Hence, an improved an improved process and device for treatment of waste water would be advantageous.

OBJECT OF THE INVENTION

An object of the present invention is to provide an alternative to the prior art.

In particular, it may be seen as a further object of the present invention to provide a process and a device that solves the above mentioned problems of the prior art.

SUMMARY OF THE INVENTION

Thus, the above described object and several other objects are intended to be obtained in a first aspect of the invention by providing a process for selectively removal of deflocculated sludge, being material resulting from a process of floc disruption into smaller fragments or fine particles eroded by from sludge flocs by shear forces, below a pre-selected size, wherein said pre-selected size is 15 micron, such as 10 micron, preferably 5 micron, from a sludge mixed liquor, the process preferably comprising:

- a first separation in which at least a fraction of said sludge mixed liquor is separated into fractions including:
  - a first fraction containing sludge flocs, and
  - a second fraction containing deflocculated sludge;
- a second separation separating at least a fraction of the second fraction into fractions including:
  - a third fraction containing a less amount of, such as substantially no, deflocculated sludge , and
  - a fourth fraction containing a higher amount, such as substantially all of the deflocculated sludge contained in the second fraction;

wherein the process further comprising

- feeding the first fraction and the third fraction into said sludge mixed liquor, and
- the fourth fraction is fed to a storage capacity, a biogas production facility, or is dewatered and disposed of.

The invention provides a “selective removal”, since the first fraction contains sludge flocs and the third fraction contains substantially no deflocculated sludge, and such matter is substantially contained in the fourth fraction which is not introduced into the sludge mixed liquor, thereby forming a selectively removal of deflocculated sludge from the sludge mixed liquor, while allowing sludge mixed

Waste water is preferably used to indicate water containing organic materials and nutrients rendering it unfit for use, consumption or discharge, and therefore requiring treatment.

The invention relates in a second aspect to device for selectively removal of deflocculated sludge, being material resulting from a process of flocs disruption into smaller fracments or fine particles eroded by from sludge flocs by shear forces, below a pre-selected size, wherein said pre-selected size is 15 micron, such as 10 micron, preferably 5 micron, from a sludge mixed liquor, the device preferably comprising:

- a tank adapted to contain sludge mixed liquor
- a first separator fluidic connected to the interior of tank for receiving said sludge mixed liquor from the tank and being configured for separating the received mixed liquor into fractions including:
  - a first fraction containing sludge flocs, and
  - a second fraction containing deflocculated sludge;
- a second separator fluidic connected with first separator for receiving at least a fraction of the second fraction and being configured for separating said second fraction into fractions including:
  - a third fraction containing a less amount of, such as substantially no, deflocculated sludge, and
  - a fourth fraction containing a higher amount of deflocculated sludge, such as substantially all the deflocculated sludge contained in the second fraction;

wherein

- the first separator is fluidic connected to the tank to feed the first fraction into the tank, and
- the second separator is fluidic connected to the tank to feed the third fraction into said tank, and
- the second separator (6) is fluidicly connected to feed the fourth fraction (8) into a storage capacity, a biogas production facility, or is dewatered and disposed of.

The first and second aspect of the present invention may be combined. These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter as well as in the claims.

BRIEF DESCRIPTION OF THE FIGURES

The present invention and in particular preferred embodiments thereof will now be described in more detail with reference to the accompanying figures. The figures show ways of implementing the present invention and are not to be construed as

CLAIMS

1. A process for selectively removal of deflocculated sludge, being material resulting from a process of floc disruption into smaller fragments or fine particles eroded by from sludge flocs by shear forces, below a pre-selected size, wherein said pre-selected size is 15 micron, such as 10 micron, preferably 5 micron, from a sludge mixed liquor (1), the process comprising:

- a first separation (2) in which at least a fraction (3) of said sludge mixed liquor (1) is separated into fractions including:
  - a first fraction (4) containing sludge flocs, and
  - a second fraction (5) containing deflocculated sludge;
- a second separation (6) separating at least a fraction of the second fraction (5) into fractions including:
  - a third fraction (7) containing a less amount of, such as substantially no, deflocculated sludge, and
  - a fourth fraction (8) containing a higher amount, such as substantially all of the deflocculated sludge contained in the second fraction;

wherein the process further comprising

- feeding the first fraction (4) and the third fraction (7) into said sludge mixed liquor (1), and
- the fourth fraction is fed to a storage capacity, a biogas production facility, or is dewatered and disposed of.

2. A process according to claim 1, wherein the process further comprising

- filtering (12) said mixed liquor (1) to provide a filtrate (11) containing substantial no sludge flocs, said filtering being preferably a membrane filtration.

3. A process according to claim 1 or 2, wherein the first separation (2) is selected from one or more or a combination of:

- a gravity-based separation in which the first fraction is provided by settling or sedimentation,
- a cyclone based separation, and/or
- a cross flow filter with opening selected in the range between 5-30 micron.

4. A process according to any of the preceding claims, wherein the second separation (6) is selected from one or more of:

- a cake filtration, where a filter cake is provided sludge flocs,
- a sock filter filtration,
- a membrane filter,
- a granular media filter, such as sand filter,
- a mesh type band filter or disc filter.

5. A process according to any of the preceding claims, wherein the process further comprising gas sparging (16) introducing gas, such as oxygen or atmospheric air into said sludge mixed liquor (1).

6. A process according to any of the preceding claims, wherein the sludge mixed liquor is contained in a first tank (15a) and wherein

- the first and the second fractions (4, 5) are provided by separating sludge mixed liquor extracted from the first tank (15a)
- the first fraction (4) and the third fraction (7) are fed into a second tank (15b) thereby introducing sludge mixed liquor from which deflocculated matter at least partly has/have been removed into the second tank (15b);
- at least a fraction of the sludge mixed liquor contained in the second tank (15b) is fed into the first tank (15a), said fraction of sludge mixed liquor typically has a higher content of sludge flocs than the sludge mixed liquor in the first tank (15a).

7. A process according to any of the preceding claims 1-5, wherein the sludge mixed liquor is contained in a tank (15), and wherein

- the first and the second fractions (4, 5) are provided by separating sludge mixed liquor extracted from the tank (15),
- the first fraction (4) and the third fraction (7) are fed into said tank (15) thereby selectively removing deflocculated sludge from the sludge mixed liquor (1) contained in the tank (15).

8. A process according to any of the preceding claims 2-7, wherein the filtering (12) of said sludge mixed liquor (1) to provide a filtrate (11) containing a less amount of such as substantially no sludge flocs, filters:

- when dependant on claim 9, the sludge mixed liquor contained in the second tank (15b),
- when dependant on claim 10, the sludge mixed liquor contained in the tank (15).

9. A process according to any of the preceding claims, wherein the fourth fraction (8) is fed to a storage capacity, a biogas production facility, or is dewatered and disposed of.

10. A process according to any of the preceding claims, further comprising treating waste water to provide said sludge mixed liquor.

11. A device for selectively removal of deflocculated sludge, being material resulting from a process of flocs disruption into smaller fracments or fine particles eroded by from sludge flocs by shear forces, below a pre-selected size, wherein said pre-selected size is 15 micron, such as 10 micron, preferably 5 micron, from a sludge mixed liquor (1), the device comprising:

- a tank (15) adapted to contain sludge mixed liquor (1)
- a first separator (2) fluidic connected to the interior of tank (15) for receiving said sludge mixed liquor (1) from the tank (15) and being configured for separating the received mixed liquor into fractions including:
  - a first fraction (4) containing sludge flocs, and
  - a second fraction (5) containing deflocculated sludge;
- a second separator (6) fluidic connected with first separator (2) for receiving at least a fraction of the second fraction (5) and being configured for separating said second fraction (5) into fractions including:
  - a third fraction (7) containing a less amount of, such as substantially no, deflocculated sludge, and
  - a fourth fraction (8) containing a higher amount of deflocculated sludge, such as substantially all the deflocculated sludge contained in the second fraction (5);

wherein

- the first separator (2) is fluidic connected to the tank (15) to feed the first fraction (4) into the tank (15), and

- the second separator (6) is fluidic connected to the tank (15) to feed the third fraction (7) into said tank (15), and
- the second separator (6) is fluidicly connected to feed the fourth fraction (8) into a storage capacity, a biogas production facility, or is dewatered and disposed of.

12. A device according to claim 11, wherein the device further comprising

- a filter (12) arranged to filter said mixed liquor (1) contained in the tank (15) to provide a filtrate (11) containing substantial no sludge flocs, said filter (12) being preferably a membrane filter and said filter (15) being preferably arranged inside the tank (15).

13. A device according to claim 11 or 12, wherein the first separator (2) is selected from one of:

- a gravity separator in which the first fraction is provided by settling or sedimentation,
- a cyclone separator, and/or
- a cross flow filter with openings selected in the range between 5-30 micron.

14. A device according to any of the preceding claims 11-13, wherein the second separator (6) is selected from one of:

- a cake filter, where a filter cake is provided by sludge flocs being deposited on a filtration cake support being a porous member allowing liquid to flow through and arresting deflocculated sludge,
- a sock filter filtration,
- a membrane filter,
- a granular media filter, such as sand filter,
- a mesh type band filter or disc filter.

15. A device according to any of the preceding claims 11-14, wherein the device further comprising a gas sparger (16) for introducing gas, such as oxygen or atmospheric air into the tank (15) for supplying said sludge mixed liquor (1) with oxygen.

16. A device according to any of the preceding claims 11-15, wherein the tank (15) comprising a first tank (15a) and a second tank (15b) and wherein

- the first separator (2) is fluidic connected
  - to the first tank (15a) to receive sludge mixed liquor from the first tank (15a), so that the first and the second fractions (4, 5) are provided by separating sludge mixed liquor extracted from the first tank (15a),
  - to the second tank (15) to feed the first fraction (4) into the second tank (15b), and
  - to the second separator (6) to feed the second fraction into the second separator (6),
- the second separator (6) is fluidic connected to the second tank (15b) to feed the third fraction (7) into the second tank (15b);
- the second tank (15b) is fluidic connected to the first tank (15a) to feed at least a fraction of the sludge mixed liquor contained in the second tank (15b) to the first tank (15a), said fraction of sludge mixed liquor typically has a higher content of sludge flocs than the content of sludge flocs in the first tank (15a).

17. A device according to any of the preceding claims 11-16, wherein the tank comprising a non-divided void (18), and wherein

- the first separator (2) is fluidic connected
  - to the non-divided void (18) to receive sludge mixed liquor from the said non-divided void (18), so that the first and the second fractions (4, 5) are provided by separating sludge mixed liquor extracted from said non-divided void, and
  - to the non-divided void (18) to feed the first fraction (4) into the said non-divided void (18)
  - to the second separator (6) to feed the second fraction into the second separator (6),
- the second separator (6) is fluidic connected to the non-divided void (18) to feed the third fraction (7) into the non-divided void (18).

18. A device according to any of the preceding claims 12-19, wherein said filter (12) filters:

- when dependant on claim 23, the sludge mixed liquor contained in the second tank (15b),
- when dependant on claim 24, the sludge mixed liquor contained in the non-divided void (18).

19. A device according to claim 18, wherein the filter (12) is a microporous membrane filter preferably a microfiltration typically having a pores size of between 10 micron and 0.1 micron and/or an ultrafiltration membrane typically having a pore size between 0.1 micron and 0.001 micron.

20. A device according to any of the preceding claims 11-19, the second separator (6) is fluidic connected to feed the fourth fraction (8) into a storage capacity, a biogas production facility, or is dewatered and disposed of.

21. A device according to any of the preceding claims 11-20, further comprising an inlet to the tank (15) for feeding waste water into said tank (15).