CLAIMS

1. A system for providing high microbiological quality cooling water to an industrial process, the system comprising:
   - a container for storing cooling water, the container comprising a bottom for receiving settled particles;
   - a feeding line of inlet water to the container;
   - a coordination means for timely activating processes necessary to adjust parameters of the cooling water within predetermined limits;
   - a chemical application means activated by the coordination means;
   - a mobile suction means for moving along the bottom of the container and suctioning cooling water containing settled particles;
   - a propelling means for moving the mobile suction means along the bottom of the container;
   - a filtration means for filtering the cooling water containing settled particles;
   - a collecting line coupled between the mobile suction means and the filtration means;
   - a return line from the filtration means to the container;
   - a heat exchanger inlet line from the container to the industrial process; and
   - a return water line from the industrial process to the container.

2. The system of claim 1, wherein the bottom of the container comprises a membrane, geomembrane, geotextile membrane, plastic liner, concrete, coated concrete, or a combination thereof.

3. The system of claim 1, wherein the coordination means is capable of receiving information, processing that information, and activating other processes.

4. The system of claim 1, wherein the chemical application means comprises an injector, a sprinkler, manual application, a weight dispenser, or combinations thereof.

5. The system of claim 1, wherein the propelling means comprises a rail system, a cable system, a self-propelled system, a manually propelled system, a robotic system, a system

guided from a distance, a boat with an engine, a floating device with an engine, or a combination thereof.

6. The system of claim 1, wherein the filtration means comprises a cartridge filter, a sand filter, a micro-filter, an ultra-filter, a nano-filter, or a combination thereof.

7. The system of claim 1, wherein the collecting line comprises a flexible hose, a rigid hose, a pipe comprising any material, or a combination thereof.

CLAIMS

1. A system for providing high microbiological quality cooling water, wherein the system is in fluid communication with an industrial process in need of cooling, and wherein the system provides cooling water to the industrial process, the system comprising:

- a manufactured container for holding a water body comprising fresh water, brackish water, or sea water for cooling the industrial process, wherein the container is an artificial lake, lagoon, or pond having a bottom comprising a liner capable of being cleaned by a mobile suction device, the water body comprises a volume of at least 10,000 m^3 and a surface area from about 50 to about 30,000 m^2 per MW of cooling required by the industrial process, and the surface area of the water body is defined by the container;
- a feeding line of inlet water to the container;
- coordination means for maintaining the cooling water in the container within predetermined water quality parameters;
- chemical application means for applying a disinfectant agent, oxidizing agent, coagulant, or flocculant to the cooling water in the container;
- a mobile suction device capable of moving along the bottom of the container and suctioning a portion of the cooling water from the bottom of the container containing the settled particles;
- propelling means for moving the mobile suction device along the bottom of the container;
- filtration means for filtering the portion of cooling water containing settled particles suctioned by the mobile suction device;
- a collecting line coupled between the mobile suction device and the filtration means;
- a return line from the filtration means to the container;

- a heat exchanger inlet line in fluid communication with the container and the industrial process, capable of feeding a heat exchanger of the industrial process with cooling water from the container; and
- a return heat exchanger water line in fluid communication with the industrial process and the container, capable of discharging the heated cooling water from the industrial process into the container;

wherein the coordination means receives information obtained by visual inspection, an empirical method, an algorithm, or a detector regarding water quality parameters and controls activation of the chemical application means, mobile suction device, and filtration means to adjust said water quality parameters within their limits.

2. The system of claim 1, wherein the liner comprises a membrane, geomembrane, geotextile membrane, plastic liner, concrete, coated concrete, or a combination thereof.

3. The system of claim 1, wherein the chemical application means comprises an injector, a sprinkler, manual application, a weight dispenser, or combinations thereof.

4. The system of claim 1, wherein the propelling means comprises a rail system, a cable system, a self-propelled system, a manually propelled system, a robotic system, a system guided from a distance, a boat with an engine, a floating device with an engine, or a combination thereof.

5. The system of claim 1, wherein the filtration means comprises a cartridge filter, a sand filter, a micro-filter, an ultra-filter, a nano-filter, or a combination thereof.

6. The system of claim 1, wherein the collecting line comprises a flexible hose, a rigid hose, a pipe comprising any material, or a combination thereof.

7. The system of claim 1, wherein the coordination means activates the chemical application means to apply an oxidizing agent to the cooling water in the container to prevent iron and manganese concentrations of the cooling water from exceeding 1.5 ppm.

8. The system of claim 1, wherein the coordination means activates the chemical application means to apply a coagulant and/or flocculant to the cooling water in the container to prevent the turbidity of the cooling water from exceeding 7 NTU.

9. The system of claim 1, wherein the coordination means activates the mobile suction device to prevent a thickness of settled material at the bottom of the container from exceeding an average 100 mm.

10. The system of claim 1, wherein the coordination means activates the chemical application means to periodically apply disinfecting agents to the cooling water in the container during 7-day intervals to establish an oxidation reduction potential (ORP) of at least 500 mV for a total treatment time during each 7-day interval that is dependent on the temperature of the cooling water being treated, wherein:

i. for cooling water having a temperature up to and including 35 °C, the total treatment time comprises a minimum period of 1 hour for each °C of the cooling water temperature;

ii. for cooling water having a temperature greater than 35 °C and less than 70 °C, the total treatment time comprises a minimum period of hours calculated by the following equation: [35 hours] - [Temperature of the water in °C - 35 x 1 hour/°C] = minimum period of hours; or

iii. for water having a temperature of 70 °C or more, said total treatment time comprises a minimum period of 1 hour.

11. The system of claim 1, wherein the cooling water is recirculated between the container industrial process by the heat exchanger inlet line and the return water line.

12. The system of claim 11, wherein the system is a closed circuit.

13. The system of claim 1, wherein the disinfectant agent comprises ozone, a biguanide compound, a bromine-based compound, a halogen-based compound, or a combination thereof.

14. The system of claim 1, wherein the oxidizing agent comprises a halogen-based compound, a permanganate salt, a peroxide, ozone, sodium persulfate, potassium persulfate, an oxidant produced by an electrolytic method, or a combination thereof.

15. The system of claim 1, wherein the coagulant and/or flocculant comprises a cationic polymer, an anionic polymers, an aluminum salt, aluminum chlorhydrate, alum, aluminum sulfate, a quat and/or polyquat, calcium oxide, calcium hydroxide, ferrous sulphate, ferric chloride, a polyacrylamide, sodium aluminate, sodium silicate, chitosan, gelatin, guar gum, an alginate, a moringa seed, a starch derivative, or a combination thereof.

16. A cooling water system for providing cooling water to an industrial process in need of cooling, wherein the system is in fluid communication with the industrial process and wherein the system provides cooling water to the industrial process, the system comprising:

a manufactured container for holding a water body comprising fresh water, brackish water, or sea water for cooling the industrial process, wherein the container is an artificial lagoon, lake, or pond having a bottom comprising a non-porous liner, the water body comprises a volume of at least 10,000 m^3 and a surface area from about 50 to about 30,000 m^2 per MW of cooling required by the industrial process, and the surface area of the water body is defined by the container;

a suction device capable of moving along the bottom of the container and suctioning a portion of the cooling water from the bottom of the container containing settled particles;

a filtration system comprising a cartridge filter, sand filter, micro-filter, ultra-filter, nanofilter, or a combination thereof;

a collecting line operatively connecting the self-propelled suction device to the filtration system, wherein the collecting line is constructed to lead suctioned water from the suction device to the filtration system;

a first return line operatively connecting the filtration system to the container, wherein the first return line is constructed to lead filtered water from the filtration system to the container;

a system for applying chemicals to the water, the system comprising a pipe, a dispenser, an injector, a sprinkler, or a combination thereof;

an automated system comprising a computer and sensors configured to receive information obtained by visual inspection, an empirical method, an algorithm, or a detector regarding water quality parameters, process the information, and control activation of the self-propelled suction device, the filtration system, and the system for applying chemicals to adjust the water quality parameters within predetermined water quality limits;

a feeding line operatively connecting the container to a heat exchanger of the industrial process, wherein the feeding line is constructed to provide cooling water from the container to the heat exchanger; and

a second return line operatively connecting the heat exchanger of the industrial process to the container, wherein the second return line is constructed to direct spent cooling water from the heat exchanger to the container.

17. The system of claim 16, wherein the system is a closed circuit.

18. The system of claim 1, wherein the manufactured container is an artificial lake.

19. The system of claim 1, wherein the manufactured container is an artificial lagoon.

20. The system of claim 1, wherein the manufactured container is an artificial pond.

21. The system of claim 16, wherein the manufactured container is an artificial lake.

22. The system of claim 16, wherein the manufactured container is an artificial lagoon.

23. The system of claim 16, wherein the manufactured container is an artificial pond.

24. The system of claim 1, wherein the system is capable of maintaining, in the cooling water within the container, concentrations of iron and manganese at or below 1.5 ppm; turbidity at or below 7 NTU; thickness of settled material at the bottom of the container at or below 100 mm; and an oxidation reduction potential (ORP) of at least 500 mV for a total treatment time during every 7-day interval that is dependent on the temperature of the cooling water being treated, wherein:

i. for cooling water having a temperature up to and including 35 °C, the total treatment time comprises a minimum period of 1 hour for each °C of the cooling water temperature;

ii. for cooling water having a temperature greater than 35 °C and less than 70 °C, the total treatment time comprises a minimum period of hours calculated by the following equation: [35 hours] - [Temperature of the water in °C - 35 x 1 hour/°C] = minimum period of hours; or

iii. for water having a temperature of 70 °C or more, said total treatment time comprises a minimum period of 1 hour.

25. The system of claim 1, wherein the mobile suction device is capable of suctioning a layer of settled particles having a thickness of about 100 mm.