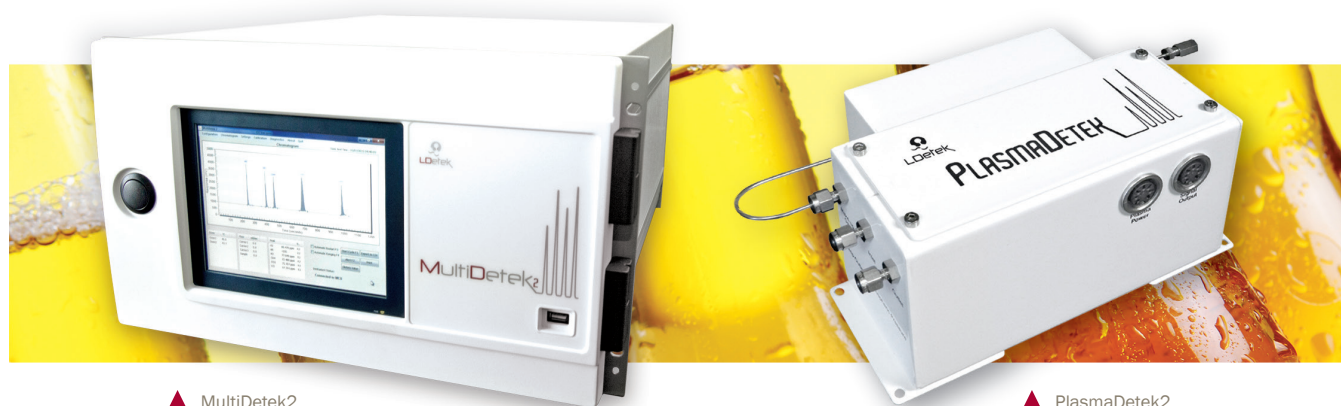


APPLICATION NOTE

LD17-04



Trace impurities in Carbon Dioxide for beverage and food packaging industry



▲ MultiDetek2

▲ PlasmaDetek2

With regards to the beverage industry, the dissolved Carbon Dioxide which is used as carbonic acid gives a pleasantly acidic flavour and a nice mouth-feel when drinking. When it is not present, the drinks taste flat. Being used in many different fields of food and beverage, the CO₂ quality management is essential to meet the market requirements.

The CO₂ is produced from different techniques such as fermentation, combustion, ammonia/hydrogen production and others. It is required by the industry, especially for bottlers to control the supply chain by monitoring the CO₂ purity allowing maintenance of the product quality.

LDETEK SOLUTION:

Following the application note LD16-12 this application note shows another configuration of the MultiDetek2 with PlasmaDetek2 also related to the beverage industry where the analysis of different components in carbon dioxide is realized.

This configuration has 3 channels to cover the analysis of benzene, hydrogen sulfide, nitrogen and oxygen. Additional channels can be added if analysis of more components is required. All the components are measured with one type detector PED using Helium as carrier gas.

- ▶ **Channel#1:** 0-1000ppb benzene
- ▶ **Channel#2:** 0-1000ppb hydrogen sulfide
- ▶ **Channel#3:** 0-10ppm oxygen and nitrogen

A FID analyser LD2000 is added to this solution for measuring THC on a scale of 0-10ppm

A TCD binary gas analyser LD8000 is added for measuring 98-100% CO₂ purity

A dewpoint meter LD500 is added for the analysis of moisture on a 0-10ppm scale

LDRACK CABINET:

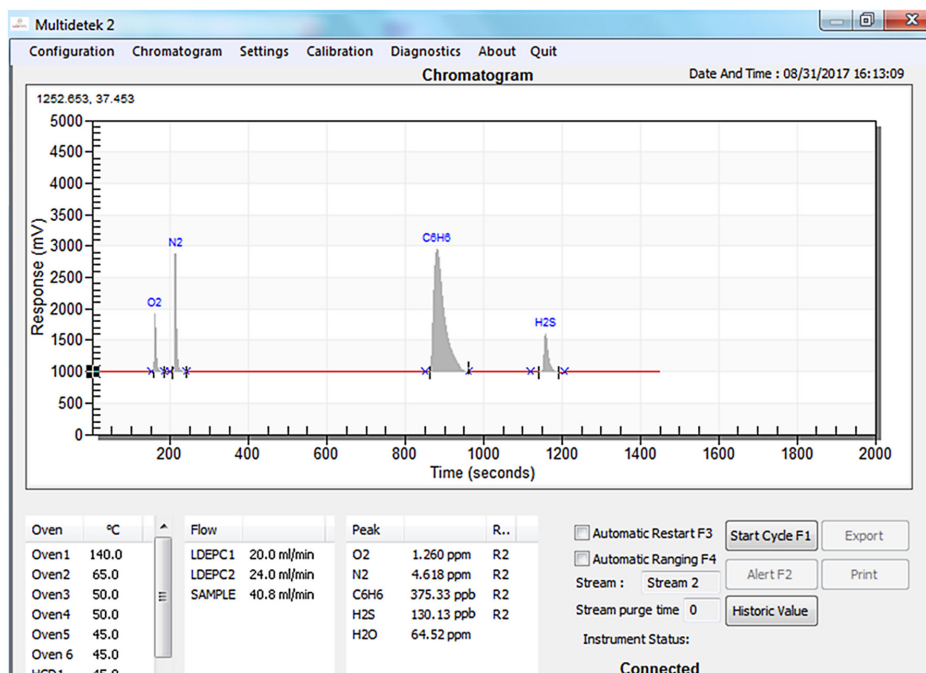
All the instruments are integrated in the LDrack cabinet. A multiple streams selector system LDGSS selects the right gas lines for analysis. The stream selector can be controlled locally or remotely with the MultiDetek2 interface. The complete solution is configured with coated stainless steel tubing to ensure stability of the system. It reduces the risk of surface absorption, especially for the sulfur components.



RESULTS:

The results show the performances of the MultiDetek2 system for a standard configuration used to measure oxygen, nitrogen, benzene and hydrogen sulfide in Carbon Dioxide. The Idl and repeatability results are demonstrated.

Analysis of a gas mixture containing a certified concentration of trace O2-N2-C6H6-H2S-H2O in balance gas CO2



LDL:

COMPONENT	CONCENTRATION	PEAK HEIGHT	NOISE	LDL (3X NOISE)
Oxygen	1.260 ppm	987 mV	4.2 mV	16.0 ppb
Nitrogen	4.618 ppm	1961 mV	2.9 mV	20.4 ppb
Benzene	375.33 ppb	1987 mV	12.6 mV	7.14 ppb
Hydrogen sulfide	130.13 ppb	611 mV	12.9 mV	8.24 ppb

Note: other LDL could be obtained with different injection volume and chromatographic condition

REPEATABILITY:

The results below show the repeatability for each component. Three times of the percentage of coefficient of variation (3*CV %) for each component must be smaller than 5% to meet the requirements.

$$s = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (x_i - \bar{x})^2}$$

COMPONENT	CV (%)	CV% x 3 < 5%
Oxygen	0.95	2.85
Nitrogen	0.66	1.98
Benzene	1.02	3.06
Hydrogen sulfide	0.74	2.22

Component : O2

Historic Values				
Date/Time	O2	N2	C6H6	
Jun/20/2017 07:53:23	4.132	3.380	<LDL	
Jun/20/2017 07:35:37	4.126	3.388	<LDL	
Jun/20/2017 07:17:51	4.114	3.380	<LDL	
Jun/20/2017 07:00:05	4.142	3.400	<LDL	
Jun/20/2017 06:42:19	4.179	3.406	<LDL	
Jun/20/2017 06:24:33	4.197	3.432	<LDL	
Jun/20/2017 06:06:47	4.211	3.435	<LDL	
Jun/20/2017 05:49:01	4.244	3.444	0.068	
Jun/20/2017 05:31:15	4.246	3.442	<LDL	
Jun/20/2017 05:13:29	4.230	3.433	<LDL	
Jun/20/2017 04:55:43	4.213	3.414	<LDL	
Jun/20/2017 04:37:57	4.218	3.428	0.089	
Jun/20/2017 04:20:11	4.229	3.453	<LDL	
Jun/20/2017 04:02:25	4.222	3.447	<LDL	
Jun/20/2017 03:44:39	4.203	3.444	<LDL	

Component : N2

Historic Values				
Date/Time	O2	N2	C6H6	
Jun/20/2017 07:53:23	4.132	3.380	<LDL	
Jun/20/2017 07:35:37	4.126	3.388	<LDL	
Jun/20/2017 07:17:51	4.114	3.380	<LDL	
Jun/20/2017 07:00:05	4.142	3.400	<LDL	
Jun/20/2017 06:42:19	4.179	3.406	<LDL	
Jun/20/2017 06:24:33	4.197	3.432	<LDL	
Jun/20/2017 06:06:47	4.211	3.435	<LDL	
Jun/20/2017 05:49:01	4.244	3.444	0.068	
Jun/20/2017 05:31:15	4.246	3.442	<LDL	
Jun/20/2017 05:13:29	4.230	3.433	<LDL	
Jun/20/2017 04:55:43	4.213	3.414	<LDL	
Jun/20/2017 04:37:57	4.218	3.428	0.089	
Jun/20/2017 04:20:11	4.229	3.453	<LDL	
Jun/20/2017 04:02:25	4.222	3.447	<LDL	
Jun/20/2017 03:44:39	4.203	3.444	<LDL	

Component : C6H6

Historic Values				
Date/Time	O2	N2	C6H6	
Jun/22/2017 07:31:16	0.235	0.721	217.452	
Jun/22/2017 07:11:09	0.237	0.721	216.403	
Jun/22/2017 06:51:02	0.238	0.722	216.805	
Jun/22/2017 06:30:55	0.237	0.782	216.725	
Jun/22/2017 06:10:48	0.237	0.718	212.256	
Jun/22/2017 05:50:41	0.239	0.728	213.026	
Jun/22/2017 05:30:34	0.238	0.722	214.129	
Jun/22/2017 05:10:27	0.234	0.729	217.782	
Jun/22/2017 04:50:20	0.236	0.735	214.711	
Jun/22/2017 04:30:13	0.239	0.739	214.861	
Jun/22/2017 04:10:06	0.240	0.746	214.218	
Jun/22/2017 03:49:59	0.241	0.753	213.506	
Jun/22/2017 03:29:52	0.239	0.739	208.152	
Jun/22/2017 03:09:45	0.239	0.777	207.693	
Jun/22/2017 02:49:38	0.236	0.736	208.471	

Component : H2S

Historic Values					
Date/Time	O2	N2	H2S	C6H6	
Jul/03/2017 06:48:40	<LDL	0.021	200.383	<LDL	
Jul/03/2017 06:28:33	0.011	0.030	199.310	0.057	
Jul/03/2017 06:08:26	<LDL	<LDL	199.189	0.089	
Jul/03/2017 05:48:19	<LDL	<LDL	201.363	0.065	
Jul/03/2017 05:28:12	<LDL	<LDL	202.909	<LDL	
Jul/03/2017 05:08:05	<LDL	<LDL	201.060	<LDL	
Jul/03/2017 04:47:58	<LDL	<LDL	200.999	<LDL	
Jul/03/2017 04:27:51	0.007	0.020	202.269	0.403	
Jul/03/2017 04:07:44	<LDL	0.030	200.069	<LDL	
Jul/03/2017 03:47:37	0.009	0.030	199.016	<LDL	
Jul/03/2017 03:27:30	0.007	0.030	199.152	<LDL	
Jul/03/2017 03:07:23	<LDL	<LDL	199.657	<LDL	
Jul/03/2017 02:47:16	<LDL	<LDL	197.671	<LDL	
Jul/03/2017 02:27:09	0.001	0.019	196.237	<LDL	
Jul/03/2017 02:07:02	<LDL	<LDL	193.154	<LDL	

CONCLUSION:

Our solution combining multiple LDetek instruments to achieve the complete carbon dioxide analysis all in one cabinet well demonstrated the capabilities to meet the food and beverage industry requirements. Have a look at our complementary application note LD16-012 that demonstrates other capabilities and results related to this market.



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