REDUCING OPTICAL INTERFERENCE IN A FLUIDIC DEVICE

CROSS-REFERENCE

This application is related to the following co-pending patent application Ser. No. 11/389,409, filed Mar. 24, 2006, which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

The discovery of a vast number of disease biomarkers and the establishment of miniaturized fluidic systems have opened up new avenues to devise methods and systems for the prediction, diagnosis and monitoring of treatment of diseases in a point-of-care setting. Point-of-care testing is particularly desirable because it rapidly delivers results to patients and medical practitioners and enables faster consultation between patients and health care providers. Early diagnosis allows a practitioner to begin treatment sooner and thus avoiding unattended deterioration of a patient's condition. Frequent monitoring of appropriate parameters such as biomarker levels and concentrations of therapeutic agents enables recognition of the effectiveness of drug therapy or early awareness that the patient is being harmed by the therapy. Examples of point-of-care analyses include tests for glucose, prothrombin time, drugs of abuse, serum cholesterol, pregnancy, and ovulation.

Fluidic devices can utilize a number of different assays to detect an analyte of interest in a sample of bodily fluid from a subject. In ELISA assays (a preferred technique for clinical assays especially in a point-of care context, if assay reagents such as enzyme-antibody conjugates and enzyme substrates remain on-board the fluidic device after the assay is performed, reagents unbound to the assay capture surface or excess reagents, if collected in the same fluidic device, can react with one another and create a signal that can interfere with the signal of interest produced by the assay. This is especially the case in luminogenic assays in which the assay reagents generate light, in contrast to assays that measure, for example, absorbance or fluorescence. Many luminogenic assays use an enzyme to generate luminescence thus improving assay sensitivity by amplification of the measured species. Moreover, in assay systems that contain all assay components, including waste washes in a small housing the potential for glowing luminogenic waste materials is further enhanced. In such assay formats, the excess or unbound enzyme-labeled reagent may react with enzyme substrate, thus creating undesired interfering signals.

Some fluidic device features may mitigate the problem of an interfering signal to a certain degree. For example, the body of the fluidic device can be opaque, optically isolating the undesired glow, or the detection system can be configured to reject light which does not originate from reaction sites within the fluidic device. These mitigating features, however, may not sufficiently eliminate the interference as light can still travel through transparent elements of the fluidic device and interfere with the signal of interest. This is especially the case in assays requiring high sensitivity where the ratio between the signal generated from the assay may represent only a small fraction, e.g., less than 1 part in 10,000, of the total signal generating reagent.

Thus, there remains a considerable need for improved fluidic devices, especially point-of-care devices, designed to minimize interfering optical signals.

SUMMARY OF THE INVENTION

One aspect of the invention is a fluidic device for detecting an analyte in a sample of bodily fluid. The fluidic device

comprises a sample collection unit adapted to provide a sample of bodily fluid into the fluidic device, an assay assembly in fluidic communication with the sample collection unit, wherein the assay assembly is adapted to yield an optical signal indicative of the presence or quantity of the analyte in the sample of bodily fluid, and a quencher assembly in fluidic communication with said assay assembly, wherein the quencher assembly is adapted to reduce interference of the optical signal.

In some embodiments the assay assembly includes reagent chambers comprising reagents used in the assay and at least one reaction site comprising a reactant that binds the analyte. The reagents can be an enzyme conjugate and an enzyme substrate.

The quencher assembly can include quenching site in fluidic communication with the reaction site and a quenching agent at the quenching site. The quencher assembly can also include an absorbent material, which may be, for example, glass fiber, silica, paper, polyacrylamide gel, agarose, or agar.

The absorbent material can be impregnated with the quenching agent. The quenching agent can be adapted to inactivate at least one reagent from the assay and thereby reduce the interfering optical signal. In some embodiments the quenching agent is 4-amino-1,11-azobenzene-3,41-disulfonic acid.

In some embodiments the assay assembly is adapted to run an immunoassay, which can be a chemiluminescent assay. The quencher assembly can be adapted to substantially eliminate the interference.

In some embodiments the fluid device has a waste chamber, wherein the waste chamber includes the quenching site.

Another aspect of the invention is a system for detecting an analyte in a sample. The system comprises a fluidic device that has an assay assembly configured to yield an optical signal that is indicative of the presence of the analyte, and a quencher assembly in fluidic communication with said assay assembly, wherein said quencher assembly is adapted to reduce interference of said optical signal, and a detection assembly for detecting said optical signal.

In some embodiments the system also includes a communication assembly for transmitting said optical signal to an external device.

In some embodiments the assay assembly comprises reagent chambers that have at least one reagent used in the assay and at least one reaction site comprising a reactant that binds the analyte. The at least one reagent can include an enzyme conjugate and an enzyme substrate.

In some embodiments the quencher assembly comprises a quenching site in fluidic communication with the reaction site and a quenching agent at the quenching site. The quencher assembly can include an absorbent material such as glass fiber, silica, paper, polyacrylamide gel, agarose, or agar. The absorbent material can be impregnated with the quenching agent, which be adapted to inactivate at least one reagent from said assay, thereby reducing said interference of said optical signal. The quenching agent can be, for example, 4-amino-1,11-azobenzene-3,41-disulfonic acid.

In some embodiments of the system, the assay assembly is adapted to run an immunoassay, and can further be a chemiluminescent assay.

The quencher assembly can be adapted to substantially eliminate the interference.

In some embodiments of the system there is a waste chamber, wherein the waste chamber comprises the quenching site.

One aspect of the invention is a method of detecting an analyte in a sample. The method comprises allowing a sample suspected to contain the analyte to react with reagents con-