

METHOD FOR TREATMENT OF WASTEWATER**FIELD OF THE INVENTION**

The invention relates to a method of removing flocculated waste materials from wastewater in a unique solids separation tank and within the same solids separating vessel to further treat the wastewater in a counter current manner with concentrated ozone gas to further reduce BOD and COD levels



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to accepted standards prior to discharging from the vessel.

BACKGROUND OF THE INVENTION

Most industries that discharge liquid waste face major problems in effectively treating this material and removing the contaminants so that acceptable discharge levels can be achieved. Common methods of treatment comprise the use of aerobic or anaerobic treatment plants, these types of systems although effective in achieving the desired results take up substantial areas of land and are expensive to operate. It is also impossible to fit these systems into existing factories or sites that have insufficient room to accommodate these types of treatment plants. The solution is compact treatment plants of the chemical treatment type, however these are normally expensive to operate due to the high cost of most chemicals. This invention reduces the amount of chemical required by only using sufficient to flocculate the materials within the wastewater that can be easily flocculated and removed by a floatation process from the surface of a vessel. The resulting wastewater is then treated within the same vessel by ultra saturated ozone gas; this has the ability to reduce the remaining contaminants to acceptable levels prior to discharge.

BRIEF DISCUSSION OF THE INVENTION

The invention relates to a method of efficiently reducing Total Suspended

Solids (TSS) but of more importance the reduction of BOD and COD by the reduced use of a wide variety of chemicals. These chemicals coagulate and flocculate the waste materials within the wastewater and by the use of an Im-Bu-Rator (subject to patent application), (IBR) to ultra saturate air or other gases into the wastewater the contaminants can be removed. By use of a specially designed solids separation vessel the flocculated contaminant's are floated to the top of a column within the solids separation vessel where they float in a containment area before being removed from the surface by a mechanical scrapper system. The semi solids are fall to an angled slide plate where they accumulate against one side of the solids separating vessel and are removed through a side opening for collection. The treated clean wastewater which still has higher than acceptable BOD and COD values passes to a secondary processing zone where it is made to come into contact with concentrated and ultra saturated ozone. This is made possible by the use of a secondary IBR to ultra saturate ozone into clean treated wastewater that is re-cycled at the bottom of the solids separation tank, this allows the concentrated ozone gas to rise at very low velocity through the clean treated wastewater which moves downwards to exit at the bottom of the solids separation tank for final discharge.

DETAILED DESCRIPTION OF THE INVENTION**REFERENCE DRAWING Fig: 1**

A flow of wastewater enters the plant for processing at (1) and is then transferred by a pump (2) to the first stage of treatment. This is normally the adjustment pH by either acid or alkali (3) at injection point (4) to suit the required process conditions to for the type of coagulant being used in the process. However in some cases adjustment of the wastewater pH may not be required.

The pH adjusted wastewater now flows to a dosing point (6) where dilute coagulant (5) is added to cause the contaminants in the wastewater to come together to form small coagulated particles. The coagulation reaction requires time, and this is carried out in a holder vessel (7) the required time may vary to suit the wastewater being processed. Wastewater now flows to a point where air or other gases can be introduced to form a liquid/gas mixture. This process is carried out by partially closing a valve (8), which is in the suction pipeline of a progressive cavity pump (11); the partial closing of the valve (8) creates a partial vacuum in the pipeline (10). Air or other gas is allowed to enter into pipeline (10) through a pipeline (9), the air or gas can be adjusted in flow to the requirement of the process. Pump (11) discharges the liquid/air or gas mixture to device (12) that ultra saturates the gas into

UNIT

the liquid. One such device is the Im-Bu-Rator (IBR) which is subject to a separate patent application, the IBR (12) unit can be incorporated into the base of the separation vessel (31) or the IBR (12) can be a separate free standing unit. The wastewater that has been ultra saturated with air or another gas discharges from the IBR (12) into a vertical riser chamber (13) where it is in-line dosed with a polymer flocculent (14) through injection pipeline (38). The polymer flocculent (14) acts within the wastewater to pull together the coagulated particles. These flocculated particles are surrounded by the ultra small air or gas droplets and attach to the flocculated particles. The flocculated particles with the ultra small air or gas bubbles attached are floated upwards through chamber (13) and eventually enter the separation area (15) where the flocculated particles with air or gas attached are made to float within a second chamber area (16). The wastewater with the flocculated particles removed passes through an annulus area (39), which is created by chamber (13) and (16). Annulus area (39) is formed by the cylindrical ring (16) and (45), cylindrical vessel (45) is held in position by two or more attachment rods (44) whilst cylindrical ring (16) is held in position by plate (32). The flocculated particles known as sludge is removed from the top surface of the wastewater contained in chamber (15) by a scraper (17), which is driven back and forth across the top surface by a

motor (37). The sludge drops on to a sloping plate (32), which seals off chamber (18) to chamber wall (16) and outer vessel (31). The plate (32) is angled in such a manner as to allow the sludge to flow to the lowest point (33) where it can exit for further processing. The treated and clarified wastewater now flows downwards in the annulus created by the wall of chamber (39) and the wall of chamber (31). During this downward flow the treated clarified wastewater which may still contain levels of ^{BOD} BOD and ^{COD} COD is brought into contact with ozone gas which has the effect by chemical reaction of reducing the BOD and COD levels in the wastewater to the desired discharge requirements. This ozone treatment process is carried out by removing the treated wastewater from the separation vessel (31) through an outlet connection pipeline (19) to a point where the ozone gas is added to form a liquid/gas mixture. This process is carried out by partially closing a valve (20), which is in the suction pipeline of a progressive cavity pump (22); the partial closing of the valve (20) creates a partial vacuum in the pipeline (40). Ozone gas is allowed to enter into pipeline (40) through a pipeline (21), the ozone gas can be adjusted in flow to the requirement of the process. Pump (22) discharges the liquid/ozone gas mixture to device (23) that ultra saturates the gas into the liquid. One such device is the Im-Bu-Rator (IBR) which is subject to a separate patent application. The treated

wastewater that has been ultra saturated with ozone gas flows to a pressure chamber (34) where it is held at a pressure above 0.5 barg. The liquid/ozone gas mixture is held for a minimum of 30 seconds. To ensure that the ozone gas does not come out of ultra saturation within the pressure chamber (34) the chamber pressure is maintained by the partial closing of a valve (36) which is positioned on the outlet of the pressure chamber (34). The liquid/gas mixture passes along pipeline (41) and passes into the lower portion of chamber (18) and into a distribution device (24) where the liquid/ozone gas mixture is distributed evenly around the lower portion of chamber (18). The ozone gas rises vertically through chamber (18) where the treated wastewater which is moving in a downward direction through chamber (18) is brought into contact with the ozone gas as it moves downward through chamber (18) to the separation tank outlet pipeline (25). Ozone and any other gases contained in the wastewater in chamber (18) rise vertically until they contact on the underside of plate (32). This plate is angled and the gas moves in an upward direction on the under surface of plate (32) until they reach the highest point where plate (32) meets the separation tank outer wall (31). All gases that accumulate at this point are allowed to vent through pipeline (30) where it goes to atmosphere or can be recovered by a gas re-compression system if installed. The wastewater level

within chamber (15) is achieved as follows. Treated wastewater exits the chamber (18) through a pipeline (42) at point (25) and rises vertically up through level control (26); which is adjustable to maintain a constant level in chamber (15). The treated wastewater is transferred from the vertical rising pipeline (25) to the downward outlet pipeline (43) by a tee piece, air is allowed to enter the pipeline (42) through vent (27) to prevent siphoning. The pH of the treated wastewater can be adjusted to meet regulating authority requirements by the injection of acid or alkali at injection point (29) through pipeline (28).

CLAIM 1.

A wastewater treatment plant comprising:

a wastewater intake, a wastewater feed pump feeding the wastewater from the intake to a reagent dosing system for the adjustment of the pH of the wastewater and for the introduction of coagulant into the wastewater, a holding vessel to which the dosed wastewater then passes and in which coagulation of contaminants in the wastewater takes place, a gas feed device located in a pipeline between the holding vessel and a high pressure pump which introduces air or other gas in the wastewater, the high pressure pump feeding the wastewater under high pressure to a fluid ultra-homogenizer in which any gas components are highly saturated into the wastewater liquid before the wastewater passes to a separation and saturation vessel comprising a vertical riser chamber through which the ultra-homogenized wastewater passes vertically, the riser chamber having a flocculant injection means, a second chamber located around the top of the vertical riser chamber and having a separation area located above the vertical riser chamber in which floating flocculated particles are removed by a scraper means, the second chamber further having an annulus area around the vertical riser chamber through which wastewater with the particles removed descends to a third chamber surrounding the riser and second chambers, the third chamber having located at its top a gas vent and having located at its base an ozone injection means and a wastewater outlet.