

A WASTEWATER TREATMENT SYSTEM

FIELD OF THE INVENTION

The present invention relates to wastewater treatment system and
5 more particularly the present invention relates to a wastewater treatment
system or treating wastewater at a construction site.

BACKGROUND OF THE INVENTION

There have been concerns about wastewater issues in construction
10 site as in how to reduce the costs in treating wastewater to a level which could
be declared satisfactory and acceptable.

Due to that one such technology has been introduced to treat
wastewater from construction site. In a Singapore Patent Application No.
15 200103323-3, an independent treatment system for treating wastewater from
a construction site was introduced. This system mainly involves chemical
coagulation technology. As the entire structure for this system is made of
metal, it is heavy and therefore difficult to handle and relocate. This prior art
integrates several automation functions to operate the system. Thus, costs,
20 maintenance and reliability of the automation functions can be of concern to
the users. In addition, this prior art comprises of a reaction tank, which is
operated by a motor means, may add on to the equipment cost and weight of
the system.

Any discussion of documents, devices, acts or knowledge in this specification is included to explain the context of the invention. It should not be taken as an admission that any of the material forms a part of the prior art base or the common general knowledge in the relevant art in Singapore or
5 elsewhere on or before the priority date of the disclosure and claims herein. All statements as to the date or representation as to the contents of these documents is based on the information available to the applicant and does not constitute any admission as to the correctness of the dates or contents of these documents.

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Therefore, its an objective of the present invention to address the concerns of many potential users by reducing or eliminating the said characteristics of the prior art system and to introduce a new system of treating wastewater from construction sites in a more adaptable, cost effective
15 and easy to operate situation. It is also another objective of the present invention to introduce a system, with easy monitoring of sludge level within the system, and with size and configuration for easy storage when not in use.

SUMMARY OF THE INVENTION

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The present invention relates to a wastewater treatment system, which comprises of a single whole structure with a reaction tank, a sedimentation tank and a bottom tank housed therein. The reaction tank further includes a plurality of spaced apart flat plates vertically positioned therein. The sedimentation tank further includes a particle retaining means to enhance the

sedimentation process and at least two collection channels to collect the treated wastewater. The bottom tank according to the present invention includes a sludge collection chamber to collect the sludge from the wastewater and thereafter discharging the sludge. The wastewater is
5 introduced into the reaction tank in a controlled speed via an inlet pipe and wherein the wastewater will flow from the reaction tank into the sedimentation tank by its own velocity thereafter filling the bottom tank slowly to allow the sludge to settle at the bottom of the bottom tank and into the sludge collection chamber. The remaining wastewater will flood the particle retaining means in
10 which other particles would be retained and thus allowing treated water to overflow into the collection channels and thereafter by gravitational means flow out of the wastewater treatment system into the drainage system or into a water tank to be reused and wherein the process is repeated each time wastewater is to be treated therein.

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The flat plates according to the present invention are positioned spaced apart creating chambers in which the wastewater would flow in a vertical up and down manner around the flat plates. The flat plates are provided therein to lengthen the flow path thereto to maximize flocculation
20 process before the wastewater enters the sedimentation tank. A pre-determined amount of chemical is introduced into the inlet pipe to ensure that the chemical is thoroughly mixed with the incoming wastewater supply before the wastewater supply is introduced into the reaction tank. Further to this a

built in static mixer is provided in the inlet pipe to further enhance the chemical reaction.

A diversion plate is provided immediately at one end of the
5 sedimentation tank and the purpose is to divert the incoming wastewater from the reaction tank into the bottom tank.

The particle retaining means in the sedimentation tank comprises of a plurality of sludge tubes inclined angularly forming a reversed slanting
10 arrangement of criss-cross structure with the adjoining tubes and wherein said sludge tubes are stacked together into blocks in a rigid manner. The inclined sludge tubes are provided to capture or retain any flocculated particles which did not settle at the bottom tank due to up flowing motion of the wastewater. The wastewater flowing from the said tubes is referred as treated water and is
15 thereafter overflowed into the collection channels via a plurality of 'V' shape like openings.

The bottom tank of the present invention is a tapered structure with one end connected to the sedimentation tank and the other end connected to the
20 sludge collection chamber. Heavier material is collected at the tapered portion of the bottom tank as the bottom tank is filled with the wastewater.

The sludge collection chamber comprises of a viewing portion and a sludge exit portion and wherein the viewing portion is provided to monitor the

amount of sludge collected therein while the sludge exit portion is provided to discharge the collected sludge. The sludge in the sludge collection chamber can be discharged manually or mechanically. Optionally a centrifugal pump could be provided at the sludge exit portion to assist in the removal of sludge
5 if the sludge is unable to be discharged by gravitational means. The sludge collection chamber is positioned in an angular position to further enhance the gravitational effect.

A wastewater treatment system according to the present invention
10 operates mainly of gravitational means.

Other aspects and preferred aspects are disclosed in the specification and / or defined in the appended claims, forming a part of the description of the invention.

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Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of
20 illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE FIGURES

Further disclosure, objects, advantages and aspects of the present application may be better understood by those skilled in the relevant art by reference to the following description of preferred embodiments taken in
5 conjunction with the accompanying drawings, which are given by way of illustration only, and thus are not limitative of the present invention, and in which:

Figure 1 shows a perspective view of the present invention in general;

Figure 2 shows a side cross-sectional view of the present invention as
10 shown in Figure 1;

Figure 3 shows an exploded side cross-sectional view of a portion of the present invention as shown in Figure 2;

Figure 4 shows a perspective view of a particle retaining means used in the present invention;

15 Figure 5 shows another view of the particle retaining means as shown in Figure 4 with the direction of water flowing thereto; and

Figure 6 shows a cross-sectional view of the sludge tubes in the particle retaining means according to the present invention.

20 DETAILED DESCRIPTION OF THE INVENTION

The present invention is particularly developed to introduce a system to treat wastewater at construction sites. The present invention utilizes effective and practical configurations, setup and low amount of chemical agents to enhance sedimentation, which would save the cost of operating the system

and to ensure that the maintenance aspect is kept at minimum. The present invention is also designed to be able to treat both high volume of wastewater and highly turbid wastewater, at the same time. This configuration significantly reduces the suspended solid content of the wastewater. The present invention
5 is designed to work independently and without disruption to the construction work site.

The present invention will now be described in detail with reference made to the accompanied Figures 1 and 2.

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The present invention comprises of at least three main compartments, each mainly referred as tanks. Said tanks could be further categorized into a reaction tank (10), a sedimentation tank (12) and bottom tank (14). It should be noted that the present invention is actually a one single structure in whole.

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The reaction tank (10) is basically a rectangular shaped like structure with a base (16) and four upstanding sidewalls (18). At one of the upstanding sidewall (18), an opening is provided (not illustrated) into which an inlet pipe (20) is mounted thereto. This inlet pipe (20) is provided to allow the
20 wastewater from an external source to be introduced into the reaction tank (10). It should be noticed that the inlet pipe (20) is position at the top portion of the said sidewall (18), Figure 1.

Further to this, the reaction tank (10) also includes a plurality of flat plates (22), which are generally rectangular shaped like plates. Each flat plate (22) has been designed in such a manner that the length of the longer edges of the flat plate (22) is marginally shorter than the internal width of the reaction tank (10). This configuration of the flat plate (22) will ensure that when the flat plates (22) are mounted inside the reaction tank (10), the shorter edges of the flat plates (22) could be mounted to the upstanding sidewalls (18) in a watertight manner. Each flat plate (22) is positioned spaced apart from the adjacent flat plate (22). In the present invention at least three flat plates (22) are provided therein. However the number of flat plates (22) could vary according to requirements. The flat plates (22) are mounted in such a manner that one flat plate (22) is mounted in such that the upper edge of the flat plate (22) is flushed with the upper edge of the reaction tank (10). In other words, the bottom of the flat plate (22) is spaced apart from the base (16). Another adjacent flat plate (22) is mounted as such that the bottom of the flat plate (22) is mounted onto the base (16) and the upper edge of the flat plate (22) is spaced apart from the upper edge of the reaction tank (10), Figure 2. This configuration is repeated along the length of the reaction tank (10), thus creating a plurality of chamber like configuration with vertically mounted flat plates (22). This is ensure, that the flow path of wastewater flowing through the reaction tank (10) is lengthen to allow maximum effect of flocculation during operation.

The sedimentation tank (12) according to the present invention has the similar shape likewise the reaction tank (10). Further to this, said sedimentation tank (12) is configured and designed in such that it is mounted to the bottom tank (14) in a tight manner. A diversion plate (24) is provided therein in the sedimentation tank (12) as shown in Figures 2 and 3. The said diversion plate (24) is designed in such that its height corresponds to the height of the sedimentation tank (12) and is positioned spaced apart from one edge of the sedimentation tank (12). Further to this, the sedimentation tank (12) is also provided with a particle retaining means (26). This particle retaining means (26) is designed to have a plurality of inclined sludge tubes provided in a plurality of blocks (28), Figures 4 and 5. Each block (28) is further configured to have a pair of solid sidewalls and a pair of open top and bottom end to allow water to freely flow thereto. This configuration further allows the water to travel from the bottom portion of the blocks (28) to the top portion of the blocks (28). Said blocks (28) are supported by convention manner in the sedimentation tank (12) and therefore the means of securing said blocks (28) would not be described further. The block (28) consists of multiple sludge tubes inclined angularly, which form a reversed slanting arrangement of 'criss-cross' structure with the adjoining tubes, Figures 5 and 6. This configuration is effective in catching any suspended solids or particles that are not easily precipitated. With these features, the processed water is of high quality with minimum usage of chemical agent. The blocks (28) are preferably made of materials that are strong enough to bear a weight of over

500kg. Because there is no frame support of any kind, it is easy to observe the quality of water from the water surface.

Referring again to Figures 2 and 3, at least two collection channels (30) are provided on the top section of the blocks (28). The collection channels (30) are designed and configured in such a manner that it includes a plurality of 'V' shaped like weirs or openings. Said 'V' weirs are provided to allow water flowing from the blocks (28) to flow into the collection channels (30) and thereafter is released into the drainage system or water tanks for reuse.

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The bottom tank (14) as mentioned earlier is mounted onto the bottom of the sedimentation tank (12). Said bottom tank (14) is preferably designed to have one tapered end to promote gravitational effect onto the waste collected therein. The tapered portion of the said bottom tank (14) is connected to a sludge collection chamber (32). The sludge collection chamber (32) includes a viewing portion (34) at one of its terminal end portion and a sludge exit port (36) on the other terminal end portion. The viewing portion (34) is provided with a double-layer safety clear panel covering to monitor the amount of sludge collected in the sludge collection chamber (32). It should be noted that the sludge collection chamber (32) is positioned in such a manner that the viewing portion (34) is positioned higher than the exit portion (36) in relation to the ground to promote gravitational effect onto the sludge inside the sludge collection chamber (32) when the sludge is released via the exit portion (36). Optionally, a centrifugal pump (38) (not illustrated) could be provided at the

exit portion (36) in case the sludge becomes too thick to be discharged using gravitational force. Said centrifugal pump (38) is preferably operated by using electrical supply.

- 5 Now the working mechanism of the present invention and other features not described earlier would be described in detail.

Optionally, wastewater from the construction site will be collected from individual discharge points via pipe works to a preliminary sedimentation pit
10 for temporary storage and preliminary removal of heavy matters such as sand, grit, mud and etc. Then, a submersible pump is utilized to pump the wastewater into the present invention via the inlet pipe (20). It should be noted that a pre-determined amount of chemical is introduced into the inlet pipe (20) before the wastewater is diverted into the reaction tank (10). The purpose of
15 doing so is to ensure that the chemical is evenly distributed onto the wastewater and this process is further enhanced by a built in static mixer (40) (not illustrated), which is provided in the inlet pipe (20). The flow of the wastewater traveling in the inlet pipe (20) into the reaction tank (10) is controlled at a pre-determined speed at the wastewater source.

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The wastewater in the reaction tank (10) will then flow in a vertical up and down manner, around the plurality of flat plates (22). This process will ensure thorough mixture of the chemical with the wastewater and promote flocculation of any suspended solids or matters. The wastewater will then flow

into the sedimentation tank (12) and immediately diverted into the bottom tank (14) by the diversion plate (24). In this process, heavier particles in wastewater will settle in the bottom tank (14) as sludge. As the bottom tank (14) is being filled with wastewater, the level of wastewater will increase and
5 thereafter flow through the blocks (28). As the wastewater flows through the blocks (28), lighter particles which did not settle in the bottom tank (14) would be trapped and captured in the blocks (28) and therefore ensuring the wastewater is as much as possible free of suspended particles. The already treated wastewater now referred as water is overflowed into the collection
10 channels (30) via the 'V' shaped openings and thereafter discharged into the drainage system or into water tank at the site.

As the sludge is being collected in the sludge collection chamber (32), the amount of the said sludge could be viewed via the viewing portion (34)
15 and when required the sludge could be discharged via the sludge exit portion (36) via gravitational force. If the visual observation shows that the sludge is too thick to be discharged by gravitational means, then the centrifugal pump (38) could be activated to assist the discharging of the sludge effectively. The optional centrifugal pump (38) is just an additional assistant provided to the
20 present invention and is only used when is required. The discharge of sludge could be done manually or mechanically, according to the user's requirements.

The advantage of the present invention is that there are no moving parts from the inlet point at the reaction tank (10) to the discharging point at the sludge exit portion (36). All processes are achieved with the use of minimum electrical power supplied. Only in any case wherein necessary or
5 requested, a motor powered mixer can be installed on the reaction tank (10) to enhance flocculation.

While this invention has been described in connection with specific embodiments thereof, it will be understood that it is capable of further
10 modification(s). This application is intended to cover any variations uses or adaptations of the invention following in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice within the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth.

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As the present invention may be embodied in several forms without departing from the spirit of the essential characteristics of the invention, it should be understood that the above described embodiments are not to limit the present invention unless otherwise specified, but rather should be
20 construed broadly within the spirit and scope of the invention as defined in the appended claims. Various modifications and equivalent arrangements are intended to be included within the spirit and scope of the invention and appended claims. Therefore, the specific embodiments are to be understood to be illustrative of the many ways in which the principles of the present

invention may be practiced. In the following claims, means-plus-function clauses are intended to cover structures as performing the defined function and not only structural equivalents, but also equivalent structures. For example, although a nail and a screw may not be structural equivalents in that

5 a nail employs a cylindrical surface to secure wooden parts together, whereas a screw employs a helical surface to secure wooden parts together, in the environment of fastening wooden parts, a nail and a screw are equivalent structures.

10 "Comprises/comprising" when used in this specification is taken to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof."

CLAIMS

1. A wastewater treatment system comprises of a plurality of storage and processing tanks to treat wastewater collected from a storage pits or
5 reservoirs at a construction site and wherein the wastewater treatment system operates on a power supply source characterized in that the wastewater treatment system comprises of a single whole structure with a reaction tank (10), a sedimentation tank (12) and a bottom tank (14) housed therein, and wherein the reaction tank (10) further includes a plurality of spaced apart flat
10 plates (22) vertically positioned therein, and wherein the sedimentation tank (12) further includes a particle retaining means (26) to capture the particles in the wastewater and at least two collection channels (30) to collect the treated wastewater, and wherein the bottom tank (14) includes a sludge collection chamber (32) to collect the sludge from the wastewater and thereafter
15 discharging the sludge, and wherein the wastewater is introduced into the reaction tank (10) in a controlled speed via an inlet pipe (20) and wherein the wastewater will flow from the reaction tank (10) into the sedimentation tank (12) by its own velocity thereafter filling the bottom tank (14) slowly to allow the sludge to settle at the bottom of the bottom tank (14) and into the sludge
20 collection chamber (32), and wherein the remaining wastewater will flood the particle retaining means (26) in which other particles would be captured and thus allowing treated water to overflow into the collection channels (30) and thereafter by gravitational means flow out of the wastewater treatment system

into the drainage system or into a water tank to be reused and wherein the process is repeated each time wastewater is to be treated therein.

2. A wastewater treatment system as claimed in Claim 1 wherein the flat
5 plates (22) are positioned spaced apart creating chambers in which the wastewater would flow in a vertical up and down manner around the flat plates (22).

3. A wastewater treatment system as claimed in Claim 1 wherein the flat
10 plates (22) are provided therein to lengthen the flow path thereto to maximize flocculation process before the wastewater enters the sedimentation tank (12).

4. A wastewater treatment system as claimed in Claim 1 wherein a pre-
15 determined amount of chemical is introduced into the inlet pipe (20) to ensure that the chemical is thoroughly mixed with the incoming wastewater supply before the wastewater supply is introduced into the reaction tank (10).

5. A wastewater treatment system as claimed in Claim 4 wherein a built in
20 static mixer is provided in the inlet pipe (20) to further enhance the chemical reaction.

6. A wastewater treatment system as claimed in Claim 1 wherein a diversion plate (24) is provided immediately at one end of the sedimentation

tank (12) and the purpose is to divert the incoming wastewater from the reaction tank (10) into the bottom tank (14).

7. A wastewater treatment system as claimed in Claim 1 wherein the
5 particle retaining means (26) in the sedimentation tank (12) comprises of a plurality of sludge tubes inclined angularly forming a reversed slanting arrangement of criss-cross structure with the adjoining tubes and wherein said sludge tubes are stacked together into blocks (28) in a rigid manner.

10 8. A wastewater treatment system as claimed in Claim 7 wherein the inclined sludge tubes is provided to capture or trap any unwanted particles which did not settle at the bottom tank (14) due to the force of upward flowing wastewater.

15 9. A wastewater treatment system as claimed in Claim 1 wherein the wastewater flowing from the particle retaining means (26) is referred as treated water and is thereafter overflowed onto the collection channels (30) via a plurality of 'V' shape like openings.

20 10. A wastewater treatment system as claimed in Claim 1 wherein the bottom tank (14) is a tapered structure with one end connected to the sedimentation tank (12) and the other end connected to the sludge collection chamber (32).

11. A wastewater treatment system as claimed in Claim 1 wherein heavier material is collected at the tapered portion of the bottom tank (14) as the bottom tank is filled with the wastewater.

5 12. A wastewater treatment system as claimed in Claim 1 wherein the sludge collection chamber (32) comprises of a viewing portion (34) and a sludge exit portion (36) and wherein the viewing portion (34) is provided to monitor the amount of sludge collected therein while the sludge exit portion (36) is provided to discharge the collected sludge.

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13. A wastewater treatment system as claimed in Claim 12 wherein the sludge in the sludge collection chamber (32) can be discharged manually or mechanically.

15 14. A wastewater treatment system as claimed in Claim 12 wherein an optionally centrifugal pump (38) could be provided at the sludge exit portion (36) to assist in the removal of sludge if the sludge is unable to be discharged by means of gravitational means.

20 15. A wastewater treatment system as claimed in Claim 1 wherein the sludge collection chamber (32) is positioned in an angular position to further enhance the gravitational effect.

16. A wastewater treatment system as claimed in any of the preceding claims wherein the said wastewater treatment system operates mainly of gravitational means.