

tact with the separation channel is provided. The device comprises a pressure sensor, a high pressure reservoir, a low pressure reservoir, and pumping device for pumping a gas from the low pressure reservoir to the high pressure reservoir. The pressure sensor is in fluid contact with the buffer reservoir, wherein the pressure sensor detects the pressure of the fluid. The high pressure reservoir is in selective fluidic communication with the buffer reservoir and in fluidic communication with the high pressure reservoir. The device comprises a first operating condition, a second operating condition, and a third operating condition, in which the high pressure reservoir is in fluid communication with the buffer reservoir in the first operating condition, such that the buffer reservoir reaches a threshold pressure, the buffer reservoir is in fluid communication with the low pressure reservoir in the second operating condition, such that a pressure ramp over time is initiated such that the pressure is varied from a starting pressure value to an ending pressure value, and the high pressure reservoir is in fluid communication with the buffer reservoir in the third operating condition, such that the buffer reservoir reaches a final pressure level, wherein the variable bulk flow of the fluid is varied.

In another embodiment, a method of varying with respect to time the bulk flow of a fluid in a separation channel of an electrophoretic device which comprises utilizing the device for varying with respect to time the bulk flow of a fluid in a separation channel of electrophoretic device having a buffer reservoir in fluid contact with the separation channel according to the present invention is provided.

These and other features and advantages of these and other various embodiments according to the present invention will become more apparent in view of the drawings, detailed description, and claims provided herein.

BRIEF DESCRIPTION OF THE DRAWINGS

The following detailed description of the embodiments of the present invention can be better understood when read in conjunction with the following drawings, where like structure is indicated with like reference numerals, and in which:

FIG. 1 is a schematic of a gradient elution moving boundary electrophoresis ("GEMBE") device which can be used in accordance with embodiments of the present invention;

FIG. 2 is a graph of detector response with respect to time for the separation of acetylcholine (~500 μM) and choline in an acetylcholinesterase assay at which the concentration of acetylcholinesterase was ~10.4 nM using a GEMBE device and is a graph of the derivative of the detector response with respect to time for the separation of acetylcholine (~500 μM) and choline in an acetylcholinesterase assay using a GEMBE device;

FIG. 3 is a graph of the derivative of the detector response with respect to time for the separation of acetylcholine (~500 μM) and choline in an acetylcholinesterase assay at which the concentration of acetylcholinesterase was ~10.4 nM using a GEMBE device in a control sample and is a graph of the derivative of the detector response with respect to time for the separation of acetylcholine (~500 μM) and choline in an acetylcholinesterase assay using a GEMBE device in the presence of malaoxon (~1 mM);

FIG. 4A is a graph of the derivative of the detector response with respect to time for the separation of acetylcholine (~500 μM) and choline in an acetylcholinesterase assay at which the concentration of acetylcholinesterase was ~10.4 nM using a GEMBE device in a control sample, wherein the GEMBE device was run for four cycles;

FIG. 4B is a graph of the derivative of the detector response with respect to time for the separation of acetylcholine (~500 μM) and choline in an acetylcholinesterase assay at which the

concentration of acetylcholinesterase was ~10.4 nM using a GEMBE device in the presence of malaoxon (~1 mM), wherein the GEMBE device was run for four cycles;

FIG. 5 is a graph of a dose response curve for acetylcholinesterase activity with respect to the concentration of malaoxon;

FIG. 6 is a graph of the conversion rate of acetylcholine (~500 μM) to choline in an acetylcholinesterase assay at which the concentration of acetylcholinesterase was ~10.4 nM with respect to the concentration of malaoxon which demonstrates the limit of detection;

FIG. 7 is a graph of the conversion rate of acetylcholine (~500 μM) to choline in an acetylcholinesterase assay at which the concentration of acetylcholinesterase was ~10.4 nM in apple juice (10 \times dilution) with respect to the concentration of malaoxon which demonstrates the limit of detection;

FIG. 8 is a graph of the conversion rate of acetylcholine (~500 μM) to choline in an acetylcholinesterase assay at which the concentration of acetylcholinesterase was ~10.4 nM in whole milk (10 \times dilution) with respect to the concentration of malaoxon which demonstrates the limit of detection;

FIG. 9 is a graph of the conversion rate of acetylcholine (~500 μM) to choline in an acetylcholinesterase assay at which the concentration of acetylcholinesterase was ~10.4 nM in soil (added as a slurry to the reaction medium) with respect to the concentration of malaoxon which demonstrates the limit of detection;

FIG. 10 is a graph of a dose response curve for acetylcholinesterase activity with respect to the concentration of tacrine;

FIG. 11 is a graph of the conversion rate of acetylcholine (~500 μM) to choline in an acetylcholinesterase assay at which the concentration of acetylcholinesterase was ~10.4 nM with respect to the concentration of tracrine which demonstrates the limit of detection;

FIG. 12 is a schematic of a device for varying with respect to time the bulk flow of a fluid in a separation channel of an electrophoretic device according to an embodiment of the present invention;

FIG. 13 is a schematic of a device for varying with respect to time the bulk flow of a fluid in a separation channel of an electrophoretic device according to an embodiment of the present invention;

FIG. 14 depicts a GEMBE device for varying with respect to time the bulk flow of a fluid in a separation channel of an electrophoretic device according to an embodiment of the present invention;

FIG. 15A is a graph of detector response with respect to time for the separation of potassium chloride, calcium chloride, sodium chloride, magnesium chloride, and lithium chloride for 0 $\mu\text{mol/L}$, 3 $\mu\text{mol/L}$, 10 $\mu\text{mol/L}$, 30 $\mu\text{mol/L}$, 100 $\mu\text{mol/L}$, and 300 $\mu\text{mol/L}$ using a GEMBE device;

FIG. 15B is a graph of the derivative of the detector response with respect to time for the separation of potassium chloride, calcium chloride, sodium chloride, magnesium chloride, and lithium chloride for 0 $\mu\text{mol/L}$, 3 $\mu\text{mol/L}$, 10 $\mu\text{mol/L}$, 30 $\mu\text{mol/L}$, 100 $\mu\text{mol/L}$, and 300 $\mu\text{mol/L}$ using a GEMBE device; and

FIG. 16 is a graph of the derivative of the detector response with respect to time for the analysis of milk, dirt, estuarine sediment, coal fly ash, tomato leaf, peach leaf, and citrus leaf with potassium "A", calcium "B", sodium "C", and magnesium "D", using a GEMBE device at an applied voltage of 400 V/cm and applied pressure starting between 47 and 57 kPa and decreasing 100 Pa/s.

Skilled artisans appreciate that elements in the figures are illustrated for simplicity and clarity and are not necessarily drawn to scale. For example, the dimensions of some of the