MACHINE READABLE DIAGNOSTIC TEST DEVICES AND METHODS AND APPARATUS TO MAKE AND/OR PROCESS THE SAME

RELATED APPLICATIONS

[0001] This patent claims priority to U.S. Provisional Patent Application Serial No. 63/129,375, which was filed on December 22, 2020 and to U.S. Provisional Patent Application Serial No. 63/032,093, which was filed on May 29, 2020. U.S. Provisional Patent Application Serial No. 63/129,375 and U.S. Provisional Patent Application Serial No. 63/032,093 are hereby incorporated herein by reference in their entireties.

FIELD OF THE DISCLOSURE

[0002] This disclosure relates generally to biosensors, and, more particularly, to a machine readable diagnostic test devices and methods and apparatus to make and/or process the same.

BACKGROUND

[0003] A biosensor (e.g., a lateral flow device, such as a lateral flow assay (LFA)) is a device that is capable of detecting a condition, disease, etc., in a human or animal based on a sample (e.g., a blood sample, a saliva sample, a urine sample, etc.) from the human or animal. LFAs have been used to detect the presence of a target analyte to determine pregnancy, presence of HIV, presence of Ebola, presence of different toxins, etc.

SUMMARY

[0003a] According to a first aspect of the present invention, there is provided a lateral flow assay device comprising:

a conjugate pad including conjugates corresponding to a target analyte in a biological sample, the conjugates labeled with an enzyme;

a porous media including a first zone and a second zone,

the first zone including at least one of immobilized antigens corresponding to the target analyte or immobilized antibodies corresponding to the target analyte,

the second zone laterally displaced from the first zone along a longitudinal axis of the lateral flow assay device,

the porous media to propagate a flow of the biological sample, the conjugates with the enzyme, and a liquid buffer along the porous media, and

a first electrode to contact the porous media in the first zone;

a second electrode to contact the porous media in the second zone, the first and second electrodes to detect an electrical signal when the target analyte is present in the biological sample and the enzyme reacts with the liquid buffer; and

a positionable flow arrestor to impede the flow in the second zone.

[0003b] According to a second aspect of the present invention, there is provided an apparatus for use with a fluid sample, the apparatus comprising:

a porous media;

a wicking pad in contact with the porous media; and

a switch including a flow arrestor to at least one of compress or shear the porous media to at least one of reduce or stop flow of liquid toward the wicking pad.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] FIG. 1A is an example environment including an example machine readable lateral flow immunoassay generator to generate a machine readable lateral flow immunoassay described in conjunction with examples disclosed herein.

[0005] FIG. 1B is a side view of the example machine readable lateral flow immunoassay of FIG. 1A.

[0006] FIG. 2A illustrates an example implementation of part the machine readable lateral flow immunoassay of FIG. 1A.

What Is Claimed Is:

1. A lateral flow assay device comprising:

a conjugate pad including conjugates corresponding to a target analyte in a biological sample, the conjugates labeled with an enzyme;

a porous media including a first zone and a second zone,

the first zone including at least one of immobilized antigens corresponding to the target analyte or immobilized antibodies corresponding to the target analyte,

the second zone laterally displaced from the first zone along a longitudinal axis of the lateral flow assay device,

the porous media to propagate a flow of the biological sample, the conjugates with the enzyme, and a liquid buffer along the porous media, and

a first electrode to contact the porous media in the first zone;

a second electrode to contact the porous media in the second zone, the first and second electrodes to detect an electrical signal when the target analyte is present in the biological sample and the enzyme reacts with the liquid buffer; and

a positionable flow arrestor to impede the flow in the second zone.

2. The lateral flow assay device of claim 1, further including a wicking pad coupled to the porous media, wherein the flow arrestor is to at least one of compress or shear the porous media to at least one of reduce or stop the flow toward the wicking pad.

3. The lateral flow assay device of claim 2, wherein the flow arrestor includes a switch that is movable from a first position to a second position to at least one of compress or shear the porous media.

4. The lateral flow assay device of claim 3, wherein movement of the switch to the second position causes the first electrode and the second electrode to contact the porous media.

5. The lateral flow assay device of claim 3, wherein the switch is spaced a first distance from the porous media in the first position and spaced a second distance from the porous media in the second position, the second distance less than the first distance.

6. The lateral flow assay device of claim 3, further including a circuit board, the first electrode and the second electrode coupled to the circuit board, the switch to move at least a portion of the circuit board proximate to the porous media.

7. The lateral flow assay device of claim 6, wherein the circuit board is pivotable, the switch to pivot the circuit board when the switch is moved.

8. The lateral flow assay device of any of claims 2-7, wherein the flow arrestor includes a first flow arrestor and a second flow arrestor.

9. The lateral flow assay device of claim 8, wherein the first flow arrestor is to at least one of compress or shear the porous media in the first zone and the second flow arrestor is to at least one of compress or shear the porous media in the second zone.

10. The lateral flow assay device of claim 9, wherein the first electrode and the second electrode are positioned between the first flow arrestor and the second flow arrestor.

11. The lateral flow assay device of any of claims 1-10, wherein the flow arrestor includes a chemical substance that is to form a barrier when wetted.

12. The lateral flow assay device of any of claims 1-11, further including an antenna in circuit with the first electrode and the second electrode, the antenna to transmit a wireless signal representative of the electrical signal to an external device.

13. The lateral assay device of any of claims 1-12, further including:

an antenna in circuit with the first electrode and the second electrode, the antenna is to receive a power signal from the external device;

a sensor to measure at least one of a voltage or a current between the first electrode and the second electrode, the sensor operable based on the power signal, the at least one of the voltage or the current being the electrical signal; and

a processor operable based on the power signal, the processor to:

compare the at least one of the voltage or the current to a threshold; and

when the at least one of the voltage or the current is more than the threshold, identify that the target analyte is present in the biological sample,

the antenna to wirelessly transmit results to the external device.

14. The lateral assay device of any of claims 1-13, wherein the electrical signal is generated by an enzymatic reaction.

15. The lateral assay device of any of claims 1-14, wherein the lateral assay device is batteryless.

16. An apparatus for use with a fluid sample, the apparatus comprising:

a porous media;

a wicking pad in contact with the porous media; and

a switch including a flow arrestor to at least one of compress or shear the porous media to at least one of reduce or stop flow of liquid toward the wicking pad.

17. The apparatus of claim 16, wherein the switch is moveable between a first position and a second position to at least one of compress or shear the porous media.

18. The apparatus of claim 17, further including an electrode, the switch to cause the electrode to contact the porous media while the switch is in the second position.

19. The apparatus of claims 17 or 18, wherein the switch is spaced a first distance from the porous media in the first position and spaced a second distance from the porous media in the second position, the second distance less than the first distance.

20. The apparatus of any of claims 16-19, further including a reservoir including a liquid buffer, the switch to cause the reservoir to release the liquid buffer onto the porous media.

21. The apparatus of any of claims 16-20, wherein the flow arrestor is to shear the porous media by cutting a portion of a depth of the porous media.