CLAIMS

1. A method for electrochemically monitoring the mobility of particles in a fluid in response to an external field, the method comprising:

monitoring an electrical characteristic of the fluid in an electrochemical cell, the fluid comprising particles that can be moved under the influence of an externally applied field;

observing changes in the electrical characteristic caused by particle movement induced by the external field; and

inferring a change in the physical state of the fluid or the particles from a change in the magnitude of the electrical characteristic observed.

2. The method of claim 1, wherein the fluid further comprises at least one soluble electroactive species that is capable of being oxidized or reduced at an electrode in the electrochemical cell.

3. The method of claim 2, wherein the electrical characteristic being measured is the electrochemical current by amperometry.

4. The method of claim 2, wherein the electroactive species are salts of ferricyanide and ferrocyanide.

5. The method of claim 2, wherein the particles are magnetic and move in response to a changing external magnetic field.

6. The method of claim 2, wherein the fluid is whole blood or plasma and the change in physical state of the blood or plasma is due to coagulation.

7. The method of claim 6, wherein the particles are magnetic and move in response to a changing external magnetic field and the electrical characteristic is the electrochemical current, wherein an algorithm is adapted to identify peaks in the electrochemical current that are caused by magnetic particle movement and determine the clotting time of blood or plasma.

8. The method of claim 7, wherein the algorithm defines the clot time based on when the n^{th} percentile of the data around each point falls below a predetermined threshold, where the n^{th} percentile is in the range of 50-100^{th} percentile.

9. The method of claim 8, wherein the n^{th} percentile is around the 80^{th} percentile.

10. The method of claim 7, wherein the algorithm calculates the height of peaks in current and defines the clot time based on when the peak height falls below a predetermined threshold.

11. The method of claim 7, wherein the algorithm makes peaks in current easier to identify by calculating $i_t-i_{t-2}+i_t-i_{t-1}+i_t-i_{t+2}+i_t-i_{t+1}$ or $i_t-i_{t-1}+i_t-i_{t+1}$, where i_t is the current measured at a given point in time and i_{t-1} the current measured one time point earlier; i_{t-2}, two time points earlier; i_{t+1}, one time point later and i_{t+2}, two time points later.

12. The method of claim 7, wherein the algorithm determines if a peak in current occurred within a predetermined time of changing the magnetic field and defines the clot time based on whether such a peak is under a predetermined threshold.

13. The method of claim 2, wherein the electrochemical cell comprises a strip comprising two electrodes.

14. The method of claim 13, wherein said two electrodes are parallel to each other and are separated by 0.05 to 0.5 mm, preferably 0.075-0.15 mm, and most preferably 0.09-0.13 mm.

15. The method of claim 13, wherein said two or more electrodes are coplanar.

16. The method of claim 13, wherein said two electrodes are separated by an electrically insulating layer, where the layer has a cavity cut in it to receive the analyte liquid, as well as an entry port to allow the liquid to enter the cavity and an exit port for the displaced air.

17. The method of claim 13, wherein said strip also contains one or more clotting factors which replace the deficient clotting factors in the sample.

18. A device for electrochemically monitoring the mobility of particles in a fluid in response to an external field using a meter, the device comprising a strip comprising two electrodes, a fluid receiving area, and a meter connection area, wherein said strip is coupled to the meter via said meter connection area.

19. The device according to claim 18, wherein the device further comprises a meter comprising a connector for electrically coupling to said electrodes at the meter connection area of said strip, and circuitry for monitoring an electrical characteristic of the fluid in contact with said electrodes.

20. A device for electrochemically monitoring the mobility of particles in a fluid in response to an external field using a strip in contact with the fluid, the strip having a plurality of electrodes, the device comprising a meter comprising a connector electrically coupling to the electrodes at a meter connection area of the strip, and circuitry monitoring an electrical characteristic of the fluid in contact with the electrodes.

21. The device according to claim 20, wherein the device further comprises a strip comprising the plurality of electrodes, a fluid receiving area and the meter connection area.

CLAIMS

1. A method for electrochemically monitoring the mobility of particles in a fluid in response to an external field, the method comprising:

monitoring an electrical characteristic of the fluid in an electrochemical cell, the fluid comprising particles that can be moved under the influence of the external field, wherein the particles are magnetic, wherein the external field comprises a changing external magnetic field;

observing the electrical characteristic caused by particle movement induced by the external field, wherein the magnitude of the electrical characteristic can change due to a change in the mobility of the particles; and

detecting a change in the physical state of the fluid or in the mobility of the particles from a change in the magnitude of the electrical characteristic observed.

2. The method of claim 1, wherein the fluid further comprises at least one soluble electroactive species that is capable of being oxidized or reduced at an electrode in the electrochemical cell.

3. The method of claim 2, wherein the electrical characteristic being measured is the electrochemical current by amperometry.

4. The method of claim 2 or claim 3, wherein the electroactive species are salts of ferricyanide and ferrocyanide.

5. The method of any one of claims 2 to 4, wherein the fluid is whole blood or plasma and the change in the physical state of the blood or plasma is due to coagulation.

6. The method of claim 5, wherein the electrical characteristic is the electrochemical current, wherein an algorithm is adapted to identify peaks in the electrochemical current that are caused by magnetic particle movement and determine the clotting time of blood or plasma.

7. The method of claim 6, wherein the algorithm defines the clot time based on when the n^{th} percentile of the data around each point falls below a predetermined threshold, where the n^{th} percentile is in the range of 50-100^{th} percentile.

8. The method of claim 7, wherein the n^{th} percentile is around the 80^{th} percentile.

9. The method of claim 6, wherein the algorithm calculates the height of peaks in current and defines the clot time based on when the peak height falls below a predetermined threshold.

10. The method of claim 6, wherein the algorithm makes peaks in current easier to identify by calculating $i_t-i_{t-2}+i_t-i_{t-1}+i_t-i_{t+2}+i_t-i_{t+1}$ or $i_t-i_{t-1}+i_t-i_{t+1}$, where i_t is the current measured at a given point in time and i_{t-1} the current measured one time point earlier; i_{t-2}, two time points earlier; i_{t+1}, one time point later and i_{t+2}, two time points later.

11. The method of claim 6, wherein the algorithm determines if a peak in current occurred within a predetermined time of changing the magnetic field and defines the clot time based on whether such a peak is under a predetermined threshold.

12. The method of any one of claims 2 to 11, wherein the electrochemical cell comprises a strip comprising two electrodes.

13. The method of claim 12, wherein said two electrodes are parallel to each other and are separated by 0.05 to 0.5 mm, preferably 0.075-0.15 mm, and most preferably 0.09-0.13 mm.

14. The method of claim 12, wherein said two electrodes are coplanar.

15. The method of claim 12 or claim 13, wherein said two electrodes are separated by an electrically insulating layer, where the layer has a cavity cut in it to receive the analyte liquid,

as well as an entry port to allow the liquid to enter the cavity and an exit port for the displaced air.

16. The method of any one of claims 12 to 15, wherein the fluid is whole blood or plasma and the change in the physical state of the blood or plasma is due to coagulation, wherein the fluid is deficient in a clotting factor, wherein the strip contains one or more clotting factors which can replace the deficient clotting factors in the fluid.

17. A device for electrochemically monitoring the mobility of particles in a fluid in response to an external field according to claim 1, the device comprising a strip comprising two or more electrodes, a fluid receiving area, and a meter connection area.

18. The device according to claim 17, wherein the device further comprises a meter comprising a connector for electrically coupling to said electrodes at the meter connection area of said strip, and circuitry for monitoring an electrical characteristic of the fluid in contact with said electrodes.

19. The device according to claim 18, wherein the meter comprises a magnet.

20. The device according to claim 19, wherein the magnet is an electromagnet.

21. The device according to claim any one of claims 18 to 20, wherein the meter comprises an ammeter.

22. The device according to any one of claims 17 to 21, wherein the two or more electrodes are parallel to each other or co-planar.

23. The device according to any one of claims 17 to 22, wherein the strip comprises at least one reagent selected from the group consisting of a clotting factor, a coagulation reagent, a magnetic particle, and an electroactive species.

24. The device according to claim 23, wherein the coagulation reagent comprises at least one reagent selected from the group consisting of a thromboplastin, snake venom, a contact activator, a phospholipid.

25. A method for electromechanically monitoring the mobility of particles in a fluid in response to an external field substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.

26. A device for electrochemically monitoring the mobility of particles in a fluid in response to an external field substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.