

[0039] washing any unbound material away from the bound analyte using a suitable fluid or gas introduced to the cartridge by way of the input port and;

[0040] detecting any labelled bound analyte present in the cartridge.

[0041] In a further aspect there is provided an assay system for conducting an assay on a fluid sample, the assay system comprising:

[0042] a) a microfluidic cartridge according to the first aspect (or preferred embodiments thereof) and;

[0043] b) a reader device, the reader device comprising:

[0044] i) a receiving port for introducing the cartridge into the reader;

[0045] ii) an internal reservoir/reservoirs for storing a fluid or a gas;

[0046] iii) means for delivering the fluid or gas to the input port(s) of the cartridge once inserted within the reader, so that fluid or gas may be transported through the microfluidic channel(s) of the cartridge and;

[0047] iv) detection means for enabling detection of any bound analyte or a reaction product formed as a result of the analyte binding the binding agent within the cartridge.

[0048] The reader includes a receiving port into which the cartridge is to be inserted. The reader may be adapted so as to ensure correct insertion of the cartridge and this could take a variety of forms. For example, the cartridge may be initially located on a carrier mechanism which enters the reader, such as may be found in computers for loading CDs and the like. Alternatively the receiving port may be sized to allow the cartridge to be received and an internal stop member may be found within the reader which the cartridge abuts once inserted correctly. Additionally, or alternatively, features found on or cut into the surface of the cartridge may be designed to co-locate with features found within the reader and only once the cartridge is correctly located in the reader, will the cartridge be able to be read.

[0049] The fluid reservoir/reservoirs is preferably sized such that more than one sample cartridge may be analysed and read before fluid in the reservoir/reservoirs needs replacing. Desirably many assays may be carried out before fluid in the reservoir/reservoirs may need to be replaced. Alternatively, in the case where the internal reservoir/reservoirs is filled with air, the reservoir/reservoirs will not require to be replaced as when the reservoir/reservoirs was completely expelled, it could retract to its starting position, drawing in air from the atmosphere. In the case of a fluid reservoir/reservoirs, the fluid may be introduced into the reservoir/reservoirs manually from another source. Preferably the reservoir/reservoirs takes the form of a replaceable cartridge, which may be introduced into the reader when required. For example, a user may have, or be provided with a reader which is able to be configured to carry out a variety of different types of assay, but the user is provided with a kit comprising assay cartridges and a fluid reservoir/reservoirs cartridge which are suitable for a particular analyte or analytes to be detected. In this manner, prior to use, the user inserts the fluid reservoir/reservoirs cartridge into the reader. The reservoir/reservoirs cartridge itself may have a unique identifier feature, such as a bar-code or chip device, which is recognised by the reader to be associated with a particular assay which is appropriate for the sample cartridges and reservoir/reservoirs cartridge, or the user may configure the reader to conduct a particular assay which is associated with the particular sample cartridge and

optionally the reservoir/reservoirs cartridge. For some assays although differently manufactured sample cartridges may be required, a single fluid reservoir/reservoirs cartridge may be used to conduct a variety of different assays. Desirably a single fluid reservoir/reservoirs cartridge may contain enough fluid to be able to carry out many assays, such as greater than 25 or 50 assays, before the reservoir/reservoirs cartridge requires to be replaced. The fluid may be a washing agent such as water, which may include a buffer, such as PBS, HEPES and the like. Other fluids may also be suitable.

[0050] In the embodiment where the binding agent is bound to the surface of magnetic agents, such as magnetic beads, it is understood that the reader will comprise a permanent magnet or electromagnet which is designed to apply a magnetic field or be brought into close proximity or a magnetic field applied, in order to concentrate and hold the magnetic particles in a particular area of said microfluidic channel of the cartridge. This area may be the detection area. Concentrating the magnetic particles into a particular area may serve to facilitate detection of any captured analyte and/or increase sensitivity of detection. Moreover, by holding the particles by way of the magnetic field it also allows unwanted fluid surrounding the bound analyte to be washed away, thereby leaving the captured analyte free of potentially interfering agents/contaminants which may be present in the initial sample. The permanent or electromagnetic field may be reduced or increased, such as by moving a permanent magnet closer to, or further away from the cartridge, or by increasing or decreasing the intensity of the applied field. This may serve to allow the magnetic particles to "relax" or become less concentrated in a particular location, whilst still being held to a certain extent by the magnetic field or not. This may facilitate further reactions to be carried out on the particles, which may be conducted more efficiently compared to if the magnetic particles were tightly concentrated. It may also be preferred in certain applications that the detection is carried out when the particles are less "concentrated" or relaxed.

[0051] In use the magnet may be used to hold any bound agent once the magnetic field has been applied to the sample. Fluid from the fluid input port may be introduced into the cartridge and the fluid may wash any non-bound components of the sample away and/or allow other reagents such as a detection agent to be brought into contact with the captured analyte.

[0052] The reader of the present invention further comprises detection means for detecting any captured analyte within the sample cartridge. The detection means may be any suitable means depending on the particular assay. For example, the detection means may be a fluorimeter, which may be used to detect a fluorescent signal, once appropriately excited, from the labelled or unlabelled bound analyte or reaction product. The bound analyte/reaction product may naturally fluoresce once light of an appropriate wavelength has been used to excite the analyte/product, or a further label may be used to separately bind the bound analyte and the label detected by fluorescent means. Other labels which may be employed and hence the detection means adapted accordingly, include radiolabels, phosphorescent labels, colloidal metal particles, bioluminescent labels, colourimetric labels, electrochemical labels and the like. Moreover, as mentioned above the bound analyte or radiation product itself may be directly detected using techniques such as Raman spectroscopy and the like.