DEVICES, SYSTEMS AND METHODS FOR SAMPLE PREPARATION

BACKGROUND

[0001] Rapid and accurate detection and identification of pathogens such as bacteria is important, and can be critical, in the diagnosis and treatment of infectious diseases, and in the prevention or amelioration of pandemics or epidemics. However, methods for detecting or identifying pathogens often require large samples, which can be difficult to obtain, or may be uncomfortable or painful for the subject. Methods for detecting or identifying pathogens often require the incubation of samples on growth media, or in host cells or animals, and so take long periods of time. Many pathogens are difficult to culture, or are similar to other organisms, and so are difficult to identify even if the sample yields a detectable culture. In addition, methods for detecting or identifying pathogens may require rare or expensive reagents or culture conditions.

[0002] Thus, detection and identification of pathogens in a biological sample may be important in the diagnosis and treatment of patients exposed to, or suspected of suffering, from infectious diseases. However, present methods for detecting or identifying pathogens are often inaccurate, difficult, expensive, and time-consuming. Accordingly, rapid, accurate and straightforward methods for the detection and identification of pathogens from small samples are desired.

INCORPORATION BY REFERENCE

[0003] All publications, patents, and patent applications mentioned in this specification are herein incorporated by reference to the same extent as if each individual publication, patent, or patent application was specifically and individually indicated to be incorporated by reference.

SUMMARY

[0003a] According to a first aspect of the present invention, there is provided a device configured to assay a sample for the presence of pathogen-identifying material, said device comprising a housing, and within said housing, a sonicator having a sonicator tip; a vessel holder configured to hold a vessel having a vessel wall; a sample handling system configured to move said vessel within the housing, wherein the vessel is configured to hold said sample for sonication; a solenoid disposed to urge said sonicator tip towards the vessel wall when said solenoid is activated, wherein the sonicator tip is configured to contact the vessel wall

effective to transfer ultrasonic energy from said sonicator to the vessel wall upon operation of the sonicator; a spring disposed so as to urge the sonicator tip away from the vessel wall; and a detector.

[0003b] According to a second aspect of the present invention, there is provided a device configured to assay a sample for the presence of pathogen-identifying material, said device comprising a housing; a sonicator within said housing, said sonicator having a sonicator tip; a sample handling means configured to move a vessel within the housing; a vessel holding means configured to hold said vessel, the vessel having a vessel wall and being configured to hold said sample for sonication; a solenoid disposed to urge said sonicator tip towards said vessel wall when said solenoid is activated, wherein the sonicator tip is configured to contact the vessel wall effective to transfer ultrasonic energy from said sonicator to the vessel wall upon operation of the sonicator; a spring disposed so as to urge the sonicator away from the vessel wall; and a detector means. **[0004]** Devices, systems and methods for sample preparation are disclosed. Devices for sample preparation as disclosed herein comprise a sonicator; the sonicator may be configured to provide ultrasonic energy to a sample solution. A sample solution may be contained within a vessel. In embodiments, a sonicator may be used to mix a solution, e.g., to mix a sample solution, or to mix two or more solutions, such as a sample solution and a reagent solution. In embodiments, a sonicator may be used for emulsification of a solution or a mixture of solutions, or of a sample in a solution or reagent. In embodiments, a sonicator

CLAIMS

1. A device configured to assay a sample for the presence of pathogen-identifying material, said device comprising a housing, and within said housing, a sonicator having a sonicator tip; a vessel holder configured to hold a vessel having a vessel wall; a sample handling system configured to move said vessel within the housing, wherein the vessel is configured to hold said sample for sonication; a solenoid disposed to urge said sonicator tip towards the vessel wall when said solenoid is activated, wherein the sonicator tip is configured to contact the vessel wall effective to transfer ultrasonic energy from said sonicator to the vessel wall upon operation of the sonicator; a spring disposed so as to urge the sonicator tip away from the vessel wall; and a detector.

2. The device of claim 1, wherein said sonicator comprises a sonicator horn comprising said sonicator tip, wherein the sonicator tip is configured to contact said vessel wall effective to transfer ultrasonic energy from the sonicator to the vessel wall upon operation of the sonicator.

3. The device of claim 1, wherein said detector comprises an optical detector.

4. The device of claim 1, further comprising a communication assembly configured to communicate with a laboratory, a network, or the cloud.

5. The device of claim 1, wherein the device is configured to apply force to said vessel while applying said sonicator tip to said vessel wall of the vessel.

6. A device configured to assay a sample for the presence of pathogen-identifying material, said device comprising a housing; a sonicator within said housing, said sonicator having a sonicator tip; a sample handling means configured to move a vessel within the housing; a vessel holding means configured to hold said vessel, the vessel having a vessel wall and being configured to hold said sample for sonication; a solenoid disposed to urge said sonicator tip towards said vessel wall when said solenoid is activated, wherein the sonicator tip is configured to contact the vessel wall effective to transfer ultrasonic energy from said sonicator to the vessel

wall upon operation of the sonicator; a spring disposed so as to urge the sonicator away from the vessel wall; and a detector means.

7. The device of claim 6, wherein said sonicator tip is configured to contact said vessel wall effective to transfer ultrasonic energy from the sonicator to the vessel wall upon operation of the sonicator.

8. The device of claim 6, wherein said detector means comprises optical detection means.

9. The device of claim 1, wherein said assay for the presence of the pathogen-identifying material comprises an assay selected from the group consisting of detection of the pathogen-identifying material in the sample, identification of the pathogen-identifying material in the sample, and measurement of an amount of the pathogen-identifying material in the sample.

10. The device of claim 6, wherein said assay for the presence of the pathogen-identifying material comprises an assay selected from the group consisting of detection of the pathogen-identifying material in the sample, identification of the pathogen-identifying material in the sample, and measurement of an amount of the pathogen-identifying material in the sample.

11. The device of claim 1, wherein said biological sample comprises a sample selected from the group consisting of blood, urine, sputum, tears, material from a nasal swab, material from a throat swab, material from a cheek swab, and another bodily fluid, excretion, secretion, and tissue obtained from a subject.

12. A system comprising the device of claim 1.

13. The device of claim 1, wherein said sample handling system is configured to apply force to the vessel while the sonicator tip is applied to the vessel wall of the vessel.