A wastewater treatment equipment comprising a reaction tank, a plurality of anodic plates, a plurality of cathodic plates, a power supply and a collection device is provided. The reaction tank comprises an inlet and an outlet. The anodic plates and the cathodic plates are placed in a staggered order in the reaction tank. The power supply is electrically connected to the anodic plates and the cathodic plates. The collection device is disposed at the bottom of the reaction tank so the colloidal particles deposited at the bottom of the reaction tank can be removed.
WASTEWATER TREATMENT EQUIPMENT
CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the priority benefit of Taiwan application serial no. 93117445, filed on Jun. 17, 2004.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention
[0003] The present invention relates to a wastewater treatment equipment. More particularly, the present invention relates to wastewater treatment equipment for collecting particles with high surface charge in the wastewater.

[0004] 2. Description of the Related Art
[0005] Recently, as the IC industry advances, the manufacturing direction of wafer has developed toward higher density, larger integration and more excellent performance. In order to increase the density and the number of conductive wire layers of the IC, a global planarization process is necessary after the lithographic and thin film deposition processes. Conventionally, the global planarization process is performed by the chemical mechanical polishing (CMP) technology. However, the CMP process consumes large amount of ultrapure water, and therefore wastewater carrying the slurry from the CMP process is produced. In general, the polishing wastewater contains a plurality of nano-grade colloidal particles having the property of high surface charge and stable suspension, which further complicates the wastewater treatment. In addition, although the diluted polishing wastewater can meet the discharge standard of the total suspended solid of the effluent, the fine polishing particles of the wastewater such as silicon, aluminum, tungsten may precipitate in the wastewater treatment plant and as a result, the performance of the wastewater treatment plant is weakened. Moreover, the biological processing unit of the wastewater treatment plant may become completely inactive.

[0006] The conventional treatment methods of the polishing wastewater in the optoelectronic and semiconductor industry include chemical coagulation and membrane filtration. The chemical coagulation method is the conventional technology for removing suspended and colloidal particles in the wastewater. The removal mechanism of chemical coagulation is performed by using inorganic salt coagulating agent to agglomerate fine particles into large particles, and then the particles will precipitate by the gravity thereof. The drawback of the chemical coagulation method is that the properties of the polishing wastewater, such as the components, the turbidity or the conductivity, are not stable. Therefore, the exact amount of the agents in the chemical coagulation process is hard to determine, thus the effect of the coagulation deposition is not obvious. Also, among other disadvantages, the oxidants of the CMP wastewater needs to be removed before the chemical coagulation method is performed, the space required for the method need to be large, the flexibility of the method is almost non-existent, and the sludge volume produced in the method is large.

[0007] Alternatively, the membrane filtration method has been broadly applied for removing micro-colloidal particles, microbes, natural organic compounds or other inorganic ion contaminants. The removal mechanism of the membrane filtration method is performed by using external pressure to filter out large molecule contaminations from the water molecule by the membrane. The drawback of the method is that although the micro particles can be effectively separated from the water, they can easily clog up the pores of the membrane. As a result, the lifetime of the membrane is shortened since the reverse cleaning of the membrane is difficult. In addition, in the method, the size of the separated particles is highly dependent on the membrane pores and should be carefully monitored. Moreover, the method is less ideal for processing polishing wastewater having a large amount of micro particles of high concentration micro particles.

[0008] In solution, the conventional technology introduces a method using the electrochemical reactions comprising the electrophoresis effect due to electric field and the coagulation effect induced by sacrificial electrodes to separate the particles with high surface charge in the wastewater. The electrochemical reactions include electro-coagulation process and electro-decantation process. The electro-coagulation process is performed by using electric field to aggregate particles by the electrical attractions thereof, wherein the anodic plate releases metal ions after anodic oxidation reaction, thus the aggregated particles may be removed by the coagulation mechanism. Alternatively, in the electro-decantation process, the charged particles move to the electrode with opposite charge due to the electrophoresis effect by using electric field to aggregate high concentration particles near the electrode plate. After the aggregated concentration reaches a certain level, the particles may settle on the bottom of the electrolysis tank along the electrode plate.

[0009] Hereinafter, the Taiwan Patent Publication No. 144872, entitled “Continuous Operation Electrolysis Device Of Processing Industry Wastewater By Using Electrochemical Method” will be briefly described. The electrolysis device includes an electrolysis tank having a plurality of staggered positive and negative charged electrode plates. A water inlet and a water outlet are disposed in both sides of the electrolysis tank, wherein the liquid enters the electrolysis tank from the water inlet, passes through every electrode plate, and then flows out through the water outlet. A plurality of scraping components are disposed between every two adjacent electrode plates, wherein each scraping component is driven by a portion of the repetition driving mechanism in the electrolysis tank to move repeatedly on each electrode plate to scrape on the surface of the electrode plate. It should be noted that, since the electrode plate described above is in a round shape, and the fluid passes through a round hole in the center of the electrode plate, the opportunity of the fluid flowing through the electrode plate is reduced. In addition, the edge of the electrode plate and the inner wall of the electrolysis tank are sealed, and thus the electrode plate is hard to assemble. Moreover, although the scraping components and the repetition driving mechanism in the electrolysis tank may successfully scrape off the sludge, the complex design of mechanism will increase the cost of the whole equipment.

[0010] Hereinafter, the U.S. Pat. No. 6,582,592, entitled “Apparatus For Removing Dissolved Metals Form Wastewater By Electro-Coagulation” will be briefly described. In the device of the pattern, a plurality of electrode plates are disposed in an electro-coagulation process tank to form a flow channel in the reaction tank. The electrode plates are
connected to the power supply, whereby electrical currents are provided to form an electric field between the electrode plates, in order to ionize the electrode surface to react with the wastewater. In addition, a cyclone filter is disposed in the outlet terminal outside the reaction tank to separate the colloidal particles by centrifugal force. It should be noted that, the colloidal particles are carried out from the reaction tank by the wastewater, then the colloidal particles are separated by cyclone filter. In other words, there is no device in the reaction tank that can directly separate the colloidal particles. In addition, the complex design of the machine inside the cyclone filter will also increase the cost of the equipment.

SUMMARY OF THE INVENTION

[0011] Therefore, the present invention is directed to providing a wastewater treatment equipment using electrochemical reactions comprising electro-coagulation process and electro-decantation process. In addition, a collection device at the bottom of the reaction tank is also provided to collect the colloidal particles with high surface charge in the wastewater so the treated wastewater can meet the effluent standard.

[0012] In accordance with one embodiment of the present invention, an equipment for treating wastewater is provided. The wastewater treatment equipment comprises, for example but not limited to, a reaction tank, a plurality of anodic plates, a plurality of cathodic plates, a power supply and a collection device. The reaction tank comprises an inlet and an outlet. The anodic plates and the cathodic plates are placed in stagger in the reaction tank. The power supply is electrically connected to the anodic plates and the cathodic plates, and provides an electrical current to each of the anodic plates. In addition, the electrical currents of all anodic plates may have equal amplitudes. It should be noted that, in another embodiment of the present invention, the power supply may also be electrically connected to an anext but not limited to, an anodic plate of the anodic plates and an anext but not limited to, an anodic plate of the anodic plates, and provides an electric current to the anext but not limited to, an anodic plate. Therefore, every two surfaces of each of the anodic plates and the cathodic plates except for the outermost anodic plate and the outermost cathodic plate will accumulate equal but opposite charges. The collection device is disposed at the bottom of the reaction tank for collecting the colloidal particles in the wastewater.

[0013] In one embodiment of the present invention, the collection device comprises, for example but not limited to, a plurality of cones and a plurality of switch valves, wherein the top of the cones is connected to the reaction tank, and switch valves are disposed at the bottom of the corresponding cones. In another embodiment of the present invention, the collection device comprises, for example but not limited to, a plurality of collection pipelines, a plurality of switch valves and a pump. The collection pipelines are connected to the reaction tank, the switch valves are disposed in the corresponding collection pipelines, and the pump is connected to the collection pipelines.

[0014] In one embodiment of the present invention, two opposite sidewalls of the reaction tank comprise a plurality of first plugs and a plurality of second plugs for installing the anodic plates and the cathodic plates respectively. The plugs also allow for the anodic and the cathodic plates to exchange with each other. In addition, the first plugs are extended to the bottom edge of the reaction tank, and the second plugs are not extended to the bottom edge of the reaction tank. Therefore, when the anodic and the cathodic plates are installed in the first plugs and the second plugs respectively, an upward and downward flow is generated between the anodic and the cathodic plates due to flow channel to increase the opportunity of the particles contacting the electrode plates.

[0015] In one embodiment of the present invention, the position of the inlet is higher than that of the outlet. In addition, the reaction tank has an operational water level, wherein the height of the operational water level is maintained between the inlet and outlet to keep the equipment in a stable condition. Moreover, the reaction tank has a deposition height, which is kept higher than the outlet to avoid draining out the deposited colloidal particles at the bottom layer produced during the electro-coagulation process or the concentrated solution at the bottom layer produced during the electrolysis in the reaction tank.

[0016] In one embodiment of the present invention, when the wastewater treatment equipment is provided to perform the electrochemical reactions of both electro-coagulation process and electro-decantation process, the anodic plates comprise, for example but not limited to, iron plates or aluminum plates, and the cathodic plates comprise, for example but not limited to, stainless steel plates. In another embodiment of the present invention, when the wastewater treatment equipment is only provided to perform the electrochemical reaction of electro-decantation process, the anodic plates and the cathodic plates comprise, for example but not limited to, stainless steel plates.

[0017] In one embodiment of the present invention, the ratio of width to height of the reaction tank is within the range of about 1.0 to about 2.0. The distance between every anodic plate and every cathodic plate is within the range of about 2 cm to about 15 cm. The current density of the power supply is within the range of about 1.0 mA/cm² to about 500 mA/cm².

[0018] In one embodiment of the present invention, the wastewater treatment equipment further comprises an inlet pipeline, wherein one terminal of the inlet pipeline is connected to the inlet of the reaction tank, and the other terminal of the inlet pipeline is connected to the wastewater collection tank. In addition, a pump is disposed in the inlet pipeline to pump the wastewater into the reaction tank for continuous treatment of the wastewater. Also, a switch valve is disposed in the inlet pipeline and between the pump and the reaction tank. Moreover, the pump is electrically connected to an automatic controller, which is applied to detect the water level, the pressure or the pH value of the reaction tank to control the suction speed.

[0019] In one embodiment of the present invention, the wastewater treatment equipment further comprises an outlet pipeline, wherein one terminal of the outlet pipeline is connected to the outlet of the reaction tank, and the other terminal of the outlet pipeline is connected to the outlet collection tank. In addition, a switch valve is also disposed in the outlet pipeline. Moreover, a suction device is disposed at the top of the reaction tank to draw out the hydrogen and oxygen gases produced between the electrode plates during the electrolysis of the water molecule in the wastewater.
Accordingly, the present invention provides an equipment using electrochemical reactions of electro-coagulation process and electro-decantation process to separate colloidal particles with high surface charge from the wastewater. In addition, the collection device at the bottom of the reaction tank is provided to collect the colloids or particles deposited at the bottom. Therefore, the treated wastewater can meet the effluent standard.

One or part or all of these and other features and advantages of the present invention will become readily apparent to those skilled in this art from the following description wherein there is shown and described an embodiment of this invention, simply by way of illustration of one of the modes best suited to carry out the invention. As it will be realized, the invention is capable of different embodiments, and its several details are capable of modifications in various, obvious aspects all without departing from the invention. Accordingly, the drawings and descriptions will be regarded as illustrative in nature and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings are included to provide a further understanding of the invention, and are incorporated in and constitute a part of this specification. The drawings illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

FIGS. 1A and 1B are schematic drawings of a wastewater treatment equipment according to embodiments of the present invention.

FIGS. 2A and 2B are schematic drawings of a wastewater treatment equipment according to another embodiments of the present invention.

DESCRIPTION OF EMBODIMENTS

FIGS. 1A and 1B are schematic drawings of a wastewater treatment equipment according to embodiments of the present invention. Referring to FIG. 1A, a wastewater treatment equipment 100 for treating wastewater having the property of nano-grade particles with high surface charge and stable suspension is provided. The wastewater treatment equipment 100 comprises, for example but not limited to, a reaction tank 110, a plurality of anodic plates 120, a plurality of cathodic plates 130, a power supply 140 and a collection device 150. It is noted that, the embodiment illustrated in FIG. 1B is similar FIG. 1B, wherein the differences between FIG. 1B and FIG. 1A will be described hereinafter.

The reaction tank 110 comprises an inlet 111 and an outlet 112, wherein the terminal of the inlet 111 is connected to one terminal of the inlet pipeline 160, and the other terminal of the inlet pipeline 160 is connected to the wastewater collection tank 10. In addition, a pump 162 is disposed in the inlet pipeline 160 to pump the wastewater in the wastewater collection tank 10 to the reaction tank 110 for continuous treatment of the wastewater. Moreover, a switch valve 164 is disposed in the inlet pipeline 160 between the pump 162 and the reaction tank 110 to control the entrance of the wastewater to the reaction tank 110. Furthermore, the outlet 112 of the reaction tank 110 is connected to the terminal of an outlet pipeline 170, and the other terminal of the outlet pipeline 170 is connected to the outlet collection tank 20. In addition, a switch valve 172 may also be disposed in the outlet pipeline 170 to control the exit of the wastewater from the reaction tank 110.

The anodic plates 120 and the cathodic plates 130 are disposed in the reaction tank 110. The anodic plates 120 can be iron plates or aluminum plates. The cathodic plates 130 can be stainless steel plates. In addition, the anodic plates 120 and the cathodic plates 130 are placed in a staggered order. In one embodiment of the present embodiment, a plurality of first plugs 113 and a plurality of second plugs 114 are disposed on two opposite sidewalls of the reaction tank 110 respectively to install the anodic plates 120 and cathodic plates 130. The design of plugs 113 and 114 enables exchangeability of the anodic and cathodic plates 120 and 130 during installation.

In addition, it should be noted that the first plugs 113 are extended to the bottom edge of the reaction tank 110, and the second plugs 114 are not extended to the bottom edge of the reaction tank 110. Therefore, after the anodic and cathodic plates 120 and 130 are installed in the first plugs 113 and the second plugs 114 respectively, an upward and downward flow between the anodic and cathodic plates 120 and 130 is generated by the flow channel thereof. As a result, the flow path of the wastewater is enlarged, and thus the opportunity of the particles contacting the electrode plates is increased. Moreover, the ratio of width to height of the reaction tank 110 ranges between about 1.0 to about 2.0. The length of the reaction tank 110 is dependent on the number of the anodic and cathodic plates 120 and 130.

Referring to FIG. 1A, in one embodiment of the present invention, the power supply 140 is electrically connected to the anodic plates 120 and the cathodic plates 130 to provide an electrical current to each anodic plate 120, therefore, each cathodic plate 130 will have corresponding electrical current in opposite direction. In addition, for example, the electrical currents of all the anodic plates 120 may have equal amplitudes. Therefore, a dual polarized electric field is formed between the anodic plates 120 and the cathodic plates 130. In addition, the power supply 140 provides a current density in a range of, for example but not limited to, about 1.0 mA/cm² to about 500 mA/cm². The distance between every anodic plate 120 and every cathodic plate 130 is in a range of, for example but not limited to, about 2 cm to about 15 cm.

Referring to FIG. 1B, in another embodiment of the present invention, the power supply 140 may also be electrically connected to an outermost anodic plate 120a of the anodic plates 120 and an outermost cathodic plate 130a of the cathodic plates 130 to provide an electrical current to the anodic plate 120a, therefore, the cathodic plate 130a will have corresponding electrical current in opposite direction. In addition, every two surfaces of each of the anodic plates 120 and the cathodic plates 130 except for the outermost anodic plate 120a and the outermost cathodic plate 130a will accumulate equal but opposite charges. Therefore, a polarized electric field is formed between the anodic plates 120 and the cathodic plates 130.

The collection device 150 is disposed at the bottom of the reaction tank 110 to collect the colloidal particles in the wastewater. In the present embodiment, the collection device 150 comprises, for example but not limited to, a
plurality of cones 152 and a plurality of switch valves 154. The top of the cones 152 is connected to the reaction tank 110, and the switch valves 154 are disposed at the bottom of the corresponding cones 152.

[0032] As shown in FIG. 1A, when the wastewater flows through the electric field, particles with high surface charge in the wastewater may be deflected by the electric field and attracted to the electrode plates having opposite charges. The moving of the charged particles to the electrode plates is called an electrophoresis effect. Therefore, charged particles are aggregated near the electrode plates with a high concentration. When the concentration is high enough, the particles will deposit at the bottom of the reaction tank 110 along the electrode plates and will be collected by the collection device 150. Meanwhile, the anodic plates 120 (e.g., an iron plate or an aluminum plate) may release metal ion (e.g., iron ion or aluminum ion) due to anodic oxidation reaction. Therefore, metal oxides are produced in the wastewater, and the aggregated particles will deposit in the bottom of the reaction tank 110 due to coagulation mechanism, and will be collected by the collection device 150. In other words, in the present embodiment, when the wastewater of the reaction tank 110 flows through the electric field, the electro-coagulation process and the electro-decantation process perform simultaneously for the colloidal particles to deposit in the bottom of the reaction tank 110.

[0033] It should be noted that, in the present embodiment, the cones 152 of the collection device 150 facilitates the collection of the colloidal particles produced during the electro-coagulation process or the particles concentrated during the electro-decantation process. Thereafter, to remove the deposited sludge, first of all, the switch valve 164 of the inlet and the switch valve 172 of the outlet should be turned off. Then, the switch valve 154 is turned on to receive the sludge from the reaction tank 110 and forward the sludge to collection tank 30. In addition, in the process of electro-coagulation, the anodic and cathodic electrodes may be connected reversibly to the power supply 140 to remove the accumulated particles on the anodic plate 120. Therefore, the treated wastewater from the outlet 112 of the reaction tank 110 may meet the effluent standard.

[0034] Accordingly, in order to facilitate the flow of the wastewater in the reaction tank 110, the position of the inlet 111 may be disposed higher than that of the outlet 112. In addition, the wastewater flows into the reaction tank 110 in an operational water level A, which may be maintained between the height of inlet 111 and outlet 112 to keep the equipment in a stable condition. Moreover, the deposited sludge at the bottom of the reaction tank has a deposition height B, which may be maintained higher than the outlet 112. Therefore, when the treated wastewater exits the reaction tank, the deposited colloidal particles at the bottom layer produced during the electro-coagulation process or the concentrated solution at the bottom layer produced during the electrolysis process will not flow out with the treated wastewater.

[0035] Furthermore, in order to control the suction speed of the pump 170 in the inlet pipeline 160, an automatic controller 180 may be connected to the pump 170. The automatic controller 180 has a sensor component to detect the water level, the pressure or the pH value of the reaction tank 110. When a change of the water level, pressure or pH value of the reaction tank 110 is detected by the sensor component of the automatic controller 180, the suction speed of the pump 170 can be adjusted by the automatic controller 180 to keep the equipment in a stable condition. In one embodiment of the present invention, the automatic controller 180 may also be electrically connected to the switch valve 154. Therefore, the whole equipment may be automatically controlled at the switch of the switch valve 154.

[0036] In addition, when the wastewater flows through the electric field, the water molecule in the wastewater may generate hydrogen and oxygen gases in the anodic plates 120 and the cathodic plates 130 respectively. In addition, for the safety issue of the gases, an enclosure and a suction device 190 may be disposed on top of the reaction tank 110 to draw out the gases.

[0037] FIGS. 2A and 2B are schematic drawings of a wastewater treatment equipment according to another embodiments of the present invention. It is noted that, the embodiment of FIG. 2A/2B is similar FIG. 1A/1B, and the difference there-between will be described hereinafter. As shown in FIG. 2A, the wastewater treatment equipment 100' has a structure similar to that described in the above embodiment except that the collection device 150 is replaced by a plurality of collection pipelines 156, a plurality of switch valves 157 and the pump 158. The collection pipelines 156 are connected to the reaction tank 110, the switch valves 157 are disposed in the corresponding collection pipelines 156, and the pump 158 is connected to the collection pipelines 156. When the deposited sludge is removed, the switch valves 157 and the pump 158 are turned on to pump the sludge from the reaction tank 110 directly to the sludge collection tank 30 via the collection pipelines 156.

[0038] Accordingly, the present invention utilizes electrochemical reactions of electro-coagulation process and electro-decantation process to separate colloidal particles with high surface charge from the wastewater. In addition, the collection device at the bottom of the reaction tank is provided to collect the colloids or particles deposited at the bottom of the reaction tank. Therefore, the treated wastewater can meet the effluent standard. In the present invention, the wastewater treatment equipment performs electrochemical reactions of electro-coagulation process and electro-decantation process for treating wastewater. However, in another embodiment of the present invention, the wastewater treatment equipment is not limited to performing the electrochemical reactions of electro-coagulation process and electro-decantation process at the same time. The present invention can be used to only perform the electrochemical reaction of electro-decantation process. In other words, when the electrochemical reaction of the wastewater treatment equipment only comprises the electro-decantation process, the anodic plates and the cathodic plates can be stainless steel plates.

[0039] Accordingly, the wastewater treatment equipment in the present invention has at least the following advantages. First, the electrochemical reactions of the present invention comprising the electro-coagulation process and the electro-decantation process can separate the nano-grade colloidal particles from the wastewater. Next, in the present invention, the collection device is disposed at the bottom of the reaction tank to remove the deposited sludge at the
bottom directly. The structure of the collection device is simple and can therefore reduce the cost of the equipment.

1. Moreover, in the present invention, the anodic and cathodic electrodes of the power supply may be reversed to facilitate the removal of the sludge accumulated on the anodic plates. Therefore, a complex mechanism of the scraped device can be spared. Furthermore, in the present invention, an upward and downward flow between the anodic and cathodic plates are generated due to the flow channel thereof. Therefore, the flow path of the wastewater is enlarged, and thus the opportunity for the particles contacting the electrode plates is increased.

2. In addition, the plugs on the sidewalk of the reaction tank in the present invention enables the exchangeability when installing the anodic and cathodic plates. Also, the wastewater treatment equipment of the present invention is suitable for treating wastewater with high charge particles produced during the semiconductor, electronic, optoelectronic, wafer machining and surface polishing manufacturing process and is thus highly applicable.

3. The foregoing description of the preferred embodiment of the present invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form or to exemplary embodiments disclosed. Accordingly, the foregoing description should be regarded as illustrative rather than restrictive. Obviously, many modifications and variations will be apparent to practitioners skilled in this art. The embodiments are chosen and described in order to best explain the principles of the invention and its best mode practical application, thereby to enable persons skilled in the art to understand the invention for various embodiments and with various modifications as are suited to the particular use or implementation contemplated. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalents in which all terms are meant in their broadest reasonable sense unless otherwise indicated. It should be appreciated that variations may be made in the embodiments described by persons skilled in the art without departing from the scope of the present invention as defined by the following claims. Moreover, no element and component in the present disclosure is intended to be dedicated to the public regardless of whether the element or component is explicitly recited in the following claims.

What is claimed is:

1. An equipment for treating wastewater, comprising:
   a reaction tank comprising an inlet and an outlet;
   a plurality of anodic plates disposed in the reaction tank;
   a plurality of cathodic plates disposed in the reaction tank, wherein the anodic plates and the cathodic plates are disposed in a staggered order;
   a power supply electrically connected in parallel with the anodic plates and the cathodic plates for providing an electrical current to each of the anodic plates in which the electrical currents have equal amplitudes, or electrically connected to an outermost anodic plate of the anodic plates and an outermost cathodic plate of the cathodic plates for providing an electrical current to the outermost anodic plate so that two surfaces of each of the anodic plates and the cathodic plates except for the outermost anodic plate and the outermost cathodic plate accumulate equal but opposite charges; and
   a collection device disposed at a bottom of the reaction tank to collect colloidal particles in the wastewater.

2. The equipment of claim 1, wherein the collection device comprises:
   a plurality of cones, wherein a top of the cone is connected to the reaction tank; and
   a plurality of switch valves, wherein each of the switch valves is disposed at a bottom of each of the cone.

3. The equipment of claim 1, wherein the collection device comprises:
   a plurality of collection pipelines connected to the reaction tank;
   a plurality of switch valves, wherein each of the switch valve is disposed in each of the collection pipelines; and
   a pump connected to the collection pipelines.

4. The equipment of claim 1, wherein a plurality of first plugs and a plurality of second plugs are disposed on two opposite sidewalls of the reaction tank for installing the anodic plates and the cathodic plates respectively, and the first plugs are extended to a bottom edge of the reaction tank, and the second plugs are not extended to the bottom edge of the reaction tank.

5. The equipment of claim 1, wherein a ratio of width to height of the reaction tank is in a range of about 1.0 to about 2.0.

6. The equipment of claim 1, wherein a position of the inlet is higher than a position of the outlet.

7. The equipment of claim 1, wherein the reaction tank comprises an operational water level, wherein a height of the operational water level is maintained between the inlet and the outlet.

8. The equipment of claim 1, wherein the reaction tank comprises a deposition height, wherein the deposition height is higher than a height of the outlet.

9. The equipment of claim 1, wherein the anodic plates comprise iron plates or aluminum plates, and the cathodic plates comprise stainless steel plates.

10. The equipment of claim 1, wherein the anodic plates and the cathodic plates comprise stainless steel plates.

11. The equipment of claim 1, wherein a distance between each of the anodic plates and each of the cathodic plates is in a range of about 0.5 cm to about 15 cm.

12. The equipment of claim 1, wherein a current density provided by the power supply is in a range of about 1.0 mA/cm² to about 500 mA/cm².

13. The equipment of claim 1, further comprising an inlet pipeline, wherein a terminal of the inlet pipeline is connected to the inlet of the reaction tank.

14. The equipment of claim 13, further comprising a pump connected to the inlet pipeline to pump the wastewater into the reaction tank.

15. The equipment of claim 14, further comprising a switch valve connected to the inlet pipeline and between the pump and the reaction tank.

16. The equipment of claim 14, further comprising an automatic controller electrically connected to the pump for detecting a water level, a pressure or a pH value of the reaction tank to control a suction speed.
17. The equipment of claim 1, further comprising an outlet pipeline, wherein the terminal of the outlet pipeline is connected to the outlet of the reaction tank.

18. The equipment of claim 17, further comprising a switch valve disposed on the outlet pipeline.

19. The equipment of claim 1, further comprising a suction device disposed on top of the reaction tank.