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TECHNOLOGY LICENSING OPPORTUNITIES

Method and device for small scale reactions

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Invention Summary

A system and device for small scale reactions of samples. Magnetic particles adhering/binding to specific compounds in the sample are transferred between different working stations or spots located on the device.

Background

There are many sample preparation methods used today. For example, electrophoresis is a widely used method for sample preparation of proteins and peptides. However, for sample preparation, electrophoresis is cumbersome and time consuming. Another drawback is that the sample must be eluted from the gel if further analysis of the sample is required.

Another example of sample preparation is liquid chromatography separation. The drawback with liquid chromatography is that it is less suited for handling very small amounts of sample. The limitation in handling small amounts of sample with chromatographic methods is in part overcome by using so called micro spin columns.

Other techniques that are currently in use for sample preparation of very small sample amounts make use of pre-coated microtiter plates. These plates can be prepared with ligands that can remove bulk impurities as well as be used for specific isolation of target components.

Yet another sample preparation approach is based on the use of magnetic beads. Magnetic beads are also available with ligands suited for removal of bulk proteins or isolation of specific target components. These materials are commonly handled in test tubes in combination with a manual pipetting procedure.

Various types of microfluidic systems have also been described for sample preparation and other manipulations. A drawback in many of these is that the macro/micro interface becomes inconvenient, i.e. the transfer of a macroscopic (microliter/milliliter) sample into channels of nano/picoliter dimensions is a weak spot in the system. Further, they are often not well suited for handling small amounts of particulate materials.

Technology

This technology encompasses a method and a device for small scale reactions, such as sample preparation of a desired substance in a sample. Samples mixed with functionalized magnetic particles are magnetically transferred between different working stations on the device. In this way a desired component of the sample can be separated from the remainder of the sample and/or impurities may be removed from a target component. The invention also has broader implications on sample manipulation in general. It may be applied wherever small amounts of magnetic particles with bound/adhering substances need to be moved, divided, separated, mixed, washed or reacted with different solutions.

The method uses a hydrophobic surface, such as a Petri dish, provided with hydrophilic spots of, for example, agarose beads located on the hydrophobic surface and provided with buffers, reactants or ligands.

Small scale reactions can be performed by: (a) adding functionalized magnetic particles to a sample to perform a first reaction on a first hydrophilic spot provided with buffers(s), reactant(s) and/or ligand(s), where the hydrophilic spot is located on a hydrophobic surface and where the magnetic particles are functionalized to bind/adhere to at least one target compound in the sample, and (b) magnetically transferring the magnetic particles with or without bound target to a second hydrophilic spot on the hydrophobic surface for a further reaction of the sample, where said second hydrophilic spot is provided with buffers(s), reactant(s) and/or ligand(s).

- The hydrophobic surface of the device can be a polymer film, a Petri dish, a planar slide, a microfabricated device or a multiwell plate.
- The magnetic beads or particles may be functionalised with affinity ligands, metal chelating ligands, ion exchange ligands, hydrophobic ligands and/or reactive groups. Depending on the application the magnetic beads or particles can be made biocompatible, i.e. provided with biocompatible outer layer(s) preventing metal leakage.
- The means to be provided beneath or above the hydrophobic surface is a handheld magnet or an automatically directed magnet or a magnetic field produced by one or more electromagnet coils.

Figure 1: shows a schematic example of the device of the invention comprising a polystyrene surface with hydrophilized spots or stations with buffer droplets.

Figure 2: shows another schematic embodiment of the device of the invention

Figure 3: shows a further schematic embodiment of the device of the invention.

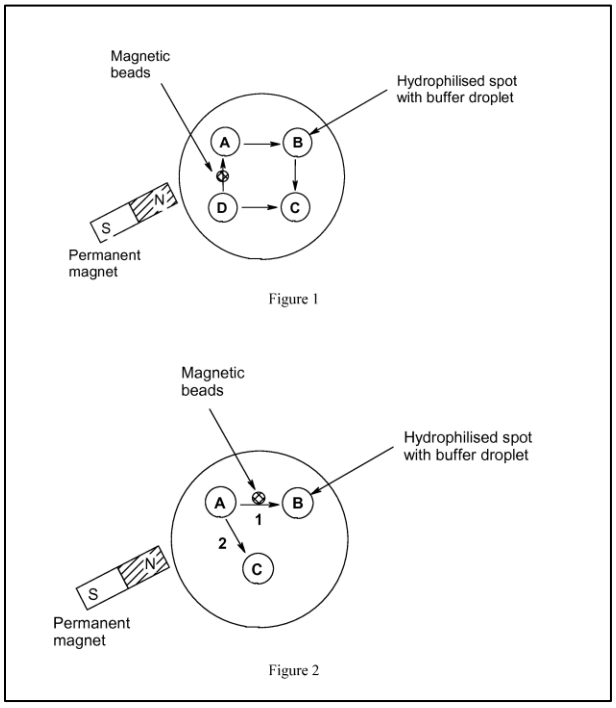

Figure 1

Figure 2

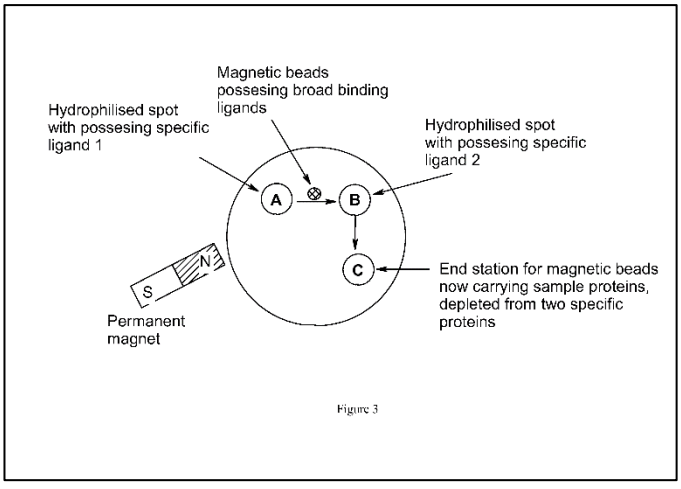

Figure 3