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Breath Analysis System for Detecting Breath Pattern Signature of COVID-19 V.1

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Coronavirus Method De... Front Line Technologies

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Protocol status: In development
We are still developing and optimizing this protocol

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Disclaimer

Abstract

The magnitude of how rapidly the COVID-19 virus could spread and infect others facilitated the need for a rapid COVID-19 test, accessible and affordable for both children and adults worldwide. As a result, an infected patient can quickly quarantine and isolate to slow the spread. Our research group has determined VOCs associated with COVID-19 and has built a prototype gas analysis system similar to a breathalyzer for detecting gasses of COVID-19. Some of the symptoms like headaches, coughing, and diarrhea result in an inflammatory response to create a unique variety of gasses like acetone, hydrogen, and carbon monoxide that can be detected when they are exhaled through a person's breath. A sample of a person's breath is first collected in a chamber when a patient breaths into the valve, the gas sensors then detect a voltage change when they contact a COVID-19 target gas. The concentration in parts-per-million is calculated based on the non-linear resistance ratio of the target gas and clean air. Log-based scale calculations and post-data processing calibrate the sensors to increase the accuracy and selectivity. Finally, the voltages and PPM of the target gas concentration data is stored in a computer database and sensor coding reveals the resulting breath pattern signature of COVID-19. At just under $15.00 United States Dollars (USD), test results are just a breath away, within seconds of taking the test and even before leaving the doctor's office. Although, this system may also be modified to sniff out other pathogens of disease, spoiled meats, and ripened fruit, we are dedicated to build a gas sensor platform for low cost, noninvasive, and rapid detection of the breath pattern signature of COVID-19, in an attempt to slow the spread of the global health threat of infection and in turn to help save lives.

Breath analysis systems serve as a noninvasive means for disease screening. Our objective is to utilize this prototype to obtain a database of H2, CO, NO, Acetone and Alcohol concentrations, whereby, COVID patient breath samples are compared to healthy individual breath samples using our breath analysis system prototype. This system is configured for measuring the aforementioned gas concentrations in ppm and recording the data to a text file in a computer database for subsequent analysis. The data obtained from this study is critical to the development of this system.

Attachments

JPG

Image_COVID_Breath.j...

444KB

Guidelines

A breath collection vessel shown below has a first check valve and a second check valve.

Equipment

USF Bull Nose	NAME
Prototype	BRAND
NA	SKU
Prototype Breath Collection Device Housing	SPECIFICATIONS

00:00:05 Take a deep exhale through mouthpiece

Standard Operating Procedure of E...

A user wears a specially adapted disposable mask with a one-way valve with filter.

Currently, gas sensors in today's market are not configured for breath analysis of COVID-19. A test bed prototype has been built and has an array of metal-oxide semiconductor gas sensors capable of detecting gas concentrations in parts-per-million (ppm) of hydrogen, CO, acetone, and alcohol and an electrochemical sensor capable of detecting gas concentrations in parts-per-million (ppm) NO. The gas sensors have a novel mucin gel replaceable insert (in conceptual phase and currently seeking patent protection) overlaying the sensing elements and heater element. This mucin gel replaceable insert has a plurality of pores to allow passage of breath to pass through and communicate with the gas sensors. The mucin gel replaceable insert is not static and has cilia-like projections coated in mucin gel located on at least a portion of a wall surface of each pore of the plurality pores of the mucin gel replaceable insert. These cilia-like projections move as the force of an individual’s breath passes through the pores of the mucin gel replaceable insert and mimics the moist environment of a nasal cavity for enhanced selectivity and detection of a target gas.

This test bed prototype is configured for measuring gas concentrations in ppm and recording the data to a text file in a computer database for subsequent analysis to determine a breath pattern signature of COVID-19. A description of our prototype is as follows: a breath collection vessel has a first check valve and a second check valve. The first check valve located at the top of the housing allows exhaled breath to enter the collection chamber. A patient will breath into this valve through a mouthpiece. The second check valve allows exhaled breath to escape the collection chamber, therefore, purging the collection chamber of encased exhaled breath. Thus, the exhaled breath is trapped within the collection chamber and is positioned between the first check valve and the second check valve. The gas sensor is retained within the collection chamber of the housing and a microcontroller is in electrical communication with a computer.

A specialized mouthpiece was built to comprise a mask and a one-way valve having a filter so that an individual could provide a breath sample into the collection vessel without having to remove a mask barrier member from their face due to COVID-19 precautions. Further, sterilization elements such as UVC light emitting diodes have been incorporated into the conceptual design of the breath sample chamber. The exhaust or output valve will be connected to a filtration system to purify the air being purged from the breath collection chamber. Our system provides a database of a plurality of different VOC concentrations from a sample of breath to form a breath pattern signature of COVID-19.

Materials

Equipment

Mask with one-way valve

NAME

Prototype

BRAND

NA

SKU

Equipment

Breath Collection Device having housing and sensor array

NAME

Prototype

BRAND

NA

SKU

Equipment

Compressed Air

NAME

NA

BRAND

NA

SKU

Troubleshooting

Safety warnings

Device must be sterilized prior to each use to prevent the spread of COVID-19.

Before start

55 % 20 °C +-2

Disclaimer

DISCLAIMER – FOR INFORMATIONAL PURPOSES ONLY; USE AT YOUR OWN RISK

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Attachments

JPG

Image_COVID_Breath.j...

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Files

SEARCH

Protocol

NAME

Mask-Based Covid-10 testing system using Exhaled Breath Condensate

VERSION 1

CREATED BY

John J Daniels

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