

INDEPENDENT WASTEWATER TREATMENT SYSTEM

EMPLOYING INTEGRATED REACTION AND SEDIMENTATION TANKS

5 The present invention relates to the field of wastewater treatment, and is particularly concerned with the design of an integrated reaction tank and sedimentation tank in a wastewater treatment system.

BACKGROUND OF THE INVENTION

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There are many sewage and wastewater treatment systems around the world including those used in factories and residential areas. But there is not yet an independent, standalone system that adopts chemical coagulation technology for an integrated reaction tank and sedimentation tank.

OBJECTIVE OF THE INVENTION

20 It is the objective of the present invention to provide an independent wastewater treatment system which adopts chemical coagulation technology for an integrated reaction tank and sedimentation tank. The system itself is easy to relocate, light in weight and simple in structure. The treated wastewater can meet a predetermined standard.

SUMMARY OF THE INVENTION

According to the invention, there is provided an integrated wastewater treatment system adopting chemical coagulation technology, comprising a chemical dosing vessel, a centrally disposed reaction tank, a
5 sedimentation tank disposed around and below the reaction tank, a chemical dosing pump, and an agitator. The chemical dosing pump pumps chemical from the chemical dosing vessel into the reaction tank and the agitator mixes the chemical with wastewater in the reaction tank
10 for coagulation, and wherein the wastewater that is stirred, mixed and coagulated is directed into the sedimentation tank for sedimentation and separation, with treated wastewater being discharged from an upper part of the sedimentation tank and sludge being discharged from a
15 lower part of the sedimentation tank. The system includes a grain collecting chamber located in the upper part of the sedimentation tank for collecting grains in wastewater, and a helical guiding element disposed in the grain collecting chamber for guiding water from the
20 reaction tank in the grain collecting chamber and maintaining said grains on its surface until such grains become larger, the helical guiding element comprising flat plates extending radially between the walls of the reaction tank and the sedimentation tank.

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Preferably, the plates are helically tilted at a common helix angle.

It is preferred that the agitator is located centrally in

the reaction tank.

Preferably, the system includes an automatic valve at the bottom of the sedimentation tank for discharging sludge.

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In a preferred construction, the system includes an automatic valve (6) at the bottom of the sedimentation tank (3) for discharging sludge.

10 BRIEF DESCRIPTION OF DRAWINGS

The invention will now be more particularly described, by way of example only, with reference to the accompanying drawings in which:

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Figure 1 is a schematic diagram depicting an embodiment of a wastewater treatment system in accordance with the invention; the said system being designed by adopting a chemical coagulation technology for an integrated
20 reaction tank and sedimentation tank;

Figure 2 is a cross-sectional side view of the treatment system of Figure 1; and

25 Figure 3 is a top plan view of the treatment system of

Figure 2.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

5 Referring initially to Figure 1 of the drawings, it shows
schematically a constructive view of an independent
wastewater treatment system designed by adopting chemical
coagulation technology for an integrated reaction tank
(2) and sedimentation tank (3) of a helically tilted
10 plate type. The parts surrounded by dashed lines are the
components of the preferred embodiment. The others are
provided by the client i.e. the user of the system.

The system includes a chemical dosing vessel (1), the
15 reaction tank (2), the sedimentation tank (3), a chemical
dosing pump (4) and an agitator (5) disposed in the
reaction tank (2). An automatic valve (6) is also
provided at the lower exit of the sedimentation tank (3).
Additional parts are to be assembled by the client,
20 including a water tank (7), a transfer pump (8) and a
sludge tank (9). There may be more than one set of
chemical dosing vessels (1), in such case there would be
a respective said chemical dosing pump (4) serving each
of the vessel (1).

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The chemical dosing pump (4) pumps chemical within the
chemical dosing vessel (1) into the reaction tank (2).
The agitator (5) is disposed in the reaction tank (2).

The wastewater treated by the reaction tank (2) flows into the sedimentation tank (3).

The operating procedures of the present wastewater
5 treatment system are described below.

Wastewater is first led into the water tank (7) by the client. The transfer pump (8) disposed in the water tank (7) delivers the wastewater in the tank (7) into the
10 reaction tank (2). At the same time, the chemical dosing pump (4) pumps the chemical in the chemical dosing vessel (1) into the reaction tank (2), which mixes the chemical with the wastewater pumped into the reaction tank (2) by the transfer pump (8). The agitator (5) stirs the mixed
15 liquid, thereby mixing the chemical completely with the wastewater and coagulating it with the grains/particles in the wastewater. As a result the grains are formed as flocs with larger size.

20 The wastewater mixed with chemical in the reaction tank (2) is directed into the sedimentation tank (3) from the bottom of the reaction tank (2) for deposition. The grains with large and small sizes suspended in the wastewater are mostly coagulated into large grains, which
25 will be deposited at the bottom of the sedimentation tank (3) as sludge. The cleaned water is discharged at the top opening of the sedimentation tank (3) as treated wastewater, which is discharged by the client or

recycled. The sludge at the bottom of the sedimentation tank (3) is discharged through the automatic valve (6) into the sludge tank (9) for further treatment.

5 There is a grain collecting chamber (3-1) in the upper part of the sedimentation tank (3). The wastewater being mixed with chemical and coagulated into grains in the reaction tank (2) is directed into sedimentation tank (3) from the outside of the bottom circumference of the
10 reaction tank (2). Large coagulated grains sink and are deposited at the bottom of the sedimentation tank (3), while the cleaned wastewater and lighter grains will be led into the grain collecting chamber (3-1) and finally being discharged at the top opening thereof.

15 A helical guiding element (3-2) is provided in the grain collecting chamber (3-1) to guide water from the reaction tank (2) into the grain collecting chamber (3-1). The helical guiding element (3-2) has a large contact area
20 which allows suspended grains, i.e. grains that do not form sufficiently large size during the chemical coagulating process, to stay on the surfaces of the helical guiding element (3-2). Such grains will accumulate into larger size and eventually flow to the
25 bottom of the sedimentation tank slowly. The volume of the sedimentation tank (3) can be greatly reduced with the design of the highly effective grain collecting chamber (3-1) and the helical guiding element (3-2). The

extent of size reduction is up to 90%.

The helical guiding element (3-2) could be constructed by
a set of concentric, helically inclined, tilted plates or
5 pipes.

Figure 2 is a cross-sectional side view of the wastewater
treatment system and Figure 3 is a top view thereof, in
which the integrated system as a preferred embodiment is
10 shown. The whole system is built by the aforementioned
respective parts, which is preferably combined together
as a single device and placed onto a frame for
transporting to different working sites to be operated or
relocation to another. The reaction tank (2) is installed
15 at the centre of the overall system, whilst the
sedimentation tank (3) is disposed around the reaction
tank (2) at its outer circumference and the lower part
thereof and is located concentric with the reaction tank
(2). As a result the one-piece integral design is
20 realised.

As shown in Figure 2, the reaction tank (2) is located at
the central part of a support structure on the frame, and
the agitator (5) is disposed at the top of the reaction
25 tank (2) for driving propelling blades at the lower part
of the reaction tank (2) for stirring. The lower part of
the sedimentation tank (3) is conically shaped and
converged to the central part at the bottom. The exit for

discharging sludge is disposed at the bottom of the sedimentation tank (3) for discharging sludge out of the system. The whole system is disposed on the frame for convenient transportation. The chemical dosing vessel (1) is placed on the surface of the frame. The chemical dosing pump (4) is located at a suitable position above the chemical dosing vessel (1). The chemical dosing pump (4) pumps the chemical in the chemical dosing vessel (1) into the reaction tank (2) which is located at a higher position in order that the mixed liquid in the reaction tank (2) is conveniently delivered into the sedimentation tank (3) underneath the reaction tank (2). The grain collecting chamber (3-1) and the helical guiding element (3-2) are disposed in the upper part of the sedimentation tank (3).

The size of the overall wastewater treatment system in this preferred embodiment is 1.7 to 2.5 metres in outside diameter and 2.5 to 4.0 metres in height.

The invention has been given by way of example only, and various modifications of and/or alterations to the described embodiment may be made by persons skilled in the art without departing from the scope of the invention as specified in the appended claims.

CLAIMS

1. An integrated wastewater treatment system adopting chemical coagulation technology, comprising:

- 5 a chemical dosing vessel (1);
a centrally disposed reaction tank (2);
a sedimentation tank (3) disposed around and below the reaction tank (2);
a chemical dosing pump (4); and
10 an agitator (5);

wherein the chemical dosing pump (4) pumps chemical from the chemical dosing vessel (1) into the reaction tank (2) and the agitator (5) mixes the chemical with wastewater in the reaction tank (2) for coagulation, and
15 wherein the wastewater that is stirred, mixed and coagulated is directed into the sedimentation tank (3) for sedimentation and separation, with treated wastewater being discharged from an upper part of the sedimentation tank (3) and sludge being discharged from a lower part of
20 the sedimentation tank (3);

the system including:

- a grain collecting chamber (3-1) located in the upper part of the sedimentation tank (3) for collecting grains in wastewater; and
25 a helical guiding element (3-2) disposed in the grain collecting chamber (3-1) for guiding water from the reaction tank (2) in the grain collecting chamber (3-1) and maintaining said grains on its surface until such

grains become larger, the helical guiding element comprising flat plates extending radially between the walls of the reaction tank and the sedimentation tank.

5 2. The system as claimed in claim 1 wherein the plates are helically tilted at a common helix angle.

3. The system as claimed in claim 1 or claim 2, wherein the agitator (5) is located centrally in the reaction
10 tank (2).

4. The system as claimed in any one of claims 1 to 3, including an automatic valve (6) at the bottom of the sedimentation tank (3) for discharging sludge.

15 5. The system as claimed in any one of claims 1 to 4, including an automatic valve (6) at the bottom of the sedimentation tank (3) for discharging sludge.