CLAIMS

1. A ~~moisture~~ 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 ~~wherein~~ a predetermined voltage and/or current ~~including~~ having a DC component and/or an AC component to the ~~is applied to at least one~~ 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 ~~that generates 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 ~~to achieve a~~ bonded ~~state~~moisture, a ~~of~~ 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 ~~elements in an object disposed to face the electrode, so that a property of the object is~~

~~able to be improved~~.

2. The ~~moisture~~ 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 ~~predetermined voltage or current~~ changes within a predetermined range smoothly or stepwise.

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

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

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

~~6. The moisture control apparatus according to claim 1, wherein an interfacial tension is controlled by the application of the predetermined voltage or current.~~

~~7~~6. The ~~moisture~~ control apparatus according to claim 1, wherein finer moisture particles are obtained by the application of the ~~predetermined~~ voltage or current.

~~8~~7. The ~~moisture~~ control apparatus according to claim 1, wherein water molecules in the moisture in the ~~object~~ substance are orientated in a substantially same direction by the application of the ~~predetermined~~ voltage or current.

~~9~~8. The ~~moisture~~ control apparatus according to claim 1, wherein the moisture inside the substance is ~~elements in the bonded state are in~~ a pearl-chain structure.

~~10~~9. The ~~moisture~~ control apparatus according to claim 1, wherein the ~~moisture~~ control apparatus is applicable to any ~~object~~ substance containing moisture.

~~11~~10. The ~~moisture~~ control apparatus according to claim 1, wherein an effect of improving the property of the ~~object~~ substance by the application of the voltage or current, ~~disposed in a space between a pair of the electrodes~~ is maintained for a predetermined period after the application of the voltage or current is terminated~~object has been removed from the space between the pair of electrodes~~.

~~12~~11. The ~~moisture~~ control apparatus according to claim 1, wherein a potential is substantially uniform over a group of molecules or particles of moisture ~~water~~ in the pearl chain formation~~bonded state~~.

~~13~~12. The ~~moisture~~ 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.

~~14~~13. The ~~moisture~~ 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.

~~15~~14. The ~~moisture~~ control apparatus according to claim 1, wherein the DC component of the voltage applied to the electrode is 100 V or lower.

~~16~~15. The ~~moisture~~ control apparatus according to claim 1, wherein the ~~object~~ substance includes at least one of solid, liquid, and gas.

~~17~~16. The ~~moisture~~ control apparatus according to claim 1, wherein the ~~predetermined~~ voltage or current is applied to the electrode to control the substance to be in at least one condition ~~voltage or current~~ selected from the group consisting of:

(1) ~~voltage or current~~a condition in which the ~~that reduces an~~ interfacial tension of the substance is reduced~~an object~~;

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

(3) ~~voltage or current that contributes to~~ 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) ~~voltage or current that contributes to~~ 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) ~~voltage or current that improves efficiency of~~ 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 ~~voltage~~ that promotes emulsification or generation of an emulsion or ~~voltage or current~~ that achieves a longer emulsion state maintained period;

(7) ~~voltage or current~~ a condition that increases the effect of an air purifier or an ionizer;

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

(9) ~~voltage for controlling~~ a condition in which temperature or humidity in a space is controlled;

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

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

~~18~~17. The ~~moisture~~ control apparatus according to claim 1, wherein the ~~comprising a~~ controller is capable of controlling at least one of the voltage applied to the electrode, the current applied to the electrode, ~~a~~ the frequency of the voltage or the current, and ~~a~~ the phase of

the voltage or the current.

~~19~~18. The ~~moisture~~ control apparatus according to claim ~~18~~17, 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.

~~20~~19. The ~~moisture~~ control apparatus according to claim ~~19~~18, wherein the controller is capable of performing feedback control on a detection value detected in the electrode.

~~21~~20. The ~~moisture~~ control apparatus according to claim ~~19~~ 18 or ~~20~~ 19, wherein a wire for supplying the ~~predetermined~~ voltage or current to the electrode and a wire for feedback are formed as a single cable.

~~22~~21. The ~~moisture~~ control apparatus according to claim ~~18~~17, wherein the controller is capable of setting at least one of the voltage applied to the electrode, the current applied to the electrode, ~~a~~ the frequency of the voltage or the current, and ~~a~~ the phase of the voltage or the current as a control target based on a type and/or state of the ~~object~~ substance.

~~23~~22. The ~~moisture~~ control apparatus according to claim ~~18~~17, wherein the controller is capable of being remotely operated and/or remotely controlled.

~~24~~23. The ~~moisture~~ control apparatus according to claim ~~18~~17, wherein the controller has at least one of functions

including DC-DC conversion, DC-AC conversion, AC-DC conversion, and AC-AC conversion.

~~25~~24. The ~~moisture~~ control apparatus according to claim ~~18~~17, wherein the controller is driven by a battery.

~~26~~25. The ~~moisture~~ control apparatus according to claim ~~18~~17, wherein the controller communicates with a server to receive a control parameter and/or a control value from the server.

~~27~~26. The ~~moisture~~ control apparatus according to claim ~~18~~17, wherein the controller is connected to a sensor configured to detect at least one of a type of the ~~object~~substance, a state of the ~~object~~ 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.

~~28~~27. The ~~moisture~~ control apparatus according to claim ~~18~~17, wherein the controller is connected to a man-machine interface.

~~29~~28. The ~~moisture~~ 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.

~~30~~29. The ~~moisture~~ 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.

~~31~~30. The ~~moisture~~ control apparatus according to claim 1, wherein the electrode is insulated.

~~32~~31. The ~~moisture~~ control apparatus according to claim 1, wherein the ~~moisture~~ control apparatus is applicable to an existing facility.

~~33~~32. The ~~moisture~~ control apparatus according to claim 1 capable of being moved, conveyed, or carried around.

~~34~~33. The ~~moisture~~ 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.

~~35~~34. A ~~moisture~~ 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 ~~including~~ a DC component and/or an AC component to ~~at least one~~ 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 ~~that generates~~ at least one of an electric field, a magnetic field, an electromagnetic field, electromagnetic waves, sound waves, ~~and~~ or ultrasonic waves applied from the electrode to a substance placed opposite the electrode,

so that formation of pearl chain, a directional formation of ~~to achieve a~~ bonded ~~state~~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 ~~of moisture elements in an object disposed to face the electrode, so that a property of the object is able to be improved~~.

~~36~~35. The ~~moisture~~ control method according to claim ~~35~~ 34, wherein a voltage value of the ~~predetermined~~ 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.

~~37~~36. The ~~moisture~~ control method according to claim ~~35~~ 34 or ~~36~~ 35, wherein a frequency of the AC component of the ~~predetermined~~ voltage or current applied to the electrode changes within a predetermined range smoothly or stepwise.

~~38~~37. The ~~moisture~~ control method according to claim ~~35~~ 34, wherein a conductivity of the moisture is increased by the applying of the ~~predetermined~~ voltage or current.

~~39~~38. The ~~moisture~~ control method according to claim ~~35~~34, wherein an interfacial tension is reduced by the applying of the ~~predetermined~~ voltage or current.

~~40. The moisture control method according to claim 35, wherein an interfacial tension is controlled by the applying of the predetermined voltage or current.~~

~~41~~39. The ~~moisture~~ control method according to claim ~~35~~ 34, wherein finer moisture particles are obtained by the applying of the ~~predetermined~~ voltage or current.

~~42~~40. The ~~moisture~~ control method according to claim ~~35~~ 34, wherein water molecules in the moisture in the ~~object~~ substance are orientated in a substantially same direction by the applying of the ~~predetermined~~ voltage or current.

~~43~~41. The ~~moisture~~ control method according to claim ~~35~~ 34, wherein the moisture inside the substance is ~~elements in the bonded state are~~ in a pearl-chain structure.

~~44~~42. The ~~moisture~~ control method according to claim ~~35~~ 34, wherein the ~~moisture~~ control method is applicable to any ~~object~~ substance containing moisture.

~~45~~43. The ~~moisture~~ control method according to claim ~~35~~ 34, wherein an effect of improving the property of the substance by the application of the voltage or current,

~~object disposed in a space between a pair of the electrodes~~ is maintained for a predetermined period after the ~~object~~ application of the voltage or current is terminated~~has been removed from the space between the pair of electrodes~~.

~~46~~44. The ~~moisture~~ control method according to claim ~~35~~34, wherein a potential is substantially uniform over a group of molecules or particles of moisture ~~of water~~ in the pearl chain formation~~bonded state~~.

~~47~~45. The ~~moisture~~ control method according to claim ~~35~~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.

~~48~~46. A program for executing the ~~moisture~~ control method according to claim ~~35~~34.

~~49~~47. A storage medium storing the program according to claim ~~48~~46.

~~50~~48. ~~An~~ A ~~object~~ substance made into a bonded formation ~~state~~ of moisture inside the substance ~~elements in the object~~ by the ~~moisture~~ control apparatus according to claim 1.

~~51~~49. The ~~moisture~~ control apparatus according to claim 1, wherein fine bubbles are further added to the~~ object~~ substance.

~~52~~50. The ~~moisture~~ control apparatus according to claim 1, wherein the ~~moisture~~ 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.

~~53~~51. The ~~moisture~~ control apparatus according to claim 1, wherein the ~~object~~ substance is at least one ~~object~~ 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, ~~objects~~ 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.

~~54~~52. A product, an apparatus, or a facility comprising the ~~moisture~~ control apparatus according to claim 1.

~~55~~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~~,~~
~~the product, apparatus, or facility comprising the moisture control apparatus according to claim 1~~.