

# **A Sludge Management Apparatus for Filtering Floc from a Mixture, a System having the same and a Sludge Managing Method**

## **Technical Field**

[0001] The present invention relates to a sludge management apparatus for filtering floc from a mixture, a system having the same and a sludge managing method.

## **Background**

[0002] At a construction or industrial site, wastewater, e.g. rainwater runoff and industrial wastewater, generated from the sites generally contain suspended solids. It is required to treat the wastewater or remove the suspended solids from the wastewater before discharging or further processing the wastewater.

[0003] The removal of suspended solids from rainwater runoff or industrial wastewater, is most commonly effected by chemical dosing, where a coagulant and a flocculent are injected into an influent or incoming wastewater to form flocs. Flocs, due to their own weight, sink in the wastewater, for example, flocs in a treatment tank filled with wastewater would sink to the bottom of the treatment tank. At the bottom of the treatment tank, a liquid sludge, which has a very high water content, e.g. > 90%, is created.

[0004] Typically, the chemical dosing reduces the suspended solids content to below 50mg/litre so that the treated water can be either discharged, e.g. into the public drainage system or recycled for further use. The residual sludge which is formed by the reaction between the suspended solids and the dosed chemicals are removed for storage and/or eventual disposal.

[0005] Generally, there are three methods of dealing with this liquid sludge. First method is the mixing of the liquid sludge with soil on site and using the mixture for backfilling the soil. This method can rarely be accomplished and would be dependent on

site conditions at the time of sludge discharge. Second method is the removal of the water from the liquid sludge by utilising a filter press. This method is very expensive and very slow. It also incorporates the use of a compressed air system, which would require annual test certificates. Third method is the removal of the liquid from site by means of a vacuum truck. This method is expensive, resource wasteful and a repetitive process although it is the most common practice. The problem the third method faces is the relatively high cost of disposal, as the contractor is required to employ the use of a vacuum truck and the sludge must be deposited at approved sites.

## **Summary**

[0006] A first aspect of the present invention provides a sludge management apparatus for filtering floc from a mixture comprising floc and fluid. Apparatus includes a container adapted to contain the mixture therein. Said container includes a first opening for discharging the floc from the container, the first opening being operable between an open configuration and a closed configuration, and a permeable wall portion having one side configured to be in contact with the mixture and another side exposed to the outside of the container. The permeable wall portion is adapted to filter floc from the mixture whereby fluid from the mixture flows through the permeable wall portion and out of the container such that the floc is retained in the container.

[0007] A second aspect of the present invention provides a system including an apparatus in the first aspect and a flocculent tank for containing flocculent. The flocculent tank is designed to be in fluid communication with the container such that the flocculent flows from the flocculent tank to the container.

[0008] A third aspect of the present invention provides a wastewater treatment system including a sludge management apparatus in the first aspect, and a wastewater treatment apparatus in fluid communication with the apparatus. The wastewater treatment apparatus is adapted to receive wastewater for treatment such that the mixture is separated from the wastewater and directed into the sludge management apparatus.

[0009] The present invention provides a sludge managing method for filtering floc from a mixture comprising floc and fluid, the method includes containing the mixture in a container of a sludge management apparatus, filtering floc from the mixture by a permeable wall portion of the container, the permeable wall portion having one side configured to be in contact with the mixture and another side exposed to the outside of the container, such that fluid from mixture flows through the wall portion and out of the container such that the floc is retained in the container; and discharging the floc from the container via a first opening.

[0010] The present invention may be used for erosion control on construction sites and the treatment of the resultant liquid sludge from the erosion.

### **Brief Description of Drawings**

[0011] Fig. 1a shows a schematic view of an exemplary embodiment of a sludge management apparatus of the present invention containing a mixture;

[0012] Fig. 1b shows a schematic view of the apparatus in Fig. 1a containing floc;

[0013] Fig. 1c shows a top view of the apparatus in Fig. 1a;

[0014] Fig. 2a shows a schematic view of another exemplary embodiment of the apparatus in Fig. 2 with the first opening in a closed position;

[0015] Fig. 2b shows a schematic view of another exemplary embodiment of the apparatus in Fig. 1 with a first opening in an open position;

[0016] Fig. 3 shows a schematic view of another exemplary embodiment of a sludge management apparatus of the present invention with a valve;

[0017] Fig. 4 shows a schematic view of another exemplary embodiment of the embodiment of the apparatus in Fig. 1;

[0018] Fig. 5 shows a schematic view of another exemplary embodiment of the embodiment of the apparatus in Fig. 1 with a support frame;

[0019] Fig. 6 shows a schematic view of an exemplary embodiment of a system having the apparatus in any one of the Figs. 1 to 5;

[0020] Fig. 7 shows a schematic view of an exemplary embodiment of a wastewater treatment system having the apparatus in any one of Figs. 1 to 5;

[0021] Fig. 8 shows an elevation view of an exemplary embodiment of the wastewater treatment system in Fig. 7 without container;

[0022] Fig. 9 shows another elevation view of the wastewater treatment system in Fig. 7 with a container; and

[0023] Fig. 10 shows an exemplary method of the present invention.

### **Detailed Description**

[0024] Fig. 1a and 1b show an exemplary embodiment of a sludge management apparatus 10 for filtering floc 52 from a mixture 50 comprising floc 52 and fluid 54. Fig. 1a shows apparatus 10 having mixture 50 and Fig. 1b shows apparatus 10 having floc 52. Sludge management apparatus 10 has a container 100 for containing the mixture 50 therein. Container 100 has a first opening 102 for discharging the floc 52 from the container 100. Apparatus 10 has a permeable wall portion 110 with one side of the wall portion 110 configured to be in contact with the mixture 50 and another side exposed to the outside of the container 100. Permeable wall portion 110 is adapted to filter floc 52 from the mixture 50 such that fluid 54 from the mixture 50 is able to flow through the wall portion 110 and out of the container 100 such that the floc 52 is retained in the container 100.

[0025] First opening 102 may be an inlet and/or outlet for mixture 50 to enter/exit. First opening 102 may be operable between an open configuration and a closed configuration. Container 100 may include a top end and a bottom end which is opposite the top end. First opening 102 may be at the bottom end of the container 100. Second opening 104 may be at the top end of the container 100.

[0026] Container 100 may have a second opening 104 for inflow of the mixture 50 into the container 100. In this configuration, second opening 104 may be an inlet for container 100 for inflow of mixture 50. First opening 102 may be an outlet for floc 52 and/or fluid 54 to exit. Container 100 may be adapted to contain flocculent for flocculating the mixture 50. Flocculent may enter the container 100 via the second opening 104 as will be explained later. Mixture 50 may be a sludge mixture.

[0027] Container 100 may be a bag with a flexible permeable wall portion such that fluid 54 may flow out of the bag through the flexible permeable wall portion. Container 100 may be a filtering bag with flexible permeable wall. Container 100 may be a rigid structure. Permeable wall portion 110 may be disposed between the second opening 104 and the first opening 102. Permeable sidewall portion 110 may extend from the second opening 104 to the first opening 102. Permeable wall portion 110 may be flexible.

[0028] As shown in Fig. 1c, container 100 may include a plurality of wall panels 112 connected to form a circumferential wall surrounding the mixture 50. Container 100 may include four wall panels 112 such that the four panels 112 form a quadrilateral, e.g. square, rectangle, when viewed from the top of the container 100. Top view may be a view in a direction along a longitudinal axis 101 of container 100 from the top end towards bottom end. Container 100 may include six wall panels 112 such that the six panels 112 form a hexagon when viewed from the top of the container 100. Container 100 may include eight wall panels 112 such that the eight panels 112 form an octagon when viewed from the top of the container 100.

[0029] Container 100 may include a base panel 114 which extends across the container 100 at about the bottom end. Base panel 114 may extend substantially perpendicular to the longitudinal axis 101. Base panel 114 may include the permeable

wall portion. The plurality of wall panels 112 may be connected to base panel 114 to form the container 100. At least one of the wall panels 112 may be permeable to allow fluid to flow through and exit container 100. The wall panels 112 and/or base panel 114 may be permeable to allow fluid 54 to flow out of the container 100. Wall panels 112 may extend between the second opening 104 and first opening 102 or extend from the second opening 104 to the first opening 102. Fluid 54 may flow out of the container 100 via the permeable wall portion 110, e.g. wall panels 112, and base wall 114.

[0030] Container 100 and/or the permeable wall portion 110 may be made of geotextile material or an equivalent material which allows fluid 54 to flow through the material for separation of floc 52 from the mixture 50. Geotextile is a permeable fabric.

[0031] As shown in Fig. 2a, apparatus 10 may include an actuator 120 designed to toggle the first opening 102 between an open and closed configuration to open or close the first opening 102. Actuator 120 may be connected to the container 100 at about the first opening 102 and operable to open and close the first opening 102. In Fig. 2a, the actuator 120 is being operated to close the first opening 102. In Fig. 2b, the actuator 120 is being operated to open the first opening 102. Actuator 10 may be a hydraulic, pneumatic, mechanical or electro-mechanical actuator.

[0032] A sealing device 122 may be used to seal the first opening 102 of the container 100. Referring to Fig. 2a and 2b, sealing device 122 may include a first sealing member 124 and a second sealing member 126. First sealing member 124 may be adjacent a first sealing portion 106 on one external side of the container 100 and the second sealing member 126 may be adjacent a second sealing portion 108 on another external side of the container 100 opposite the one external side. First sealing member 124 may be connected to the actuator 120. When actuated by actuator 120 to open the first opening 102 (into a open position), first sealing member 124 may be actuated away from the second sealing member 126 thus forcing a first sealing portion 106 of container 100 in contact with the first sealing member 124 away from the second sealing portion 108 of container 100 in contact with the second sealing member 126. When the first sealing portion 106 is moved away from the second sealing portion 108, the first opening 102 of the container 100 would be opened or in a open position. Vice versa, when first sealing

member 124 is actuated towards the second sealing member 126, the first opening 102 may be closed or be in a closed position when first sealing portion 106 contacts the second sealing portion 108. First sealing member 124 and second sealing member 126 may be elongated bars.

[0033] Container 100 may comprises a valve 130 at the first opening 102 as shown in Fig. 3. Actuator 120 may be connected to the valve 130 to actuate the valve 130 between a close and open position.

[0034] Apparatus 10 may include a detector 140 adapted to detect a pre-determined volume of mixture 50 in the container 100. Detector 140 may be mounted on an internal surface of the container 100 and at a distance from the first opening 102. Detector 140 may be a sensor for sensing the level of mixture 50 in the container 100. Detector 140 may be a sensor for sensing the presence of mixture 50. Detector 140 may send a signal to a controller (not shown in Fig. 3) when the mixture 50 in container 100 reaches a certain height so as to stop the inflow of mixture 50 into the container 100. In this way, the amount of mixture 50 to be contained in the container 100 may be controlled automatically.

[0035] As shown in Fig. 4, apparatus 10 may include a flocculent injector 150 in fluid communication with the container 100. Flocculent injector 150 may be designed to be connectable to a flocculent source (not shown in Fig. 4) so as to establish fluid communication between the flocculent injector 150 and the flocculent source. Flocculent injector 150 may inject flocculent 154 from the flocculent source into the container 100. Flocculent injector 150 may include a pump 152 for pumping flocculent from the flocculent source into the container 100.

[0036] Apparatus 10 may include a collecting tank 160 adjacent the first opening 102 for collecting the fluid 54 and/or the floc 52 that is discharged from the container 100. Collecting tank 160 may be in fluid communication with the container 100 such that floc 52 or fluid 54 exiting the container 100 flows into the collecting tank 160. Collecting tank 160 may be on rollers for easy moving of the collecting tank 160.

[0037] As shown in Fig. 5, apparatus 10 may include a support frame 170 for supporting the container 100. Support frame 170 may include mounting elements 172, e.g. hooks, clamps, and container 100 may include corresponding mounting means 174, e.g. holes, for mounting of the container 100 to the support frame 170. Support frame 170 may be designed to receive collecting tank 160 as shown in Fig. 5 so as to allow fluid 54 and/or floc 52 to be discharged from the container 100 into the collecting tank 160. Support frame 170 may elevate container 100 above the collecting tank 160 so as to allow fluid 54 and/or floc 52 to be discharged into the collecting tank 160 parked below the first opening 102 of the container 100.

[0038] Apparatus 10 may include a control panel (not shown in Fig. 5) in communication with detector 140 and sealing device 122. Control panel may be in communication with valve 130 (not shown in Fig. 5).

[0039] Container 100 may include a moisture sensor (not included in Fig. 5). Moisture sensor being designed to measure the amount of moisture remaining the container after mixture 50 entered the container 100. Moisture sensor may be attached to the container 100. Moisture sensor may be connected to about bottom end of the container 100 so as to measure the moisture content of the mixture 50/floc 52 at about the bottom of the container 100 when the mixture 50 is left in the container 100 to drain of fluid 54. Moisture sensor may be used to monitor the amount of fluid in the mixture 50. Moisture sensor may be controlled by control panel such that signal from the moisture sensor may be sent to the control panel for monitoring of the fluid level in the mixture 50.

[0040] Collecting tank 160 may include an opening for draining fluid 54 from collecting tank. A release valve may be installed at the opening to control the flow of fluid 54 from the collecting tank 160. Release valve may be controlled by a control panel to toggle between an open and closed position for releasing of fluid 54 from the collecting tank 160. As mentioned earlier, fluid 54 from the mixture 50 may exit the container 100 and flow into the collecting tank 160. As this happens, the amount of fluid 54 in the container 100 will drop and monitored by the moisture sensor. In the event that the moisture content drops significantly, moisture sensor sends a signal to the control

panel which in turn opens release valve of the collecting tank 160 and releases the fluid 54 collected in the collecting tank. When the fluid 54 is released from the collecting tank 160, e.g. by determining the time taken for such release, the release valve will be closed and the first opening 102 of the container 100 will be opened by the actuating of the actuator 120 and therefore, releases floc 52 from the container 100 into the collecting tank 160. In this way, it is clear that the process of collecting floc 52 from the mixture 50 may be automated.

[0041] Apparatus 10 may include a hose reel (not shown in Fig. 5) connectable to a water source (not shown in Fig. 5) such that the hose reel may be used to clean the apparatus 10.

[0042] Fig. 6 shows a system 200 which includes apparatus 10 as shown in any one of the embodiments earlier. System 200 may be a sludge management system. System 200 has a flocculent tank 210 containing flocculent, the flocculent tank 210 being in fluid communication with the container 100 such that the flocculent flows from the flocculent tank 210 to the container 100. System 200 may include a mixer 220 in fluid communication with and connected between the flocculent tank 210 having flocculent and the container 100. Mixer 220 is adapted to mix the flocculent with a substance, e.g. water, before entering the container 100. System 200 may include a pump 230 for pumping flocculent from the flocculent tank 210 into the container 100. Pump 230 may be in fluid communication between the flocculent tank 210 and the container 100. Flocculent may be mixed with the substance by the mixer 220 before being pumped into the container 100 by pump 230. System 200 may include a power source 240 electrically connected to the pump 230 and/or mixer 220 for supplying power to the pump 230 and/or mixer 220. At least one of flocculent tank 210, mixer 220, pump 230 or power source 240 may be disposed within the support frame 170. Power source 240 may be an electro-hydraulic power pack. Power source 240 may be portable.

[0043] System 200 may include a mixture holding tank 250 for storing mixture 50. Holding tank 250 may be in fluid communication with container 100. Holding tank 250 may be designed to receive and hold the mixture 50 in the holding tank 250 before transferring the mixture 50 from the holding tank 250 into the container 100. Mixture 50

may be pumped into the holding tank 250 before entering the container 100. This arrangement allows mixture 50 to be stored in the holding tank 250 in the event that the mixture 50 in the container 100 is not ready to be discharged and therefore not able to receive any more mixture 50 into the container 100. System 200 may include a collecting tank 160 in fluid communication with the container 100. Collecting tank 160 may be in fluid communication with container 100. Collecting tank 160 may be disposed adjacent the first opening 102 for collecting the fluid 54 and/or the floc 52 discharged from the container 100.

[0044] System 200 may include flocculent injector 150 in fluid communication with the container 100 for injecting the flocculent into the container 100. Flocculent injector 150 may be designed to be connectable to a flocculent source (not shown in Fig. 6) to establish fluid communication between the flocculent injector 150 and the flocculent source.

[0045] System 200 may be an independent system connectable to any wastewater treatment system that produces mixture 50, e.g. sludge. Mixture 50 from the wastewater treatment system may be injected into the container 100 of the apparatus 10. System 200 may be portable.

[0046] Fig. 7 shows a wastewater treatment system 300. Wastewater treatment system 300 includes a wastewater treatment apparatus 310 and apparatus 10 as shown in any one of the embodiments earlier. Wastewater treatment apparatus 310 is in fluid communication with the apparatus 10 such that wastewater treatment apparatus 310 is adapted to receive wastewater for treatment. Wastewater, as mentioned earlier, may be rainwater runoff or industrial wastewater which comes from construction or industrial sites. After receiving the wastewater, wastewater treatment apparatus 310 separates the mixture 50 from the wastewater and directs the mixture 50 into the apparatus 10. Wastewater treatment apparatus 310 may include a control panel for controlling the pumps and discharge valves as will be mentioned below.

[0047] As shown in Fig. 7, wastewater treatment apparatus 310 may include a first chamber 320, a second chamber 330 in fluid communication with the first chamber 320,

and a chemical processing chamber 340 fluidly connected to the first chamber 320 and second chamber 330.

[0048] First chamber 320 may include inclined plates 326 or filter plate attached to a vertical plate 328. First chamber 320 may include an injection nozzle (not shown in Fig. 7) for injecting wastewater into the inclined plates 326. First chamber 320 may include a first discharge valve 324. First discharge valve 324 may include an electric actuator (not shown in Fig. 7) for actuating the first discharge valve 324.

[0049] Second chamber 330 may include at least one lamella block 336 or an overflow weir 376. Second chamber 330 may include a second discharge valve 332. Second discharge valve 332 may include an electric actuator (not shown in Fig. 7) for actuating the second discharge valve 332. Overflow weir 376 may be disposed between the first chamber 320 and the second chamber 330 for dividing the first chamber 320 and second chamber 330 while leaving a gap between the weir 376 and the ceiling of the chambers 320,330. In this way, wastewater may flow over the weir 376 through the gap from the first chamber 320 into the second chamber 330.

[0050] Chemical processing chamber 340 may include a flocculent tank 346 and a coagulant tank 348. Flocculent tank 346 may include at least one of a flocculent dosing pump 342 for dosing the mixture 50 before entering the first chamber 320. Flocculent tank 346 may include an eductor and clean water supply assembly (not shown in Fig. 7). Coagulant tank 348 may include at least one of a coagulant dosing pump 344 for dosing the mixture 50 before entering the first chamber 320. Coagulant tank 348 may include a clean water supply assembly (not shown in Fig. 7). Wastewater may flow into first chamber 320 through a nozzle at the first chamber 320 via the static mixer 372 in which flocculent and/or coagulant may be mixed into the wastewater before entering the first chamber 320. Flocculent and/or coagulant may be mixed into the wastewater via injection points 362 into static mixer 372 along a conduit fluidly connected to the first chamber 320 as the wastewater flows through the conduit and into the first chamber 320.

[0051] Wastewater treatment apparatus 310 may include a mixture container 350 in fluid communication with the first chamber 320 and second chamber 330. Mixture

container 350 may include a submersible pump 378 for pumping mixture 50 from the mixture container 350 into container 100. A static mixer 360 may be disposed between and fluidly communicable to both the mixture container 350 and container 100 for mixing flocculent into the mixture 50 before entering container 100. Mixture container 350 may include and fluidly connected to a submersible pump 378 which is adapted to pump mixture 50 into the apparatus 10. Static mixer 360 may be fluidly connected to another flocculent pump 352. Flocculent pump 352 may be used to pump flocculent from the flocculent tank 346 into the static mixer 360. Flocculent pump 352 may be located within the chemical processing chamber 340. Mixture container 350 may include a level sensor (not shown in Fig. 7) for sensing the mixture 50 at a pre-determined level so that the inflow of mixture 50 may be stopped when the pre-determined level is reached.

[0052] Wastewater may first be pumped into the first chamber 320 by a submersible pump 374 through an inlet valve 322. Submersible pump 374 may be connected to a conduit leading to first chamber 320. Generally, submersible pump 374 may be located in a sedimentation tank (not shown in Fig. 7). Before entering the first chamber 320, flocculent and/or coagulant may be injected into first chamber 320 via the static mixer 372 to mix flocculent and/or coagulant with the wastewater before the wastewater enters into the first chamber 320. Mixture 50, e.g. sludge, which comprises floc 52 and fluid 54, is formed from the reaction between the wastewater and the flocculent and coagulant. At the inclined plates 326, floc 52 may slide off the inclined plates 326 while fluid 54 may go through holes of a vertical plate 328, i.e. filter plate, to which the inclined plates 326 are attached to. Floc 52, due to its weight, sinks to the bottom of the first chamber 320. Mixture 50, which has substantially high level of total suspended solution (TSS), may be discharged from the first chamber 320 via the discharge valve 324. The remaining wastewater in first chamber 320 may flow over weir 376 disposed between the first chamber 320 and second chamber 330 to flow into the second chamber 330. Wastewater may flow through at least one lamella block 336 in the second chamber 330. Similarly, mixture 50 in second chamber 330 may sink to the bottom of second chamber 330 due to its own weight. Mixture 50 may then be discharged from the second chamber 330 through a second discharge valve 332 into the mixture container 350. The remaining wastewater in second chamber 330 may be much cleaner than that of the first chamber 320. Clean water in the second chamber 330 may be discharged directly from the second

chamber 330. First discharge valve 324 and second discharge valve 332 may be opened at pre-determined times, e.g. every 30, 45 or 60 minutes. Meanwhile, mixture 50 from the first chamber 320 and/or second chamber 330 would have been collected in the mixture container 350. Mixture 50 in the mixture container 350 may be injected by submersible pump 378 into container 100. Flocculent may be mixed in with the mixture 50 via static mixer 360 before injecting the mixture 50 into the container 100 by pumping flocculent via flocculent pump 352 into the static mixer 360 so as to re-floc the mixture 50.

[0053] Wastewater treatment system 300 may include a holding tank 380 (not shown in Fig. 7) in fluid communication with the apparatus 10 such that the holding tank 380 may hold the mixture 50 before being transferred into the apparatus 10. Holding tank 380 may be in fluid communication with the submersible pump 378 such that mixture 50 may be pumped into the holding tank 380 before being transferred into the container 100.

[0054] Fig. 8 shows an elevation view of an exemplary embodiment of the wastewater management system 300. Reference numerals used for features in the earlier embodiments will be used on the same features in the wastewater management system 300. Fig. 8 shows wastewater treatment apparatus 310 connected to support frame 170 of apparatus 10. Container 100 is not shown in Fig. 8. As shown, first chamber 320 may include the inclined plates 326. Second chamber 330 may include lamella block 336. Mixture container 350 may be fluidly connected to the first chamber 320 and second chamber 330.

[0055] Fig. 9 shows another elevation view of the wastewater management system 300. In Fig. 9, container 100 may be mounted within support frame 170. Container 100 may be fluidly connected to the mixture tank 350 via conduit 338.

[0056] Fig. 10 shows a method 1000 for filtering floc 52 from a mixture 50 comprising floc 52 and fluid 54. Method 1000 may include step 1100 of containing the mixture 50 in a container. As mentioned, mixture 50 is being injected by submersible pump 378 into container 100 so that mixture 50 is contained in container 100. Mixture 50 may be filled to a depth when the mixture 50 contacts and triggers the detector 140.

When triggered, detector 140 may send a signal to the submersible pump 378 via a control panel to stop the injection of mixture 50 into the container 100.

[0057] In the event that a mixture holding tank 250 or holding tank 380 is used, submersible pump 378 may inject the mixture 50 into the mixture holding tank 250 or holding tank 380 first. Mixture holding tank 250 or holding tank 380 may include level sensor for sensing the level of mixture 50 in the respective tank so as to stop inflow of mixture into the respective tank when the level is reached.

[0058] In step 1200, floc 52 is filtered from the mixture 50 by a permeable wall portion of the container. Permeable wall portion has one side configured to be in contact with the mixture 50 and another side exposed to the outside of the container such that fluid 54 from mixture 50 flows through the wall portion and out of the container such that the floc 52 is retained in the container. Meanwhile, fluid 54 from the mixture 50 may be removed or filtered from the mixture 50. Fluid 54 may flow through the permeable wall portion 110, out of the container 100 and into the collecting tank 160. Fluid 54 in the collecting tank 160 may be discharged or transferred before collecting floc 52 from the container 100 so that it may be used for collection of floc 52. The filtration may take about 12-24 hours in order for the fluid 54 to substantially exit the container 100. Fluid 54 may also be discharged into a suitable separate storage tank or into the public drainage system as it is generally of low level of total suspended solid (TSS). Fluid 54 in collecting tank 160 may be discharged by opening release valve when activated by moisture sensor when moisture in the mixture 50 falls drastically.

[0059] In step 1300, the floc 52 is discharged from the container via the first opening which is operable between an open configuration and a closed configuration. Once the filtration process is completed, i.e. when fluid 54 has stopped excreting from the floc 52, first opening 102 may be actuated into the open position to let the floc 52 out of the container 100. In an example, first sealing portion 106 may be separated from the second sealing portion 108 by actuating the first sealing member 124 away from the second sealing member 126. In another example, valve 130 may be actuated into an open position to let the floc 52 out from the container 100.

[0060] Floc 52, e.g. in the form of sludge cake, from the container 100 may be conveyed or dropped into the collecting tank 160. Thereafter, the floc 52 may be transported to a vehicle for disposal or put back into the site as fill material depending on the site condition. Floc 52 may be reused on site. Floc 52, e.g. in the form of a sludge cake, may be handled or disposed off in a much easier manner. For example, the floc 52 may be disposed without the need for a vacuum truck and by a conventional tipper truck.

[0061] Apparatus 10 may be used to remove in the order of 50% of the inherent fluid content in the mixture 50. After removal of the fluid 54, it may then be possible to handle the floc 52 as a “solid” as the floc 52 may be in the form of a cake, e.g. sludge cake.

[0062] As mentioned earlier, apparatus 10 and system 200 may be supplied as an accessory to be used with existing wastewater treatment system which are already used on site or as a stand-alone unit for sites where only liquid mixtures, e.g. sludge, are required to be treated to produce a substantially solid waste product.

## Claims

1. A sludge management apparatus for filtering floc from a mixture comprising floc and fluid, the apparatus comprising:
  - a container adapted to contain the mixture therein, the container comprising:
    - a first opening for discharging the floc from the container; and
    - a permeable wall portion having one side configured to be in contact with the mixture and another side exposed to the outside of the container, the wall portion adapted to filter floc from the mixture whereby fluid from the mixture flows through the sidewall portion and out of the container such that the floc is retained in the container.
2. The sludge management apparatus of claim 1, wherein the container is a rigid structure.
3. The sludge management apparatus of claim 1 or 2, wherein the container comprises a base panel wherein the base panel includes the permeable wall portion.
4. The sludge management apparatus of any one of claims 1 to 3, wherein the container comprises a plurality of wall panels connected to form a circumferential wall surrounding the mixture.
5. The sludge management apparatus of any one of claims 1 to 4, wherein the container includes four wall panels such that a quadrilateral shape is formed when viewed from the top of the container.
6. The sludge management apparatus of any one of claims 1 to 5, wherein at least one of the plurality of wall panels is permeable to allow fluid to flow through.
7. The sludge management apparatus of any one of claims 4 to 6, wherein the container further comprises a second opening for inflow of the mixture.
8. The sludge management apparatus of any one of claims 1 to 7, wherein the first opening being operable between an open configuration and a closed configuration.

9. The sludge management apparatus of any one of claims 1 to 7, further comprising an actuator designed to toggle the first opening between an open and closed configuration to open or close the first opening.
10. The sludge management apparatus of any one of claims 1 to 9, further comprising a detector attached to the container, said detector adapted detect a pre-determined volume of mixture in the container.
11. The sludge management apparatus of any one of claims 1 to 10, further comprising a flocculent injector in fluid communication with the container, the flocculent injector for injecting flocculent into the container, the flocculent injector designed to be connectable to a flocculent source so as to establish fluid communication between the flocculent injector and the flocculent source.
12. The sludge management apparatus of any one of claims 1 to 11, wherein the flocculent injector comprises a pump.
13. The sludge management apparatus of any one of claims 1 to 12, further comprising a collecting tank in fluid communication with the container to collect the fluid and/or the floc discharged from the container.
14. A system comprising,
  - a sludge management apparatus as claimed in any one of claims 1 to 13; and
  - a flocculent tank for containing flocculent, the flocculent tank designed to be in fluid communication with the container, wherein the flocculent flows from the flocculent tank to the container.
15. The system of claim 14, further comprising a flocculent injector in fluid communication with the container for injecting the flocculent into the container, the flocculent injector designed to be connectable to a flocculent source to establish fluid communication between the flocculent injector and the flocculent source.
16. The system of claim 14 or 15, further comprising a mixer in fluid communication with and between the flocculent tank having flocculent and the container, wherein the mixer is adapted to mix the flocculent with a substance before entering the container.

17. The system of any one of claims 14 to 16, further comprising a power source electrically connected to the pump and/or mixer for supplying power to the pump and/or mixer.
18. The system of any one of claims 14 to 17, further comprising a holding tank in fluid communication with the container, the holding tank being designed to receive and hold the mixture in the holding tank before transferring the mixture from the holding tank into the container.
19. The system of any one of claims 14 to 18, further comprising a collecting tank in fluid communication with the container for collecting the fluid and/or the floc discharged from the container.
20. A wastewater treatment system comprising,
  - a sludge management apparatus as claimed in any one of claims 1 to 13;
  - a wastewater treatment apparatus in fluid communication with the sludge management apparatus, the wastewater treatment apparatus adapted to receive wastewater for treatment, wherein the mixture is separated from the wastewater and directed into the sludge management apparatus.
21. The wastewater treatment system of claim 20, further comprising a flocculent tank for containing flocculent, the flocculent tank adapted to connect and be in fluid communication with the sludge management apparatus, wherein the flocculent is flowable from the flocculent tank into the sludge management apparatus.
22. The wastewater treatment system of claim 20 or 21, further comprising a holding tank in fluid communication with the sludge management apparatus, the holding tank for holding the mixture before being transferred into the sludge management apparatus.
23. A sludge managing method for filtering floc from a mixture comprising floc and fluid, the method comprising,
  - containing the mixture in a container of a sludge management apparatus;
  - filtering floc from the mixture by a permeable wall portion of the container; the permeable wall portion having one side configured to be in contact with the mixture and another side exposed to the outside of the container, wherein fluid from

mixture flows through the wall portion and out of the container such that the floc is retained in the container; and

discharging the floc from the container via a first opening.