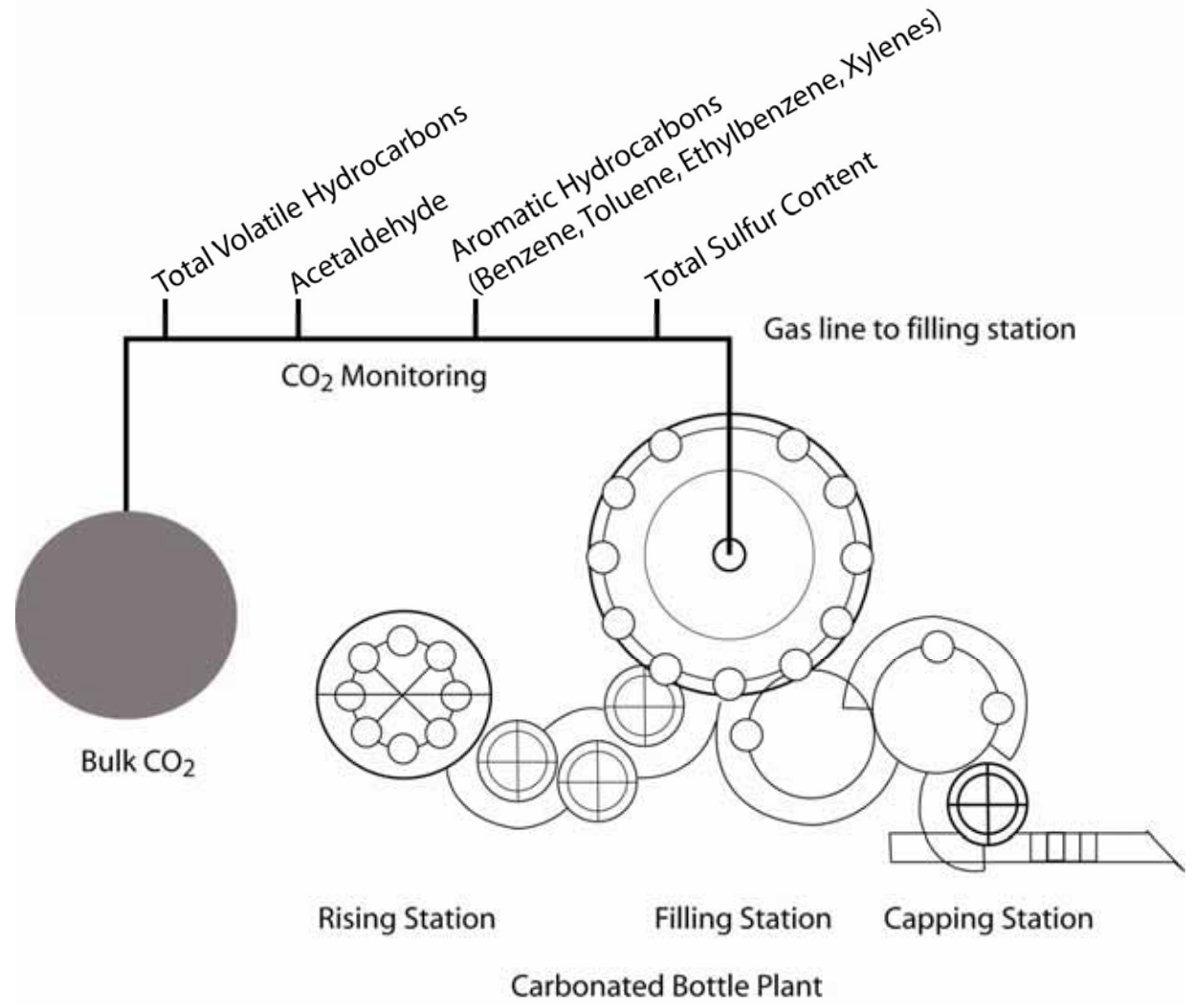
## How Baseline - MOCON can help

- Common impurities that are measured include:
  - Benzene, toluene, ethylbenzene, xylenes (BTEX)
  - Acetaldehyde
  - Vinyl chloride
  - Methanol
  - Total Sulfur (organic sulfides, sulfur dioxide, carbonyl sulfide and hydrogen sulfide)

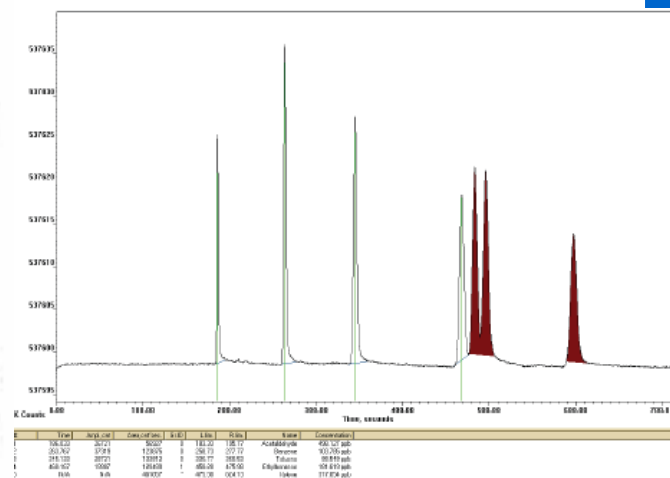
# Why Monitor Impurities within CO<sub>2</sub>?

- Protect product brand (taste and safety)
- Local Laws might require monitoring
- Optimize multi-batch operations
  - Isolate poor sources, before a large batch is contaminated
- In this effort, individual companies and larger organizations (like ISBT) outline methods for testing CO<sub>2</sub> for impurities

# [ How CO<sub>2</sub> is currently monitored ]



# BevAlert 8900 is a GC based system



System is configured with the options and needs of the customer

- Analysis of the listed impurities
- Continuous unattended operation
- Integrated concentration and diagnostic alarm relays
- Multipoint sampling options

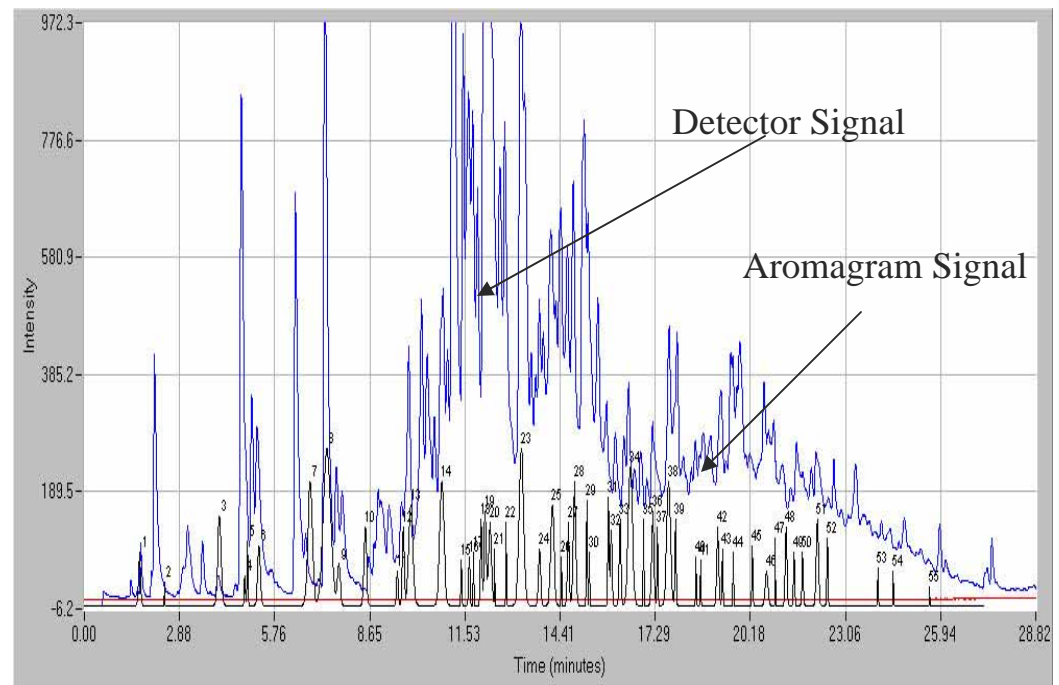
## Additional Impurities that Affect Sensory?

- Might not be harmful, just “poor” flavor
- Could come from the package or ingredients
- Typical methods involve sensory panels
- Other methods involve gas chromatographs in an effort to “find the peak”
- Need a method that combines “sensory” with “instrumental” analytics

# Aroma Profile of “Good” Polymer Bottle

## Aromagram (PID Signal & Aroma Notes)

A “Good” sample had over 55 odor significant peaks.

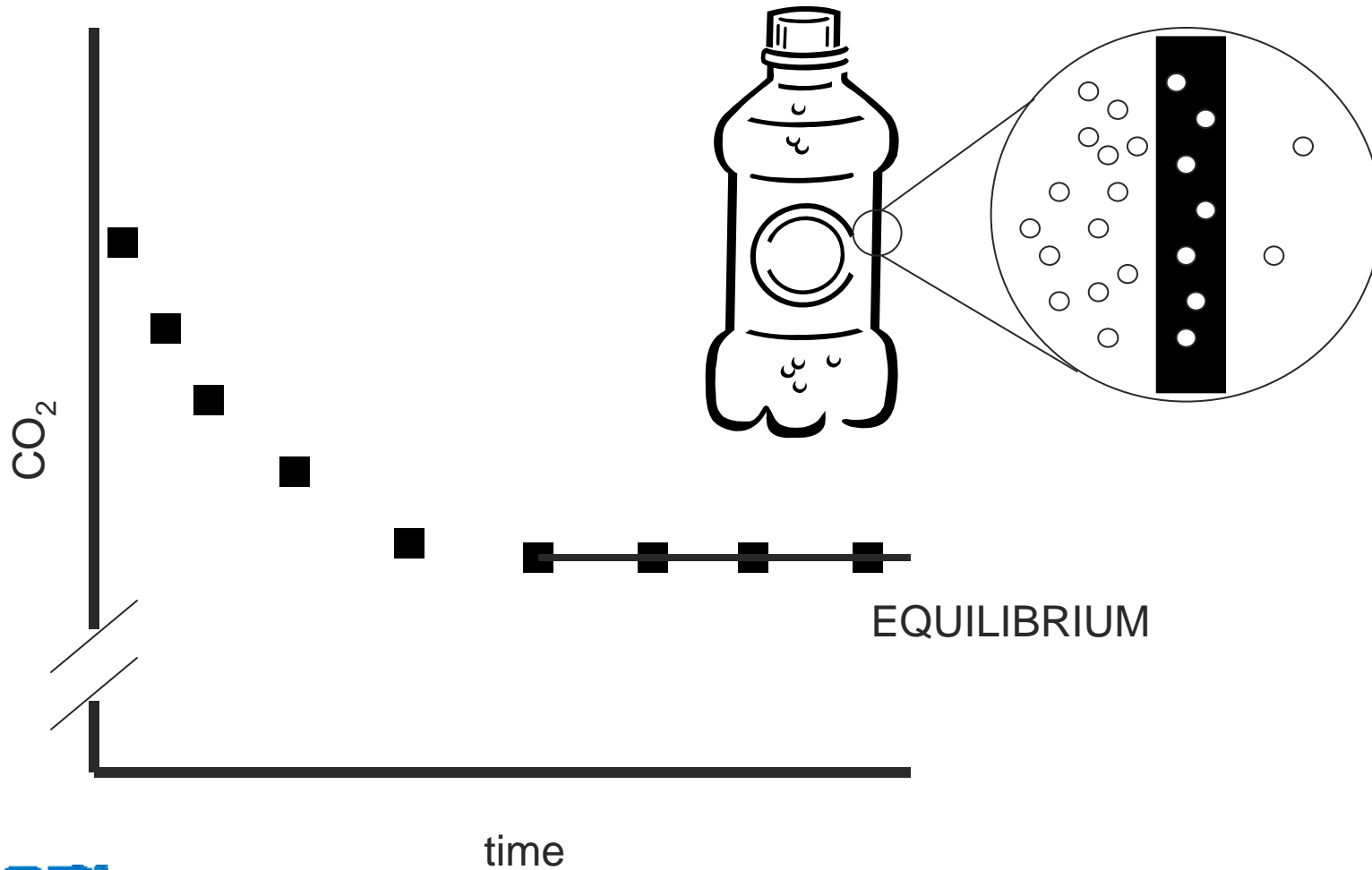


- Isolate poor sample lots (bad production lines)
- Poor QC with ingredients
- Off-odor due to material handling supplies

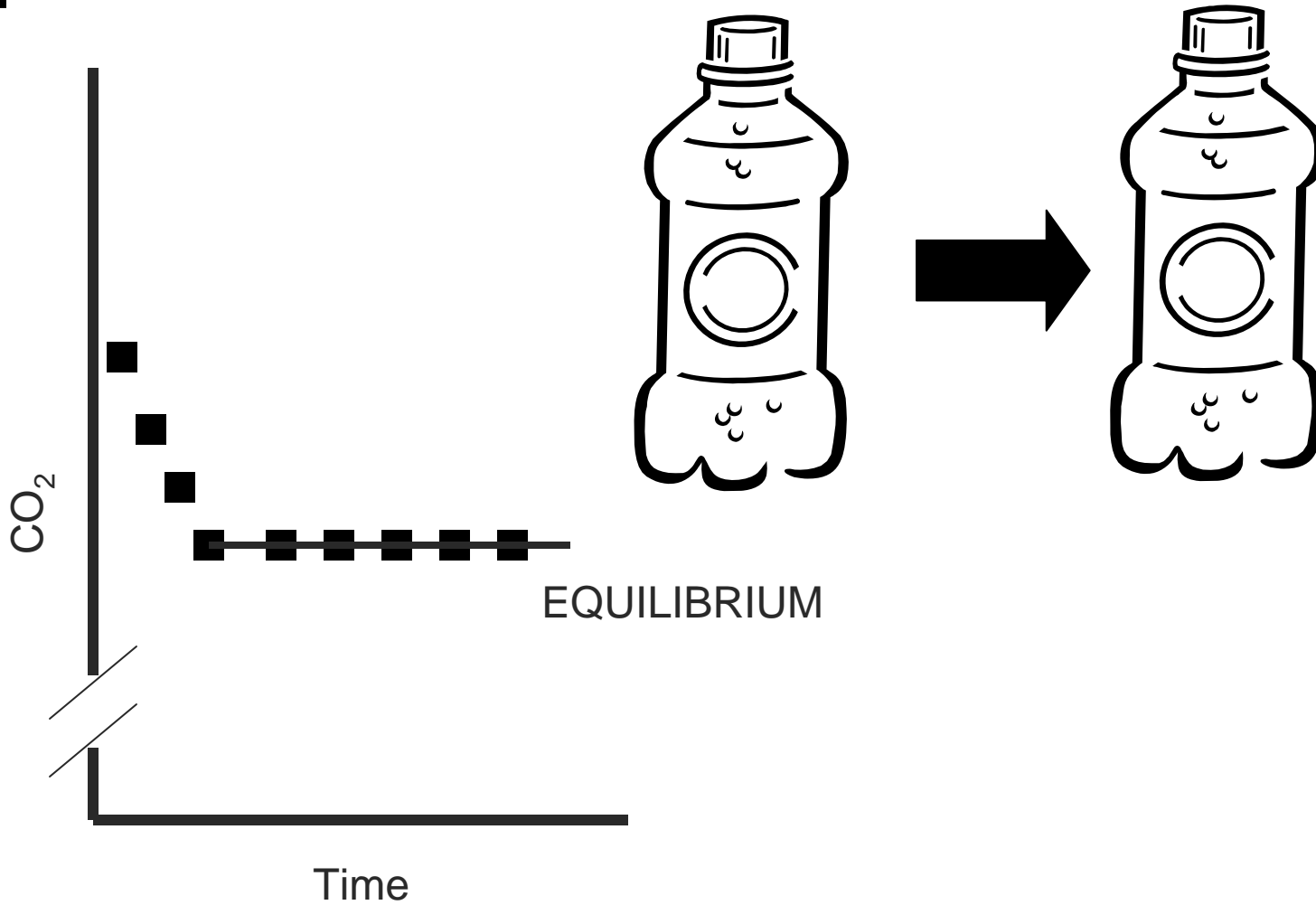
# For Carbonated Soft Drinks, CO<sub>2</sub> Retention is Critical

- CO<sub>2</sub> Concentration is a key measure for Sensory Perception
- Sources for CO<sub>2</sub> loss
  - Sorption of gas into the bottle wall
  - Expansion of bottle due to pressurization
  - Transmission and Leak of CO<sub>2</sub> through the bottle walls and closures

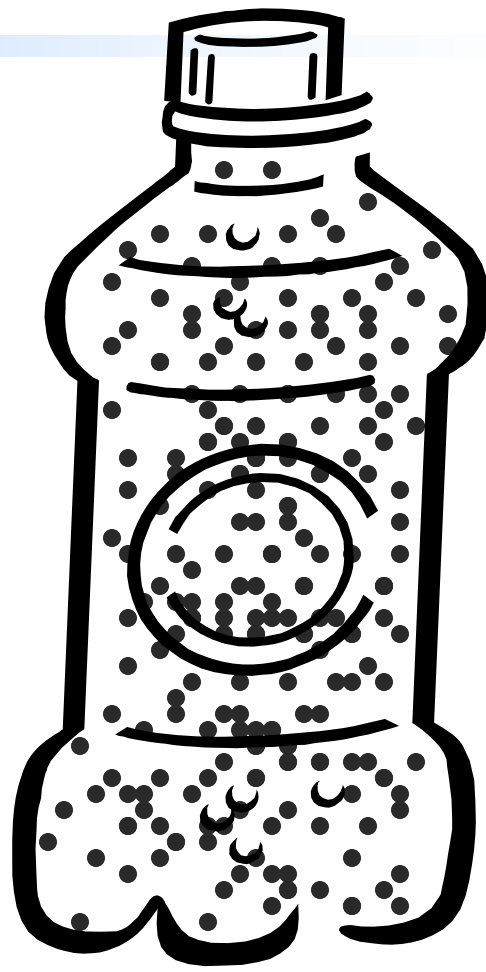
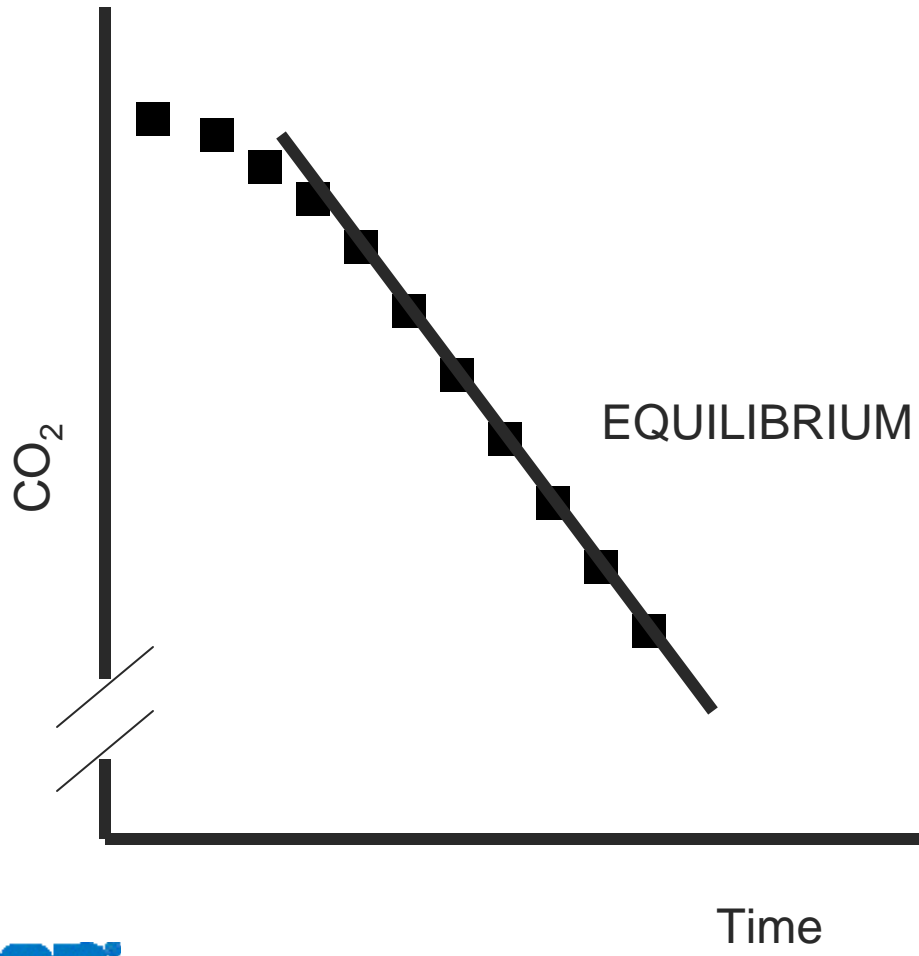
# CO<sub>2</sub> Loss due to sorption in the bottle wall



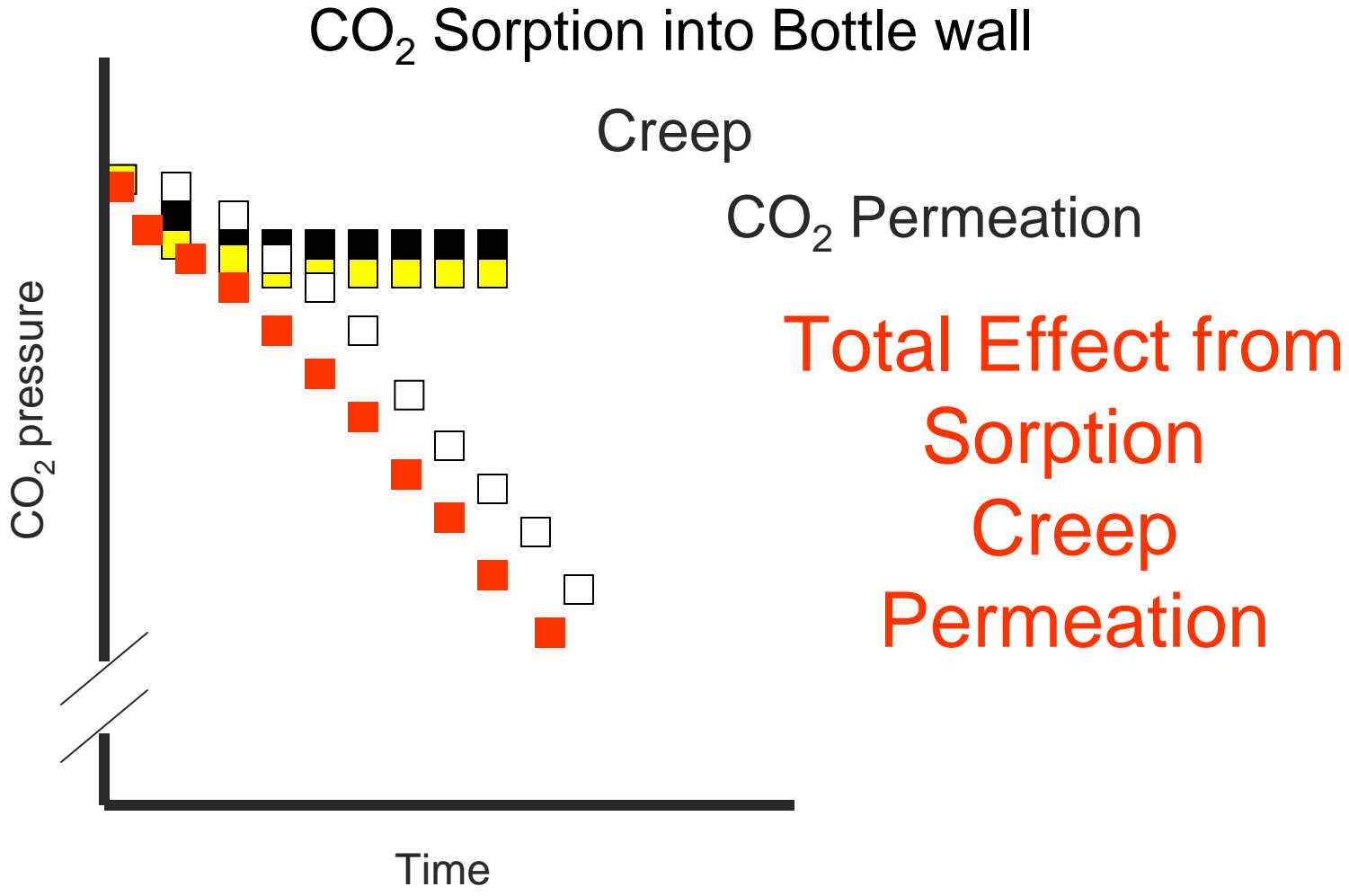
# CO<sub>2</sub> Loss due to bottle creep



# [ CO<sub>2</sub> Loss is due to permeation ]

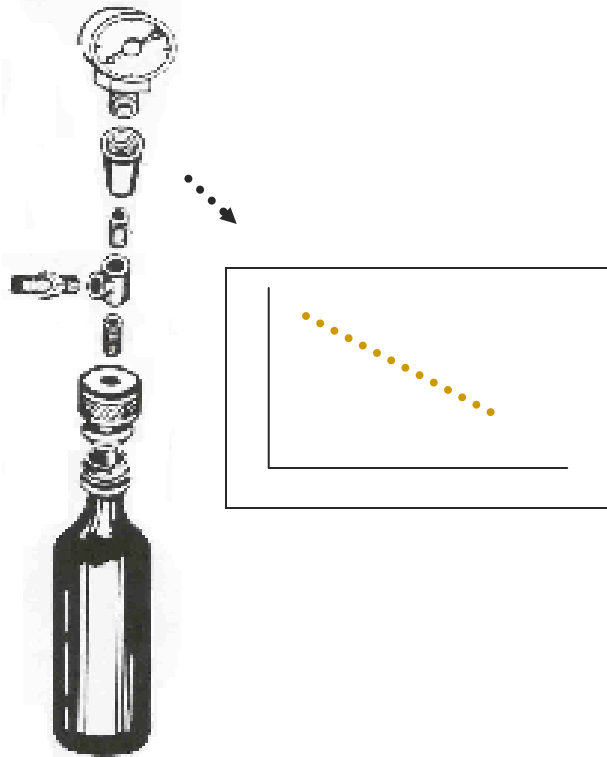


# CO<sub>2</sub> Loss in CSD Bottle



# Traditional CO<sub>2</sub> Measurement

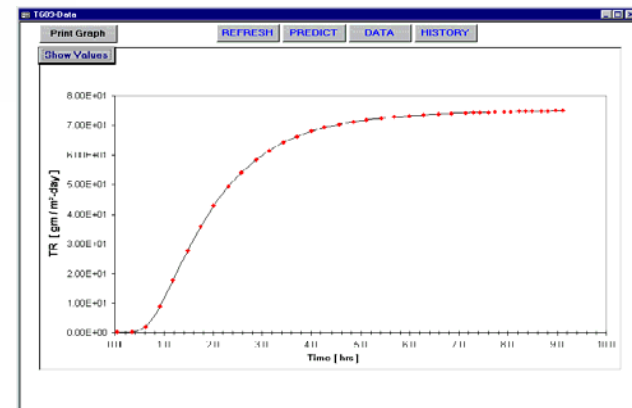
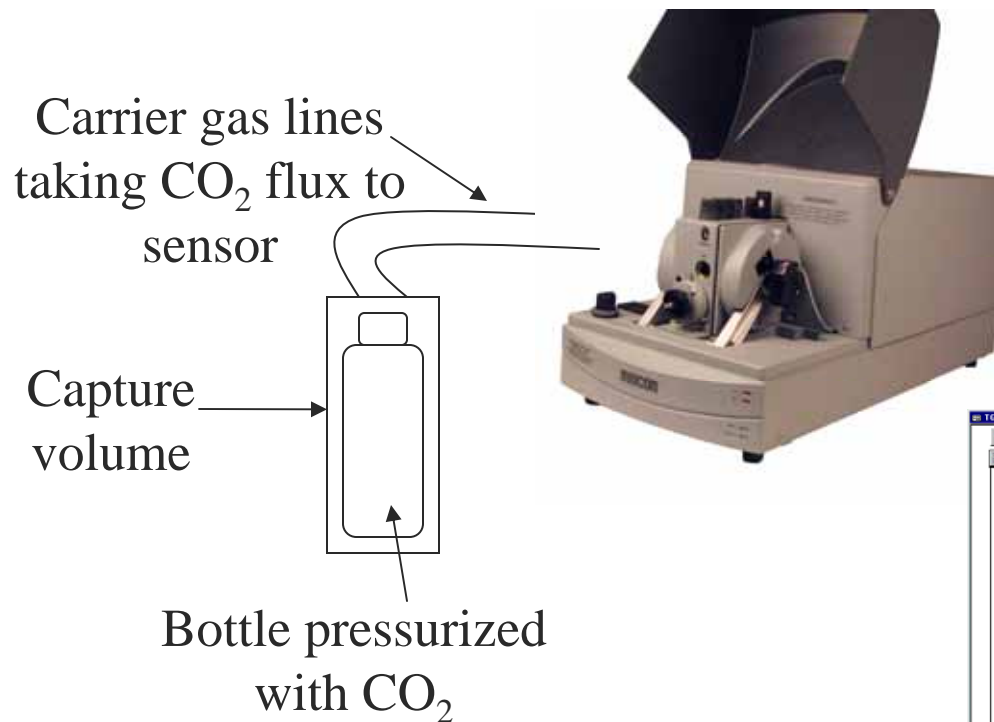
Historical method measured pressure loss over time



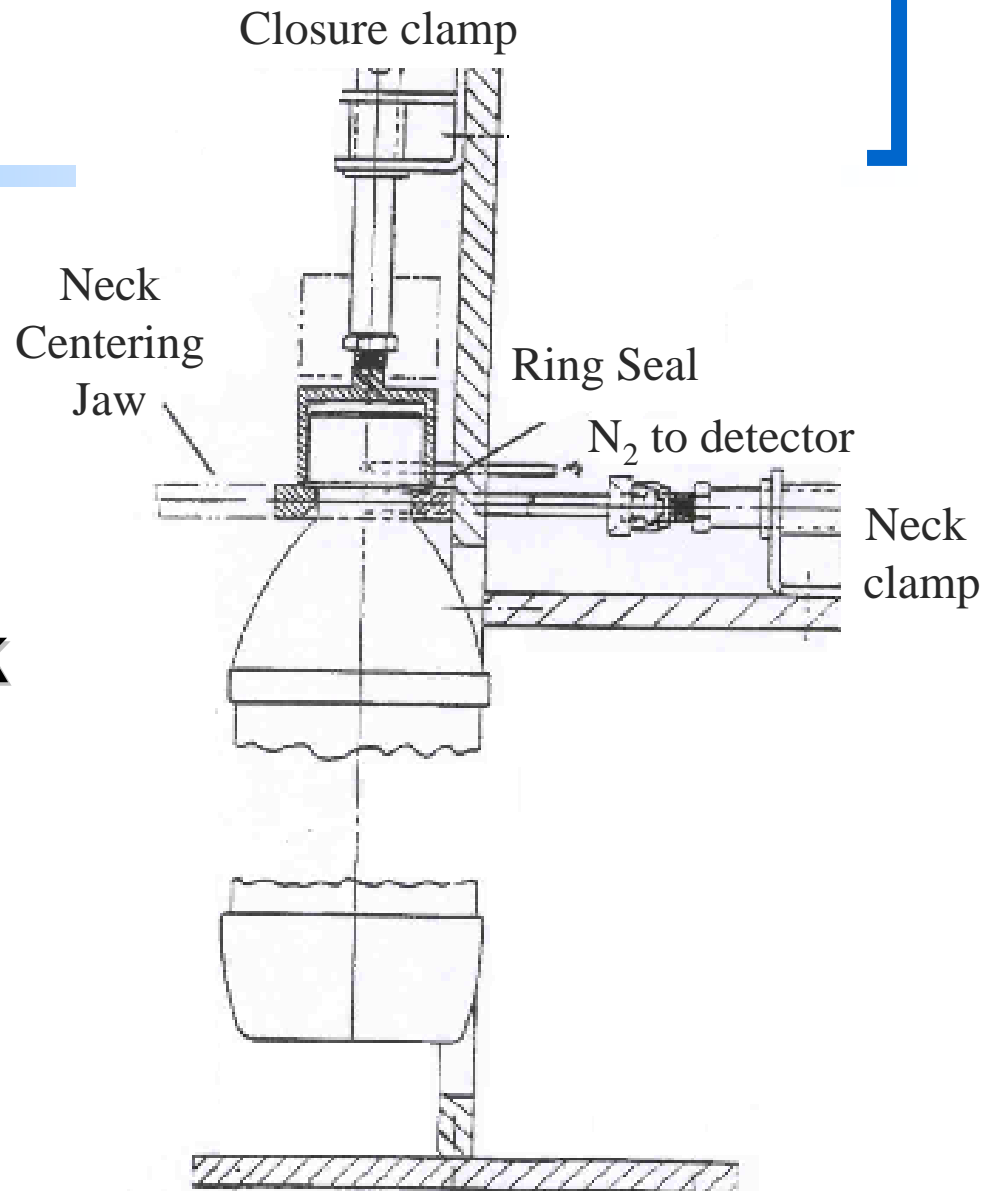
- Measures total pressure loss due to:
  - permeation
  - volume change
  - leakage
- Correlate pressure loss to gas volume change (solubility within the beverage)
- From data, calculate the shelf-life (days)

# Traditional Whole Bottle Testing with the Permatran-C 4/41

Measures rate of carbon dioxide  
transmitting from the bottle



**Isolated permeation / leak rate through closure**



# PERMATRAN-C<sup>®</sup> Model 10



# Conducting a test with the C-10

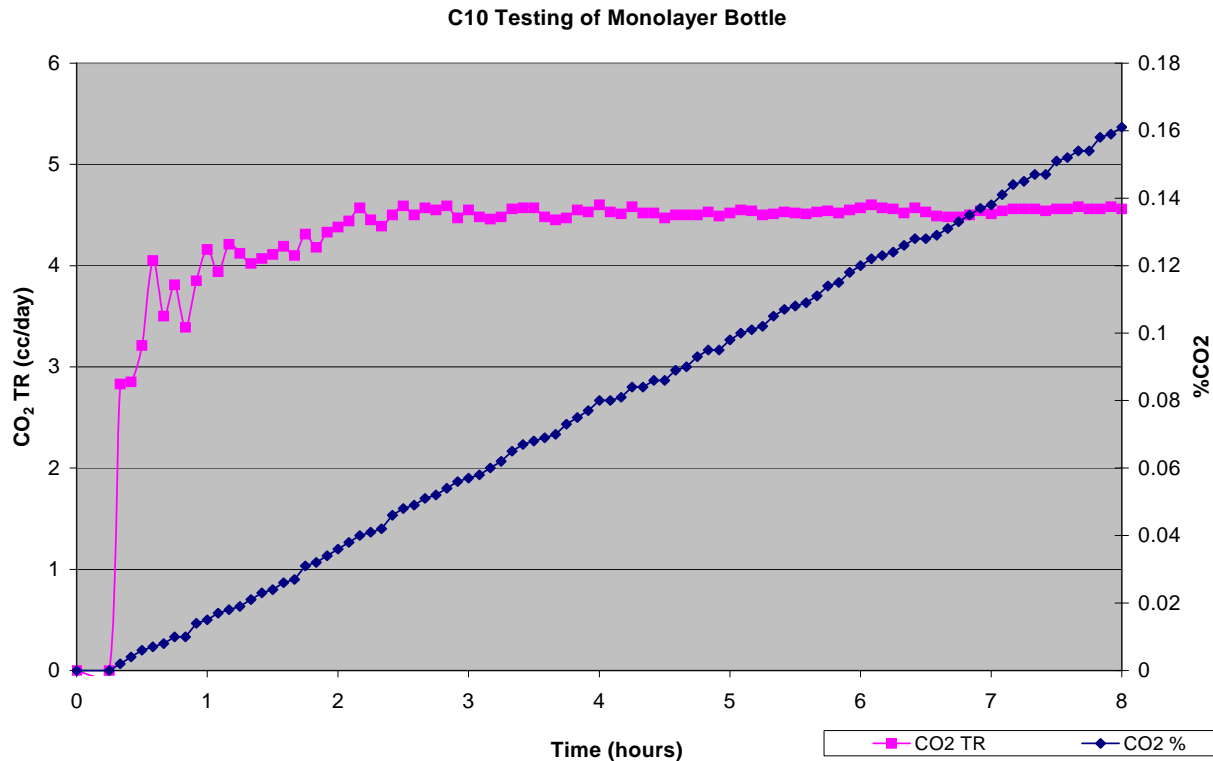


# Conducting a test with the C-10



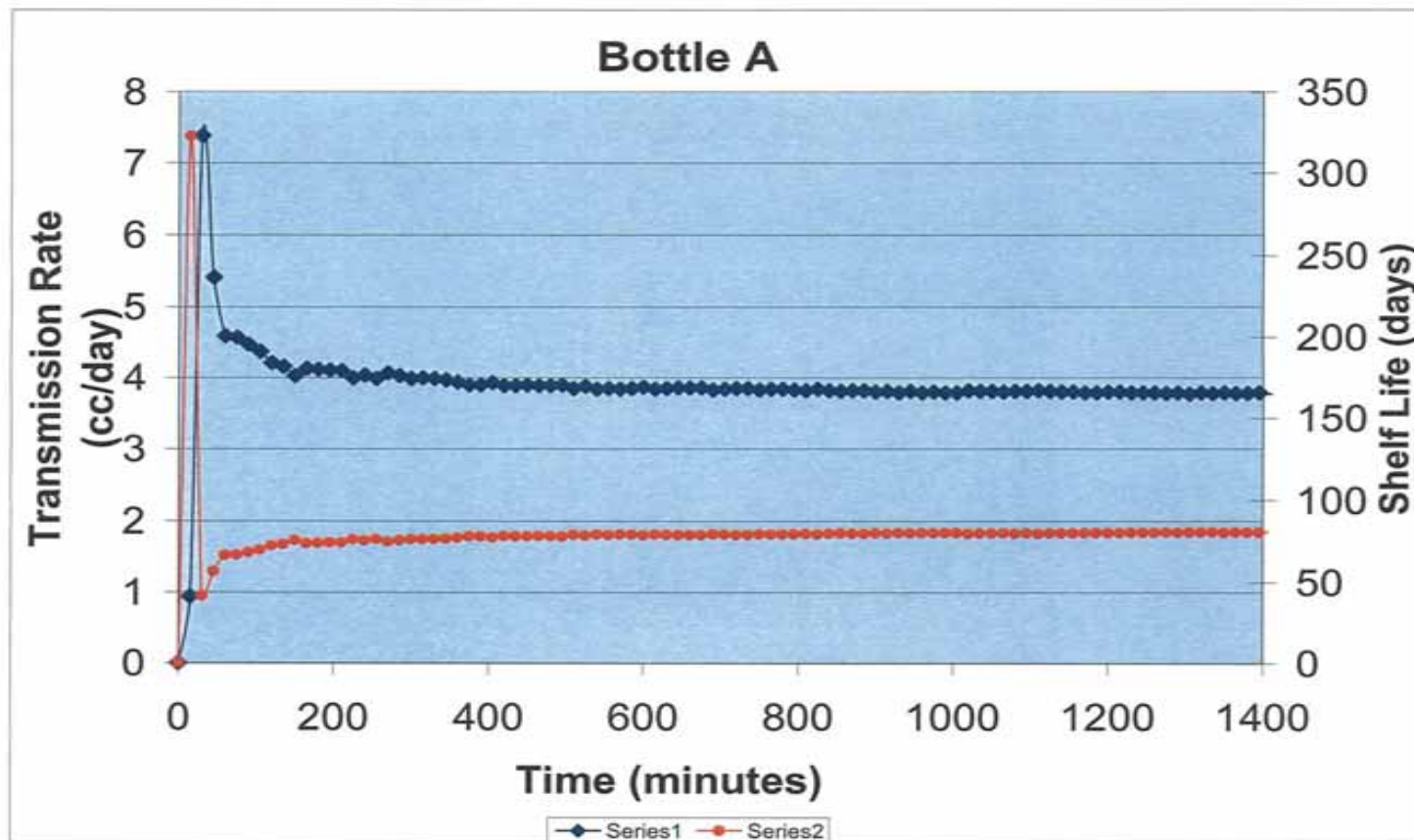
VOLUMES  
1 INTERNAL BOTTLE  
2 EXTERNAL BOTTLE  
3 INITIAL GAS  
4 EXPIRED GAS  
5 CAPTURE

# How does the C-10 Operate?



- The CO<sub>2</sub> transmitting from the bottle accumulates within the C-10 chamber.
- Using the measured CO<sub>2</sub> concentration, a transmission rate is determined

# TR versus Shelf Life



# Main menu, Results screen, Transient data

```
PRODUCT      USER  
  
PRESSURE 740 MMHG  
  34.1 DAYS  
12.42 CC/D  
  
DURATION 11:00:00
```

```
TIME    TRANS    S.L  
00:05   0.14    123.1  
00:10   0.11    125.2  
00:15   0.09    102.4  
00:20   0.12     93.5  
00:25   0.13     92.7  
00:30   0.13     92.0  
DURATION 11:00:00
```

# Independent C-10 Shelf-life Study

Results correlate with the current industry standard methodology

Bottle Size	Conditioning Time (Weeks)	C-10 Shelf-life (Weeks)	Specified Expired GV	Actual GV (ZN method)	GV Difference +/-
16 Oz	1	14.4	3.85	3.76	0.09
20 Oz	6.7	8.7	3.60	3.64	0.04
20 Oz	7.8	12.5	3.40	3.43	0.03
1.5 L	2	15.7	3.60	3.57	0.03
1.5 L	5	15.9	3.60	3.58	0.02
2 L	1	15.3	3.40	3.49	0.09



\*All bottles filled to 4.2 GV

# Summary of Permatran C-10 Testing

1. Many bottle types and sizes can be tested
2. Samples can be tested quickly with great correlation
3. Because the test is conducted quickly (in a matter of hours), temperature is very important



# Summary: Three areas where MOCON can help with Carbonated Beverages

- CO<sub>2</sub> Gas Purity
- Sensory Analysis
- Shelf-life (CO<sub>2</sub> Loss)





**Questions?**

Email [webinars@mocon.com](mailto:webinars@mocon.com) for  
further questions or a copy of  
today's seminar.

# [ Next Month's Seminar ]

---

## Ultra-high Barrier Films – Testing for OLEDs/ Solar Panels/ Photovoltaics

Wednesday, December 9<sup>th</sup>  
10:00am CDT



Go to [www.mocon.com](http://www.mocon.com) to register