

DESCRIPTION**AERATION APPARATUS FOR CULTURE POND AND METHOD OF HARVESTING
CULTIVATED CROP USING SUCH AERATION APPARATUS**

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Technical Field

The present invention relates to an aeration apparatus suitable for use with a culture pond for cultivating a crop such as shrimps, for example, and a method of harvesting a cultivated crop using such an aeration apparatus.

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Background Art

Heretofore, a culture pond for cultivating a crop such as shrimps, for example, is equipped with an aeration apparatus for supplying air (oxygen) to the culture pond to prevent water in the culture pond from being contaminated. One conventional aeration apparatus comprises, as shown in FIG. 4 of the accompanying drawings, a paddle wheel aerator 110 which is floated on a culture pond 100. The paddle wheel aerator 110 has a rotary paddle 113 mounted on a float 111 on the culture pond 100. The rotary paddle 113 is rotated by an actuating means (not shown) to splash the water in the pond and supply air to the splashed water, thereby aerating the water.

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The conventional aeration apparatus, however, has suffered the following problems:

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(1) When the paddle wheel aerator 110 is actuated, it produces circulating water flows as indicated by the arrows in a wide range within the culture pond 100, thus eroding the soil of slanted surfaces 101 and bottom 103 of the culture pond 100.

The eroded soil is mixed with feed that remains unconsumed by the crop, excrements of the crop, dead bodies of the crop, and dead bodies of vegetable plankton, and the like, and deposited on a central area of the bottom 103, thus forming anaerobic sludge 120. The anaerobic sludge 120 contaminates the water in the culture pond 100, checks the growth of the crop to reduce the harvest thereof, and shortens the service life of the culture pond 100. In addition, when the contaminated water in the culture pond 100 is discharged out of the culture pond 100, it contaminates the surrounding environment.

(2) The culture pond 100 contains various floating substances produced by the feed that remains unconsumed by the crop, the excrements of the crop, the dead bodies of the crop, and the dead bodies of vegetable plankton, etc. These floating substances are responsible for causing diseases of the crop. Attempts to remove the floating substances result in a need for the installation of a floating substance removal facility, which incurs an extra facility cost.

(3) When the crop cultivated in the culture pond 100 is harvested, the water in the culture pond 100 is discharged. For discharging the water in the culture pond 100, a temporary mobile pump is required to be installed, which also incurs an extra facility cost.

Disclosure of Invention

The present invention has been made in view of the above drawbacks. It is therefore an object of the present invention to provide an aeration apparatus for a culture pond which can

reduce sludge by aeration of water in the culture pond, and can remove floating substances in the culture pond and discharge the water from the culture pond without the need for any special dedicated installations.

5 Another object of the present invention is to provide a method of harvesting cultivated crop using such aeration apparatus.

10 In order to achieve the above object, according to a first aspect of the present invention, there is provided an aeration apparatus for aerating water in a culture pond for cultivating a crop therein, comprising: an inlet pipe line disposed in the culture pond; a pump for drawing in the water from the culture pond through the inlet pipe line; an ejector for mixing air with the water drawn by the pump; and an outlet pipe line disposed
15 in the culture pond for discharging the water which has been aerated by the ejector into the culture pond.

20 According to a preferred aspect of the present invention, the inlet pipe line is installed near the bottom of the culture pond so as to spread in a plane extending over the bottom of the culture pond, and has a plurality of inlet ports defined in respective portions of the inlet pipe line for drawing in the water from the culture pond through the respective portions.

25 According to a preferred aspect of the present invention, the outlet pipe line is installed near the bottom of the culture pond so as to spread in a plane extending over the bottom of the culture pond, and has a plurality of outlet ports defined in respective portions of the outlet pipe line for discharging the aerated water into the culture pond through the respective

portions.

According to a preferred aspect of the present invention, the aeration apparatus further comprises a filter unit for removing suspended substances from the water drawn from the culture pond through the inlet pipe line.

According to a preferred aspect of the present invention, the aeration apparatus further comprises a drain pipe for draining the water in the culture pond, the drain pipe being connectable to the inlet pipe line through a valve.

According to a preferred aspect of the present invention, the aeration apparatus further comprises a protective net for covering each of the inlet ports.

According to a preferred aspect of the present invention, the aeration apparatus further comprises a protective net for covering each of the outlet ports.

According to a second aspect of the present invention, a method of harvesting a crop cultivated in a culture pond, comprising: draining water from the culture pond when the crop is harvested, by drawing in the water from the culture pond with the pump of any of the aeration apparatuses described above, through the inlet pipe line.

Brief Description of Drawings

FIG. 1 is a schematic perspective view of an aeration apparatus according to an embodiment of the present invention which is incorporated in a culture pond;

FIG. 2 is an enlarged perspective view of an inlet port (or an outlet port) of an inlet pipe line (or an outlet pipe

line) of the aeration apparatus;

FIG. 3 is a schematic view showing flows of water in the culture pond when the water is aerated by the aeration apparatus according to the present invention; and

5 FIG. 4 is a schematic view showing flows of water in a culture pond when the water is aerated by a conventional paddle wheel aerator.

Best Mode for Carrying Out the Invention

10 An aeration apparatus for culture pond and a method of harvesting cultivated crop using such aeration apparatus according to an embodiment of the present invention will be described below with reference to the drawings.

15 FIG. 1 is a schematic perspective view showing an aeration apparatus 20 according to an embodiment of the present invention which is incorporated in a culture pond 10. As shown in FIG. 1, the culture pond 10 is formed by a pit in the ground. The aeration apparatus 20 has an inlet pipe line 30 and an outlet pipe line 50 near the bottom 12 of the culture pond 10, and an
20 extension pipe 40 extending from the inlet pipe line 30 to the outside of the culture pond 10. The extension pipe 40 is connected to a filter unit F, a pump P, a three-way valve V, and an ejector E, and the extension pipe 40 extends into the culture pond 10 and is connected to the outlet pipe line 50.

25 The various components of the aeration apparatus 20 will be described in detail below. The inlet pipe line 30 comprises a piping which is made of synthetic resin or any of various other materials, and has a main pipe 31 extending centrally in the

culture pond 10 and a plurality of branch pipes 33 extending laterally from the main pipe 31. The main pipe 31 and the branch pipes 33 are disposed near the bottom 12 of the culture pond 10 so as to spread in a plane extending over the bottom 12 of the culture pond 10. The inlet pipe line 30 has a plurality of inlet ports 35 defined in the branch pipes 33 (in the embodiment, two inlet ports 35 in each branch pipe 33) for drawing in water from the culture pond 10 such that the amount of water drawn in the inlet pipe line 30 will be substantially uniform throughout the inlet pipe line 30.

FIG. 2 is an enlarged perspective view showing each of the inlet ports 35 of the inlet pipe line 30. As shown in FIG. 2, a pair of inlet ports 35 is formed in laterally spaced facing walls of the branch pipe 33, and is covered with a protective net 37 of mesh screen. The protective net 37 serves to prevent fish and shellfish from being drawn into the inlet pipe line 30, i.e., to prevent fry from being drawn into the inlet pipe line 30 or from swimming with the stream into the inlet pipe line 30 and also to prevent shellfish from entering the inlet pipe line 30. Although the inlet ports 35 are entirely covered with the protective mesh 37, for the purpose of illustrating the inlet ports 35 clearly, the protective mesh 37 is partly omitted from the illustration of FIG. 2.

As shown in FIG. 1, the inlet pipe line 30 also has a plurality of legs 39 extending downwardly from the branch pipes 33 and mounted on the bottom 12 of the culture pond 10 for placing the inlet pipe line 30 including the branch pipes 33 at the location spaced from the bottom 12 of the culture pond 10 to prevent the

inlet ports 35 from being buried in the soil and mud on the bottom 12 of the culture pond 10.

The outlet pipe line 50 comprises a piping which is made of synthetic resin or any of various other materials, and has a main pipe 51 extending centrally in the culture pond 10 and a plurality of branch pipes 53 extending laterally from the main pipe 51. The main pipe 51 and the branch pipes 53 are disposed near the bottom 12 of the culture pond 10 so as to spread in a plane extending over the bottom 12 of the culture pond 10. The outlet pipe line 50 has a plurality of outlet ports 55 defined in the branch pipes 53 (in the embodiment, two outlet ports 55 in each branch pipe 53) for discharging water into the culture pond 10 such that the amount of water discharged from the outlet pipe line 50 will be substantially uniform throughout the outlet pipe line 50.

FIG. 2 is an enlarged perspective view showing each of the outlet ports 55 of the outlet pipe line 50. The outlet port 55 has the same structure as the inlet port 35. As shown in FIG. 2, a pair of outlet ports 55 is formed in laterally spaced facing walls of the branch pipe 53, and is covered with a protective net 57 of mesh screen. The protective net 57 serves to break up air bubbles, which have been gathered into clusters while air flows together with water through the outlet pipe line 50, into smaller air bubbles and to discharge them into the culture pond 10, thereby effectively aerating the water in the culture pond 10.

As shown in FIG. 1, the outlet pipe line 50 also has a plurality of legs 59 extending downwardly from the branch pipes

53 and mounted on the bottom 12 of the culture pond 10 for placing the outlet pipe line 50 including the branch pipes 53 at the location spaced from the bottom 12 of the culture pond 10 to prevent the outlet ports 55 from being buried in the soil and mud on the bottom 12 of the culture pond 10.

The layout of each of the inlet pipe line 30 and the outlet pipe line 50 may be changed or modified. The inlet ports 35 and the outlet ports 55 may also be changed or modified in shape and structure, and the protective nets 37, 57 which protect the inlet ports 35 and the outlet ports 55 may also be changed or modified in structure. If switching means such as valves are employed to switch between the inlet pipe line 30 and the outlet pipe line 50, the inlet pipe line 30 may be used as an outlet pipe line, and the outlet pipe line 50 may be used as an inlet pipe line.

The filter unit F comprises a filter or the like and has a function to remove suspended substances from the water flowing through the extension pipe 40. A drain pipe 60 is provided to drain the water in the culture pond 10, and the drain pipe 60 is capable of being connected to the inlet pipe line 30 through the three-way valve V. The three-way valve V has a function to switch between the connection between the inlet pipe line 30 and the outlet pipe line 50 and the connection between the inlet pipe line 30 and the drain pipe 60. The ejector E has a function to mix air with the water that flows through the extension pipe 40.

A process of operating the culture pond 10 equipped with the aeration apparatus 20 will be described below. Water is

introduced into the culture pond 10 shown in FIG. 1 to start cultivating a crop such as shrimps or the like in the culture pond 10, and the water in the culture pond 10 is aerated by the aeration apparatus 20. The aeration apparatus 20 is operated
5 as follows: First, the inlet pipe line 30 and the outlet pipe line 50 are connected to each other by the three-way valve V, and the pump P is actuated to draw the water in the culture pond 10 into the inlet pipe line 30 through the inlet ports 35. The inlet ports 35 are positioned at substantially equal spaced
10 intervals over the inlet pipe line 30, and the inlet pipe line 30 is laid substantially fully over the bottom 12 of the culture pond 10. Thus, the water is simultaneously pumped from the entire area of the culture pond 10 into the inlet pipe line 30.

The water thus drawn into the inlet pipe line 30 flows
15 through the filter unit F, which removes suspended substances from the water. When the water flows through the ejector E, air is introduced into the water, and the water is thus aerated and then discharged from the outlet ports 55 of the outlet pipe line 50 into the culture pond 10. Because the outlet ports 55 are
20 positioned substantially uniformly over the outlet pipe line 50 and the outlet pipe line 50 is laid substantially fully over the bottom 12 of the culture pond 10, the aerated water is simultaneously supplied from the outlet pipe line 50 to the entire area of the culture pond 10.

25 According to the present invention, as shown in FIG. 3, the water is drawn substantially uniformly from the entire planar area of the culture pond 10 and discharged substantially uniformly into the entire planar area of the culture pond 10. Therefore,

no circulating water flows are developed in a wide range within the culture pond 10, unlike the culture pond with the conventional aeration apparatus shown in FIG. 4. Therefore, the soil of slanted side surfaces 11 and bottom 12 of the culture pond 10 is hardly eroded or is less liable to be eroded. In addition, feed that remains unconsumed by the crop, excrements of the crop, dead bodies of the crop, and dead bodies of vegetable plankton, and the like, are not deposited on the central area of the bottom 12. Thus, any sludge formed on the bottom 12 of the culture pond 10 is minimized in quantity. Since the aeration apparatus 20 has the filter unit F connected to the extension pipe 40, suspended substances can effectively be removed from the water in the culture pond 10, thus preventing the crop from suffering diseases. The water in the culture pond 10 is thus prevented from being contaminated, the growth of the crop is not inhibited, and the harvest of the crop is maintained at a desired level. The service life of the culture pond 10 is increased, and even when the water in the culture pond 10 is discharged out of the culture pond 10, it does not contaminate the surrounding environment. Accordingly, the culture pond 10 and the surrounding environment are protected against contaminations. The inlet pipe line 30 and the outlet pipe line 50 thus disposed near the bottom 12 of the culture pond 10 are capable of efficiently aerating the entire water in the culture pond 10.

For harvesting the crop that has been cultivated in the culture pond 10, the three-way valve V shown in FIG. 1 is operated to connect the inlet pipe line 30 to the drain pipe 60, and the pump P is actuated. The water in the culture pond 10 is drawn

from the inlet ports 35 of the inlet pipe line 30, and discharged through the drain pipe 60 into a canal 70 which is positioned adjacent to the culture pond 10. Alternatively, the water from the culture pond 10 may be drained into any of various drainage facilities such as a drainage ditch, a drainage pipe, or the like. Therefore, the aeration apparatus 20 according to the present invention doubles as a drainage facility.

Although a certain preferred embodiment of the present invention has been shown and described in detail, it should be understood that the present invention is not limited to the above embodiment, but various changes and modifications may be made therein without departing from the scope of the technical concept described and illustrated in the appended claims, description, and drawings. Any shapes, structures, and materials which are not directly referred to in the description and drawings should be interpreted to fall within the scope of the technical concept of the present invention insofar as they have the same function and the same result as the present invention. For example, the order in which the pump P, the ejector E, and the filter unit F are connected, and the number of the pump P, the ejector E, and the filter unit F may be changed in various ways. The connected position of the valve V and the structure of the valve V may also be changed in various ways. The valve V may even be eliminated, and the connections between the pipes 30, 50 and 60 may directly be changed to selectively supply water to the culture pond 10 and discharge water from the culture pond 10. While the inlet pipe line 30 and the outlet pipe line 50 are installed in the planar area over the entire bottom 12 of the culture pond 10

in the illustrated embodiment, the inlet pipe line 30 and the outlet pipe line 50 may be installed in a planar area over a portion of the bottom 12 of the culture pond 10.

As described above, the present invention offers the following advantages:

(1) Since the inlet pipe line and the outlet pipe line are installed in the culture pond to draw in water from the culture pond and discharge aerated water into the culture pond, the water can be drawn and discharged at a plurality of locations in the culture pond, without developing circulating water flows in a wide area which would otherwise tend to erode the side surfaces and bottom of the culture pond. Therefore, undesirable sludge is prevented from being formed on the bottom of the culture pond, the culture pond and the surrounding environment thereof are protected against contaminations, and the service life of the culture pond is increased, while at the same time the water in the culture pond is aerated as required for cultivating the crop in the culture pond.

According to the conventional cultivating process, after a cultivating period is over, it has been necessary to remove the sludge formed on the bottom of the culture pond with a significant expenditure of both time and labor, and also to expose the culture pond to sunlight after the sludge has been removed in order to prepare the culture pond for a next cultivating cycle. According to the present invention, because the sludge formed on the bottom of the culture pond is extremely reduced, the time and labor that needs to be consumed to prepare the culture pond for a next cultivating cycle is reduced, and hence the culture

pond can be prepared in a shorter period of time for cultivating a crop again. Accordingly, the culture pond has an increased productivity.

(2) Since the aeration apparatus has the filter unit
5 incorporated therein, suspended substances which would be responsible for diseases of the crop can easily be removed at a low cost from the water in the culture pond without the need for a separated dedicated filtering facility.

(3) Because the aeration apparatus according to the present
10 invention can be used to drain the water from the culture pond at the time of harvesting the crop that has been cultivated in the culture pond, any additional drainage facility such as a temporary mobile pump is not required to be installed.

15 **Industrial Applicability**

The present invention is applicable to an aeration apparatus suitable for use with a culture pond for cultivating a crop such as shrimps and a method of harvesting a cultivated crop using such an aeration apparatus.

CLAIMS

1. An aeration apparatus for aerating water in a culture pond for cultivating a crop therein, comprising:

5 an inlet pipe line disposed in said culture pond;

 a pump for drawing in the water from said culture pond through said inlet pipe line;

 an ejector for mixing air with the water drawn by said pump; and

10 an outlet pipe line disposed in said culture pond for discharging the water which has been aerated by said ejector into said culture pond.

2. An aeration apparatus according to claim 1, wherein
15 said inlet pipe line is installed near the bottom of said culture pond so as to spread in a plane extending over the bottom of said culture pond, and has a plurality of inlet ports defined in respective portions of said inlet pipe line for drawing in the water from said culture pond through said respective portions.

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3. An aeration apparatus according to claim 1, wherein
 said outlet pipe line is installed near the bottom of said culture pond so as to spread in a plane extending over the bottom of said culture pond, and has a plurality of outlet ports defined
25 in respective portions of said outlet pipe line for discharging the aerated water into said culture pond through said respective portions.

4. An aeration apparatus according to claim 1 or 2 or 3, further comprising a filter unit for removing suspended substances from the water drawn from said culture pond through said inlet pipe line.

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5. An aeration apparatus according to any one of claims 1 to 4, further comprising a drain pipe for draining the water in said culture pond, said drain pipe being connectable to said inlet pipe line through a valve.

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6. An aeration apparatus according to claim 2, further comprising a protective net for covering each of said inlet ports.

7. An aeration apparatus according to claim 3, further comprising a protective net for covering each of said outlet ports.

8. A method of harvesting a crop cultivated in a culture pond, comprising:

20 draining water from said culture pond when the crop is harvested, by drawing in the water from said culture pond with said pump of said aeration apparatus according to any one of claims 1 to 7, through said inlet pipe line.

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