A Bioreactor To Quantify Headspace of Volatile Organic Gases From Cells In Culture

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PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,597,941	12/03/2013	2010-127

BRIEF DESCRIPTION

The current technology generally relates to systems and devices (e.g., bioreactors) used for collecting and accurately quantifying trace amounts of volatile organic gases (VOCs) obtained from the headspace above cell cultures.

INVENTORS

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FULL DESCRIPTION

It is known that useful information may be obtained using human exhaled breath biomarkers relevant to diseases ranging from cystic fibrosis and asthma to diabetes. Despite considerable efforts to understand the underlying cellular sources and determinants of exhaled compounds, knowledge of the underlying chemical and biochemical processes of exhaled gases remains limited in many cases. For example, cells may be collected and the headspace above the cells may be analyzed for gaseous products. However, the identification of gases in the headspace above cells growing in culture is not a simple task. Most of the gases of interest exist in concentrations so small that their accurate measurement can be a challenge.

The collection and measurement of these trace concentrations requires the fabrication of bioreactors which can accommodate a sufficient number of cells and can allow ready access to the culture medium and headspace for sampling gases with negligible ambient contamination. Prior studies utilized a glass bottle sealed with a septum to culture human lung cancer cells. Headspace gases were sampled by puncturing the septa with a hypodermic needle. A better design to capture and accurately measure headspace gases is needed.

A method is disclosed that includes placing a culture inside a glass bioreactor and purging the ambient air inside of the glass bioreactor. The inside of the glass bioreactor is charged with air with a known composition of volatile organic gases and, optionally, doped with 5% (by volume) carbon dioxide (commonly used for cell culture studies). In one aspect, the air is substantially free of VOCs although it is sufficient for the air to have a known composition of VOCs. The culture is then incubated for a period of time. A gas sample is then obtained from inside the glass bioreactor after incubation and the concentration of one or more chemical species is measured. The culture may contain cells, bacteria, or viruses. The chemical species (or individual chemical species) may serve as a fingerprint or signature for particular gases released by the cells, bacteria, or viruses. These signatures may then be used, for example, in testing to identify and monitor various disease or pathogenic states of a subject.

SUGGESTED USES

OTHER INFORMATION

CATEGORIZED AS

- **Agriculture & Animal Science**
  - Devices
  - Other
- **Biotechnology**
  - Other
- **Medical**
  - Diagnostics
  - Other
  - Research Tools

The method may be used to measure or quantify the headspace VOC content from cultures. The total VOC content or concentration may be determined. Alternatively, or in addition, the concentration of various VOC constituents may be determined. The culture sample may include human cells and in particular diseased human cells. Exemplary VOCs that can be quantified may include, for instance, acetaldehyde and hexanaldehyde. Of course, other chemical species may also be detected.

The chemical species (or individual chemical species) may serve as a fingerprint or signature for particular gases released by the cells, bacteria, or viruses. These signatures may then be used, for example, in testing to identify and monitor various disease or pathogenic states of a subject.

ADVANTAGES

The current technology allows researchers to capture and accurately measure headspace gases.

RELATED CASES

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