## CLAIMS

1. Apparatus for the treatment of an aqueous organic waste liquid to provide a treated liquid containing less organic matter, the apparatus comprising

a treatment reservoir defining first and second treatment zones separated by a porous membrane,

carbon-based adsorbent material capable of electrochemical regeneration provided in said first and second treatment zones,

an agitator operable to distribute the carbon-based adsorbent material in aqueous organic waste liquid contained in each of the first and second treatment zones,

a first electric current feeder operably connected to the carbon-based adsorbent material in the first treatment zone and a second electric current feeder operably connected to the carbon-based adsorbent material in the second treatment zone, and

a controller to operate the first and second electric current feeders to pass an electric current through the carbon-based adsorbent material in the first and second treatment zones in one direction to regenerate the carbon-based adsorbent material in one of the first and second treatment zones and to then reverse the direction of the current applied to the carbon-based adsorbent material in the first and second treatment zones to regenerate the carbon-based adsorbent material in the other of the first and second treatment zones.

2. Apparatus according to claim 1, wherein the agitator comprises a chamber under the treatment reservoir defining one or more inlets and a pump to deliver fluid under pressure through said inlet(s).

3. Apparatus according to claim 1 or 2, wherein a lower section of the treatment reservoir defines a smaller horizontal cross-sectional area than an upper section of the treatment reservoir.

4. Apparatus according to claim 1, 2 or 3, wherein the porous membrane is configured to prevent carbon-based adsorbent material from passing between the first and second treatment zones but to permit water and/or ionic species to pass between the first and second treatment zones.

5. Apparatus according to any preceding claim, wherein the carbon-based adsorbent material is an unexpanded graphite intercalation compound and/or activated carbon.

6. Apparatus according to any preceding claim, wherein the carbon-based adsorbent material is in powder or flake form.

7. Apparatus according to any one of claims 1 to 6, wherein the apparatus is configured to deliver an electric current of 1 to 10 amps.

8. Apparatus according to claim 7, wherein the apparatus is configured to deliver an electric current of around 5 amps.

9. A method for the treatment of an aqueous organic waste liquid to provide a treated liquid containing less organic matter, the method comprising

admitting the aqueous organic waste liquid into first and second treatment zones of a treatment reservoir, the first and second treatment zones being separated by a porous membrane, each treatment zone containing carbon-based adsorbent material capable of electrochemical regeneration;

distributing the carbon-based adsorbent material in the aqueous organic waste liquid within each treatment zone;

allowing the carbon-based adsorbent material to settle within each treatment zone;

operating first and second electric current feeders operably connected to the first and second treatment zones respectively to pass an electric current in one direction through the carbon-based adsorbent material within each treatment zone to regenerate the carbon-based adsorbent material in one of the first and second treatment zones; and

operating the first and second electric current feeders to reverse the direction of the current applied to the carbon-based adsorbent material in the first and second treatment zones to regenerate the carbon-based adsorbent material in the other of the first and second treatment zones.

10. A method according to claim 9, wherein the steps of distributing the carbon-based adsorbent material in the aqueous organic waste liquid and allowing the carbon-based adsorbent material to settle are repeated one or more times to remove organic matter from the aqueous organic waste liquid prior to operating the first and second

electric current feeders to reverse the direction of the current applied to the carbon-based adsorbent material.

11. A method according to claim 9 or 10, wherein the steps of distributing the carbon-based adsorbent material in the aqueous organic waste liquid and allowing the carbon-based adsorbent material to settle are repeated one or more times to remove organic matter from the aqueous organic waste liquid prior to removing the treated liquid from the treatment reservoir.

12. A method according to claim 9, 10 or 11, wherein the or each cycle of distribution and settling steps is effected over a time period of 1 to 60 minutes.

13. A method according to claim 9, 10 or 11, wherein the or each cycle of distribution and settling steps is effected over a time period of around 20 minutes.

14. A method according to any one of claims 9 to 13, wherein distribution of the carbon-based adsorbent material is effected by admitting a fluid under pressure into the carbon-based adsorbent material.

15. A method according to claim 14, wherein the fluid comprises air and/or aqueous organic waste liquid in need of treatment.

16. A method according to any one of claims 9 to 15, wherein the current feeders are operated to provide a pH of less than 7 in the treated liquid.

17. A method according to any one of claims 9 to 15, wherein the current feeders are operated to provide a pH of around 1 to 4 in the treated liquid.

18. A method according to any one of claims 9 to 17, wherein charged inorganic species are generated during the passage of the electric current through the carbon-based adsorbent material in the first and second treatment zones and the current feeders are operated to minimise the electrodeposition of said charged inorganic species on the current feeders during operation.

19. A method according to any one of claims 9 to 18, wherein the first and second current feeders are operated to pass the electric current through the carbon-based

adsorbent material in the treatment zones in said one direction for a time period of 1 to 240 minutes.

20. A method according to claim 19 wherein the first and second current feeders are operated to pass the electric current through the carbon-based adsorbent material in the treatment zones in said one direction for a time period of around 5 minutes.

21. A method according to any one of claims 9 to 20, wherein the first and second current feeders are operated to pass the electric current through the carbon-based adsorbent material in the treatment zones in said other direction for a time period of 1 to 240 minutes.

22. A method according to claim 21 wherein the first and second current feeders are operated to pass the electric current through the carbon-based adsorbent material in the treatment zones in said other direction for a time period of around 5 minutes.

23. A method according to any one of claims 9 to 22, wherein the first and second current feeders are operated to apply an electric current density of around 1 to 30 $mAcm^{-2}$ to the carbon-based adsorbent material in each treatment zone.

24. A method according to any one of claims 9 to 23, wherein an electrolyte is provided in the treatment reservoir.

25. A method according to any one of claims 9 to 24, wherein the aqueous organic waste liquid contains radioactive species.

26. A method according to claim 25, wherein said radioactive species are present in said treated liquid.

27. A method according to any one of claims 9 to 26, wherein the carbon-based adsorbent material is an unexpanded graphite intercalation compound and/or activated carbon.

28. A method according to any one of claims 9 to 27, wherein the carbon-based adsorbent material is in powder or flake form.

29. A method according to any one of claims 9 to 28, wherein said electric current is 1 to 10 amps.

30. A method according to claim 29, wherein said electric current is around 5 amps.

31. Apparatus for the continuous treatment of an aqueous organic waste liquid to provide a treated liquid containing less organic matter, the apparatus comprising

a treatment reservoir defining first and second treatment zones separated by a porous membrane,

carbon-based adsorbent material capable of electrochemical regeneration provided in said first and second treatment zones,

a pump operable to admit aqueous organic waste liquid selectively into each of said first and second treatment zones to contact carbon-based adsorbent material in the respective treatment zone at a flow rate which is sufficiently high to pass the aqueous organic waste liquid through the carbon-based adsorbent material but below the flow rate required to fluidise the carbon-based adsorbent material,

a first electric current feeder operably connected to the carbon-based adsorbent material in the first treatment zone and a second electric current feeder operably connected to the carbon-based adsorbent material in the second treatment zone, and

a controller to operate the first and second electric current feeders to pass an electric current through the carbon-based adsorbent material in the first and second treatment zones in one direction to regenerate the carbon-based adsorbent material in one of the first and second treatment zones and to then reverse the direction of the current applied to the carbon-based adsorbent material in the first and second treatment zones to regenerate the carbon-based adsorbent material in the other of the first and second treatment zones.

32. Apparatus according to claim 31, wherein the apparatus comprises one or more spaced inlets through which the contaminated liquid is admitted under pressure into the bed of adsorbent material.

33. Apparatus according to claim 32, wherein the apparatus comprises a plurality of said inlets spaced apart by a sufficient distance to establish a corresponding plurality of discrete liquid flow paths through the adsorbent bed.

34. Apparatus according to claim 33, wherein the spacing of the plurality of inlets is sufficient to define a region around each liquid flow path through which adsorbent material that has adsorbed contaminant can flow so as to define a discrete, endless stream of adsorbent material within the bed of adsorbent material.

35. Apparatus according to any one of claims 31 to 34, wherein the apparatus comprises a reservoir in fluid communication with the adsorbent bed, the reservoir being adapted to receive liquid from the bed which has been contacted by the adsorbent material.

36. Apparatus according to any one of claims31 to 35, wherein the carbon-based adsorbent material is an unexpanded graphite intercalation compound and/or activated carbon.

37. Apparatus according to any one of claims 31 to 36, wherein the carbon-based adsorbent material is in powder or flake form.

38. Apparatus according to any one of claims 31 to 37, wherein the apparatus is configured to admit aqueous organic waste liquid at a flow rate of 1 to 500 L per hour.

39. Apparatus according to claim 38, wherein the apparatus is configured to admit aqueous organic waste liquid at a flow rate of around 150 L per hour.

40. A method for the continuous treatment of an aqueous organic waste liquid to provide a treated liquid containing less organic matter, the method comprising

operating a pump to admit aqueous organic waste liquid into a first treatment zone of a treatment reservoir which also includes a second treatment zone, the first and second treatment zones being separated by a porous membrane, the aqueous organic waste liquid being admitted into said first treatment zone to contact carbon-based adsorbent material in a bed in the first treatment zone at a flow rate which is sufficiently high to pass the aqueous organic waste liquid through the bed carbon-based adsorbent material but below the flow rate required to fluidise the bed of carbon-based adsorbent material;

operating first and second electric current feeders operably connected to the first and second treatment zones respectively to pass an electric current in one

direction through the carbon-based adsorbent material within each treatment zone to regenerate the carbon-based adsorbent material in said first treatment zone;

operating the pump to admit aqueous organic waste liquid into said second treatment zone to contact carbon-based adsorbent material in a bed in the second treatment zone at a flow rate which is sufficiently high to pass the aqueous organic waste liquid through the bed of carbon-based adsorbent material but below the flow rate required to fluidise the bed of carbon-based adsorbent material; and

operating the first and second electric current feeders to reverse the direction of the current applied to the carbon-based adsorbent material in the first and second treatment zones to regenerate the carbon-based adsorbent material in the second treatment zone.

41. A method according to claim 40, wherein the aqueous organic waste liquid is admitted under pressure through one or more inlets into each bed of carbon-based adsorbent material.

42. A method according to claim 41, wherein the aqueous organic waste liquid is admitted through a plurality of said inlets spaced apart by a sufficient distance to establish a corresponding plurality of discrete liquid flow paths through the bed of carbon-based adsorbent material in each treatment zone.

43. A method according to claim 42, wherein the spacing of the plurality of inlets is sufficient to define a region around each liquid flow path through which carbon-based adsorbent material that has adsorbed contaminant can flow so as to define a discrete, endless stream of carbon-based adsorbent material within each bed of carbon-based adsorbent material.

44. A method according to any one of claims 40 to 43, wherein liquid that has contacted the carbon-based adsorbent material is passed to a reservoir in fluid communication with the corresponding bed of carbon-based adsorbent material.

45. A method according to any one of claims 40 to 44, wherein the current feeders and the pump are operated to provide a pH of approximately 7 in the treated liquid.

46. A method according to any one of claims 40 to 45, wherein charged inorganic species are generated during the passage of the electric current through the carbon-based adsorbent material in the first and second treatment zones and the current

feeders and pump are operated to minimise the electrodeposition of said charged inorganic species on the current feeders during operation.

47. A method according to any one of claims 40 to 46, wherein the carbon-based adsorbent material is an unexpanded graphite intercalation compound and/or activated carbon.

48. A method according to any one of claims 40 to 47, wherein the carbon-based adsorbent material is in powder or flake form.

49. A method according to any one of claims 40 to 48, wherein said electric current is 1 to 10 amps.

50. A method according to claim 49, wherein said electric current is around 5 amps.

51. A method according to any one of claims 40 to 50, wherein the first and second current feeders are operated to pass the electric current through the carbon-based adsorbent material in the treatment zones in said one direction for a time period of 1 to 240 minutes.

52. A method according to claim 51 wherein the first and second current feeders are operated to pass the electric current through the carbon-based adsorbent material in the treatment zones in said one direction for a time period of around 5 minutes.

53. A method according to any one of claims 40 to 52, wherein the first and second current feeders are operated to pass the electric current through the carbon-based adsorbent material in the treatment zones in said other direction for a time period of 1 to 240 minutes.

54. A method according to claim 53 wherein the first and second current feeders are operated to pass the electric current through the carbon-based adsorbent material in the treatment zones in said other direction for a time period of around 5 minutes.

55. A method according to any one of claims 40 to 54 wherein the aqueous organic waste liquid is admitted at a flow rate of 1 to 500 L per hour.

56. A method according to claim to 55 wherein the aqueous organic waste liquid is admitted at a flow rate of around 150 L per hour.

## CLAIMS

1. Apparatus for the treatment of an aqueous organic waste liquid to provide a treated liquid containing less organic matter, the apparatus comprising

a treatment reservoir defining first and second treatment zones separated by a porous membrane,

carbon-based adsorbent material capable of electrochemical regeneration provided in said first and second treatment zones,

an agitator operable to distribute the carbon-based adsorbent material in aqueous organic waste liquid contained in each of the first and second treatment zones,

a first electric current feeder operably connected to the carbon-based adsorbent material in the first treatment zone and a second electric current feeder operably connected to the carbon-based adsorbent material in the second treatment zone, and

a controller to operate the first and second electric current feeders to pass an electric current through the carbon-based adsorbent material in the first and second treatment zones in one direction to regenerate the carbon-based adsorbent material in one of the first and second treatment zones and to then reverse the direction of the current applied to the carbon-based adsorbent material in the first and second treatment zones to regenerate the carbon-based adsorbent material in the other of the first and second treatment zones.

2. Apparatus according to claim 1, wherein the agitator comprises a chamber under the treatment reservoir defining one or more inlets and a pump to deliver fluid under pressure through said inlet(s).

3. A method for the treatment of an aqueous organic waste liquid to provide a treated liquid containing less organic matter, the method comprising

admitting the aqueous organic waste liquid into first and second treatment zones of a treatment reservoir, the first and second treatment zones being separated by a porous membrane, each treatment zone containing carbon-based adsorbent material capable of electrochemical regeneration;

distributing the carbon-based adsorbent material in the aqueous organic waste liquid within each treatment zone;

allowing the carbon-based adsorbent material to settle within each treatment zone;

operating first and second electric current feeders operably connected to the first and second treatment zones respectively to pass an electric current in one direction through the carbon-based adsorbent material within each treatment zone to regenerate the carbon-based adsorbent material in one of the first and second treatment zones; and

operating the first and second electric current feeders to reverse the direction of the current applied to the carbon-based adsorbent material in the first and second treatment

zones to regenerate the carbon-based adsorbent material in the other of the first and second treatment zones.

4. A method according to claim 3, wherein the steps of distributing the carbon-based adsorbent material in the aqueous organic waste liquid and allowing the carbon-based adsorbent material to settle are repeated one or more times to remove organic matter from the aqueous organic waste liquid prior to operating the first and second electric current feeders to reverse the direction of the current applied to the carbon-based adsorbent material.

5. A method according to claim 3 or 4, wherein the steps of distributing the carbon-based adsorbent material in the aqueous organic waste liquid and allowing the carbon-based adsorbent material to settle are repeated one or more times to remove organic matter from the aqueous organic waste liquid prior to removing the treated liquid from the treatment reservoir.

6. A method according to any one of claims 3 to 5, wherein charged inorganic species are generated during the passage of the electric current through the carbon-based adsorbent material in the first and second treatment zones and the current feeders are operated to minimise the electrodeposition of said charged inorganic species on the current feeders during operation.

7. A method according to any one of claims 3 to 6, wherein the aqueous organic waste liquid contains radioactive species.

8. Apparatus for the continuous treatment of an aqueous organic waste liquid to provide a treated liquid containing less organic matter, the apparatus comprising

a treatment reservoir defining first and second treatment zones separated by a porous membrane,

carbon-based adsorbent material capable of electrochemical regeneration provided in said first and second treatment zones,

a pump operable to admit aqueous organic waste liquid selectively into each of said first and second treatment zones to contact carbon-based adsorbent material in the respective treatment zone at a flow rate which is sufficiently high to pass the aqueous organic waste liquid through the carbon-based adsorbent material but below the flow rate required to fluidise the carbon-based adsorbent material,

a first electric current feeder operably connected to the carbon-based adsorbent material in the first treatment zone and a second electric current feeder operably connected to the carbon-based adsorbent material in the second treatment zone, and

a controller to operate the first and second electric current feeders to pass an electric current through the carbon-based adsorbent material in the first and second treatment zones in one direction to regenerate the carbon-based adsorbent material in one of the first and second treatment zones and to then reverse the direction of the current applied to the

carbon-based adsorbent material in the first and second treatment zones to regenerate the carbon-based adsorbent material in the other of the first and second treatment zones.

9. Apparatus according to claim 8, wherein the apparatus comprises one or more spaced inlets through which the contaminated liquid is admitted under pressure into the bed of adsorbent material.

10. Apparatus according to claim 9, wherein the apparatus comprises a plurality of said inlets spaced apart by a sufficient distance to establish a corresponding plurality of discrete liquid flow paths through the adsorbent bed.

11. A method for the continuous treatment of an aqueous organic waste liquid to provide a treated liquid containing less organic matter, the method comprising

operating a pump to admit aqueous organic waste liquid into a first treatment zone of a treatment reservoir which also includes a second treatment zone, the first and second treatment zones being separated by a porous membrane, the aqueous organic waste liquid being admitted into said first treatment zone to contact carbon-based adsorbent material in a bed in the first treatment zone at a flow rate which is sufficiently high to pass the aqueous organic waste liquid through the bed carbon-based adsorbent material but below the flow rate required to fluidise the bed of carbon-based adsorbent material;

operating first and second electric current feeders operably connected to the first and second treatment zones respectively to pass an electric current in one direction through the carbon-based adsorbent material within each treatment zone to regenerate the carbon-based adsorbent material in said first treatment zone;

operating the pump to admit aqueous organic waste liquid into said second treatment zone to contact carbon-based adsorbent material in a bed in the second treatment zone at a flow rate which is sufficiently high to pass the aqueous organic waste liquid through the bed of carbon-based adsorbent material but below the flow rate required to fluidise the bed of carbon-based adsorbent material; and

operating the first and second electric current feeders to reverse the direction of the current applied to the carbon-based adsorbent material in the first and second treatment zones to regenerate the carbon-based adsorbent material in the second treatment zone.

12. A method according to claim 11, wherein the aqueous organic waste liquid is admitted under pressure through one or more inlets into each bed of carbon-based adsorbent material.

13. A method according to claim 12, wherein the aqueous organic waste liquid is admitted through a plurality of said inlets spaced apart by a sufficient distance to establish a corresponding plurality of discrete liquid flow paths through the bed of carbon-based adsorbent material in each treatment zone.

14. A method according to any one of claims 11 to 13, wherein liquid that has contacted the carbon-based adsorbent material is passed to a reservoir in fluid communication with the corresponding bed of carbon-based adsorbent material.

15. A method according to any one of claims 11 to 14, wherein charged inorganic species are generated during the passage of the electric current through the carbon-based adsorbent material in the first and second treatment zones and the current feeders and pump are operated to minimise the electrodeposition of said charged inorganic species on the current feeders during operation.