CLAIMS

1. A control apparatus controlling at least one of the voltage, current, frequency, and/or phase applied to at least one electrode, the control apparatus comprising:

a controller capable of controlling at least one of voltage applied to the electrode, current applied to the electrode, a frequency of the voltage or the current, and a phase of the voltage or the current, by applying a predetermined voltage and/or current having a DC component and/or an AC component to the electrode, and controlling the voltage value of the voltage in the range of 0Vpp/cm to 2000Vpp/cm and/or the frequency of the AC component of the voltage or the current in the range of 0Hz to 1MHz,

to control at least one of an electric field, a magnetic field, an electromagnetic field, electromagnetic waves, sound waves, and ultrasonic waves applied from the electrode to a substance placed opposite the electrode,

so that formation of a pearl chain, a directional formation of bonded moisture, a moisture bonded state, or a moisture activity of the moisture in the substance is controlled;

an interfacial polarization, an interfacial tension, or an emulsion state between a moisture phase and another phase of the substance is controlled;

a state of a reactive oxygen species in the substance or a conductivity of the substance is controlled;

a temperature, a humidity, a movement of moisture in the space opposite the electrode is controlled; or

a liquid opposite the electrode is controlled to improve water quality.

2. The control apparatus according to claim 1, wherein a voltage value of the voltage applied to the electrode

and/or a current value of the current applied to the electrode changes within a predetermined range smoothly or stepwise.

3. The control apparatus according to claim 1 or 2, wherein a frequency of the AC component of the voltage or current applied to the electrode changes within a predetermined range smoothly or stepwise.

4. The control apparatus according to claim 1, wherein a conductivity of the substance is increased by the application of the voltage or current.

5. The control apparatus according to claim 1, wherein the interfacial tension is reduced by the application of the voltage or current.

6. The control apparatus according to claim 1, wherein finer moisture particles are obtained by the application of the voltage or current.

7. The control apparatus according to claim 1, wherein water molecules in the moisture in the substance are orientated in a substantially same direction by the application of the voltage or current.

8. The control apparatus according to claim 1, wherein the moisture inside the substance is a pearl-chain structure.

9. The control apparatus according to claim 1, wherein the control apparatus is applicable to any substance containing moisture.

10. The control apparatus according to claim 1, wherein an effect of improving the property of the substance by the application of the voltage or current, is maintained for a predetermined period after the application of the voltage or current is terminated.

11. The control apparatus according to claim 1, wherein a potential is substantially uniform over a group of molecules or particles of moisture in the pearl chain formation.

12. The control apparatus according to claim 1, wherein a DC component is present, the voltage or current applied to the electrode includes an AC component in addition to the DC component.

13. The control apparatus according to claim 1, wherein the voltage or current applied to at least one of a plurality of the electrodes is different from the voltage or current applied to the other of a plurality of the electrodes in at least one of a voltage or current value, a frequency of the voltage or the current, and a phase of the voltage or the current.

14. The control apparatus according to claim 1, wherein the DC component of the voltage applied to the electrode is 100 V or lower.

15. The control apparatus according to claim 1, wherein the substance includes at least one of solid, liquid, and gas.

16. The control apparatus according to claim 1, wherein the voltage or current is applied to the electrode to control the substance to be in at least one condition selected from the group consisting of:

(1) a condition in which the interfacial tension of the substance is reduced;

(2) a condition that prevents food, drink or liquid from becoming rotten;

(3) at least one of the following conditions: fresh flower preservation, drinking water preservation, hydroponic cultivation promotion or environmental improvement, germination rate improvement, hatching rate improvement, aquarium antifouling or purification, water quality improvement, rock sugar growth promotion, fuel reforming, or fuel efficiency improvement;

(4) at least one of the following conditions: preservation of blood or blood components, improvement in symptoms of diabetes, improvement in symptoms of chronic kidney disease, improvement in artificial dialysis, improvement of blood flow, revascularization, improvement in symptoms of peripheral neuropathy, improvement in symptoms of arthropathy or rheumatism, organ preservation, antitumor effect, improvement in symptoms of ischemia, improvement in symptoms of lymphatic edema, improvement in symptoms of bed sores, necrosis prevention or improvement, improvement in symptoms of circulatory diseases, or infection control;

(5) at least one condition of improving the efficiency of the following: charging or discharging of a capacitor, a generator, or a power transmission facility;

(6) a condition that promotes emulsification or generation of an emulsion or that achieves a longer emulsion state maintained period;

(7) a condition that increases the effect of an air

purifier or an ionizer;

(8) a condition that separates atoms or molecules into types;

(9) a condition in which temperature or humidity in a space is controlled;

(10) a condition that separates moisture from at least one of bacteria, germs, viruses, or microorganisms; and

(11) a condition that facilitates chemical polishing, mechanical polishing, chemical-mechanical polishing, or magnetic polishing.

17. The control apparatus according to claim 1, wherein the controller is capable of controlling at least one of the voltage applied to the electrode, the current applied to the electrode, the frequency of the voltage or the current, and the phase of the voltage or the current.

18. The control apparatus according to claim17, wherein the controller is capable of performing feedback control on at least one of the voltage applied to the electrode, the current applied to the electrode, the frequency of the voltage or the current, and the phase of the voltage or the current.

19. The control apparatus according to claim18, wherein the controller is capable of performing feedback control on a detection value detected in the electrode.

20. The control apparatus according to claim 18 or 19, wherein a wire for supplying the voltage or current to the electrode and a wire for feedback are formed as a single cable.

21. The control apparatus according to claim17, wherein the controller is capable of setting at least one of the voltage applied to the electrode, the current applied to the electrode, the frequency of the voltage or the current, and the phase of the voltage or the current as a control target based on a type and/or state of the substance.

22. The control apparatus according to claim 17, wherein the controller is capable of being remotely operated and/or remotely controlled.

23. The control apparatus according to claim17, wherein the controller has at least one of functions including DC-DC conversion, DC-AC conversion, AC-DC conversion, and AC-AC conversion.

24. The control apparatus according to claim17, wherein the controller is driven by a battery.

25. The control apparatus according to claim17, wherein the controller communicates with a server to receive a control parameter and/or a control value from the server.

26. The control apparatus according to claim17, wherein the controller is connected to a sensor configured to detect at least one of a type of the substance, a state of the substance, a state of the electric field, a state of the magnetic field, a state of the electromagnetic field, a state of the electromagnetic waves, a state of the sound waves, a state of the ultrasonic waves, a state of the current, and a state of the voltage.

27. The control apparatus according to claim17, wherein

the controller is connected to a man-machine interface.

28. The control apparatus according to claim 1, wherein the electrode has a plate shape, a bar shape, a spherical shape, a semi-spherical shape, a cylindrical shape, a semi-cylindrical shape, a conical shape, a semi-conical shape, a substantially L shape, a substantially rectangular U shape, a polygonal shape, a polygonal columnar shape, a polygonal conical shape, a curved shape, a bend shape, a foil shape, a film shape, or a layer shape.

29. The control apparatus according to claim 1, wherein the electrode includes electrodes all made of a same material or electrodes including at least one electrode made of a different material, and the electromagnetic waves generated from the electrode are adjusted by selecting the material of the electrode.

30. The control apparatus according to claim 1, wherein the electrode is insulated.

31. The control apparatus according to claim 1, wherein the control apparatus is applicable to an existing facility.

32. The control apparatus according to claim 1 capable of being moved, conveyed, or carried around.

33. The control apparatus according to claim 1, wherein the electrode includes two or more electrodes, and at least one of the voltage applied to each electrode, the current applied to each electrode, the frequency of the voltage or the current, and the phase of the voltage or the current are capable of being set.

34. A control method controlling at least one of the voltage, current, frequency, and/or phase applied to at least one electrode, wherein the method comprising:

controlling by applying a predetermined voltage and/or current having a DC component and/or an AC component to the electrode, and controlling the voltage value of the voltage in the range of 0Vpp/cm to 2000Vpp/cm and/or the frequency of the AC component of the voltage or the current in the range of 0Hz to 1MHz,

to control at least one of an electric field, a magnetic field, an electromagnetic field, electromagnetic waves, sound waves, or ultrasonic waves applied from the electrode to a substance placed opposite the electrode,

so that formation of pearl chain, a directional formation of bonded moisture, a moisture bonded state, or a moisture activity of the moisture in the substance is controlled;

an interfacial polarization, an interfacial tension, or an emulsion state between a moisture phase and another phase of the substance is controlled;

a state of a reactive oxygen species in the substance or a conductivity of the substance is controlled;

a temperature, a humidity, a movement of moisture in the space opposite the electrode is controlled; or

a liquid opposite the electrode is controlled to improve water quality.

35. The control method according to claim 34, wherein a voltage value of the voltage applied to the electrode and/or a current value of the current applied to the electrode changes within a predetermined range smoothly or stepwise.

36. The control method according to claim 34 or 35, wherein a frequency of the AC component of the voltage or current applied to the electrode changes within a predetermined range smoothly or stepwise.

37. The control method according to claim 34, wherein a conductivity of the moisture is increased by the applying of the voltage or current.

38. The control method according to claim34, wherein an interfacial tension is reduced by the applying of the voltage or current.

39. The control method according to claim 34, wherein finer moisture particles are obtained by the applying of the voltage or current.

40. The control method according to claim 34, wherein water molecules in the moisture in the substance are orientated in a substantially same direction by the applying of the voltage or current.

41. The control method according to claim 34, wherein the moisture inside the substance is in a pearl-chain structure.

42. The control method according to claim 34, wherein the control method is applicable to any substance containing moisture.

43. The control method according to claim 34, wherein an effect of improving the property of the substance by the application of the voltage or current, is maintained for a

predetermined period after the application of the voltage or current is terminated.

44. The control method according to claim 34, wherein a potential is substantially uniform over a group of molecules or particles of moisture in the pearl chain formation.

45. The control method according to claim 34, wherein a DC component is present, the voltage or current applied to the electrode includes an AC component in addition to the DC component.

46. A program for executing the control method according to claim 34.

47. A storage medium storing the program according to claim 46.

48. A substance made into a bonded formation of moisture inside the substance by the control apparatus according to claim 1.

49. The control apparatus according to claim 1, wherein fine bubbles are further added to the substance.

50. The control apparatus according to claim 1, wherein the control apparatus is applied to at least one field of manufacturing, distribution, logistics, warehouse, sales, engineering, construction, civil engineering, machine engineering, electric engineering, electronic engineering, communications, optics, chemistry, petrochemistry, energy, stockbreeding, agriculture, commerce, fishery, food,

restaurant business, cooking, services, medicine, health, welfare, and nursing care.

51. The control apparatus according to claim 1, wherein the substance is at least one substance selected from the group consisting of:
(1) agricultural products, fresh flowers, livestock products, fishery products, processed food products, health food products, beverages, alcoholic beverages, dry food products, broth, soup, seasonings, or other food items,
(2) resin, rubber, glass, lenses, pottery, wooden materials, cement, concrete, minerals, paper, inks, dyes, fibers, ceramics, abrasives, cleaners, additives, printed circuit boards, plating products, refining products, paints, India ink, water-repellent products, chemical products, fertilizers, animal feeds, microorganisms, water, cloth, gunpowder, or other like products,
(3) gasoline, light oil, heavy oil, kerosene, petroleum, or other fuels,
(4) blood, vaccines, medicines, organs, cells, ointments, dialysis machines, therapy equipment, or other medical products,
(5) cosmetics, detergents, soap, shampoo, hair-care products, or other commodities,
(6) apparatuses for power generation, power storage, power transmission, or combustion,
(7) quality-maintained, dried, preserved, frozen, or thawed products,
(8) emulsions, substances resulting from oxidation or reduction, water absorption, or extraction,
(9) abrasives or abrasive grains used for polishing including at least one of chemical polishing, mechanical polishing, chemical-mechanical polishing, or magnetic

polishing, and
(10) equipment including health appliances, exercise machines, muscle-building machines, or playground equipment.

52. A product, an apparatus, or a facility comprising the control apparatus according to claim 1.

53. A product, an apparatus, or a facility comprising the control apparatus according to claim 1 including at least one of a refrigerator, a freezer, a refrigerating warehouse, a freezer warehouse; a storage house, a warehouse, a refrigerator car, a freezing car, a cooler box, a container for transport, a container for storage, a showcase, a shelf, a drawer, a fryer, a cultivation container, a fuel tank, a personal computer, a mobile phone, a chair bed, furniture, bedding, home appliances, various manufacturing equipment in a factory, processing equipment, medical equipment, health equipment, beauty equipment, cooking equipment, polishing equipment, vehicles, semiconductor cleaning equipment, and equipment for controlling vapor resulting from cooling during a refining step, a baking step, and a drying step.