

DESCRIPTION

Title: WASTEWATER TREATMENT SYSTEM AND WASTEWATER TREATMENT METHOD

Technical Field

[0001] The technology disclosed herein relates to a wastewater treatment system, and to a wastewater treatment method.

Background Art

[0002] A wastewater treatment system is known in which disposer wastewater containing kitchen waste crushed by a disposer is treated by a bio treatment device (see, for example, Japanese Patent Application Laid-Open (JP-A) No. 2011-177637, and JP-A No. 2021-122772).

SUMMARY OF INVENTION

Technical Problem

[0003] The wastewater treatment system disclosed in JP-A No. 2011-177637 includes a first solid-liquid separation device and a second solid-liquid separation device. The first solid-liquid separation device separates solid matter (organic matter) from disposer wastewater discharged as wastewater from a disposer. The solid matter separated by the first solid-liquid separation device is supplied to the bio treatment device where it is broken down (rendered harmless).

[0004] The second solid-liquid separation device separates solid matter from mixed wastewater of disposer wastewater discharged as wastewater from the first solid-liquid separation device mixed with kitchen wastewater discharged as wastewater from a washing station or the like in a kitchen. The solid matter separated by the second solid-liquid separation device is supplied to the bio treatment device where it is broken down (rendered harmless).

[0005] Thus in such a wastewater treatment system as disclosed in JP-A No. 2011-177637, mixed wastewater resulting from mixing the disposer wastewater with the kitchen wastewater is subjected to solid-liquid separation by a single second solid-liquid separation device. This means that in the wastewater treatment system disclosed in JP-A No. 2011-177637, the number of installations of solid-liquid separation devices can be reduced compared to cases in which the disposer wastewater and the kitchen wastewater are subjected to solid-liquid separation by separate respective solid-liquid separation devices.

[0006] Incidentally, in the second solid-liquid separation device, this is, for example, combined with the use of flocculation processing to flocculate solid matter by adding a

flocculation agent to the mixed wastewater of the disposer wastewater and the kitchen wastewater.

[0007] However, there is not always a need to perform flocculation processing on both the disposer wastewater and the kitchen wastewater. Moreover, even in cases in which flocculation processing is needed for both the disposer wastewater and the kitchen wastewater, an oil content concentration, a wastewater volume, and a wastewater frequency, and the like are different between the disposer wastewater and the kitchen wastewater. This means that the addition amount of flocculation agent required is different in the disposer wastewater to in the kitchen wastewater.

[0008] This means that, as stated above, there is a possibility of unnecessary flocculation agent being added to the mixed wastewater in cases in which solid-liquid separation of the mixed wastewater resulting from mixing the disposer wastewater with the kitchen wastewater is performed by a single second solid-liquid separation device.

[0009] An object of the technology disclosed herein is to optimize an addition amount of flocculation agent.

Solution to Problem

[0010] A wastewater treatment system according to a first aspect includes a first solid-liquid separation device that separates a first organic wastewater containing kitchen waste crushed by a crusher into a first solid matter and a second organic wastewater, a second solid-liquid separation device that flocculates and separates a second solid matter from the second organic wastewater, a third solid-liquid separation device that separates a third solid matter from a third organic wastewater, and a wastewater treatment device that performs wastewater treatment on the first solid matter, the second solid matter, and the third solid matter.

[0011] In the wastewater treatment system according to the first aspect, the first solid-liquid separation device separates the first organic wastewater containing the kitchen waste crushed by the crusher into the first solid matter and the second organic wastewater. The second solid-liquid separation device flocculates and separates the second solid matter from the second organic wastewater.

[0012] The third solid-liquid separation device separates the third solid matter from the third organic wastewater. The first solid matter, the second solid matter, and the third solid matter are then subjected to wastewater treatment by the wastewater treatment device.

[0013] Thus in the present aspect, the second solid matter is flocculated and separated from the second organic wastewater by the second solid-liquid separation device. The third solid

matter is separated from the third organic wastewater by the third solid-liquid separation device.

[0014] This means that in the present aspect, an addition amount of flocculation agent to be added to the second organic wastewater can be set in the second solid-liquid separation device based on an oil content concentration, a wastewater volume, a wastewater frequency, and the like of the second organic wastewater.

[0015] This means that in the present aspect, the addition amount of the flocculation agent to be added to the second organic wastewater can be better optimized than cases in which mixed wastewater resulting from mixing the second organic wastewater with the third organic wastewater is subjected to solid-liquid separation by a single solid-liquid separation device.

[0016] A wastewater treatment system according to a second aspect includes a first solid-liquid separation device that separates a first organic wastewater containing kitchen waste crushed by a crusher into a first solid matter and a second organic wastewater, a second solid-liquid separation device that separates a second solid matter from the second organic wastewater, a third solid-liquid separation device that flocculates and separates a third solid matter from a third organic wastewater, and a wastewater treatment device that performs wastewater treatment on the first solid matter, the second solid matter, and the third solid matter.

[0017] In the wastewater treatment system according to the second aspect, the first solid-liquid separation device separates the first organic wastewater containing the kitchen waste crushed by the crusher into the first solid matter and the second organic wastewater. The second solid-liquid separation device separates the second solid matter from the second organic wastewater.

[0018] The third solid-liquid separation device flocculates and separates third solid matter from third organic wastewater. The first solid matter, the second solid matter, and the third solid matter are then subjected to wastewater treatment by the wastewater treatment device.

[0019] Thus in the present aspect, the second solid matter is separated from the second organic wastewater by the second solid-liquid separation device. Moreover, the third solid matter is flocculated and separated from the third organic wastewater by the third solid-liquid separation device.

[0020] This means that in the present aspect, an addition amount of flocculation agent to be added to the third organic wastewater can be set in the third solid-liquid separation device according to the oil content concentration, the wastewater volume, the wastewater frequency, and the like of the third organic wastewater.

[0021] This means that the addition amount of the flocculation agent to be added to the third organic wastewater can be better optimized than cases in which mixed wastewater resulting from mixing the second organic wastewater with the third organic wastewater is subjected to solid-liquid separation by a single solid-liquid separation device.

[0022] A wastewater treatment system according to a third aspect is the wastewater treatment system according to the first aspect or the second aspect, wherein an oil content concentration of the third organic wastewater is higher than an oil content concentration of the second organic wastewater.

[0023] In the wastewater treatment system according to the third aspect the oil content concentration of the third organic wastewater is higher than the oil content concentration of the second organic wastewater. In such cases the necessity of flocculation processing readily differs between the second organic wastewater and the third organic wastewater.

[0024] Moreover, even in cases in which there is a need for flocculation processing for both the second organic wastewater and the third organic wastewater, a large difference readily arises between the required addition amount of flocculation agent to be added to the second organic wastewater and the required addition amount of flocculation agent to be added to the third organic wastewater.

[0025] The present aspect is particularly effective in such cases. Namely, in the present aspect the second solid matter is separated from the second organic wastewater by the second solid-liquid separation device, and the third solid matter is separated from the third organic wastewater by the third solid-liquid separation device.

[0026] Thus in the present aspect, the addition amount of the flocculation agent to be added to the second organic wastewater or the third organic wastewater can be better optimized than cases in which mixed wastewater resulting from mixing the second organic wastewater with the third organic wastewater is subjected to solid-liquid separation by a single solid-liquid separation device.

[0027] A wastewater treatment system according to a fourth aspect is the wastewater treatment system according to the third aspect, wherein the wastewater treatment device includes a methane fermentation tank that causes methane fermentation to occur using the first solid matter, the second solid matter, the third solid matter, and an additive as a fermentation feedstock, and the additive keeps a ratio of normal hexane extract concentration of the fermentation feedstock with respect to a loss-on-ignition of the fermentation feedstock to a specific value or lower.

[0028] In the wastewater treatment system according to the fourth aspect, the wastewater treatment device includes the methane fermentation tank. The methane fermentation tank causes methane fermentation to occur with the first solid matter, the second solid matter, the third solid matter, and the additive as the fermentation feedstock. The fermentation feedstock is thereby broken down (rendered harmless).

[0029] When the oil content concentration of the fermentation feedstock is high then there is a possibility of the methane fermentation of the fermentation feedstock being impeded. Thus in the present aspect, a ratio of the normal hexane extract concentration of the fermentation feedstock with respect to the loss-on-ignition of the fermentation feedstock is kept to a specific value or lower by adding the additive to the first solid matter, the second solid matter, and the third solid matter.

[0030] Namely, the oil content concentration of the fermentation feedstock is kept at the specific value or lower by adding the additive to the first solid matter, the second solid matter, and the third solid matter. This thereby enables the fermentation feedstock to be efficiently methane fermented.

[0031] Moreover, the addition amount of the additive is, for example, computed based on the supply amount, loss-on-ignition, and normal hexane extract concentration of the first solid matter, the second solid matter, and the third solid matter supplied into the methane fermentation tank. When this is performed, the loss-on-ignition and the normal hexane extract concentration of the first solid matter, the second solid matter, and the third solid matter are, for example, analyzed from respective samples taken from the first solid matter, the second solid matter, and the third solid matter.

[0032] The second solid matter and the third solid matter are mixed together in cases in which a mixed wastewater resulting from mixing the second organic wastewater with the third organic wastewater is subjected to solid-liquid separation using a single solid-liquid separation device. This means that respective measurement of the supply amounts of the second solid matter and the third solid matter supplied into the methane fermentation tank is difficult.

[0033] Moreover, in cases in which there are different generation frequencies for the second organic wastewater and for the third organic wastewater, the proportions of the second solid matter and the third solid matter in the mixture vary depending on the timing a sample is taken from the mixture of the second solid matter and the third solid matter. The loss-on-ignition and the normal hexane extract concentration of the mixture of the second solid matter and the third solid matter also change accompanying this variance, making it difficult to

analyze the loss-on-ignition and the normal hexane extract concentration of the mixture with good accuracy.

[0034] In contrast thereto, the present aspect the supply amounts of the first solid matter, the second solid matter, and the third solid matter supplied into the methane fermentation tank can be measured separately. Moreover, in the present aspect respective samples can be taken from the first solid matter, the second solid matter, and the third solid matter.

Moreover, the loss-on-ignition and the normal hexane extract concentration of the first solid matter, the second solid matter, and the third solid matter can be analyzed separately from the samples taken of the first solid matter, the second solid matter, and the third solid matter.

[0035] This means that in the present aspect, the addition amounts of the additive to be added to the first solid matter, the second solid matter, and the third solid matter can be computed with high accuracy even in cases in which the generation frequencies are different for the second organic wastewater and for the third organic wastewater. This means that in the present aspect, the oil content concentration of the fermentation feedstock can be reliably kept at the specific value or lower.

[0036] A wastewater treatment system according to the fifth aspect is the wastewater treatment system according to the fourth aspect, wherein the wastewater treatment device includes a feedstock tank that holds the first solid matter and the second solid matter, and a mixture of the first solid matter and the second solid matter is supplied from the feedstock tank into the methane fermentation tank.

[0037] In the wastewater treatment system according to the fifth aspect, the wastewater treatment device includes the feedstock tank that holds the first solid matter and the second solid matter. The mixture of the first solid matter and the second solid matter is supplied from the feedstock tank into the methane fermentation tank.

[0038] A constant volume of the mixture of the first solid matter and the second solid matter can be supplied continuously from the feedstock tank to the methane fermentation tank due to the first solid matter and the second solid matter being held in the feedstock tank in this manner. This thereby enables the fermentation efficiency of the fermentation feedstock to be raised in the methane fermentation tank.

[0039] A wastewater treatment system according to a sixth aspect is the wastewater treatment system according to the fourth aspect or the fifth aspect, further including a holding tank that holds the third solid matter, wherein the third solid matter is supplied from the holding tank into the wastewater treatment device.

[0040] In the wastewater treatment system according to the sixth aspect, the holding tank holds the third solid matter. The third solid matter is supplied from the holding tank into the wastewater treatment device.

[0041] A constant volume of the third solid matter can be supplied continuously from the feedstock tank into the wastewater treatment device due to the third solid matter being held in the holding tank. This thereby enables a higher efficiency of wastewater treatment by the wastewater treatment device.

[0042] A wastewater treatment system according to a seventh aspect is the wastewater treatment system according to the sixth aspect, wherein the holding tank includes a heater that heats the third solid matter.

[0043] In the wastewater treatment system according to the seventh aspect, the holding tank includes the heater that heats the third solid matter.

[0044] The oil content concentration of the third organic wastewater is higher than the oil content concentration of the second organic wastewater. This means that the third solid matter tends to have a higher oil content concentration than the first solid matter and the second solid matter.

[0045] Thus the fluidity of the third solid matter can be efficiently raised by heating the third solid matter with the heater separately to the first solid matter and the second solid matter. As a result thereof, the third solid matter can be supplied from the holding tank into the wastewater treatment device easily.

[0046] A wastewater treatment system according to an eighth aspect is the wastewater treatment system according to any one of the fourth aspect to the seventh aspect, further including a first flow rate measurement section that measures a flow rate of the first solid matter, a second flow rate measurement section that measures a flow rate of the second solid matter, and a third flow rate measurement section that measures a flow rate of the third solid matter.

[0047] In the wastewater treatment system according to the eighth aspect, the flow rates of the first solid matter, the second solid matter, and the third solid matter are respectively measured by the first flow rate measurement section, the second flow rate measurement section, and the third flow rate measurement section.

[0048] This means that a computation accuracy of the addition amounts of the additive to be added to the first solid matter, the second solid matter, and the third solid matter can be raised even in cases in which the generation frequencies are different for the first solid matter, the second solid matter, and the third solid matter.

[0049] A wastewater treatment system according to an ninth aspect is the wastewater treatment system of any one of the fourth aspect to the seventh aspect, further including a mixture flow rate measurement section that measures a flow rate of a mixture of the first solid matter and the second solid matter, and a third flow rate measurement section that measures a flow rate of the third solid matter.

[0050] In the wastewater treatment system according to the ninth aspect, the flow rate of the mixture of the first solid matter and the second solid matter is measured by the mixture flow rate measurement section. The flow rate of the third solid matter is measured by the third flow rate measurement section.

[0051] This means that the computation accuracy of the addition amounts of the additive to be added to the first solid matter, the second solid matter, and the third solid matter can be raised even in cases in which the generated volumes or the generation frequencies are different between the mixture of the first solid matter and the second solid matter, and the third solid matter.

[0052] A wastewater treatment method according to the tenth aspect includes a first solid matter separation process that separates a first organic wastewater containing kitchen waste crushed by a crusher into a first solid matter and a second organic wastewater, a second solid matter separation process that flocculates and separates a second solid matter from the second organic wastewater, a third solid matter separation process that separates a third solid matter from a third organic wastewater, and a wastewater treatment process that performs wastewater treatment on the first solid matter, the second solid matter, and the third solid matter.

[0053] In the wastewater treatment method according to the tenth aspect, in the first solid matter separation process, the first organic wastewater containing the kitchen waste crushed by the crusher is separated into the first solid matter and the second organic wastewater by the first solid-liquid separation device. Next, in the second solid matter separation process, the second solid matter is flocculated and separated from the second organic wastewater by the second solid-liquid separation device.

[0054] On the other hand, in the third solid matter separation process the third solid matter is separated from the third organic wastewater by the third solid-liquid separation device. Note that the third solid matter separation process may be executed in parallel to the first solid matter separation process and the second solid matter separation process, and may be executed before or after the first solid matter separation process and the second solid matter separation process.

[0055] Next, in the wastewater treatment process, the first solid matter, the second solid matter, and the third solid matter are subjected to wastewater treatment.

[0056] Thus in the present aspect, the second solid matter is flocculated and separated from the second organic wastewater by the second solid-liquid separation device. Moreover, the third solid matter is separated from the third organic wastewater by the third solid-liquid separation device.

[0057] Thus in the present aspect, the addition amount of the flocculation agent to be added to the second organic wastewater in the second solid-liquid separation device can be set based on the oil content concentration, the wastewater volume, the wastewater frequency, and the like of the second organic wastewater.

[0058] The present aspect accordingly enables the addition amount of the flocculation agent to be added to the second organic wastewater to be better optimized than cases in which mixed wastewater resulting from mixing the second organic wastewater and the third organic wastewater together is subjected to solid-liquid separation in a single solid-liquid separation device.

[0059] A wastewater treatment method according to an eleventh aspect includes a first solid matter separation process that separates a first organic wastewater containing kitchen waste crushed by a crusher into a first solid matter and a second organic wastewater using a first solid-liquid separation device, a second solid matter separation process that separates a second solid matter from the second organic wastewater using a second solid-liquid separation device, a third solid matter separation process that flocculates and separates a third solid matter from a third organic wastewater using a third solid-liquid separation device, and a wastewater treatment process that performs wastewater treatment on the first solid matter, the second solid matter, and the third solid matter.

[0060] In the wastewater treatment method according to the eleventh aspect, in the first solid matter separation process the first organic wastewater containing the kitchen waste crushed by the crusher is separated into the first solid matter and the second organic wastewater by the first solid-liquid separation device. Next, in the second solid matter separation process the second solid matter is separated from the second organic wastewater by the second solid-liquid separation device.

[0061] On the other hand, in the third solid matter separation process the third solid matter is flocculated and separated from the third organic wastewater by the third solid-liquid separation device. Note that the third solid matter separation process may be executed in parallel to the first solid matter separation process and the second solid matter separation

process, and may be executed before or after the first solid matter separation process and the second solid matter separation process.

[0062] Next, in the wastewater treatment process, the first solid matter, the second solid matter, and the third solid matter are subjected to wastewater treatment.

[0063] Thus in the present aspect, the second solid matter is separated from the second organic wastewater by the second solid-liquid separation device. Moreover, the third solid matter is flocculated and separated from the third organic wastewater by the third solid-liquid separation device.

[0064] This means that in the present aspect, the addition amount of the flocculation agent to be added to the third organic wastewater in the second solid matter separation process can be set according to the oil content concentration, the wastewater volume, the wastewater frequency, and the like of the third organic wastewater.

[0065] Thus in the present aspect, the addition amount of the flocculation agent to be added to the third organic wastewater can be better optimized than cases in which a mixed wastewater of the second organic wastewater and the third organic wastewater is subjected to solid-liquid separation by a single solid-liquid separation device.

[0066] A wastewater treatment method according to a twelfth aspect is the wastewater treatment method according to the tenth aspect or the eleventh aspect, wherein an oil content concentration of the third organic wastewater is higher than an oil content concentration of the second organic wastewater.

[0067] In the wastewater treatment method according to the twelfth aspect, the oil content concentration of the third organic wastewater is higher than the oil content concentration of the second organic wastewater. In such cases, the necessity of flocculation processing readily differs between the second organic wastewater and the third organic wastewater.

[0068] Moreover, even in cases in which flocculation processing is needed for both the second organic wastewater and the third organic wastewater, a large difference readily arises between the required addition amount of flocculation agent to be added to the second organic wastewater and the required addition amount of flocculation agent to be added to the third organic wastewater.

[0069] The present aspect is particularly effective in such cases. Namely, in the present aspect the second solid matter is separated from the second organic wastewater by the second solid matter separation device, and the third solid matter is separated from the third organic wastewater by the third solid matter separation device.

[0070] Thus in the present aspect, the addition amounts of the flocculation agent to be added to the second organic wastewater or the third organic wastewater can be better optimized than cases in which a mixed wastewater of the second organic wastewater and the third organic wastewater is subjected to solid-liquid separation by a single solid-liquid separation device.

[0071] A wastewater treatment method according to a thirteenth aspect is the wastewater treatment method according to the twelfth aspect, wherein in the wastewater treatment process, the first solid matter, the second solid matter, the third solid matter, and an additive are employed as a fermentation feedstock, and the fermentation feedstock is methane fermented in a state in which a ratio of normal hexane extract concentration of the fermentation feedstock with respect to a loss-on-ignition of the fermentation feedstock is a specific value or lower.

[0072] In the wastewater treatment method according to the thirteenth aspect, in the wastewater treatment process the first solid matter, the second solid matter, the third solid matter, and the additive are employed as the fermentation feedstock, and the fermentation feedstock is methane fermented in a state in which the ratio of normal hexane extract concentration of the fermentation feedstock with respect to the loss-on-ignition of the fermentation feedstock is the specific value or lower. The fermentation feedstock is broken down (rendered harmless) thereby.

[0073] When the oil content concentration of the fermentation feedstock is high, there is a possibility that the methane fermentation of the fermentation feedstock is impeded. Thus in the present aspect, the ratio of the normal hexane extract concentration of the fermentation feedstock with respect to the loss-on-ignition of the fermentation feedstock is kept to the specific value or lower by adding the additive to the first solid matter, the second solid matter, and the third solid matter.

[0074] Namely, the oil content concentration of the fermentation feedstock is kept to the specific value or lower by adding the additive to the first solid matter, the second solid matter, and the third solid matter. This thereby enables the fermentation feedstock to be efficiently methane fermented.

[0075] Moreover, the addition amount of the additive is, for example, computed based on the quantity, the loss-on-ignition, and the normal hexane extract concentration of the first solid matter, the second solid matter, and the third solid matter to be methane fermented. When doing so, the loss-on-ignition and the normal hexane extract concentration of the first solid matter, the second solid matter, and the third solid matter are, for example, analyzed from samples taken of the first solid matter, the second solid matter, and the third solid matter.

[0076] An issue here is that the second solid matter and the third solid matter would be mixed together in cases in which a mixed wastewater resulting from mixing the second organic wastewater and the third organic wastewater together is subjected to solid-liquid separation in a single solid-liquid separation device. This would mean that it would be difficult to measure the respective quantities of the second solid matter and the third solid matter to be methane fermented.

[0077] Moreover, in cases in which the generation frequencies of the second organic wastewater and the third organic wastewater are different, the proportions of the second solid matter and the third solid matter in the mixture vary depending on the timing a sample is taken from the mixture of the second solid matter and the third solid matter. Due to the loss-on-ignition and the normal hexane extract concentration of the mixture of the second solid matter and the third solid matter also changing according to this variance, the loss-on-ignition and the normal hexane extract concentration of the mixture would be difficult to analyze with good accuracy.

[0078] In contrast thereto, in the present aspect these quantities can be measured separately for the first solid matter, the second solid matter, and the third solid matter to be methane fermented. Moreover, in the present aspect the loss-on-ignition and the normal hexane extract concentration in the first solid matter, the second solid matter, and the third solid matter can be analyzed separately from samples respectively taken from the first solid matter, the second solid matter, and the third solid matter.

[0079] This means that in the present aspect, the addition amounts of the additive to be added to the first solid matter, the second solid matter, and the third solid matter can be computed with high accuracy even in cases in which the generation frequencies are different between the second organic wastewater and the third organic wastewater. This means that in the present aspect, the oil content concentration of the fermentation feedstock can be more reliably kept at the specific value or lower.

[0080] The technology disclosed herein enables an optimization of an addition amount of flocculation agent.

BRIEF DESCRIPTION OF DRAWINGS

[0081] Fig. 1 is a system configuration diagram illustrating a wastewater treatment system according to a first exemplary embodiment.

Fig. 2 is a system configuration diagram illustrating a wastewater treatment system according to a first exemplary embodiment.

Fig. 3 is a system configuration diagram illustrating a modified example of a wastewater treatment system according to the second exemplary embodiment.

Fig. 4 is a system configuration diagram illustrating a modified example of a wastewater treatment system according to the first exemplary embodiment and the second exemplary embodiment.

DESCRIPTION OF EMBODIMENTS

[0082] First Exemplary Embodiment

First description follows regarding a first exemplary embodiment.

[0083] Wastewater Treatment System

Fig. 1 illustrates a wastewater treatment system 10 according to the present exemplary embodiment. The wastewater treatment system 10 is applied, as an example, to a building structure such as a commercial complex or the like, and is a disposer wastewater treatment system that performs wastewater treatment on kitchen waste (food scraps) and on kitchen wastewater generated by the kitchens of plural restaurants and bars in the building structure.

[0084] Note that the wastewater treatment system 10 is not limited to application to commercial complexes, and is also applicable to building structures such as housing complexes.

[0085] The wastewater treatment system 10 includes a disposer 20, a first solid-liquid separation device 30, a second solid-liquid separation device 50, a third solid-liquid separation device 80, a holding tank 100, a wastewater treatment device 110, and a wastewater treatment device 130.

[0086] Disposer

The disposer 20 is a crusher that crushes kitchen waste. Moreover, the disposer 20 is, for example, installed below a sink in a kitchen of respective restaurants and bars, and flushes crushed kitchen waste into a first wastewater pipe 22 together with water (tap water). Disposer wastewater containing kitchen waste (hereafter referred to as "first organic wastewater") is generated by the disposer 20.

[0087] The first solid-liquid separation device 30 is connected to the disposer 20 through the first wastewater pipe 22. The first organic wastewater generated by the disposer 20 is supplied into the first solid-liquid separation device 30 via the first wastewater pipe 22 either as natural wastewater (gravity fed wastewater) or by a non-illustrated pump or the like.

[0088] Note that the disposer 20 is not limited to being a sink in a kitchen of a restaurant or bar, and may be installed below a sink of a house. Moreover, at least one of the disposer 20 is sufficient. Moreover, the disposer 20 is an example of a crusher.

[0089] First Solid-liquid Separation Device

The first solid-liquid separation device 30 is, for example, a screen type solid-liquid separation device that separates first solid matter from the first organic wastewater. The first solid-liquid separation device 30 includes a separation tank 32. The first wastewater pipe 22 is connected to the separation tank 32. The first organic wastewater is supplied from the disposer 20 into the separation tank 32 through the first wastewater pipe 22. A screen 34 is installed inside the separation tank 32.

[0090] The screen 34 is, for example, formed in a slit shape or a mesh shape. The screen 34 partitions the inside of the separation tank 32. The first organic wastewater passes through the screen 34. The first organic wastewater is accordingly separated into the first solid matter having a size not less than a specific value at which size it becomes unable to pass through the screen 34, and into second organic wastewater containing a liquid and second solid matter having a size less than a specific value at which size it becomes able to pass through the screen 34.

[0091] Note that the second organic wastewater is wastewater resulting from removing the first solid matter from the first organic wastewater (disposer wastewater).

[0092] A feedstock tank 112 of a wastewater treatment device 110, described later, is connected to the separation tank 32 through a first distribution pipe 40. A pump 42 such as a slurry pump or the like, is provided to the first distribution pipe 40. The first solid matter inside the separation tank 32 is supplied into the feedstock tank 112 through the first distribution pipe 40 by actuation of the pump 42.

[0093] A flocculation reaction tank 82 of a second solid-liquid separation device 50, described later, is connected to the separation tank 32 through a distribution pipe 44. A pump 46 such as a slurry pump or the like, is provided to the distribution pipe 44. Second organic wastewater inside the separation tank 32 is supplied into the flocculation reaction tank 82 through the distribution pipe 44 by actuation of the pump 46.

[0094] Second Solid-liquid Separation Device

The second solid-liquid separation device 50 is, for example, configured by a screen type solid-liquid separation device that flocculates and separates second solid matter from the second organic wastewater. The second solid-liquid separation device 50 includes the flocculation reaction tank 52 and a separation tank 54.

[0095] The flocculation reaction tank 52 is configured by a tank where a flocculation agent is added to the second organic wastewater, as illustrated by arrow a, and the second solid matter is flocculated. The second organic wastewater containing the second solid matter flocculated in the flocculation reaction tank 52 is supplied into the separation tank 54 through a non-illustrated distribution pipe or the like.

[0096] Note that the flocculation agent is, for example, added to the flocculation reaction tank 52 at a specific amount and a specific timing by an operator. Examples of the flocculation agent include, for example, an aluminum salt, iron chloride, a polyiron, or the like.

[0097] A screen 56 is provided inside the separation tank 54. The screen 56 is formed, for example, in a slit shape or a mesh shape. The screen 56 partitions the inside of the separation tank 54. The second organic wastewater containing the flocculated second solid matter is passed through the screen 56. The second organic wastewater is thereby separated into the second solid matter having a size not less than a specific value at which size it becomes unable to pass through the screen 56, and process water able to pass through the screen 56.

[0098] The feedstock tank 112 of the wastewater treatment device 110, described later, is connected to the separation tank 54 through a second distribution pipe 60. A pump 62 such as a slurry pump or the like, is provided to the second distribution pipe 60. The second solid matter inside the separation tank 54 is supplied into the feedstock tank 112 through the second distribution pipe 60 by actuation of the pump 62.

[0099] The wastewater treatment device 130 is connected to the separation tank 54 through a distribution pipe 64. A pump 66 is provided to the distribution pipe 64. Process water inside the separation tank 54 is supplied into the wastewater treatment device 130 through the distribution pipe 64 by actuation of the pump 66.

[0100] Third Solid-liquid Separation Device

The third solid-liquid separation device 80 is, for example, a flotation type solid-liquid separation device that flocculates and separates third solid matter from third organic wastewater. The third solid-liquid separation device 80 includes a flocculation reaction tank 82 and a separation tank (flotation tank) 84.

[0101] A wastewater port of a generation source 70 such as, for example, a washing station in a kitchen or the like is connected to the flocculation reaction tank 82 through a second wastewater pipe 72. Restaurant kitchen wastewater (home kitchen wastewater) containing washing water from washing dishes and the like is discharged as wastewater from the

generation source 70 through the second wastewater pipe 72 and into the flocculation reaction tank 82.

[0102] An oil content concentration of the kitchen wastewater (hereafter referred to as "third organic wastewater") is higher than the oil content concentration of the first organic wastewater (disposer wastewater) and of the second organic wastewater. Moreover, the third organic wastewater is generated at a higher frequency with a larger generated volume than the first organic wastewater and the second organic wastewater.

[0103] The flocculation reaction tank 82 is configured by a tank in which a flocculation agent is added to the third organic wastewater, as indicated by arrow b, and that flocculates the third solid matter contained in the third organic wastewater. The third solid matter flocculated in the flocculation reaction tank 82 is supplied to a separation tank 84 through a non-illustrated distribution pipe or the like.

[0104] Note that the flocculation agent is, for example, added to the flocculation reaction tank 82 at a specific amount and at specific timing by an operator. Examples of flocculation agents include, for example, an aluminum salt, iron chloride, a polyiron, or the like.

[0105] The third organic wastewater containing the third solid matter such as scum flocculated in the flocculation reaction tank 82 is supplied into the separation tank 84. In the separation tank 84, the third solid matter floating in the vicinity of the liquid surface of the third organic wastewater is removed by a non-illustrated removal device. The third organic wastewater is thereby separated into third solid matter and process water (liquid).

[0106] A holding tank 100 is connected to the removal device through a distribution pipe 90. A pump 92 such as a slurry pump is provided to the distribution pipe 90. The third solid matter removed in the removal device is supplied into the holding tank 100 through the distribution pipe 90 by actuation of the pump 92.

[0107] The wastewater treatment device 130 is connected to the separation tank 84 through a distribution pipe 94. A pump 96 is provided to the distribution pipe 94. The process water inside the separation tank 84 is supplied into the wastewater treatment device 130 through the distribution pipe 94 by actuation of the pump 96.

[0108] Holding Tank

The holding tank 100 is a tank for holding the third solid matter such as scum. The feedstock tank 112 of the wastewater treatment device 110, described later, is connected to the holding tank 100 through a third distribution pipe 102. A pump 104 such as a slurry pump is provided to the third distribution pipe 102. The third solid matter inside the holding

tank 100 is supplied into the feedstock tank 112 through the third distribution pipe 102 by actuation of the pump 104.

[0109] Wastewater Treatment Device

The wastewater treatment device 110 is a bio treatment device that breaks down fermentation feedstock by causing methane fermentation to occur using the first solid matter, the second solid matter, and the third solid matter as a fermentation feedstock. The wastewater treatment device 110 includes the feedstock tank 112, and a methane fermentation tank 120.

[0110] Feedstock Tank

The feedstock tank 112 is configured by a holding tank for holding a mixture of the first solid matter, the second solid matter, and the third solid matter as the fermentation feedstock. A heater 114 is provided to the feedstock tank 112. The heater 114 heats the mixture to a specific temperature (to, for example, from 30°C to 40°C) at which the mixture follows readily.

[0111] The methane fermentation tank 120 is connected to the feedstock tank 112 through a distribution pipe 116. A pump 118 such as a slurry pump is provided to the distribution pipe 116. The fermentation feedstock is supplied from the feedstock tank 112 into the methane fermentation tank 120 through the distribution pipe 116 by actuation of the pump 118.

[0112] Methane Fermentation Tank

The methane fermentation tank 120 breaks down (rendered harmless) the fermentation feedstock by causing the fermentation feedstock to undergo methane fermentation. A biogas containing methane is generated when this occurs. A distribution pipe 122 is connected to the methane fermentation tank 120. The biogas generated in the methane fermentation tank 120 is supplied through the distribution pipe 122 into a biogas utilization device, such as a non-illustrated generator or the like.

[0113] The distribution pipe 124 is connected to the methane fermentation tank 120. A pump 126 is provided to the distribution pipe 124. Process water such as digestive fluid or the like generated in the methane fermentation tank 120 is supplied into the wastewater treatment device 130 through the distribution pipe 124 by actuation of the pump 126.

[0114] Note that the methane fermentation method employed in the methane fermentation tank 120 is not particularly limited, and a medium temperature fermentation method may be employed having a fermentation temperature of around 37°C, or a high temperature fermentation method may be employed having a fermentation temperature of around 55°C. Moreover, the methane fermentation method adopted in the methane fermentation tank 120

may be a wet method having a comparatively high water content, or may be dry method having a comparatively low water content.

[0115] Water Treatment Device

The wastewater treatment device 130 includes a water treatment tank 132 that performs water treatment on process water supplied from the second solid-liquid separation device 50, the third solid-liquid separation device 80, and the methane fermentation tank 120. The process water treated in the water treatment tank 132 is, for example, discharged as wastewater through a distribution pipe 134 into a public sewer or the like outside the building structure.

[0116] Wastewater Treatment Method

Next, description follows regarding an example of a wastewater treatment method by the wastewater treatment system 10.

[0117] In the wastewater treatment method according to the present exemplary embodiment, first, in a first solid matter separation process, the first organic wastewater containing the kitchen waste crushed by the disposer 20 is separated into first solid matter and second organic wastewater by the first solid-liquid separation device 30. Next, in a second solid matter separation process, the second solid matter is flocculated and separated from the second organic wastewater by the second solid-liquid separation device 50.

[0118] In a third solid matter separation process, the third solid matter is flocculated and separated from the third organic wastewater by the third solid-liquid separation device 80. Note that the third solid matter separation process may be executed in parallel to the first solid matter separation process and the second solid matter separation process, and may be executed before or after the first solid matter separation process and the second solid matter separation process.

[0119] Next, in a wastewater treatment process, the first solid matter, the second solid matter, and the third solid matter are subjected to wastewater treatment by the wastewater treatment device 110.

[0120] Operation and Advantageous Effects

Next, description follows regarding the operation and advantageous effects of the first exemplary embodiment.

[0121] As illustrated in Fig. 1, the first solid-liquid separation device 30 separates the first organic wastewater containing the kitchen waste crushed by the disposer 20 into the first solid matter and the second organic wastewater.

[0122] Moreover, the second solid-liquid separation device 50 flocculates and separates the second solid matter from the second organic wastewater. The third solid-liquid separation device 80 flocculates and separates the third solid matter from the third organic wastewater.

[0123] In this manner, the present exemplary embodiment flocculates and separates the second solid matter from the second organic wastewater using the second solid-liquid separation device 50. This means that in the present exemplary embodiment, the addition amount of flocculation agent to be added to the second organic wastewater can be set for the flocculation reaction tank 82 of the second solid-liquid separation device 50 based on the oil content concentration, wastewater volume, wastewater frequency, and the like of the second organic wastewater.

[0124] Moreover, in the present exemplary embodiment, the third solid matter is flocculated and separated from the third organic wastewater by the third solid-liquid separation device 80. This means that in the present exemplary embodiment, the addition amount of flocculation agent to be added to the third organic wastewater can be set for the flocculation reaction tank 82 of the third solid-liquid separation device 80 based on the oil content concentration, wastewater volume, wastewater frequency, and the like of the third organic wastewater.

[0125] This means that in the present exemplary embodiment, a better optimization can be achieved for the addition amount of the flocculation agent to be added to the second organic wastewater and the third organic wastewater than cases in which mixed wastewater resulting from mixing the second organic wastewater with the third organic wastewater is subjected to solid-liquid separation by a single solid-liquid separation device.

[0126] Moreover, the oil content concentration of the third organic wastewater is higher than the oil content concentration of the second organic wastewater. The present exemplary embodiment is particularly effective in such cases. In cases in which the oil content concentration of the third organic wastewater is higher than the oil content concentration of the second organic wastewater, a large difference readily arises between the required addition amount of flocculation agent to be added to the second organic wastewater and the required addition amount of flocculation agent to be added to the third organic wastewater.

[0127] Moreover, the wastewater treatment device 110 includes the methane fermentation tank 120. The methane fermentation tank 120 causes methane fermentation to occur using the first solid matter, the second solid matter, and the third solid matter as a fermentation feedstock. The organic matter in the fermentation feedstock is broken down (rendered harmless) thereby.

[0128] Moreover, the wastewater treatment device 110 includes the feedstock tank 112 that holds the first solid matter, the second solid matter, and the third solid matter. The fermentation feedstock is supplied from the feedstock tank 112 into the methane fermentation tank 120.

[0129] Holding the fermentation feedstock in the feedstock tank 112 in this manner enables a constant volume of fermentation feedstock to be supplied continuously from the feedstock tank 112 into the methane fermentation tank 120. This thereby enables the fermentation efficiency of the fermentation feedstock in the methane fermentation tank 120 to be raised.

[0130] Furthermore, the third solid matter is supplied into the feedstock tank 112 from the holding tank 100. Holding the third solid matter in the holding tank 100 in this manner enables a constant volume of the third solid matter to be supplied continuously from the feedstock tank 112 into the feedstock tank 112. This thereby enables the fermentation efficiency of the fermentation feedstock in the methane fermentation tank 120 to be raised.

[0131] Modified Examples of First Exemplary Embodiment

In the exemplary embodiment described above the oil content concentration of the second organic wastewater is higher than the oil content concentration of the first organic wastewater. However, the oil content concentration of the second organic wastewater may be the same as the oil content concentration of the first organic wastewater, and may be lower than the oil content concentration of the first organic wastewater.

[0132] Moreover, in the first exemplary embodiment described above the wastewater treatment device 110 is configured by a bio treatment device. However, the wastewater treatment device 110 is not limited to being a bio treatment device, and may be a mechanical treatment device.

[0133] Second Exemplary Embodiment

Next, description follows regarding a second exemplary embodiment. Note that the same reference numerals are appended in the second exemplary embodiment to members and the like having the same configuration to those of the first exemplary embodiment, and explanation thereof will be omitted as appropriate.

[0134] Wastewater Treatment Device

Fig. 2 illustrates a wastewater treatment system 140 according to a second exemplary embodiment. The wastewater treatment device 110 of the wastewater treatment system 140 includes a methane fermentation tank 120. The methane fermentation tank 120 causes methane fermentation to occur with a first solid matter, a second solid matter, a third solid

matter, and an additive as a fermentation feedstock. The fermentation feedstock is broken down (rendered harmless) thereby.

[0135] Additive

As the oil content concentration of the fermentation feedstock increases there is a tendency for methane fermentation of the fermentation feedstock to be retarded. Thus in the present exemplary embodiment, in order to suppress retardation of the methane fermentation of the fermentation feedstock, an additive (subsidiary material) is added to the fermentation feedstock, as illustrated by arrow c in Fig. 2, so as to keep the oil content concentration of the fermentation feedstock in the methane fermentation tank 120 at a specific value or lower.

[0136] Specifically, the additive is added to the first solid matter, the second solid matter, and the third solid matter such that an n-Hex concentration/loss-on-ignition for the fermentation feedstock in the methane fermentation tank 120 becomes the specific value or lower.

[0137] Note that the n-Hex concentration/loss-on-ignition is an index indicating the oil content concentration of the fermentation feedstock. The value of the n-Hex concentration/loss-on-ignition becomes larger as the oil content concentration of the fermentation feedstock increases. On the other hand, the value of the n-Hex concentration/loss-on-ignition becomes smaller as the oil content concentration of the fermentation feedstock decreases.

[0138] "n-Hex" means normal hexane extract, and "n-Hex concentration" means the normal hexane extract concentration. The "n-Hex concentration/loss-on-ignition" means a ratio of normal hexane extract concentration with respect to loss-on-ignition. Namely, "n-Hex concentration/loss-on-ignition" indicates the n-Hex concentration per unit of loss-on-ignition.

[0139] The additive is configured by organic waste matter having a lower oil content concentration than the third solid matter. The additive is added to the feedstock tank 112. Note that the additive is not limited to being added to the feedstock tank 112, and may be added to at least one out of the feedstock tank 112 or the methane fermentation tank 120.

[0140] Examples of the additive include dried kitchen waste (ecofeed), waste sugar liquid (for example organic waste liquid generated from a canning factory), bread crumb refuse, recycled paper (for example cardboard boxes), waste starch, rice powder from old rice, waste sugar, bean curd refuse (soy pulp), seaweed (for example sea lettuce), waste syrup, waste glycerin, and the like.

[0141] Note that the additive preferably has a lower oil content concentration than the first solid matter, and more preferably has a lower oil content concentration than the second solid matter.

[0142] From the perspective of suppressing retardation of the methane fermentation in the methane fermentation tank 120, the value of the n-Hex concentration/loss-on-ignition of the fermentation feedstock in the methane fermentation tank 120 is preferably 0.4 or lower. Moreover, from the perspective of reducing the material cost of the additive, the n-Hex concentration/loss-on-ignition of the fermentation feedstock in the methane fermentation tank 120 is preferably 0.2 or greater. Namely, the n-Hex concentration/loss-on-ignition of the fermentation feedstock in the methane fermentation tank 120 is preferably from 0.2 to 0.4.

[0143] Fermentation Feedstock n-Hex Concentration/Loss-on-Ignition Computation Method

The n-Hex concentration/loss-on-ignition of the fermentation feedstock in the methane fermentation tank 120 is, for example, derived from the following Equation (1).

$$\frac{\text{n-Hex concentration/loss-on-ignition of the fermentation feedstock} = \text{(total n-Hex of the fermentation feedstock) / (total loss-on-ignition of the fermentation feedstock)}}{\text{Equation (1)}}$$

Wherein: total n-Hex of the fermentation feedstock is a sum of the n-Hex quantity per unit time for each of the first solid matter, the second solid matter, the third solid matter, and the additive; and the total loss-on-ignition of the fermentation feedstock is a sum of the loss-on-ignition per unit time for each of the first solid matter, the second solid matter, the third solid matter, and the additive.

[0144] In the present exemplary embodiment, for example, samples are taken of each of the first solid matter, the second solid matter, and the third solid matter from non-illustrated inspection ports in the first distribution pipe 40, the second distribution pipe 60, and the third distribution pipe 102. The n-Hex concentration and the loss-on-ignition of the first solid matter, the second solid matter, and the third solid matter are respectively analyzed from these samples.

[0145] A first flow rate measurement section 150 that measures the flow rate of the first solid matter being supplied into the feedstock tank 112 is provided to the first distribution pipe 40. The flow rate of the first solid matter flowing through the first distribution pipe 40 is measured by the first flow rate measurement section 150.

[0146] The n-Hex quantity and the loss-on-ignition per unit time of the first solid matter being supplied into the feedstock tank 112 are respectively found based on the analyzed n-

Hex concentration and the loss-on-ignition of the first solid matter, and based on the flow rate of the first solid matter as measured by the first flow rate measurement section 150.

[0147] A second flow rate measurement section 152 for measuring the flow rate of the second solid matter being supplied into the feedstock tank 112 is provided to the second distribution pipe 60. The flow rate of the second solid matter flowing through the second distribution pipe 60 is measured by the second flow rate measurement section 152.

[0148] The n-Hex quantity and the loss-on-ignition quantity per unit time of the second solid matter being supplied into the feedstock tank 112 are respectively found based on the analyzed n-Hex concentration and the loss-on-ignition of the second solid matter, and based on the flow rate of the second solid matter as measured by the second flow rate measurement section 152.

[0149] A third flow rate measurement section 154 for measuring the flow rate of the third solid matter being supplied into the feedstock tank 112 is provided to the third distribution pipe 102. The flow rate of the third solid matter flowing through the third distribution pipe 102 is measured by the third flow rate measurement section 154.

[0150] The n-Hex quantity and the loss-on-ignition quantity per unit time of the third solid matter being supplied into the feedstock tank 112 are respectively found based on the analyzed n-Hex concentration and the loss-on-ignition of the third solid matter, and based on the flow rate of the third solid matter as measured by the third flow rate measurement section 154.

[0151] Moreover, the addition amount of the additive being added to the feedstock tank 112 is set such that the n-Hex concentration/loss-on-ignition of the fermentation feedstock is the specific value or lower. Namely, addition amount of the additive is computed based on the n-Hex concentrations and the loss-on-ignitions of the first solid matter, the second solid matter, and the third solid matter as analyzed from the samples, based on the n-Hex concentration and the loss-on-ignition of the additive, and based on the flow rates of the first solid matter, the second solid matter, and the third solid matter as measured by the first flow rate measurement section 150, the second flow rate measurement section 152, and the third flow rate measurement section 154.

[0152] Note that the first flow rate measurement section 150, the second flow rate measurement section 152, and the third flow rate measurement section 154 are, for example, flow rate measurement instruments.

[0153] Wastewater Treatment Method

Next, description follows regarding an example of a wastewater treatment method by the wastewater treatment system 140.

[0154] In the wastewater treatment method according to the present exemplary embodiment, first in a first solid matter separation process, the first organic wastewater containing the kitchen waste crushed by the disposer 20 is separated into the first solid matter and the second organic wastewater by the first solid-liquid separation device 30. Next, in a second solid matter separation process, the second solid matter is flocculated and separated from the second organic wastewater by the second solid-liquid separation device 50.

[0155] Moreover, in a third solid matter separation process, the third solid matter is flocculated and separated from the third organic wastewater by the third solid-liquid separation device 80. Note that the third solid matter separation process may be executed in parallel to the first solid matter separation process and the second solid matter separation process, and may be executed before or after the first solid matter separation process and the second solid matter separation process.

[0156] Next, in a wastewater treatment process by the wastewater treatment device 110, the first solid matter, the second solid matter, the third solid matter, and the additive are employed as a fermentation feedstock, and the fermentation feedstock is methane fermented in a state in which the ratio of the normal hexane extract concentration of the fermentation feedstock with respect to the loss-on-ignition of the fermentation feedstock (n-Hex concentration/loss-on-ignition) is the specific value or lower.

[0157] When doing so, the n-Hex concentration/loss-on-ignition of the fermentation feedstock is adjusted by the addition amount of the additive added to the feedstock tank 112.

[0158] Operation and Advantageous Effects

Next, description follows regarding the operation and advantageous effects of the second exemplary embodiment.

[0159] As described above, when the oil content concentration of the fermentation feedstock is high there is a possibility that the methane fermentation of the fermentation feedstock is impeded. Thus in the present exemplary embodiment, the ratio of the n-Hex concentration of the fermentation feedstock with respect to the loss-on-ignition of the fermentation feedstock (n-Hex concentration/loss-on-ignition) is kept to the specific value or lower by addition of the additive to the first solid matter, the second solid matter, and the third solid matter.

[0160] Namely, in the present exemplary embodiment, the oil content concentration of the fermentation feedstock is kept to the specific value or lower by adding the additive to the first

solid matter, the second solid matter, and the third solid matter. This thereby enables the fermentation feedstock to be efficiently methane fermented.

[0161] The addition amount of the additive is computed, for example, based on the quantities, the loss-on-ignition, and the n-Hex concentration of the first solid matter, the second solid matter, and the third solid matter to be methane fermented. When this is performed, the loss-on-ignition and the n-Hex concentration of the first solid matter, the second solid matter, and the third solid matter are analyzed, for example from samples taken from the first solid matter, the second solid matter, and the third solid matter.

[0162] In cases in which the solid-liquid separation is performed on mixed wastewater of the second organic wastewater mixed with the third organic wastewater using a single solid-liquid separation device, the second solid matter and the third solid matter are mixed. This makes it difficult to respectively measure the supply amounts of the second solid matter and the third solid matter being supplied into the methane fermentation tank 120.

[0163] Moreover, the generation frequency of the first organic wastewater (disposer wastewater) and second organic wastewater discharged as wastewater from the disposer 20, and the generation frequency of the third organic wastewater (kitchen wastewater) discharged as wastewater from a washing station or the like in a kitchen, are different from each other.

[0164] In such cases in which the generation frequency of the second organic wastewater and the third organic wastewater are different from each other, the proportions of the second solid matter and the third solid matter in the mixture vary depending on the timing at which samples are taken from the second solid matter and the third solid matter mixture. Due to the loss-on-ignition and the n-Hex concentration of mixture of the second solid matter and third solid matter changing accompanying such variation, analyzing the loss-on-ignition and the n-Hex concentration of the mixture is difficult to perform with good accuracy.

[0165] To address this issue, the present exemplary embodiment enables the supply amounts of the first solid matter, the second solid matter, and the third solid matter supplied into the methane fermentation tank 120 to be measured separately by the first flow rate measurement section 150, the second flow rate measurement section 152, and the third flow rate measurement section 154.

[0166] Moreover, in the present exemplary embodiment samples of the first solid matter, the second solid matter, and the third solid matter can be respectively taken from the first distribution pipe 40, the second distribution pipe 60, and the third distribution pipe 102. The loss-on-ignition and the n-Hex concentration of the first solid matter, the second solid matter,

and the third solid matter can then be analyzed separately from the samples taken of the first solid matter, the second solid matter, and the third solid matter.

[0167] This means that in the present exemplary embodiment, the computation accuracy of the addition amount of the additive to be added to the first solid matter, the second solid matter, and the third solid matter can be raised even in a case in which the generation frequencies of the second organic wastewater and the third organic wastewater are different. This means that in the present exemplary embodiment, the oil content concentration of the fermentation feedstock can be more reliably kept at the specific value or lower.

[0168] Second Exemplary Embodiment Modified Example

Next, description follows regarding a modified example of the second exemplary embodiment.

[0169] In the second exemplary embodiment, an additive is added to the feedstock tank 112. However, the additive may be added to at least one of the feedstock tank 112 or the methane fermentation tank 120.

[0170] Moreover, in the second exemplary embodiment described above the first flow rate measurement section 150 is provided to the first distribution pipe 40. Moreover, the second flow rate measurement section 152 is provided to the second distribution pipe 60. However, for example as in a modified example illustrated in Fig. 3, a mixture flow rate measurement section 162 may be provided to a collecting pipe 160 of the first distribution pipe 40 and the second distribution pipe 60 to measure the flow rate of a mixture of the first solid matter and the second solid matter. This is because the generation frequency of the first solid matter and the second solid matter are fundamentally the same.

[0171] On the other hand, the flow rate of the third solid matter is measured by the third flow rate measurement section 154. Adopting such a configuration enables the computation accuracy of the addition amount of the additive to be added to the first solid matter, the second solid matter, and the third solid matter to be raised even in cases in which the generation frequencies are different between the mixture of the first solid matter and the second solid matter, and the third solid matter.

[0172] Modified Examples of First Exemplary Embodiment and Second Exemplary Embodiment

Next, description follows regarding modified examples of the first exemplary embodiment and the second exemplary embodiment. Note that although modified examples of each type are described below using the first exemplary embodiment as an example, these modified examples may be suitably applied to the second exemplary embodiment too.

[0173] In the first exemplary embodiment described above the third solid matter is supplied from the holding tank 100 into the feedstock tank 112 through the third distribution pipe 102. However, as in the modified example illustrated in Fig. 4, the third solid matter may be supplied from the holding tank 100 into the methane fermentation tank 120 through the third distribution pipe 102.

[0174] More specifically, the holding tank 100 is connected to the methane fermentation tank 120 through the third distribution pipe 102. The third solid matter is supplied from the holding tank 100 into the methane fermentation tank 120 through the third distribution pipe 102 by actuation of the pump 104 provided to the third distribution pipe 102.

[0175] Moreover, in the modified example illustrated in Fig. 4, a heater 170 is provided to the holding tank 100. The fluidity of the third solid matter is raised by the third solid matter inside the holding tank 100 being heated by the heater 170 (to, for example, from 30°C to 40°C). This thereby enables the third solid matter to be supplied from the holding tank 100 into the wastewater treatment device 110 easily.

[0176] Moreover, the third organic wastewater has a higher oil content concentration than the first organic wastewater. This means that the third solid matter tends to have a higher oil content concentration than the first solid matter and the second solid matter. The fluidity of the third solid matter can accordingly be efficiently raised by heating the third solid matter, separately to the first solid matter and the second solid matter, using the heater 170 in the holding tank 100.

[0177] On the other hand, the first solid matter and the second solid matter tend to have an oil content concentration lower than the third solid matter. This means that fluidity is readily secured in the first solid matter and the second solid matter even at room temperature (for example 20°). This means that the heater 114 (see Fig. 2) of the feedstock tank 112 is omitted in the modified example illustrated in Fig. 4. The cost can accordingly be reduced in the modified example illustrated in Fig. 4.

[0178] Moreover, in the first exemplary embodiment described above the feedstock tank 112 is provided to the wastewater treatment device 110. However, the feedstock tank 112 may be omitted, and the first solid matter, the second solid matter, and the third solid matter may be supplied into the methane fermentation tank 120 from the first solid-liquid separation device 30, the second solid-liquid separation device 50, and the holding tank 100.

[0179] Moreover, in the above first exemplary embodiment the third solid-liquid separation device 80 is connected to the wastewater treatment device 110 through the holding tank 100.

However, the holding tank 100 may be omitted, and the third solid matter may be supplied to the wastewater treatment device 110 from the third solid-liquid separation device 80.

[0180] Moreover, in the first exemplary embodiment described above, flocculation processing is performed on the second solid matter in the second solid-liquid separation device 50, and flocculation processing is also performed on the third solid matter in the third solid-liquid separation device 80. However, the flocculation processing may be performed in at least one of the second solid-liquid separation device 50 or the third solid-liquid separation device 80. This is because the necessity of flocculation processing varies depending on the oil content concentration and the like of the second organic wastewater and the third organic wastewater.

[0181] Moreover, in the first exemplary embodiment described above the second solid-liquid separation device 50 is configured by a screen type solid-liquid separation device. However, the second solid-liquid separation device 50 is not limited to being a screen type, and may be configured by a flotation type solid-liquid separation device.

[0182] Moreover, in the first exemplary embodiment described above the crusher for crushing the kitchen waste is configured by the disposer 20. However, the crusher is not limited to being the disposer 20, and may be configured by another crusher.

[0183] This ends the description of the exemplary embodiments of technology disclosed herein. However, the technology disclosed herein is not limited to these exemplary embodiments, and appropriate combinations may be employed of the exemplary embodiments and the various modified examples. Moreover, obviously various other embodiments may be implemented within a scope not departing from the spirit of the technology disclosed herein.

CLAIMS

Claim 1. A wastewater treatment system comprising:

a first solid-liquid separation device that separates a first organic wastewater containing kitchen waste crushed by a crusher into a first solid matter and a second organic wastewater;

a second solid-liquid separation device that flocculates and separates a second solid matter from the second organic wastewater;

a third solid-liquid separation device that separates a third solid matter from a third organic wastewater; and

a wastewater treatment device that performs wastewater treatment on the first solid matter, the second solid matter, and the third solid matter.

Claim 2. A wastewater treatment system comprising:

a first solid-liquid separation device that separates a first organic wastewater containing kitchen waste crushed by a crusher into a first solid matter and a second organic wastewater;

a second solid-liquid separation device that separates a second solid matter from the second organic wastewater;

a third solid-liquid separation device that flocculates and separates a third solid matter from a third organic wastewater; and

a wastewater treatment device that performs wastewater treatment on the first solid matter, the second solid matter, and the third solid matter.

Claim 3. The wastewater treatment system of claim 1 or claim 2, wherein an oil content concentration of the third organic wastewater is higher than an oil content concentration of the second organic wastewater.

Claim 4. The wastewater treatment system of claim 3, wherein:

the wastewater treatment device includes a methane fermentation tank that causes methane fermentation to occur using the first solid matter, the second solid matter, the third solid matter, and an additive as a fermentation feedstock; and

the additive keeps a ratio of normal hexane extract concentration of the fermentation feedstock with respect to a loss-on-ignition of the fermentation feedstock to a specific value or lower.

Claim 5. The wastewater treatment system of claim 4, wherein:

the wastewater treatment device includes a feedstock tank that holds the first solid matter and the second solid matter; and

a mixture of the first solid matter and the second solid matter is supplied from the feedstock tank into the methane fermentation tank.

Claim 6. The wastewater treatment system of claim 4 or claim 5, further comprising:

a holding tank that holds the third solid matter,

wherein the third solid matter is supplied from the holding tank into the wastewater treatment device.

Claim 7. The wastewater treatment system of claim 6, wherein:

the holding tank includes a heater that heats the third solid matter.

Claim 8. The wastewater treatment system of any one of claim 4 to claim 7, further comprising:

a first flow rate measurement section that measures a flow rate of the first solid matter;

a second flow rate measurement section that measures a flow rate of the second solid matter; and

a third flow rate measurement section that measures a flow rate of the third solid matter.

Claim 9. The wastewater treatment system of any one of claim 4 to claim 7, further comprising:

a mixture flow rate measurement section that measures a flow rate of a mixture of the first solid matter and the second solid matter; and

a third flow rate measurement section that measures a flow rate of the third solid matter.

Claim 10. A wastewater treatment method comprising:

a first solid matter separation process that separates a first organic wastewater containing kitchen waste crushed by a crusher into a first solid matter and a second organic wastewater;

a second solid matter separation process that flocculates and separates a second solid matter from the second organic wastewater;

a third solid matter separation process that separates a third solid matter from a third organic wastewater; and

a wastewater treatment process that performs wastewater treatment on the first solid matter, the second solid matter, and the third solid matter.

Claim 11. A wastewater treatment method comprising:

a first solid matter separation process that separates a first organic wastewater containing kitchen waste crushed by a crusher into a first solid matter and a second organic wastewater using a first solid-liquid separation device;

a second solid matter separation process that separates a second solid matter from the second organic wastewater using a second solid-liquid separation device;

a third solid matter separation process that flocculates and separates a third solid matter from a third organic wastewater using a third solid-liquid separation device; and

a wastewater treatment process that performs wastewater treatment on the first solid matter, the second solid matter, and the third solid matter.

Claim 12. The wastewater treatment method of claim 10 or claim 11, wherein an oil content concentration of the third organic wastewater is higher than an oil content concentration of the second organic wastewater.

Claim 13. The wastewater treatment method of claim 12, wherein, in the wastewater treatment process, the first solid matter, the second solid matter, the third solid matter, and an additive are employed as a fermentation feedstock, and the fermentation feedstock is methane fermented in a state in which a ratio of normal hexane extract concentration of the fermentation feedstock with respect to a loss-on-ignition of the fermentation feedstock is a specific value or lower.