

droplets can be located at the bottom of the well and do not evaporate or disperse into the channels 40 because of the surface tension at the interface of water and oil 55, the friction force of the droplet with the glass surface, and the walls of the wells. The channels 40 comprise an oil 70. The droplets do not flow out of the channel even with gentle agitation. The magnetic beads 75, on the other hand, can be pulled by the magnetic force provided by a magnet 80 located over or under the substrate and come in and out of the aqueous fluid droplets and move between the different fluids in the channels and wells. Because the droplets are physically separated by the wells, they can contain different components for different processing purposes, and their sizes can be tuned depending on the applications. For example, in a small RNA extraction process, after the RNAs on the magnetic beads are cleaned in washing wells, the beads are moved into a narrower channel region and then into a well containing a droplet with a smaller volume. This was the elution droplet. Smaller the volume of the elution solution, higher concentration of the small RNA after eluted, improving sensitivity in detection.

**[0039]** The dimensions of the wells and channels of the device can be varied. With reference to FIG. XXXX, certain dimensions are identified, however, these dimensions can be varied depending upon the size of the substrate, the number of wells and channels, the particular use and the types of fluids to be used in the channels and wells.

**[0040]** A variety of working fluids can be used in the systems such as, but not limited to, water (and other aqueous fluids/solutions), silicon oil, mineral oil and glycerol. The fluid selected will be based on the partition coefficient of the analyte to be analyzed. In one embodiment, an aqueous solution is used.

**[0041]** Microfluidic channels 40 can be formed in any number of materials. Thus, the devices of the disclosure include at least one flow channel 40 that allows the passage of an analyte or bead comprising a sample to other channels, wells, components or modules of the system. As will be appreciated by those in the art, the flow channels may be configured in a wide variety of ways, depending on the use of the channel. For example, a single flow channel starting at a sample inlet port may be separated into a variety of smaller channels, such that the original sample is divided into discrete subsamples for parallel processing or analysis. Alternatively, several flow channels from different modules, for example, the sample inlet port and a reagent storage module (e.g., a nanoparticle storage module) may feed together (i.e., converge). As will be appreciated by those in the art, there are a large number of possible configurations; what is important is that the flow channels allow the movement of sample and reagents from one part of the device to another. For example, the path lengths of the flow channels may be altered as needed; for example, when mixing and timed reactions are required, longer flow channels can be used.

**[0042]** In one embodiment, the devices of the disclosure include at least one inlet port for the introduction of a sample to the device. This may be part of or separate from a sample introduction or a sample mixing chamber.

**[0043]** In another aspect of the disclosure, the devices of the disclosure may include a manipulation chamber/well that allows for the mixing of probes and a fluid sample. Optionally, an aggregation stimulant (such as a salt) can be mixed in the manipulation chamber.

**[0044]** In addition to individual straight channels, a functional microfluidic circuit often consists of channel junctions. The positioning of liquid flow at channel junctions can include valve systems.

**[0045]** A fluid device of the disclosure comprises a substrate (which may be one or more substrates associated with one another to define fluid channels there between). The fluid device can comprise a sample inlet in fluid communication with sample fluid flow channel and buffer inlet in fluid communication with buffer fluid flow channel.

**[0046]** In one embodiment, substrate comprises an insulating (e.g. glass or polymer), or a semiconducting (e.g. silicon structures) in which various features (e.g., channels, chambers, valves and the like) are designed. Such features can be made by forming those features into a surface and/or a sub-surface structure of substrate using microfabrication techniques known to those skilled in the art.

**[0047]** By extending the above channels and adding more sorting regions downstream, the disclosure provides sorting devices with multi-stage purification. In one aspect, the disclosure provides methods and systems that utilize massive parallelism and multistaging. This allows full utilization of the central benefits of microfabrication technology to achieve high throughput, purity and recovery simultaneously.

**[0048]** Microfabrication technologies provide the ability to implement multiple staging and massive parallelism on a single chip, thus allowing for the production of inexpensive, disposable, flexible, and portable devices.

**[0049]** The devices, systems, methods and techniques can be used to measure any number of agents in any number of industrial applications. The devices, systems and method of the disclosure offer ease of use, speed, and identification of analytes in a portable, relatively inexpensive implementation. Thus, a wide variety of analytes can be identified and analyzed by the disclosed devices, methods and systems. Detectable analyte include broad ranges of chemical classes such as organics including, for example, alkanes; alkenes; alkynes; dienes; alicyclic hydrocarbons; arenes; alcohols; ethers; ketones; aldehydes; carbonyls; carbanions; sugars; biogenic amines; thiols; polynuclear aromatics and derivatives of such organics, e.g., halide derivatives, and the like; biomolecules such as proteins, DNA, RNA, hormones, other signaling components of the endocrine and other biosystems, components of biotissues, blood, and other biofluids; isoprenes and isoprenoids; and fatty acids and derivatives. Accordingly, commercial applications include environmental toxicology and remediation, biomedicine, materials quality control, food (and beverage) and agricultural products monitoring, the presence of wine freshness or bottling, cork or barrel contamination (by contaminants such as 2,4,6-trichloroanisole (TCA) guaiacol, geosmin, 2-methylisoborneol (MIB), octen-3-ol and octen-3-onein), measuring cadaverine for rapid assessment of bacterial quality and/or food spoilage, anaesthetic detection, automobile oil, gasoline, fuel or radiator fluid monitoring, breath alcohol and drug analyzers, hazardous spill identification, explosives detection, biowarfare detection, fugitive emission identification, medical diagnostics, glucose monitoring, fish freshness, detection and classification of bacteria and microorganisms for biomedical uses and medical diagnostic uses, and the like. A wide variety of commercial applications are available including, but not limited to, heavy industrial manufacturing, ambient air monitoring, worker protection, emissions control, product quality testing, leak detection and identification, oil/gas petrochemi-