

DESCRIPTION

Title of Invention: FILTRATION MEMBRANE MODULE CLEANING METHOD AND CLEANING DEVICE

5 **Technical Field**

[0001] The present invention relates to a filtration membrane module cleaning method and a cleaning device through which pollution matter contained in domestic sewage and industrial wastewater is put into a reaction tank to be subjected to
10 biological treatment or flocculation/precipitation treatment for carrying out a filtering operation.

Background Art

[0002] In a membrane separation treatment system in which pollution matter contained in domestic sewage and industrial
15 wastewater is treated through biological treatment or coagulation/precipitation treatment and then filtered by a filtration membrane module, the filtration membrane module is placed in a reaction tank and water to be filtered is subjected to a membrane separation by a filtering operation.

20 [0003] Due to the filtering operation, the pollution matter that has been removed tends to be deposited on membrane surfaces of the filtration membrane module and accumulated in minute pores inside the membrane surfaces of the module. Usually, for elongating the filtration operation time and thus increasing the
25 filtration operation efficiency by suppressing deposition and accumulation of the pollution matter on the membrane surfaces, scrubbing air is led into the reaction tank so that aeration is made from a bottom part of the filtration membrane module to cause air bubble flows to impinge violently against the membrane
30 surfaces for suppression of deposition and accumulation of the pollution matter. In addition to this, pressurized filtered water is applied to the filtration membrane module in a given period to effect a backwash to the pollution matter to remove the same.

However, even the method of using the scrubbing air and backwash has a limit in exhibiting satisfied power for a long time. Accordingly, in order to remove the pollution matter that has been deposited and accumulated on the membrane surfaces in spite of the treatment by the scrubbing air and backwash, it is indispensably necessary to make a chemical solution-used cleaning for chemically removing the deposited and accumulated pollution matter from the membrane surfaces.

[0004] As a chemical for the chemical solution, a sodium hypochlorite is widely used when the deposited and accumulated pollution matter is organic substance, and oxalic acid is used when the pollution matter is inorganic substance.

[0005] As the filtration membrane module clearing method that uses the chemical solution, so-called in-line cleaning and on-air cleaning are known.

[0006] The in-line cleaning is a cleaning method for cleaning a filtration membrane module by using a chemical solution, in which with a filtration membrane module kept immersed in a reaction tank, a sodium hypochlorite solution is poured into the secondary side (viz., outlet side for filtered water) of the filtration membrane module to cause the chemical solution to penetrate in the filtration membrane module toward the primary side (viz., inlet side for water to be filtered) of the module (This method will be referred to a first clearing method in the following).

[0007] The on-air cleaning is a cleaning method for cleaning a filtration membrane module by using a chemical solution, in which with the filtration member module kept exposed to air, a sodium hypochlorite solution is poured into the secondary side of the of the filtration membrane module to cause the chemical solution to penetrate in the filtration membrane module from the secondary side to the primary side.

[0008] More specifically, as the on-air cleaning, the following three methods are widely known.

[0009] The first one is a method for cleaning a filtration membrane module by using a chemical solution, in which the filtration membrane module immersed in the reaction tank is taken out from the tank and exposed to air, then a sodium hypochlorite solution is poured into the secondary side of the filtration membrane module to cause the chemical solution to penetrate in the module from the second side to the primary side (This method will be referred to a second cleaning method in the following).

[0010] The second one is a method for cleaning a filtration membrane module by using a chemical solution, in which from a reaction tank in which the filtration membrane module has been kept immersed, a solution is taken out to expose the filtration membrane module to air and then a sodium hypochlorite solution is poured into the secondary side of the filtration membrane module to cause the chemical solution to penetrate in the filtration membrane module toward the primary side (This method will be referred to a third cleaning method in the following).

[0011] The third one is an immersion tank-used method in which an external tank for immersing therein a filtration membrane module is provided besides a reaction tank, and in which in case of treating pollution matter for carrying out the chemical solution-used cleaning, only the solution in the external immersion tank is discharged. Thus, in this method, the amount of discharged solution can be reduced as compared with that in the above-mentioned third cleaning method, and furthermore, it is possible that after the discharged solution is temporarily reserved in the reaction tank, the filtration membrane module is treated by the chemical solution-used cleaning of the above-mentioned third cleaning method (This method will be referred to a fourth cleaning method in the following). One of documents

that show the above-mentioned clearing method is Patent Document-1.

Prior Art Documents

Patent Documents

- 5 [0012] Patent Document-1: Japanese Laid-open Patent Application (Tokkai) 2005-66548.

Summary of Invention

Problems to be solved by Invention

- 10 [0013] In the above-mentioned first cleaning method (viz., in-line cleaning method), since the chemical solution is poured into the filtration membrane module that is kept immersed in the reaction tank, penetration of the chemical solution into the filtration membrane module is not easily made due to the fluid pressure in the reaction tank. Furthermore, the chemical solution
- 15 having made penetration at the outer surfaces of the filtration membrane module is subjected to a dilution in concentration by the solution in the tank, and thus, the cleaning effect applied to pollution matter deposited and accumulated on the membrane surfaces of the filtration membrane module is reduced.
- 20 Furthermore, in case wherein the filtration membrane module is kept clogged, the chemical solution fails to be distributed to the clogged part of the module, which tends to cause unevenness in cleaning. In order to solve the cleaning unevenness, it is necessary to pour a large amount of chemical solution into the
- 25 filtration membrane module at much higher pressure, which needs usage of a high pressure pump and a larger amount of chemical solution.

- 30 [0014] In the above-mentioned second cleaning method (viz., on-air cleaning method), for taking out the filtration membrane module from the reaction tank and moving the same in air, it is necessary to use a hoisting/lowering machine, such as a chain block or the like. Furthermore, complicated works, such as a work of dismantling pipe arrangements for handling filtered water

and scrubbing air and a work of mantling the pipe arrangements are needed.

[0015] In the above-mentioned third cleaning method (viz., on-air cleaning method), it is necessary to provide a separate
5 reservoir tank for temporarily reserve therein the solution drawn from the reaction tank. Usually, the filtration membrane module is placed in the bottom part of a reaction tank of which depth of water is 4 to 5m, and thus, in order to expose the entire
10 construction of the filtration membrane module to air, almost all of the solution in the reaction tank needs to be drawn out from the tank, which needs construction of a large capacity of tank that temporarily reserve therein the solution drawn from the reaction tank and construction of a transfer pump, causing
15 increase in construction and operating costs.

[0016] In the above-mentioned fourth cleaning method (viz., on-air cleaning method), that is, in the immersion tank-used
20 method in which an external immersion tank for immersing therein a filtration membrane module is provided besides a reaction tank, it is only necessary to take out the solution in the external immersion tank, and thus, the amount of discharged solution can be reduced as compared with the above-mentioned third cleaning method. Furthermore, when the discharged
25 solution is transferred to the reaction tank, the external immersion tank can be used as a temporary reservoir tank. However, because of necessity of the external immersion tank and necessity of the transfer pump for transferring the solution from the reaction tank to the external immersion tank, the construction and operating costs are increased although these
30 costs are not so large as those of the above-mentioned third cleaning method.

[0017] An object of the present invention is to provide a filtration membrane module cleaning method and a cleaning device, which are able to solve the drawbacks of the above-

mentioned first cleaning method which are the reduction in cleaning ability, the high pressure load applied to the pump used for pouring the chemical solution and the large amount of the chemical solution, the drawbacks of the above-mentioned second
 5 cleaning method which are the need of usage of hoisting/lowering machine, such as a chain block or the like, the complicated works, such as a work of dismantling pipe arrangements for handling filtered water and scrubbing air and a work of mantling the pipe arrangements, and the drawbacks of the above-mentioned third
 10 cleaning method which are the need of a separate reservoir tank for temporarily reserve therein the solution drawn from the reaction tank and the need of a transfer pump and the drawbacks of the above-mentioned fourth cleaning method which are the need of an external immersion tank and a transfer pump, and are
 15 able to exhibit such a high cleaning effect as that of the above-mentioned conventional on-air cleaning with a simplicity of the in-line cleaning in which the filtration membrane module is cleaned by a chemical solution having the module kept immersed in a reaction tank.

20 **Means for solving problems**

[0018] A filtration membrane module cleaning method of the present invention includes pouring a cleaning chemical solution into the secondary side of a filtration membrane module that is kept immersed in a solution in a reaction tank, thereby causing
 25 the chemical solution to penetrate in the filtration membrane module toward the primary side for cleaning the filtration membrane module, wherein the filtration membrane module is received in a module casing (or cleaning casing), air is led into the module casing, and with the filtration membrane module kept
 30 exposed to air, the chemical solution is poured into the secondary side of the filtration membrane module to cause the solution to penetrate in the module toward the primary side of the module.

[0019] A filtration membrane module cleaning device of the invention includes a chemical solution pouring device for pouring a chemical solution into the secondary side of a filtration membrane module that is kept immersed in a solution in a reaction tank, the chemical solution being poured into the secondary side of the filtration membrane module by the chemical solution pouring device thereby to clean the filtration membrane module, wherein a module casing is provided which receives therein the filtration membrane module and is able to reserve air for exposing the filtration membrane module to air, and an air feeding device is provided which feeds the interior of the module casing with air causing the filtration membrane module to be exposed to air.

[0020] The module casing is shaped like a lidded cylindrical member that has a bottom portion opened and an open upper portion closed by a lid plate, and the lid plate is provided with a solution/air discharge valve through which the interior and exterior of the module casing are connectable. A pressurized air driven valve may be used as the solution/air discharge valve.

[0021] As the air feeding device for feeding air into the module casing, an air diffusing blower or a scrubbing blower may be used.

Advantages of Invention

[0022] In the filtration membrane module cleaning method of the invention, air is fed to the interior of the module casing having a filtration membrane module kept received in the casing, so as to fill the interior of the module casing with air, and with the filtration membrane module kept exposed to air, the chemical solution is poured into the secondary side of the filtration membrane module, and thus, as compared with the case of the above-mentioned conventional in-line cleaning method in which the chemical solution is poured into the filtration membrane module having the filtration membrane module kept immersed in

the solution in the reaction tank, penetration of the chemical solution in the filtration membrane module is easily made by a degree that corresponds to a hydraulic pressure that is not applied to the filtration membrane module. It never occurs that the effect of the chemical solution lowers due to reaction between the chemical solution seeping out from minute pores inside the membrane surfaces of the filtration membrane module and the solution in the reaction tank. Furthermore, since the chemical solution is not diluted by the solution in the reaction tank, lowering of cleaning effect caused by dilution of the chemical solution is suppressed. The filtration membrane module cleaning method of the invention can be carried out by adding a simple step to the conventional in-line cleaning method in such a manner that after the filtration membrane module is received in the module casing, air is led into the module casing.

[0023] The filtration membrane module cleaning device of the invention can be carried out by applying a simple improvement to the conventional in-line cleaning device in such a manner that after the filtration membrane module is received in the module casing, air is fed to the interior of the module casing by the air feeding device. By feeding air into the module casing by the air feeding device, the interior of the module casing is filled with air causing the filtration membrane module to be exposed to air, and thus, the filtration membrane module can be cleaned through an on-air cleaning by pouring the chemical solution into the secondary side of the module with the aid of a chemical solution pouring device.

[0024] Since the module casing is shaped like a lidded cylindrical member that has a bottom portion opened and an open upper portion closed by a lid plate, air can be led into the interior of the module casing through the opened bottom portion by the air feeding device. Since the lid plate of the module casing is provided with a solution/air discharge valve, air can be

reserved in and discharged from the module casing by opening/closing the solution/air discharge valve. Accordingly, by adding only the above-mentioned solution/air discharge valve to a control system of the conventional in-line cleaning device, a
 5 control system of the filtration membrane module cleaning device is easily produced.

[0025] By using an air diffusing blower or scrubbing blower as the air feeding device that feeds the interior of the module casing with air, it is not necessary to use an exclusive air
 10 compressor as the air feeding device, and thus, cost of the cleaning device can be reduced by a degree that corresponds to the cost of the air compressor.

BRIEF DESCRIPTION OF DRAWINGS

[0026] Fig. 1 is a schematic view of a sewage treatment
 15 system equipped with a filtration membrane module cleaning device of the invention, the system being operated by carrying out a membrane bioreactor method (MBR).

Fig. 2 is an enlarged view of the filtration membrane module clearing device of the invention.

EMBODIMENTS OF INVENTION

[0027] Fig. 1 is a schematic view of a sewage treatment
 system equipped with a filtration member module cleaning device
 of the invention, the system being operated by carrying out a
 membrane bioreactor method (MBR). In the sewage treatment
 25 system shown, raw water 1, such as domestic sewage, industrial
 wastewater or the like, is led to a screen tank 2 and filtered by a
 fine screen 3 to remove solid waste therefrom and led to a flow
 rate adjusting tank 4. Then, with the aid of a pump 5 that
 adjusts the flow rate, the raw water having the solid waste
 30 removed therefrom is led from the flow rate adjusting tank 4 to a
 denitration tank 6 and then to a reaction tank 7 following a
 gravitation flow caused by the difference in level difference. Due
 to operation of a return pump 8, the water is returned to the

denitration tank 6 from the reaction tank 7, so that activated sludge is forced to circulate around and between the denitration tank 6 and reaction tank 7 and part of the activated sludge is taken out from the reaction tank 7 as a surplus sludge by a
5 sludge taking out valve 9.

[0028] In the denitration tank 6, stirring is carried out by a stirring device 10 in the absence of oxygen. In the reaction tank 7, the inflow water (which will be referred to "under filtering water" hereinafter) is biologically treated by the activated sludge
10 and filtered by a filtration membrane module 11 arranged in the reaction tank 7, and the water thus filtered (which will be referred to "filtered water" hereinafter) is led to a filtered water tank 13 through a filtered water piping 12 and temporarily reserved in the filtered water tank 13, and then, the filtered
15 water is discharged from the filter water tank 13 by a pump 14.

[0029] As the filtration membrane module 11, there is used a cylindrical hollow-fiber membrane module made of polyvinylidene fluoride (PVDF) or the like. The filtration membrane module 11 filters the solution (or water) in the
20 reaction tank 7 by forcing the same to penetrate therethrough. One or plural filtration membrane modules 11 are installed in the reaction tank 7.

[0030] In the reaction tank 7, aerobic treatment is carried out by an air diffusing blower (or air exposing blower) 15 in the presence of dissolved oxygen, and at the same, the filtration membrane module 11 is constantly vibrated by a scrubbing
25 blower 16 and a scrubbing air diffusing device 17 to suppress undesired clogging of the filtration membrane module 11 by the activated sludge. Denoted by 15a is an air diffusing device for air exposure.
30

[0031] In a half-way of the filtered water piping 12, there is arranged a filtering/backwash pump 18. This filtering/backwash pump 18 is operated when it is needed to filter the under filtering

water, it is needed to make a backwash to the filtration membrane module 11 by feeding the filtered water from the filtered water tank 13 to the filtration membrane module 11 every set time or it is needed to wash a chemical solution way after the filtration membrane module 11 is cleaned by the chemical solution with the aid of an after-mentioned chemical solution pouring device 26.

[0032] To the filtered water piping 12, there are connected first and second valves 19 and 20 at an upstream side (viz., the side of the reaction tank 7) and a downstream side (viz., the side of filtered water tank 13) of the water piping having the filtering/backwash pump 18 placed therebetween. Furthermore, to the filtered water piping 12, there is connected a first filtered water backflow passage 21 that connects the upstream side of the first valve 19 to a portion between the filtering/backwash pump 18 and the second valve 20. To the first filtered water backflow passage 21, there is connected a third valve 22. Furthermore, to the filter water piping 12, there is connected a second filtered water backflow passage 23 that connects a portion between the filtering/backwash pump 18 and the first valve 19 to the filtered water tank 13, and to the second filtered water backflow passage 23, there is connected a fourth valve 24.

[0033] The filtration membrane module 11 is cleaned by a filtration membrane module cleaning device 25 that will be described in the following.

[0034] As is seen from Figs. 1 and 2, the filtration membrane module cleaning device 25 comprises a chemical solution pouring device 26 that, upon need of cleaning the module, pours a cleaning chemical solution, such as a sodium hypochlorite solution or the like, into the secondary side of the filtration membrane module 11, a module casing (or cleaning casing) 27 that receives therein the filtration membrane module 11 and is able to reserve air for exposing the filtration membrane module

11 to air and an air feeding device 28 that feeds the interior of the module casing 27 with air.

[0035] The air feeding device 28 functions to serve as the scrubbing blower 16, and by placing the scrubbing air diffusing device 17 at a bottom part of the module casing 27, air is led into the module casing 27 through an opening formed in the bottom part of the module casing 27.

[0036] The chemical solution pouring device 26 comprises a chemical solution tank 29 that contains a cleaning chemical solution, such as sodium hypochlorite solution or the like, a chemical solution feeding pump 30, a chemical solution feeding passage 31 that transfers the chemical solution from the chemical solution tank 29 to the filtration membrane module 11 and a fifth valve 32 that is connected to the chemical solution feeding passage 31. The chemical solution feeding passage 31 is connected to the filtered water piping at a position upstream (viz., at the side of the filtration membrane module 11) of the first filtered water backflow passage 21.

[0037] The module casing 27 is constructed of a metal or the like that is not easily eroded by the above-mentioned chemical solution and has hermeticity.

[0038] The module casing 27 is shaped into an elongate cylindrical structure that is larger in diameter than the filtration membrane module 11 and longer than the filtration membrane module 11. The module casing 27 contains therein one or plural filtration membrane modules 11.

[0039] On the module casing 27, there is mounted a solution/air discharge valve 33.

[0040] The bottom portion of the module casing 27 is opened, and an upper portion of the casing is closed by a lid plate. When, upon need of the chemical solution-used cleaning, air is led into the casing 27 from the opening by the air feeding device 28 having the solution/air discharge valve 33 kept closed, the air is

gradually accumulated in the module casing 27 while pushing the activated sludge (under filtering water) downward out of the casing 27, so that the air finally surrounds the outer surface of the filtration membrane module 11 in the module casing 27.

5 [0041] While, by opening the solution/air discharge valve 33, the air is discharged from the module casing 27 permitting the activated sludge to enter the module casing 27, and once the interior of the module casing 27 is filled with the activated sludge, a circulation flow of the activated sludge between the interior and exterior of the module casing 27 is achieved. As the solution/air discharge valve 33, it is desirable to use a pressurized air driven valve. If a plurality of solution/air discharge valves 33 are employed, both the discharging speed of air from the module casing 27 and the circulation flow of the activated sludge between the interior and exterior of the module casing 27 can be improved.

15 [0042] The position where the solution/air discharge valve 33 is provided is not necessarily the lid plate provided on the module casing 27. However, the valve 33 may be so placed as to discharge the air by such an amount that the filtration membrane module 11 is not exposed to air reserved in the module casing 27.

20 [0043] In the following, operation of the above-mentioned filtration membrane module cleaning device will be described. Upon need of filtration, the fifth valve 32 of the chemical solution pouring device 26 is closed, the solution/air discharge valve 33 is opened, and the first and second valves 19 and 20 connected to the filtered water piping 12 are opened and then, the filtering/backwash pump 18 is operated to run. Upon this, the under filtering water in the reaction tank 7 is filtered by the filtration membrane module 11 to become filtered water and led to the filtered water tank 13 and temporarily reserved therein.

30 [0044] Upon need of cleaning the filtration membrane module 11 by the on-air cleaning, the air diffusing blower 15 is stopped, the filtering/backwash pump 18 is stopped, the first and

second valves 19 and 20 are closed and the solution/air discharge valve 33 is closed. When, under this condition, the scrubbing blower 16 is operated to run, air blown from the scrubbing blower 16 is led into the interior of the module casing 27 from the opening formed in the bottom portion of the module casing 27 through the scrubbing air diffusing device 17, and the air is gradually accumulated in the module casing 27 while pushing the activated sludge downward out of the casing 27.

[0045] Once the interior of the module casing 27 is filled with air and thus the filtration membrane module 11 in the module casing 27 is surrounded by the air, the scrubbing blower 16 is stopped to stop the air feeding.

[0046] If stopping the scrubbing blower 16 is delayed, the fed air is subjected to a so-called overflow state and thus leaked to the outside of the module casing 27 from the bottom portion of the casing 27. However, even if such leakage occurs but a little, the treating performance and other operation are not affected by the leakage, and thus, there is no need of strictly adjusting the air stopping timing by the scrubbing blower 16 and thus only a simple timer setting is sufficient.

[0047] When, with the interior of the module casing 27 being filled with air, the condition is so made that the filtration membrane module 11 is exposed to air, the fifth valve 32 is opened and the chemical solution feeding pump 30 is operated to pour a given amount of chemical solution in the chemical solution tank 29 into the filtration membrane module 11 in a given time for cleaning the filtration membrane module 11 with the chemical solution.

[0048] When the cleaning by the chemical solution is finished, the chemical solution feeding pump 30 is stopped, the fifth valve 32 is closed, the first and second valves 19 and 20 are kept closed, the third and fourth valves 22 and 24 are opened and the filtering/backwash pump 18 is operated again. With this, the

filtered water in the filtered water tank 13 is led through the second filtered water backflow passage 23 and the first filtered water backflow passage 21 to the filtration membrane module 11 to clean the module 11 by the filtered water, and thus, the chemical solution staying on the membrane surfaces of the filtration membrane module 11 is washed out to finish the cleaning of the filtration membrane module 11. The process of washing out the chemical solution may be carried out after the interior of the module casing 27 is filled with the activated sludge.

[0049] After the cleaning of the filtration membrane module 11 is finished, the solution/air discharge valve 33 is opened. Upon opening of the solution/air discharge valve 33, air in the module casing 27 is discharged to the outside of the module casing 27 through the opened solution/air discharge valve 33, and at the same time, the activated sludge is forced to enter the module casing 27, and thus, finally, the interior of the module casing 27 becomes filled with the activated sludge. Upon this, the first and second valves 19 and 20 are opened and all the air diffusing blower 15, filtering/backwash pump 18 and scrubbing blower 17 are operated to restart the filtering. The timing when the system is returned to the filtering operation may be made by timer setting.

[0050] The filtration membrane module cleaning device has the above-mentioned construction and has the following effects.

(1) With a simple method in which, with a filtration membrane module kept in a module casing, feeding of air is carried out, on-air cleaning can be made having the filtration membrane module kept immersed in the solution in the reaction tank, and thus, the on-air cleaning of the filtration membrane module can be easily carried out as compared with a known method in which on-air cleaning is made after the activated sludge is discharged from the reaction tank or after the filtration membrane module is taken out from the reaction tank.

(2) The filtration membrane module can be separately cleaned by on-air cleaning without taking the filtration membrane module to air. If, in a known method, on-air cleaning is carried out after the activated sludge is discharged from the reaction tank in which a plurality of filtration membrane modules are set, all of the filtration membrane modules set in the reaction tank become out of order and thus the entire processing power of the system is greatly reduced. However, in case of the invention, on-air cleaning can be carried out to the filtration membrane modules separately (for each module casing), and thus, filtration membrane modules other than those that are under cleaning can be practically used, and thus, stable filtering and treating processing is achieved.

(3) Since the cleaning by chemical solution can be made having the filtration membrane module kept immersed in the reaction tank, the filtration membrane module cleaning device can be easily incorporated with an automatic operation of a sewage treatment system. Accordingly, frequency in effecting the cleaning by chemical solution can be set high, and thus, undesired clogging of the filtration membrane module 11 is suppressed and stable treating power is achieved.

(4) In the filtration membrane module cleaning device of the invention, parts that are specially used in the device are only the module casing for containing the filtration membrane module, the solution/air discharge valve connected to the module casing and the air source for the valves and thus, the device of the invention can be constructed at a relatively low cost. Especially, if a scrubbing blower is used as the air feeding device that feeds the module casing with air, the number of parts used is reduced and thus cost reduction is achieved for that. Accordingly, as compared with a conventional on-air cleaning device, the air feeding device can be produced at a very low cost. Furthermore, energy for driving the air feeding device is small.

[0051] In the above-mentioned embodiment, the scrubbing blower 16 and scrubbing air diffusing device 17 are used as elements of the air feeding device 28 and the scrubbing air diffusing device 17 is arranged to face the opening of the bottom portion of the module casing 27 for feeding the interior of the module casing 27 with air. However, it is not always necessary to feed air from the opening of the bottom portion of the module casing 27. For example, an arrangement may be employed in which a branched passage (not shown) is connected through a switch valve (not shown) to an air feeding passage 34 that connects the scrubbing blower 16 and scrubbing air diffusing device 17, and a leading end of the branched passage is connected to the module casing 27 to feed the interior of the module casing 27 with air. In case of feeding air, air feeding to the scrubbing air diffusing device 17 is stopped by the switch valve. The leading end of the branched passage is equipped with a check valve (not shown). The leading end of the branched passage is connected to any position of the module casing 27. Furthermore, in place of the scrubbing blower 16, the air diffusing blower 15 may be used for feeding air the interior of the module casing 27 with air.

[0052] Furthermore, if desired, a dedicated air feeding blower may be used in place of the scrubbing blower 16 and diffusing blower 15. Although, in the embodiment, the module casing 27 is a lidded cylindrical member, the shape of the module casing 27 is not limited to such lidded cylindrical type. That is, the module casing may have a suitable shape, for example a shape corresponding to that of the filtration membrane module 11. Although, in the embodiment, both the filtering and backwashing are made by one filtering/backwash pump 18, the filtering and backwashing may be respectively made by different pumps. Furthermore, although in the embodiment, a cylindrical hollow-fiber membrane module made of polyvinylidene fluoride

(PVDF) or the like is used as the filtration membrane module 11, the material of the filtration membrane module 11 may be organic membrane or inorganic membrane. Furthermore, the construction of the filtration membrane module 11 may be flat
5 membrane, hollow-fiber membrane or mono tubular membrane. Furthermore, in the above-mentioned embodiment, the filtration membrane module cleaning device is mainly explained. In this explanation, a filtration membrane module cleaning method of the invention is disclosed which includes pouring a cleaning
10 chemical solution into the secondary side of a filtration membrane module that is kept immersed in a solution in a reaction tank, thereby causing the chemical solution to penetrate in the filtration membrane module toward the primary side for cleaning the filtration membrane module, wherein the filtration membrane
15 module is received in a module casing, air is led into the module casing, and with the filtration membrane module kept exposed to air, the chemical solution is poured into the secondary side of the filtration membrane module to cause the solution to penetrate in the module toward the primary side of the module. Furthermore,
20 in the above-mentioned embodiment, it is explained that the filtration membrane module cleaning method and filtration membrane module cleaning device of the present invention are used in a membrane separation treatment system in which pollution matter or the like in domestic sewage and industrial
25 wastewater is treated by biochemical treatment and then filtered by a filtration membrane module. However, if desired, the method and device of the invention may be used in a membrane separation treatment system in which a flocculating agent is added to the domestic sewage and industrial wastewater to
30 subject the pollution matter to a flocculation/precipitation treatment for carrying out the filtration by the filtration membrane module.

[0053] The present invention is applicable to not only an immersed membrane but also a membrane module of a casing receiving type.

Explanation on Reference Numerals

- | | |
|----|--|
| 5 | [0054] 1..... raw water |
| | 2..... screen tank |
| | 3..... coarse screen |
| | 4..... flow rate adjusting layer |
| | 6..... denitration tank |
| 10 | 7..... reaction tank |
| | 8..... return pump |
| | 9..... sludge taking out valve |
| | 10.... stirring device |
| | 11.... filtration membrane module |
| 15 | 12.... filtered water piping |
| | 13..... filtered water tank |
| | 15..... diffusing blower (air exposing blower) |
| | 15a.... air diffusing device for air exposure |
| | 16..... scrubbing blower |
| 20 | 17..... scrubbing air diffusing device |
| | 18..... filtering/backwash pump |
| | 19..... first valve |
| | 20..... second valve |
| | 21..... first filtered water backflow passage |
| 25 | 22..... third valve |
| | 23..... first filtered water backflow |
| | 24..... fourth valve |
| | 25..... filtration membrane module cleaning device |
| | 26..... chemical solution pouring device |
| 30 | 27..... module casing (cleaning casing) |
| | 28..... air feeding device |
| | 29..... chemical solution tank |
| | 30..... chemical solution feeding tank |

- 31..... chemical solution feeding passage
- 32..... fifth valve
- 33..... solution/air discharge valve
- 34..... air feeding passage

5

10

CLAIMS

- [Claim 1] A filtration membrane module cleaning method including pouring a cleaning chemical solution into the secondary side of a filtration membrane module that is kept immersed in a solution in a reaction tank, thereby causing the chemical solution to penetrate in the filtration membrane module toward the primary side for cleaning the filtration membrane module, which is characterized in that the filtration membrane module is received in a module casing, air is led into the module casing, and with the filtration membrane module kept exposed to air, the chemical solution is poured into the secondary side of the filtration membrane module to cause the solution to penetrate in the module toward the primary side of the module.
- [Claim 2] A filtration membrane module cleaning device including a chemical solution pouring device for pouring a chemical solution into the secondary side of a filtration membrane module that is kept immersed in a solution in a reaction tank, the chemical solution being poured into the secondary side of the filtration membrane module by the chemical solution pouring device thereby to clean the filtration membrane module, which is characterized in that a module casing is provided which receives therein the filtration membrane module and is able to reserve air for exposing the filtration membrane module to air, and an air feeding device is provided which feeds the interior of the module casing with air causing the filtration membrane module to be exposed to air.
- [Claim 3] A filtration membrane module cleaning device as claimed in Claim 2, which is further characterized in that the module casing has a bottom portion that is opened and an open upper portion that is closed by a lid plate, and the lid plate is provided with a solution/air discharge valve.

[Claim 4] A filtration membrane module cleaning device as claimed in Claim 3, which is further characterized in that the solution/air discharge valve is a pressurized air driven valve.

5 [Claim 5] A filtration membrane module clearing device as claimed in either one of Claims 2 to 4, which is further characterized in that the air feeding device is constructed to act as a scrubbing blower or an air diffusing blower.