

CLAIMS

1. A device for isolating a biological material from a sample, the device comprising:
a housing defining a plurality of compartments and a plurality of fluid channels, wherein each compartment is configured to be fluidically connected to a respective fluid channel, and wherein each fluid channel comprises a respective end terminating at a track disposed on the housing;
a slider movable along the track, the slider comprising a plurality of connecting channels extending therethrough, wherein a selected one of the connecting channels is configured to connect ends of selected ones of the fluid channels based on a position of the slider along the track; and
a dry reagent capsule configured to be mounted to the housing, the dry reagent capsule comprising at least one dry reagent for mixing with the sample, wherein the dry reagent capsule is further configured to be fluidically connected to a respective fluid channel *in-situ*.
2. The device as claimed in claim 1, wherein the plurality of compartments comprises a sample compartment configured to receive the sample, a plurality of liquid reagent compartments and a waste compartment, and wherein the plurality of liquid reagent compartments are preloaded with respective liquid reagents.
3. The device as claimed in claim 2, wherein each of the sample and liquid reagent compartments comprises a respective inlet configured to be connected to pneumatic source for controlling a fluid flow to or from said compartment, the device further comprising a first pneumatic vent disposed in one of the liquid reagent compartments and a second pneumatic vent disposed in the waste compartment.
4. The device as claimed in claim 2, wherein, in a first position, the slider is configured to connect a first liquid reagent compartment containing a hydration buffer with a first chamber of the dry reagent capsule, the first chamber containing a first dry reagent, for mixing the hydration buffer with the first dry reagent to form a first solution.
5. The device as claimed in claim 4, wherein, in a second position, the slider is configured to connect the first liquid reagent compartment with a second liquid reagent compartment containing a lysis buffer, for mixing the first solution with the lysis buffer to form a second solution.

6. The device as claimed in claim 5, wherein, in a third position, the slider is configured to:

connect the second liquid reagent compartment with a second chamber of the dry reagent capsule, the second chamber containing a second dry reagent, for mixing the second solution with the second dry reagent to form a third solution; and

connect the second chamber of the dry reagent capsule with the sample compartment for mixing the third solution with the sample to form a fourth solution.

7. The device as claimed in claim 6, wherein the fluid channels comprise a binding channel, and wherein, in a fourth position, the slider is configured to connect the sample compartment with the binding channel to store the fourth solution in the binding channel for a predetermined period for extracting the biological material from the fourth solution and binding the extracted biological material to a surface of the binding channel.

8. The device as claimed in claim 7, wherein, in a fifth position, the slider is configured to:

connect a third liquid reagent compartment containing a first wash buffer with the binding channel to wash the biological material bound to the surface of the binding channel; and

connect the binding channel with the waste compartment for discarding a first waste solution without the biological material to the waste compartment.

9. The device as claimed in claim 8, wherein, in a sixth position, the slider is configured to:

connect a fourth liquid reagent compartment containing a second wash buffer with the binding channel to wash the biological material bound to the surface of the binding channel; and

connect the binding channel with the waste compartment for discarding a second waste solution without the biological material to the waste compartment.

10. The device as claimed in claim 9, wherein, in a seventh position, the slider is configured to:

connect a fifth liquid reagent compartment containing an elution buffer with the binding channel to elute the biological material from the surface of the binding channel; and

connect the binding channel with an outlet for collecting the eluted biological material.

11. The device as claimed in claim 2, wherein, in a first position, the slider is configured to:

connect a first liquid reagent compartment containing a lysis buffer with a chamber of the dry reagent capsule, the chamber containing the at least one dry reagent, for mixing the lysis buffer with the at least one dry reagent to form a reagent solution; and

connect the chamber of the dry reagent capsule with the sample compartment for mixing the reagent solution with the sample to form a sample solution.

12. The device as claimed in claim 11, wherein the fluid channels comprise a binding channel, and wherein, in a second position, the slider is configured to connect the sample compartment with the binding channel to store the sample solution in the binding channel for a predetermined period for extracting the biological material from the sample solution and binding the extracted biological material to a surface of the binding channel.

13. The device as claimed in claim 12, wherein, in a third position, the slider is configured to:

connect a second liquid reagent compartment containing a first wash buffer with the binding channel to wash the biological material bound to the surface of the binding channel; and

connect the binding channel with the waste compartment for discarding a first waste solution without the biological material to the waste compartment.

14. The device as claimed in claim 13, wherein, in a fourth position, the slider is configured to:

connect a third liquid reagent compartment containing a second wash buffer with the binding channel to wash the biological material bound to the surface of the binding channel; and

connect the binding channel with the waste compartment for discarding a second waste solution without the biological material to the waste compartment.

15. The device as claimed in claim 14, wherein, in a fifth position, the slider is configured to:

connect a fourth liquid reagent compartment containing a third wash buffer with the binding channel to wash the biological material bound to the surface of the binding channel; and

connect the binding channel with the waste compartment for discarding a third waste solution without the biological material to the waste compartment.

16. The device as claimed in claim 15, wherein, in a sixth position, the slider is configured to:

connect a fifth liquid reagent compartment containing an elution buffer with the binding channel to elute the biological material from the surface of the binding channel; and

connect the binding channel with an outlet for collecting the eluted biological material.

17. The device as claimed in claim 7 or 12, wherein the at least one dry reagent comprises lyophilized beads containing a crosslinker selected to attach to the biological material, and wherein the surface of the binding channel is coated with a functional group selected to attach to the crosslinker.

18. An automated biological material extraction system comprising:

a receptacle configured to receive the device as claimed in claim 2;

a pressure source configured to control a fluid flow to and from a selected compartment of the sample compartment and liquid reagent compartments;

an actuator configured to move the slider of the device to predetermined positions along the track; and

a mechanism configured to exert a force on the dry reagent capsule to break a seal covering at least one chamber of the capsule to fluidically connect the capsule with the respective fluid channel *in-situ*.

19. A method of isolating a biological material from a sample, the method comprising: disposing the sample in the sample compartment of the device as claimed in claim 2;

breaking a seal covering at least one chamber of the dry reagent capsule to fluidically connect the capsule with the respective fluid channel *in-situ*; and

moving the slider to predetermined positions along the track to:

mix the liquid reagents and the at least one dry reagent with the sample for extracting the biological material from the sample;

bind the extracted biological material to a surface of a binding channel disposed in the device;

purify the biological material bound to the surface of the binding channel;
and
elute the purified biological material.