Application Note

Measurements of gas volume and air content in carbonated fruit juice beverages of different size containers (500mL, 1500mL) by Gas volume analyzer

Industry	Food & beverage
Instrument	Gas Volume and Air Content Analyzer
Measurement method	Gas volume measurement method
Standards	GB/T 10792

1. Scope

Caution

This instrument needs a 6 mol/L sodium hydroxide aqueous solution which may cause blindness when it contacts human eyes. Be sure to wear protective goggles during handling it.

The measurement of the gas volume, air content, and oxygen concentration of carbonated beverages is an important factor in determining the mouthfeel, taste and flavor, and best-by date. This Application Note introduces an example of measuring commercially available carbonated fruit juice beverages of two different size containers using a gas volume and air content analyzer. The gas volume is calculated by continuously rotating the sample container and measuring the equilibrium pressure of the gas and the sample temperature. Then, gas in the sample is transferred to the absorbent cylinder and the carbon dioxide gas is absorbed by an absorbent solution (sodium hydroxide solution) filled in the cylinder to measure the air content and oxygen concentration.

2. Precautions

- The instrument and samples should be sufficient temperature equilibration with the laboratory room temperature where is maintained at a constant temperature.
- Either the instrument air system or an independent air compressor, both of which can adjust in the pressure range between 0.5 and 0.7 MPaG, is required for piercing and rotating sample bottle/can.
- When measuring samples containing solids like the pulp of small fruits, wash the nozzle after every 5-10 measurements to prevent clogging of the tubing.

3. After measurement

- Samples should be disposed of properly after the measurement is complete, as they may be contaminated with the absorbent solution.
- The measurement instrument should be rinsed properly at the end of the day.
- When measuring samples containing solids such as pulp, clean the net filter of the instrument after measurement for the day is complete.

4. Apparatus

Equipment	Gas volume and air content analyzer
Option	Oxygen concentration measurement unit

5. Reagents

Absorbent solution	6 mol/L sodium hydroxide solution
Rinse solution	Pure water

6. Procedure

1) Select “gas volume/gas pressure + air content measurement (GV/P+AIR)” on the measurement mode, and enter the following parameters into the measurement conditions.

< Mode >	GV/P+AIR
GV/P Cal.	Soft
DISSOLVE	AUTO
O2 Meas.	ON
< Method >	
Start Time	0 sec
Rot0 Time	0 sec
Wait Time	0 sec
Snift Press	.005 MPa
MAX Time	180 sec
MIN Time	10 sec
Error Press	.015 MPa
Rot1 Time	70 sec
Trial Press	.010 MPa
max Time	180 sec
Min Time	10 sec
Trial Count	5 times
Skip Press	.015 MPa
Rot2 Time	20 sec
End Press	.015 MPa

Note that the above measurement parameters are an example and optimizing these parameters might be necessary depending on the sample’s property.

2) Set the sample bottle/can on the sample stage and press the Start button.

7. Example

Table 1 shows the measurement results of carbonated fruit juices.

Table 1. Measurement results list (Volume 500mL and 1500mL) *

Sample	n	TGAS [mL]	O2 conc. [%]	Air Volume [mL]	Gas Volume [V/V]	Gas Pres [MPa]	Press [MPa]	Temp. [°C]
Sample C 500mL	n1	19.2	1.4	1.27	2.23	0.161	0.231	21.8
	n2	15.7	1.4	1.03	2.26	0.165	0.232	21.9
	n3	17.9	1.4	1.24	2.23	0.161	0.232	21.9
	n4	17.8	1.4	1.18	2.24	0.162	0.233	21.9
	n5	18.8	1.4	1.22	2.27	0.166	0.236	21.9
	Avg.	17.9	1.4	1.19	2.25	0.163	0.233	21.9
	SD	1.326	0.036	0.096	0.018	0.002	0.002	0.046
	RSD	7.4	2.6	8.1	0.8	1.3	1.0	0.2
Sample C 1500mL	n1	22.8	1.0	1.11	2.27	0.166	0.216	22.1
	n2	17.3	1.3	1.10	2.26	0.165	0.211	22.1
	n3	15.2	1.3	0.96	2.30	0.170	0.213	22.0
	n4	18.5	1.3	1.11	2.29	0.168	0.214	22.0
	n5	22.6	1.5	1.59	2.29	0.168	0.220	22.5
	Avg.	19.3	1.3	1.17	2.28	0.167	0.215	22.1
	SD	3.333	0.166	0.241	0.016	0.002	0.004	0.198
	RSD	17.3	13.0	20.6	0.7	1.2	1.6	0.9

* Measurement items

Gas Volume	Carbon dioxide volume (mL) of 1mL sample volume
Air Volume	Gas volume except carbon dioxide in sample bottle/can (mL)
Gas Press	Converted pressure in sample bottle/can at 20 ℃ (MPa)
Press	Measured pressure (MPa)
Temp.	Measured sample temperature (° C)