Claims

1. A method of changing a property of a polar liquid, comprising:

disposing a first transducer comprising a first electrically conductive solenoidal coil at least partially within the polar liquid, the coil formed of a plurality of loops each having an interior, the loop interiors forming an interior of the coil, wherein the polar liquid is substantially prevented from penetrating the interior of the coil, and

applying a first alternating electrical current to the coil so as to produce an alternating magnetic field about the coil,

wherein a portion of the alternating magnetic field penetrates the polar liquid and the first alternating electrical current has a first frequency and a first amplitude such that the alternating magnetic field has an effect on the polar liquid molecules further from the transducer through a contagion or domino effect so as to provide a change in a property of the polar liquid at a distance of at least 5 meters from the first transducer, wherein the property is gas exchange rate and the change is at least 5%, or the property is surface tension and the change is at least 1%, or the property is viscosity and the change is at least 0.5%.

2. A method as defined in claim 1, wherein at the distance of at least 5 meters freezing point of the polar liquid changes at least 0.5 degree C or partial vapor pressure of the polar liquid changes by at least 1%.

3. A method as defined in claim 1, wherein the property of the polar liquid is changed at a distance of at least 40 meters from the first transducer.

4. A method as defined in claim 1, wherein at least one of the gas exchange rate, or surface tension, or viscosity, changes at the distance of 5 meters within 10 minutes.

5. A method as defined in claim 1, wherein the first transducer produces an electric field that penetrates the polar liquid thereof of less than 1 V/m.

6. A method as defined in claim 1, wherein a root mean square of the first amplitude is less than 3 amperes.

7. A method as defined in claim 6, wherein a root mean square of the first amplitude is less than 500 mA.

8. A method as defined in claim 7, wherein a root mean square of the first amplitude is less than 50 mA.

9. A method as defined in claim 7, wherein the first alternating electrical current is a sinusoidal current.

10. A method as defined in claim 7, wherein the first frequency is 5 kHz or less.

11. A method as defined in claim 1, wherein the first transducer comprises two ferromagnetic end pieces disposed at the ends of the coil and transverse thereto for shaping the magnetic field.

12. A method as defined in claim 11, wherein the first transducer comprises a ferromagnetic core within the interior of the coil for increasing the change in the polar liquid.

13. A method as defined in claim 11, wherein the end pieces are electrically coupled to the ferromagnetic core or integral therewith.

14. A method as defined in claim 11, wherein each of the end pieces has a diameter of at least half of a height of the coil.

15. A method as defined in claim 11, wherein the end pieces are planar and normal to the coil.

16. A method as defined in claim 11, wherein the end pieces are round pieces centered at the coil.

17. A method as defined in claim 1, wherein a feedback loop is provided to control the first alternating electrical current in dependence upon a measured parameter.

18. A method as defined in claim 17, comprising selection of the first frequency from a plurality of predefined frequencies.

19. A method as defined in claim 1, wherein the first alternating electrical current has an amplitude with a root mean square (rms) of 100 ±15 microAmperes and a frequency of 2500 ± 10 Hz, or an amplitude with an rms of 99±15 microAmperes and a frequency of 2700 ± 10 Hz, or an amplitude with an rms of 140 ±15 microAmperes and a frequency of 4000 ± 10 Hz.

20. A method as defined in claim 19, wherein a cross-section of the solenoidal coil is a circle.

21. A method as defined in claim 1, comprising using a first at least partially immersive device comprising a first signal generator and the first transducer, electrically coupled to each other and electrically isolated from the polar liquid when immersed thereto, and a second at least partially immersive device comprising a second transducer and a second signal generator for providing a second alternating electrical current to the second transducer.

22. A method as defined in claim 21, wherein the first and second at least partially immersive devices are controlled with a control center.

23. A method as defined in claim 21, wherein a frequency of the second electrical current is equal to the first frequency and wherein the first and second alternating electrical currents are in phase, having a zero degree phase relationship for increasing the change in the polar liquid.

24. A method as defined in claim 21, wherein a frequency of the second alternating electrical current is different from the first frequency, for changing the property of the polar liquid oppositely, with respect to a baseline of the property when the liquid has not been treated by a magnetic field, to the change caused by the first transducer alone.

25. A method as defined in claim 24, wherein the frequency of the second alternating electrical current is different from the first frequency by at least 1 Hz, for changing the property of the polar liquid oppositely, with respect to a baseline of the property when the liquid has not been treated by a magnetic field, to the change caused by the first transducer alone.

26. A method as defined in claim 25, comprising a gradual change in a difference between the first frequency and the frequency of the second alternating electrical current for controlling the effect on the polar liquid.

27. A method as defined in claim 21, wherein the first alternating electrical current and the second alternating electrical current are offset in phase for controlling the effect on the polar liquid.

28. A method as defined in claim 27, comprising a gradual change of an offset in phase between the first and second alternating electrical currents for controlling the effect.

29. A method as defined in claim 11, wherein the polar liquid is used for aquaculture.

30. A method as defined in claim 11, comprising providing oxygen or air to the polar liquid.

31. A method as defined in claim 11, wherein the method is used as pretreatment before drip irrigation, desalination, or aquaculture.