Syringe Compatibility & Longevity Testing with QuinTron BreathTracker Instruments

Abstract

QuinTron recommends using syringes that are supplied in our AlveoSampler and GaSampler kits to collect and analyze patient breath samples. These syringes have been tested for compatibility with the BreathTracker instrument and can store a sample for the recommended hold time of two hours. In addition to the 35 mL (QT00861) and 30 mL (QT01741) syringes supplied in our kits, other acceptable syringes include HSW AL50, Air-Tite ML30 and Excel EL30. BD and Medallion syringes are not compatible with QuinTron instruments and should not be used to collect or analyze patient breath samples as it risks compromising both the instrument and the sample.

Introduction

When bacteria digest (or ferment) food substances, they produce acids, water and gases. The major gases produced by bacteria include, primarily, hydrogen (H_2), methane (CH_4), carbon dioxide (CO_2) and small concentrations of aromatic gases.[1] These gases are absorbed into the blood circulating near the site of digestion and are carried to lungs, where they are equilibrated with the air in the alveoli. When a patient exhales, gases contained in alveolar air can be captured and measured.

QuinTron manufactures instruments and accessories which are designed to capture and analyze the contents of a patient's breath sample. Specifically, our instrumentation measures concentrations of breath hydrogen (H_2) and methane (CH_4) in parts per million (ppm) and the percentage of exhaled carbon dioxide (CO_2). In the AlveoSampler breath collection system, an end-expiratory breath sample is drawn into a syringe for immediate analysis. The GaSampler breath collection system also contains a syringe to transfer the breath sample from the bag to the gas analyzer.

The syringes used in the AlveoSampler and GaSampler systems have been tested extensively for compatibility with QuinTron's BreathTracker gas analyzer. Most syringe manufacturers use silicone oils as lubricants on the surfaces of syringes to help seal it and lower friction during actuation. QuinTron Application Note #7 discusses how excessive silicone in evacuated glass tubes can cause false high H_2 readings in the BreathTracker. Likewise, excessive silicone in syringes can have the same effect on the H_2 sensor. Because of this, QuinTron only supplies syringes in our kits that have been thoroughly tested for compatibility with our instruments.

Breath samples in QuinTron syringes must be analyzed relatively quickly after they are collected. QuinTron recommends sample are not held longer than two hours in a syringe. If it cannot be analyzed right away, the sample can be transferred to a sample

holding bag for long-term storage (see QuinTron Application Notes 1 & 2 for information about the storage of samples in the sample holding bag).

The purpose of this study was to investigate various syringes for compatibility with QuinTron BreathTracker instruments. Syringes that are deemed compatible with the BreathTracker will also be submitted to longevity testing to see which ones can adequately hold a sample for the recommended two hours.

Materials/Method

Two control syringes were used: a 35mL (QT00861) and a 30mL (QT01741). These are syringes that have been supplied in QuinTron kits for years and are known compatible syringes that can hold a sample for two hours. Other samples of different syringes were obtained will be tested: Merit Medallion, HSW AL50, Air-Tite ML30, Excel EL30, and BD 30131.

The syringes were tested using calibration gas and breath samples to determine if they were compatible with the BreathTracker. Each syringe was subjected to a linearity test using calibration gas. Then, a patient breath sample was taken and stored in a collection bag. This sample was measured on a BreathTracker model SC with the 35mL and the test syringe. The 35mL syringe was used to calibrate the instrument. Each test was completed twice with the same syringe. A syringe passed compatibility testing if the reading was between ± 3 ppm for H_2 and CH_4 and ±0.2% for CO_2 during the linearity test (exception at 1/24 dilution). For the breath test, H_2 and CH_4 had to read within ± 2 ppm and ±0.2% for CO_2 of the 35mL syringe concentration. The baseline voltages were also monitored throughout the test to monitor what effect, if any, the syringes were having on the sensors.

If the syringe passed compatibility testing, its ability to hold a sample for at least two hours was tested. Syringes were filled with calibration gas and tested at regular intervals (Hour 0 – baseline, Hour 1, Hour 2) to monitor loss of sample over time. In order for the syringe to pass longevity testing, there must be less than a 10% error between the gas concentrations in the syringe and the calibration gas tank values (H_2 = 150 ppm, CH_4 = 75 ppm, CO_2 = 6.2% with an uncertainty of ±2 ppm for H_2 and CH_4 and ±0.2% for CO_2). Syringes must pass both compatibility and longevity testing in order to be approved to be used with BreathTracker instruments.

Results

In addition to the 35 mL (QT00861) and 30 mL (QT01741) syringes, the HSW AL50, Air-Tite ML30 and Exel EL30 were found to be compatible with BreathTracker instruments and could hold a sample for at least two hours with minimal losses in H_2, CH_4 and CO_2 concentrations.

The Medallion syringes passed compatibility testing, but could not hold an adequate sample for longer than 10 minutes. Testing with the BD syringes showed a dramatic increase in the baseline voltages for H_2 and CH_4 after several gas samples were injected into the BreathTracker. Instances of reading zeroes instead of the true gas concentration have also been reported to QuinTron when using BD syringes. Because the BD syringes failed compatibility testing, they were not subjected to longevity testing. Calls from customers in the past have also indicated that BD syringes are not compatible with QuinTron Microlyzer instruments.

Conclusion

QuinTron recommends only using syringes supplied in AlveoSampler and GaSampler kits to collect and analyze patient samples using the BreathTracker. These syringes are known to be compatible with the BreathTracker and can store a sample for the recommended hold time of two hours. The instrument manuals instruct end user to use only products supplied by QuinTron with our instruments. Customers may contact QuinTron if they have syringes they want to use other than the ones provided in our kits to see if they have been tested for compatibility and its ability to adequately hold a sample. In addition to the 35 mL (QT00861) and 30 mL (QT01741) syringes supplied in our kits, the HSW AL50, Air-Tite ML30 and Exel EL30 were found to be compatible with BreathTracker instruments and could hold a sample for at least two hours with minimal losses in H_2, CH_4 and CO_2 concentrations.

For further information on the history and science of breath-testing, sample protocols and collection techniques please reference Breath-Tests & Gastroenterology, 1998 edition, written by Lyle Hamilton Ph.D. or request information from QuinTron directly.

References

1. Bond, J.H., Levitt, M.D. Quantitative measurement of lactose absorption. Gastroenterol. 1976; 70(6):1058-62