Claims

1. Process apparatus comprising: at least one filter element, the filter element being an elongate hollow semi-permeable member; at least one anode; and at least one cathode; wherein at least one anode and at least one cathode are semi-permeable, such that liquid can pass therethrough; wherein the anode and cathode are arranged radially and concentrically with respect to the filter element; and wherein the filter element is either: inside of the at least one anode and at least one cathode, or outside of the at least one anode and at least one cathode.

2. Process apparatus as claimed in claim 1, wherein adjacent anodes and cathodes alternate between cathode and an anode to define an electrolysis zone therebetween.

3. Process apparatus as claimed in claim 1 or claim 2, wherein the sequence of anode and cathode when viewed radially inwards or outwards from the filter element is selected from the following:

(i) Cathode, Anode;
(ii) Anode, Cathode;
(iii) Anode, Cathode, Anode;
(iv) Cathode, Anode, Cathode;
(v) Anode, Cathode, Anode, Cathode;
(vi) Cathode, Anode, Cathode, Anode;
(vii) Cathode, Anode, Cathode, Anode, Cathode; or
(viii) Anode, Cathode, Anode, Cathode, Anode.

4. Process apparatus as claimed in any preceding claim wherein the filter element is formed as an anode.

5. Process apparatus as claimed in any of claims 1 to 3 wherein the filter element is formed as a cathode.

6. Process apparatus as claimed in claim 5, wherein the filter element is a hollow and semi-permeable cathode and an anode is located radially and concentrically with respect thereto.

7. Process apparatus as claimed in claim 6, wherein a cathode is located radially and concentrically with respect to the anode.

8. Process apparatus as claimed in claim 4, wherein the hollow semi-permeable member is a hollow and semi-permeable anode and a cathode is located radially and concentrically with respect thereto.

9. Process apparatus as claimed in any of claims 1 to 8, wherein the filter element is a water or seawater filter element.

10. Process apparatus as claimed in any preceding claim, wherein the anode and or cathode extend around substantially the entire circumference of an adjacent anode or cathode.

11. Process apparatus as claimed in any of claims 1 to 9, wherein circumferentially the anode/cathode is/are divided into discrete sections by means of electrically isolating spacers; and

adjacent anodes and cathodes extend between adjacent electrically isolating spacers.

12. Process apparatus as claimed in claim 11, wherein electrically isolating spacers are provided dividing the apparatus into 2 or more discrete radial flow paths.

13. Process apparatus as claimed in any preceding claim wherein one or both ends of said filter element is/are open and arranged in use to permit liquid to flow there-through.

14. Process apparatus as claimed in claim 13, wherein liquid is arranged to flow into the apparatus through one or both ends of the filter element and radially outwards through a wall of the filter element.

15. Process apparatus as claimed in claim 13, wherein liquid is arranged to flow into the apparatus radially inwards through a wall of the filter element and out of the apparatus along the elongate axis of the filter element.

16. Process apparatus as claimed in any preceding claim, wherein at least one anode and cathode are elongate and each arranged circumferentially and radially around the filter element.

17. Process apparatus as claimed in any of claims 1 to 15, wherein at least one anode and cathode are elongate and each arranged circumferentially and radially within the filter element.

18. Process apparatus as claimed in any preceding claim wherein the separation of adjacent anodes and cathodes is between 0.1 and 20mm.

19. Process apparatus as claimed in any preceding claim, wherein at least one anode and adjacent cathode are activated by means of an electrical supply arranged in use to generate potential difference and an electrical current between an anode and an adjacent cathode.

20. Process apparatus as claimed in claim 19, comprising pairs of adjacent anodes and cathode defining electrode pairs or groups; and

wherein electrode pairs or groups may be independently and selectively electrically activated.

21. Process apparatus as claimed in any preceding claim, wherein the polarity of an electrical supply to the at least one anode and cathode may be reversed to cause an opposite potential difference and electrical current between a respective anode and cathode.

22. Process apparatus as claimed in any preceding claim wherein the at least one anode is formed of a conductive substrate and an outer coating.

23. Process apparatus as claimed in claim 22, wherein the anode is a dimensionally stable anode formed of a substrate coated with precious metals selected from platinum, gold, silver or a mixed metal oxide solution.

24. Process apparatus as claimed in claim 22 wherein the anode is a boron doped diamond anode formed from a substrate coated with boron doped diamond.

25. Process apparatus as claimed in any preceding claim wherein the at least one cathode is formed of a conductive substrate and optionally an outer coating.

26. Process apparatus as claimed in any of claims 22 to 24 when claim 22 is dependent on claim 20, wherein the anode substrate and/or coating material for one electrode pair or

group is/are the same or dissimilar to the anode substrate and/or coating material of another electrode pair or group.

27. Process apparatus as claimed in claim 25 when dependent on claim 20, wherein the cathode substrate and/or coating material for one electrode pair or group is/are the same or dissimilar to the cathode substrate and/or coating material of another electrode pair or group.

28. Process apparatus as claimed in claim 25 when dependent on any of claims 22 to 24 when claim 22 is dependent on claim 20, wherein the anode substrate and/or coating material for one electrode is/are the same or dissimilar to the cathode substrate and/or coating material of another electrode pair or group.

29. Process apparatus as claimed in any preceding claim, said apparatus comprises a controller arranged to control electrical activation of the at least one anode and cathode; and at least one detector arranged to measure a property of a liquid flowing through the apparatus, wherein the controller is adapted to independently control anodes and cathodes in response to a signal received from said detector.

30. Process apparatus as claimed in claim 29, wherein the detector is adapted to detect the conductivity of the liquid.

31. Process apparatus as claimed in claim 29 or 30 wherein the detector is adapted to detect residual concentrations of chemicals selected from oxidants in the water or liquid including as Fluorine, Hydroxyl free radicals, forms of Oxygen, Ozone, Hydrogen Peroxide, Hypochlorite, Chlorine and Total Residual Oxidants.

32. Process apparatus as claimed in any preceding claim comprising a plurality of filter elements and a plurality of cathode and anode pairs associated therewith.

33. Process apparatus as claimed in any preceding claim comprising a single filter element and associated anodes and cathodes and further comprising a housing having an inlet and an outlet and adapted to communicate liquid from said inlet through said filter element, through or proximate to the anodes and cathodes, and to said outlet.

34. Process apparatus as claimed in any of claims 1 to 32, comprising a plurality of elongate hollow members and associated anodes and cathode and further comprising a housing having an inlet and an outlet and adapted to communicate liquid from said inlet

through said plurality of elongate hollow semi-permeable members, through or proximate to anodes and cathodes, to said outlet.

35. Process apparatus as claimed in claim 12, wherein the circumferential dimension of the electrically isolating spacers may be manually or automatically increased/reduced in order to increase/reduce the liquid velocity and/or turbulence in the discrete radial flow paths.

36. A method of processing a liquid by causing a liquid to pass through an apparatus as claimed in any preceding claim.