

enzymes) bacteria, amino-acids, glucose, and a variety of inorganic ions, epithelial cells, leucocytes, food residue, and various dissolved gases. The documented viscosity found in human saliva ranges from approximately 2.8 centipoise (cp) to approximately 15.5 cp. In various embodiments, use of certain drugs of abuse may cause “dry mouth” among certain individuals, and the saliva of these drug users may be more viscous than normal. In certain embodiments the fluid sample sizes may be at the microfluidic level, meaning in the range of a few microlitres up to tens of millilitres.

[0059] As used herein, term “molecularly imprinted polymer” or “MIP” denotes selective binding materials prepared by polymerization of one or more functional monomers and one or more cross-linkers in the presence of a template molecule. Extraction of the template gives rise to selective recognition sites. These are complementary in functionality and spatial features of the template by virtue of the fixation of pre-polymerisation complexes present in the polymerisation mixture by the formation of a highly cross-linked porous matrix. The resulting molecularly imprinted polymer is capable of rebinding the template molecule selectively under appropriate conditions. MIPs may be prepared by a number of polymerisation techniques and the interactions between the template and polymer may be covalent, semi-covalent or non-covalent in nature, or any combination of the above. For a more detailed introduction to MIPs, refer to “Mimicking molecular receptors for antibiotics—analytical implications” by Fernandez-Gonzalez, A.; Guardia, L.; Baadia-Laino, R.; Diaz-Garcia, M. E. *Trends Anal. Chem.* 2006, 25, 949-957.

[0060] Referring to FIG. 1, in one aspect an analysis system 10 comprises a disposable cartridge 11 and an integrated optical detection reader 13. In various embodiments, the reader 13 may be integrated with an apparatus 12 comprising a mother instrument for transport and ease of handling. In various embodiments the cartridge 11 is designed for the retrieval of a fluid sample from a fluid sample collection device, the conditioning of that fluid sample to reduce contaminations such as bubbles and solid impurities, and for subsequently facilitating single or multiple analyses of the conditioned sample to ascertain the presence and concentrations of specific target analytes or groups of target analytes. According to some of these embodiments the optical detection reader 13 receives and aligns the cartridge 11, to substantially simultaneously interrogate the status of each of the individual analyses taking place within the cartridge 11, and to subsequently process and display the obtained signals.

[0061] Referring to FIG. 2, in various embodiments the cartridge 11 comprises a front part 21, a rear part 22, and an extraction chamber 23 with a hinged lid 24, a guillotine 25, a fluidic chip 26 and water tight seals 27. In various embodiments, the seals 27 may be made of Silicone material. Alternatively the seals may be made of thermoplastic elastomers (TPE) and can be integrated into the housing by means of two shot injection moulding. Alternatively the features of the extraction chamber 23 can be incorporated into the front part 21 and the rear part 22.

[0062] Referring to FIG. 3, in various embodiments the cartridge 11 may be designed to work in conjunction with a swab 30 comprising a handle 31 and a foam head 32 that permits absorption of a sample of swabbed fluid from a donor's mouth. Upon insertion of a swab 30 into the extraction chamber 23, the chamber is closed by pushing down the hinged lid 24 until optional locking features 33 passively lock the lid in place. The housing end wall and the lid 24 have a

co-operating recess 35 and notch 36, respectively, that allow the swab handle 31 to protrude from the cartridge while the swab head 32 is retained, enclosed in the extraction chamber 23. In various embodiments, during the closing process, a guillotine blade 25 may be employed to ensure that no part of the swab 30 protrudes outside of the extraction chamber 23. In this way, the swab head 32 may be kept, without risk of cross-contamination, permitting further analysis of the retained fluid sample in a laboratory at a later time. When the lid 24 is closed upon a swab 30, the fluid sample is retrieved from the swab 30 as the lid 24 compresses the sponge attached to the swab head 32. The fluid sample is forced to run into an internal fluidic network that is located above a fluidic chip 26, the active sensor locations which are visible through an optical inspection window 34. During this step, the fluid sample may be passively conditioned to reduce contaminations such as bubbles and solid impurities. When the conditioned fluid sample flows onwards into the fluidic chip 26 and eventually passes near individual active sensors inside the chip, an assay occurs at each sensor producing a signal that can be read, for example, by eye and/or by an optical transducer such as the reader 13, through the inspection window 34. In order to ensure that accurate optical measurements may be carried out at each active sensor location using the reader 13, the cartridge 11 is equipped with guiding 37, locking 38 and alignment 39 features that facilitate providing reproducible and robust registration with the internal mechanics of the optical detection reader 13 by direct engagement.

[0063] Referring to FIGS. 4a and 4b, the fluidic chip 26 may be configured to permit multiple, substantially simultaneous, rapid assays to be performed with each assay resulting in production, at each active sensor location, of a signal that can be read, for example, by the optical transducer. In one embodiment, the fluidic chip 26 may comprise multiple fluidic channels 42, with dimensions of 1.7 mm in width, 0.55 mm in depth and 35 mm in length, spaced 3 mm apart and linked together via a distribution chamber 40. More generally, the dimensions may be in the range of about 1.3 to about 5 mm in width, about 0.25 mm to about 1 mm in depth and about 25 mm to 50 mm in length, spaced, between 0.5 to 5 mm apart. The resulting cross-sectional area of each channel can be defined to be in the range of about 0.3 mm² to about 5 mm², preferably 1 mm² to 2 mm².

[0064] In various embodiments, each channel may comprise a sample inlet port 41, a reagent pad 43, a diffusion zone 44, a sensor pad 45, a second diffusion zone 44, an absorbent pad 46, a channel vent 47, and, if necessary, a surfactant or hydrophilic coating on the internal channel surfaces. In various embodiments, the chip 26 may consist of a laminated PET substructure and PMMA superstructure. Alternatively such fluidic chips may be fabricated inexpensively with micro- to milli-metre dimensions in materials such as polymers and plastics, e.g. Cyclic Olefin Copolymers (COC), Polyethylene terephthalates (PET) or Polypropylene (PP) using, for example, injection moulding, screen printing, hot embossing, laser cutting, die cutting, and in silicon and other materials using micro-fabrication techniques such as photolithography and etching.

[0065] It will be appreciated that a variety of designs can be used ranging from complex microfluidic lab-on-a-chip designs in which the elements of an analytical instrument are reproduced on a silicon wafer or some other chip, to simpler designs in which external forces such as gravity or wetting processes such as capillary action or other fluidic effects are