

Multi-Sample Cartridge

[0057] The methods described herein may be practiced with a multi-sample cartridge **700** or **720**, as shown in FIGS. **3A**, **3B**, and **3C** respectively. A multi-sample cartridge may be used to convert a number of samples, including at least a first sample and a second sample, wherein the first sample and the second sample each contain one or more polynucleotides (which may be the same as, or different from, one another), into respective forms suitable for analyzing the one or more polynucleotides.

[0058] Multi-sample cartridge **700**, in which microfluidic circuitry **708**, **710** is shown schematically, comprises at least a first microfluidic cartridge **704** and a second microfluidic cartridge **706**, separably affixed to one another. Multi-sample cartridge **720** is another embodiment in which sample lanes such as **723** and **725** are grouped in pairs, and comprises at least a first microfluidic cartridge **724** having a first pair of sample lanes, and a second microfluidic cartridge **726** having a second pair of sample lanes, wherein the first and second microfluidic cartridges are separably affixed to one another. A sample lane is an independently controllable set of elements by which a sample can be prepared, according to methods described herein. A lane comprises at least a reagent inlet, a sample luer, a microfluidic component, and a waste chamber, as further described herein in connection with a microfluidic cartridge.

[0059] By separably affixed is meant that one cartridge is joined to another such that both can be placed together into a cartridge receiving element of a microfluidic system, but that at least the first and second cartridges could be broken apart from one another and used separately from one another. To facilitate the breaking apart, a score line, for example, may be fabricated between the two cartridges.

[0060] In FIG. **3A**, preferably each of the first microfluidic cartridge **704** and the second microfluidic cartridge **706** is according to that further described herein, see e.g., FIG. **4**, and the first microfluidic cartridge accepts a first sample, and the second microfluidic cartridge accepts a second sample. Thus first cartridge **704** comprises at least a first microfluidic component **708**, and second cartridge **706** comprises at least a second microfluidic component **710**.

[0061] In FIG. **3B**, preferably each sample lane of the first microfluidic cartridge **714** and each sample lane of the second microfluidic cartridge **716** is according to that further described herein, see e.g., FIG. **4**, and the first microfluidic cartridge accepts a first and second sample, and the second microfluidic cartridge accepts a third and fourth sample. Thus first cartridge **714** comprises at least a first and a second microfluidic component, and second cartridge **716** comprises at least a third and fourth microfluidic component.

[0062] Preferably a multi-sample cartridge is the same size as a 96-well plate, as used in the art. Preferably, a multi-sample cartridge has 8 cartridges, as depicted in FIG. **3A**, or has 8 lanes, arranged in pairs, as depicted in FIG. **3B**. It would be understood that alternative multi-sample cartridges, having different numbers of independent cartridges and/or lanes, are consistent with the methods and apparatus described herein; such numbers include 4, 6, 10, 12, or 16 single-lane cartridges, and 2, 3, 5, 6, or 8 two-lane cartridges. It is additionally possible that a cartridge can be configured with 4, 6, or 8 lanes and be consistent with the description herein.

[0063] Still further preferably, each cartridge of a multi-lane cartridge is configured with a PCR tube for each cartridge, separated from one another by 9 mm, or about 9 mm, centroid-to-centroid, and preferably the individual PCR tubes are connected to one another by a strip so that all the tubes can be removed from the multi-lane cartridge simultaneously.

[0064] The multi-sample cartridge has additionally and optionally a mechanical key that prevents a user from inserting it into a microfluidic system incorrectly, and also ensures accurate engagement of the cartridge with instrumentation such as a cartridge receiving element **12** of system **10** of FIG. **1**. Preferably the mechanical key is engineered on the edge of cartridge **700**, or of cartridge **720**, that is inserted first into system **10**. Such a key can comprise, e.g., a single cut-out corner **702** of the multi-sample cartridge as in FIG. **3A**, or several, such as two or more, notches **722** cut in the edge of cartridge **720** of FIG. **3B**. Where the key comprises one or more notches, it is preferable that there is at least one notch associated with each lane, as in FIG. **3B**, or of each cartridge.

[0065] Multi-sample cartridges **700** and **720** have, respectively, one or more luers for sample introduction. In FIG. **3A**, there is a luer **712** and a luer **714** associated with, respectively, first cartridge and second cartridge. In FIG. **3B**, luers **732** and **734** are associated with, respectively, first lane **723** and second lane **725**. In FIGS. **3A** and **3B**, luers in adjacent cartridges or lanes, are offset with respect to one another. Such an offset is a design feature in one embodiment and facilitates efficient configuration of microfluidic circuitry, but is not a requirement of the multi-sample cartridge.

[0066] Multi-sample cartridge **700** also has a first reagent inlet **716** and a second reagent inlet **718** for each of first cartridge **704** and second cartridge **706**, respectively. Multi-sample cartridge **720** also has a reagent inlet **736** associated with each sample lane.

[0067] Multi-sample cartridge **720** additionally and optionally comprises one or more sighting elements **730** that facilitate positioning of a liquid reagent dispenser head when dispensing reagents into the cartridge. Such sighting elements may be used in conjunction with an optical positioning system used in conjunction with a dispenser head, and as may be incorporated into system **10** by one of ordinary skill in the art.

[0068] FIG. **3C**, comprising FIGS. **3C-1**, **3C-2** and **3C-3**, shows an alternative embodiment **740** of a multi-sample cartridge in which multiple lanes (eight are shown) are fabricated in a single microfluidic substrate. It is preferred, in this embodiment, that the chambers and substrate are also integral. In the embodiment shown chambers are arranged in two pairs of rows, such that there are four sample lysis chambers **742**, with separate inlets, and one waste chamber **744** per row. Each row of chambers can therefore service four sample lanes. Preferably this cartridge does not have ramped funnels within each lysis chamber (as further described herein) and is therefore inclined at an angle to the horizontal during analysis. FIG. **3C-1** is a perspective view of the cartridge from above showing reagent inlets **746** (the lysis and sample chambers are obscured by a protective cover, and the individual sample inlets are not shown). FIG. **3C-2** is a perspective view from the underside showing