CLAIMS

1. A control apparatus configured to control a voltage applied to at least one electrode, the control apparatus comprising:

the controller configured to control the voltage applied to the at least one electrode so as 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 disposed opposite the electrode;

A) wherein the electrode is at least one of:

(a1) an electrode serving as a detection unit;

(a2) an electrode configured to contact the substance; and

(a3) an electrode configured to generate electromagnetic waves in a space and to generate a space potential;

wherein:

(1) the controller includes an AI learning model configured to obtain a control parameter by using, as input, detection data including an electrical detection value corresponding to a state of the substance detected by the detection unit, the AI learning model being trained using AI learning based on at least detection data of the detection unit; and

(2) detection data including the electrical detection value corresponding to the state of the substance detected by the detection unit is transmitted to at least one of the controller and a server communicating with the controller, wherein at least one of the controller and the server includes a storage unit storing control parameter information including at least a voltage value of a target voltage, a frequency, and an application time corresponding to the electrical detection value, or

B) wherein the electrode is at least one of:

(b1) an electrode disposed to face the substance;

(b2) an electrode configured to contact the substance; and
(b3) an electrode configured to apply electromagnetic waves in a space and to generate a space potential;

wherein a control parameter corresponding to a state of the substance is set based on information relating to the substance and time information including at least a voltage application time to the electrode,
and the control parameter is determined based on at least one of A)(1), A)(2), and B),

and the controller controls at least one of a voltage value and a frequency of the voltage applied to the electrode based on the control parameter,
and a predetermined voltage including at least an AC component is applied to the electrode,

wherein the voltage value is controlled within a range of 0 V to 2000 V, or a frequency of the AC component is controlled within a range of 0 Hz to 1 MHz,
and at least one of the electric field, the magnetic field, the electromagnetic field, the electromagnetic wave, the sound waves, and the ultrasonic waves applied from the electrode to the substance disposed opposite the electrode is controlled,
so that formation of a pearl chain of the moisture in the substance is controlled; or
an interfacial tension between a moisture phase and an oil phase of the substance is controlled.

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 voltage applied to at least one electrode with a controller, wherein the method comprising:

controlling the voltage applied to the at least one

electrode so as 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 disposed opposite the electrode;

A) wherein the electrode is at least one of:

(a1) an electrode serving as a detection unit;

(a2) an electrode configured to contact the substance; and

(a3) an electrode configured to generate electromagnetic waves in a space and to generate a space potential;

wherein:

(1) the controller includes an AI learning model configured to obtain a control parameter by using, as input, detection data including an electrical detection value corresponding to a state of the substance detected by the detection unit, the AI learning model being trained using AI learning based on at least detection data of the detection unit; and

(2) detection data including the electrical detection value corresponding to the state of the substance detected by the detection unit is transmitted to at least one of the controller and a server communicating with the controller, wherein at least one of the controller and the server includes a storage unit storing control parameter information including at least a voltage value of a target voltage, a frequency, and an application time corresponding to the electrical detection value, or

B) wherein the electrode is at least one of:

(b1) an electrode disposed to face the substance;

(b2) an electrode configured to contact the substance; and

(b3) an electrode configured to apply electromagnetic waves in a space and to generate a space potential;

wherein a control parameter corresponding to a state of the substance is set based on information relating to

the substance and time information including at least a voltage application time to the electrode,
and the control parameter is determined based on at least one of A)(1), A)(2), and B),

and controlling at least one of a voltage value and a frequency of the voltage applied to the electrode based on the control parameter,

and a predetermined voltage including at least an AC component is applied to the electrode,

wherein the voltage value is controlled within a range of 0 V to 2000 V, or a frequency of the AC component is controlled within a range of 0 Hz to 1 MHz,
and at least one of the electric field, the magnetic field, the electromagnetic field, the electromagnetic wave, the sound waves, and the ultrasonic waves applied from the electrode to the substance disposed opposite the electrode is controlled,
so that formation of a pearl chain of the moisture in the substance is controlled; or
an interfacial tension between a moisture phase and an oil phase of the substance is controlled.

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.