Application Note

Rapid Analysis of Neon and Carbon Monoxide for Mouse Lung Diffusion Capacity Calculation Using Micro GC Fusion®

OVERVIEW This application not describes the advantages when using Micro GC Fusion to accurately and rapidly analyze mouse lung components to generate lung diffusion models.

INTRODUCTION One of the most efficient ways to study the effect of different pathologies on human lung function is to generate models of mouse lung function using the diffusion capacity of the lung for carbon monoxide (often referred to as DLCO or DFCO). Diffusion models established by conducting experiments using carbon monoxide and neon exhaled from the mouse lung are applicable to human lungs. These models provide valuable insight into disease such as chronic idiopathic fibrosis and emphysema, and allow for the evaluation of potential interventions and treatments1,2. During an experiment, carbon monoxide and neon are introduced to the mouse lung at the same time using a small volume syringe. Carbon monoxide diffuses in the lung at different rates for each pathology as well as over the duration of the disease. Neon is used as a tracer gas, since it does not diffuse in the lung. The exhaled gas from the mouse lung is then diluted to 2 mL with room air and analyzed for composition. The concentrations of carbon monoxide and neon are used by the researcher to calculate the DLCO, which is used to produce a stable model of the disease1.
Micro GC Fusion Gas Analyzer has a microliter sample loop embedded in its microelectromechanical systems (MEMS) injection system, which is proven to be effective in analyzing small sample volumes. With its compact footprint, Micro GC Fusion can be placed next to the mouse when conducting the experiment. The user can start a run from the instrument front panel and immediately inject the gas sample, avoiding delays in triggering sample runs from an external computer.
Since each sample run is less than a minute, multiple analyses on the same mouse can be conducted to provide extra data points to establish the DLCO model.

EXPERIMENTAL A single module Micro GC Fusion configured with a 10m Molsieve 5A column was used to analyze a calibration gas standard containing 0.3% each of neon and carbon monoxide in an air balance (Air Liquide). See Table 1 for calibration gas standard concentration information. The column temperature was operated isothermally at 130°C for 40 seconds.

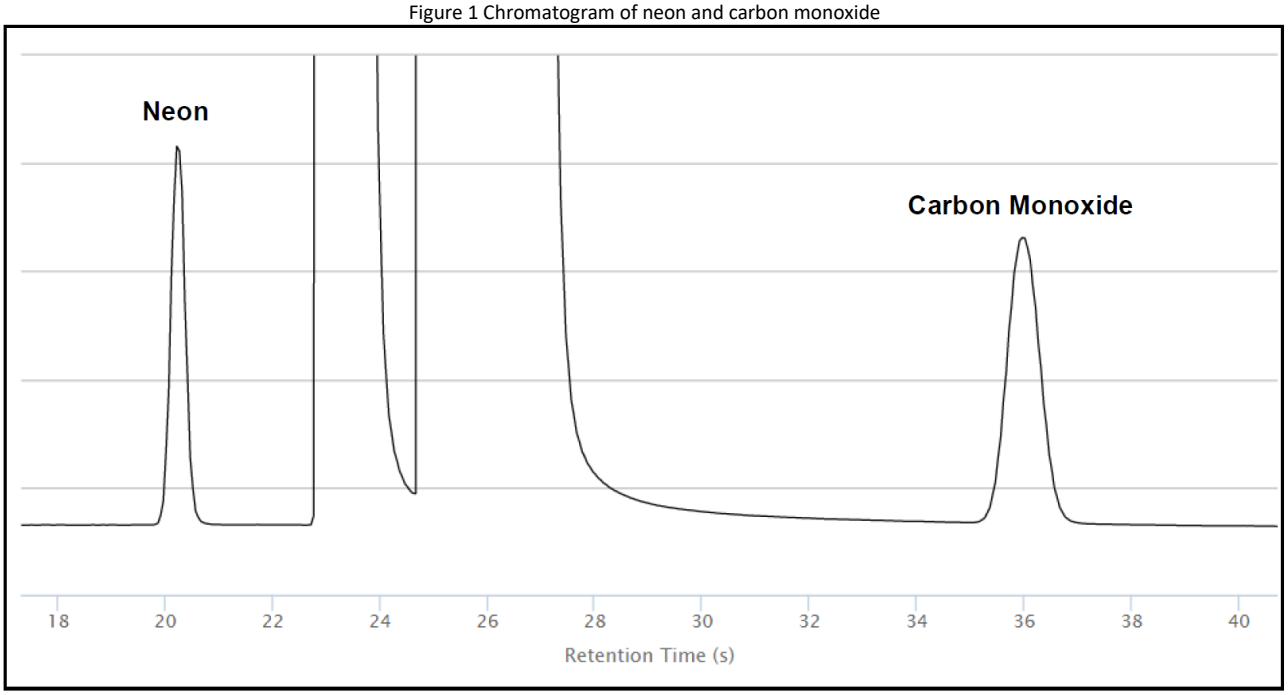
Table 1 Calibration gas standard concentration

Component	Concentration (Mole %)
Neon	0.300
Carbon monoxide	0.300
Air	Balance

Ten consecutive runs of the calibration gas standard were analyzed for repeatability. A volume of 4 mL of the calibration gas standard was injected into Micro GC Fusion over the course of three seconds using a gas tight syringe. The sample pump was turned off to allow continuous flow of gas through the injector to ensure the freshest possible sample.

RESULTS Figure 1 displays excellent separation of neon and carbon monoxide within 40 seconds.
Ten runs of 4mL of calibration gas standard show excellent repeatability. Percent relative standard deviation (%RSD) for both components is under 0.33% for area count and under 0.03% for retention time, demonstrating consistent results. (See Table 2.

Figure 1 Chromatogram of neon and carbon monoxide



Column: Molsieve 5A, 10 m, variable volume injector
Detector: Thermal conductivity detector
Column Temperature: 130°C, isothermal; Column Head Pressure: 35 psi

Table 2 Repeatability data for the calibration gas standard

Compound	Retention Time (s)	RT %RSD	Area %RSD
Neon	20.26	<0.001	0.326
Carbon Monoxide	36.00	0.023	0.310

CONCLUSION Fast determination of the DLCO using the analysis of carbon monoxide and neon as a tracer gas exhaled from a mouse lung is an extremely valuable means for researchers studying the effects of diseases on lung function. Using calculations, models of different pathologies can be created and studied. Micro GC Fusion provides rapid and precise measurement of carbon monoxide and neon in less than 40 seconds, allowing for multiple sample runs of exhaled gas from each mouse specimen.

REFERENCES

1 Limjunyawong N. Phenotyping Mouse Pulmonary Function In Vivo with the Lung Diffusing Capacity. Jove. Jan 2015.
2 Limjunyawong N. A mouse model of chronic idiopathic pulmonary fibrosis. Physiology Reports. Jan 2014.