

5 REFUSE COMBUSTION SYSTEM, REFUSE COMBUSTION POWER
GENERATION SYSTEM, AND METHOD FOR TREATING REFUSE WASTE
WATER

Technical Field

10 [0001]

The present disclosure relates to a refuse combustion system, a refuse combustion power generation system, and a method for treating refuse waste water.

Background Art

15 [0002]

Conventionally, a refuse combustion system that combusts refuse is known. For example, in a refuse combustion system disclosed in Patent Document 1, waste water separated from waste for combustion in a waste receiving pit is stored in a waste water pit. The stored waste water is drawn to a waste water spraying nozzle by a pump, and is then sprayed on the waste in the waste receiving pit. The waste water is treated along with combustion of the waste. Furthermore, in a refuse combustion system disclosed in Patent Document 2, the temperature of combustion exhaust gas in the refuse combustion furnace is measured, and water drained from the refuse is sprayed into the furnace so that the temperature is kept constant. The water drained from refuse passes through a drainage treatment facility, a storage tank, a water supply pump, and a flow control valve in this order before being supplied to a spraying nozzle.

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Citation List

Patent Literature

[0003]

Patent Document 1: JP 05-118525 A

Patent Document 2: JP 59-215512 A

35

Summary of Invention

Technical Problem

[0004]

40 However, spraying the waste water stored in the waste water pit to the waste for combustion in the waste receiving pit in the manner disclosed in Patent Document 1 may render the moisture content of the waste unstable. As a

5 result, the amount of heat obtained by combustion of refuse may be rendered unstable.

Furthermore, in Patent Document 2, the equipment used for spraying the water drained from refuse into the furnace is complicated, so the refuse combustion system may be costly.

10 [0005]

An object of the present disclosure is to provide a refuse combustion system, a refuse combustion power generation system, and a method for treating refuse waste water that stabilize the amount of heat obtained by combustion of refuse with a simple configuration.

15

Solution to Problem

[0006]

A refuse combustion system according to at least one embodiment of the present disclosure includes: a refuse combustion furnace; a refuse supply unit
20 configured to supply refuse to the refuse combustion furnace; a refuse waste water pit configured to store refuse waste water separated from the refuse in the refuse supply unit; a moisture meter configured to measure a moisture content of the refuse in the refuse supply unit; a spraying device configured to spray the refuse waste water stored in the refuse waste water pit on the refuse; and a
25 controller configured to control the spraying device according to the moisture content of the refuse measured by the moisture meter.

[0007]

A refuse combustion power generation system according to at least one embodiment of the present disclosure includes: the refuse combustion system
30 described above, a waste heat boiler configured to use combustion gas generated in the refuse combustion furnace as a heat source, a turbine configured to rotate with steam from the waste heat boiler as a drive source, and a generator configured to generate power by rotation of the turbine.

[0008]

35 A method for treating refuse waste water according to at least one embodiment of the present disclosure is a method for treating refuse waste water in a refuse combustion system including a refuse combustion furnace, a refuse supply unit that supplies refuse to the refuse combustion furnace, and a refuse waste water pit for storing refuse waste water separated from the refuse
40 in the refuse supply unit, and the method includes: measuring a moisture content of the refuse in the refuse supply unit; and spraying the refuse waste

5 water stored in the refuse waste water pit on the refuse according to the moisture content of the refuse measured in the measuring step.

Advantageous Effects of Invention

[0009]

10 According to the present disclosure, it is possible to provide a refuse combustion system, a refuse combustion power generation system, and a method for treating refuse waste water that stabilize the amount of heat obtained by combustion of refuse with a simple configuration.

Brief Description of Drawings

[0010]

FIG. 1 is a configuration diagram schematically illustrating a configuration of a refuse combustion power generation system according to one embodiment of the present disclosure.

20 FIG. 2 is a flowchart illustrating spraying processing according to one embodiment of the present disclosure.

FIG. 3 is a flowchart illustrating training processing according to one embodiment of the present disclosure.

25 FIG. 4A is a configuration diagram conceptually illustrating a refuse combustion system according to one embodiment of the present disclosure.

FIG. 4B is a configuration diagram conceptually illustrating a refuse combustion system according to another embodiment of the present disclosure.

FIG. 5A is a configuration diagram conceptually illustrating a feeding device according to one embodiment of the present disclosure.

30 FIG. 5B is a configuration diagram conceptually illustrating a feeding device according to another embodiment of the present disclosure.

FIG. 6 is a block diagram illustrating an electrical configuration of a refuse combustion power generation system according to one embodiment of the present disclosure.

35 FIG. 7 is a flowchart illustrating spraying processing according to another embodiment of the present disclosure.

Description of Embodiments

[0011]

40 Hereinafter, some embodiments of the present disclosure will be described with reference to the accompanying drawings. However, the dimensions, materials, shapes, relative dispositions, or the like of components

5 described in the embodiments or illustrated in the drawings are not intended to limit the scope of the present disclosure and are merely illustrative examples.

For example, expressions indicating relative or absolute disposition such as "in a direction," "along a direction," "parallel," "orthogonal," "center," "concentric," or "coaxial" shall not be construed as indicating only such
10 disposition in a strict literal sense but also as indicating a state of being relatively displaced by a tolerance, or by an angle or a distance as long as the same function can be obtained.

For example, expressions indicating a state of being equal such as "same," "equal," or "uniform" shall not be construed as indicating only a state
15 of being strictly equal but also as indicating a state in which there is a tolerance or a difference as long as the same function can be obtained.

For example, expressions indicating a shape such as a rectangular shape or a cylindrical shape shall not be construed as only indicating a shape such as a rectangular shape or a cylindrical shape in a strict geometrical sense but also
20 as indicating a shape including depressions, protrusions, chamfered corners, or the like as long as the same effect can be obtained.

On the other hand, expressions such as "comprising," "including," or "having" one component is not intended as an exclusive expression that excludes the presence of other components.

25 Note that the same reference signs may be assigned to similar configurations, with descriptions thereof being omitted.

[0012]

Overview of Overall Configuration of Refuse Combustion Power Generation System 1

30 FIG. 1 is a configuration diagram schematically illustrating a configuration of a refuse combustion power generation system according to one embodiment of the present disclosure. In the embodiment illustrated in FIG. 1, a refuse combustion power generation system 1 includes a refuse combustion system 10, and a power generation system 20 configured to generate power by
35 using heat generated by combustion of refuse by the refuse combustion system 10.

[0013]

In the illustrated embodiment, the refuse combustion system 10 includes a refuse combustion furnace 30, and a refuse supply unit 80 for supplying
40 refuse 2 to the refuse combustion furnace 30. The refuse supply unit 80 stores the refuse 2 that has been carried in by a transportation vehicle, for example. As an example, the refuse supply unit 80 includes a feeder 89 for transferring

5 the refuse 2 to the refuse combustion furnace 30. In the refuse combustion furnace 30, the refuse 2 transferred by a stoker 9 is combusted on the downstream side of the transfer path. The temperature of combustion gas generated by combustion is measured by an exhaust gas thermometer 4 while flowing through a flue gas duct 8. After heat exchange with a waste heat boiler 10 22 to be described later is complete, the combustion gas passes through a gas tube 17 and a bag filter 18 in this order before being discharged from a stack 19. The oxygen concentration of the combustion gas flowing through the gas tube 17 is measured by an oxygen densitometer 5.

[0014]

15 The power generation system 20 includes the waste heat boiler 22 that uses the exhaust gas generated by the refuse combustion furnace 30 as a heat source, a turbine 24 configured to rotate using steam from the waste heat boiler 22 as a drive source, and a generator 25 configured to generate power from rotation of the turbine 24.

20 [0015]

The waste heat boiler 22 includes a heat transfer tube (not illustrated) provided in the flue gas duct 8. Water flowing through the heat transfer tube exchanges heat with the combustion gas flowing through the flue gas duct 8 to turn into steam. The steam flows through a steam supply tube 23 of the waste 25 heat boiler 22 and flows to the turbine 24. In the steam supply tube 23, there are provided a steam flow meter 6 for measuring the flow rate of steam, and a steam pressure meter 7 for measuring the pressure of steam. The steam that passed through the turbine 24 condenses into water in a condenser 26, and is supplied to the above-described heat transfer tube.

30 [0016]

A rotational shaft of the generator 25 is connected to a rotational shaft of the turbine 24. Rotation of the turbine 24 by steam supplied from the steam supply tube 23 drives the generator 25. Power generated by the generator 25 is supplied to a power system.

35 [0017]

The amount of power generated by the refuse combustion power generation system 1 varies depending on the amount of heat obtained by combustion of the refuse 2. Therefore, it is necessary to stabilize the amount of heat obtained by the refuse combustion system 10 to stabilize the power 40 generating capacity. Moreover, in order to stabilize the amount of heat obtained, the moisture content of the refuse 2 supplied to the refuse combustion furnace 30 must fall within a prescribed range. This is because refuse 2 having

5 moisture content that falls outside the prescribed range is too dry or too wet, so the amount of heat obtained by combustion will be too much or too little.

[0018]

Overview of Overall Configuration of Refuse Combustion System 10

10 The refuse combustion system 10 according to one embodiment further includes, in addition to the refuse combustion furnace 30 and the refuse supply unit 80 described above, a refuse waste water pit 35 for storing refuse waste water separated from the refuse 2 in the refuse supply unit 80, a moisture meter 60 for measuring the moisture content of the refuse 2 in the refuse supply unit 80, a spraying device 70 for spraying the refuse waste water stored in the refuse waste water pit 35 to the refuse 2, and a controller 90 for controlling the spraying device 70 according to the moisture content of the refuse 2 measured by the moisture meter 60. The controller 90 may be realized by one computing device, or may be realized by a plurality of computing devices located remotely from each other. A specific configuration of the controller 90 will be described later (see FIG. 6).

[0019]

As an example, the controller 90 determines whether a timing at which the spraying device 70 sprays refuse waste water has arrived based on the measurement result of the moisture meter 60. When it is determined that the timing has arrived, the controller 90 sends a control signal to the spraying device 70 so that the refuse waste water is sprayed. The sprayed amount of the refuse waste water by the spraying device 70 may vary depending on the measurement result of the moisture meter 60, or may be the same regardless of the measurement result of the moisture meter 60. Furthermore, the spraying time of the refuse waste water may be managed instead of managing the sprayed amount of refuse waste water.

[0020]

According to the configuration described above, refuse waste water is sprayed on the refuse 2 in the refuse supply unit 80 according to the moisture content of the refuse 2 measured by the moisture meter 60. In this way, the moisture content of the refuse 2 that has been gathered to the refuse supply unit 80 by, for example, a transport vehicle and is not yet supplied to the refuse combustion furnace 30 can be kept within a prescribed range. Thus, the amount of heat obtained by combustion of the refuse 2 is stabilized. Furthermore, since the configuration for keeping the moisture content of the refuse waste water in the refuse supply unit 80 within the prescribed range is realized by the moisture meter 60 and the spraying device 70, the configuration of the refuse

5 combustion system 10 can be simplified. In this manner, the realized refuse
combustion system 10 stabilizes the amount of heat obtained by combustion of
the refuse 2 with a simple configuration. Furthermore, the realized refuse
combustion power generation system 1 stabilizes the amount of heat obtained
by combustion of the refuse 2 with a simple configuration.

10 [0021]

In some embodiments, the controller 90 is configured to control the
spraying device 70 so that, when the moisture content of the refuse 2 measured
by the moisture meter 60 is below a lower threshold value, the moisture content
becomes greater than or equal to the lower threshold value.

15 [0022]

According to the configuration described above, when the moisture
content of the refuse 2 of the refuse supply unit 80 is so dry as to be below the
lower threshold value, the spraying device 70 sprays refuse waste water under
the control of the controller 90, and this makes it possible to cause the moisture
20 content of the refuse 2 supplied to the refuse combustion furnace 30 to become
greater than or equal to the lower threshold value. Thus, the refuse combustion
system 10 can suppress the amount of heat obtained by combustion of the
refuse 2 from becoming too large.

[0023]

25 In some embodiments, the controller 90 is configured to increase the
stoker speed of the refuse combustion furnace 30 (i.e., the speed at which the
stoker 9 transfers the refuse 2) when the moisture content of the refuse 2
measured by the moisture meter 60 is above an upper threshold value. As a
more specific example, the controller 90 sends a control signal for increasing
30 the stoker speed to a stoker drive unit 3 (see FIG. 6) that drives the stoker 9. In
this way, when refuse 2 that is too wet is supplied to the refuse combustion
furnace 30, the amount of the refuse 2 combusted in the refuse combustion
furnace 30 increases.

[0024]

35 According to the configuration described above, when the moisture
content of the refuse 2 in the refuse supply unit 80 is so wet as to be above the
upper threshold value, the amount of the refuse 2 to be combusted increases.
Thus, the refuse combustion system 10 can suppress insufficiency of the
amount of heat obtained by combustion of the refuse 2.

40 [0025]

Note that in other embodiments, when sending a control signal for
increasing the stoker speed to the stoker drive unit 3, the controller 90 may

5 send a control signal for increasing the supply speed of the refuse 2 to the feeder 89 of the refuse supply unit 80. In this way, insufficiency of the refuse 2 used for combustion in the refuse combustion furnace 30 can be suppressed.
[0026]

Further, according to the configuration described above, the moisture
10 content of the refuse 2 supplied to the refuse combustion furnace 30 can be kept within a prescribed range greater than or equal to the lower threshold value and less than or equal to the upper threshold value, so the amount of heat obtained by combustion of the refuse 2 is stabilized. Therefore, the amount of steam generated by the waste heat boiler 22 is stabilized, and the rotation of the
15 turbine 24 is stabilized. Thus, power generating capacity of the generator 25 can be stabilized.
[0027]

Spraying Processing according to One Embodiment

FIG. 2 is a flowchart illustrating spraying processing according to one
20 embodiment of the present disclosure. The control of the spraying device 70 and the stoker drive unit 3 by the controller 90 described above is performed as follows, for example.
[0028]

First, the controller 90 measures the moisture content of the refuse 2 in
25 the refuse supply unit 80 based on a measurement result of the moisture meter 60 (S1). The controller 90 determines whether the moisture content acquired in S1 is below the lower threshold value (S3). When the moisture content is below the lower threshold value (S3: YES), the timing at which to spray refuse waste water has arrived. In this case, the controller 90 controls the spraying device 70
30 so that refuse waste water is sprayed (S5), and returns the processing to S1. Spraying the refuse waste water increases the moisture content of the refuse 2 in the refuse supply unit 80.
[0029]

When the moisture content is greater than or equal to the lower
35 threshold value (S3: NO), whether the moisture content acquired in S1 is above the upper threshold value is determined (S7). When the moisture content is above the upper threshold value (S7: YES), the controller 90 generates a control signal for increasing the stoker speed (S9). Sending this control signal to the stoker drive unit 3 increases the stoker speed. Thereafter, the processing
40 returns to S1.
[0030]

5 When the moisture content is less than or equal to the upper threshold value (S7: NO), the controller 90 returns the processing to S1. While the moisture content measured in S1 falls within the prescribed range (S3: NO and S7: NO), a processor 91 repeats S1, S3, and S7.

10 The spraying processing of one embodiment is performed while the refuse combustion power generation system 1 is in operation.
[0031]

Determination of Threshold Values for Moisture Content of Refuse 2 Using Learning Model

15 In the embodiment illustrated in FIG. 1, the controller 90 is configured to control the power generation system 20 in addition to the refuse combustion system 10. As a more specific example, the controller 90 is configured to control at least one process value (hereinafter sometimes simply referred to as the "process value") of the refuse combustion power generation system 1. The process value is a value that can be identified based on a measurement result of
20 a measuring instrument provided in the refuse combustion power generation system 1. Examples of the process value include the temperature of the combustion gas measured by the exhaust gas thermometer 4, the oxygen concentration of the combustion gas measured by the oxygen densitometer 5, the flow rate of steam measured by the steam flow meter 6, and the pressure of
25 steam measured by the steam pressure meter 7. Note that the process value may be a value identified based on a measurement result of a measuring instrument and a prescribed relational expression.
[0032]

30 The process value is correlated with the amount of heat obtained by combustion of the refuse 2. Therefore, controlling the moisture content of the refuse 2 supplied from the refuse supply unit 80 can keep the process value within the target range. To accomplish this, it is necessary to determine the lower threshold value and the upper threshold value for the moisture content of the refuse 2 corresponding to the target range of the process value.
35 [0033]

 In some embodiments, the lower threshold value and the upper threshold value for the moisture content of the refuse 2 are determined using a learning model. Specifically, the controller 90 includes a model creation unit 101 and a threshold value determination unit 102.
40 [0034]

 The model creation unit 101 is configured to create a learning model that has learned the relationship between the moisture content of the refuse 2

5 measured by the moisture meter 60 and at least one process value of the refuse
combustion power generation system 1. The relationship between the moisture
content and the process value can be mastered by the operator through
experience, but is difficult to express in a mathematical formula. In the present
10 example, the measured moisture content of the refuse 2 and the measured
process value are input as training data to the learning model, and the
relationship described above is learned by the learning model. As a more
specific example, while the refuse combustion power generation system 1 is
running and in rated operation under the operation of the operator, the
15 measured moisture content of the refuse 2 and the measured process value are
associated with each other, and are input to the learning model. When input is
continuously performed, the learning model learns the relationship between the
range of the process value and the range of the moisture content controlled by
the operation of the operator. In this way, a learning model that has completed
learning is created.

20 [0035]

The threshold value determination unit 102 is configured to determine
such an upper threshold value and a lower threshold value for the moisture
content of the refuse 2 that causes at least one process value to fall within the
target range based on the learning model created by the model creation unit
25 101.

[0036]

For example, when the threshold value determination unit 102 inputs a
target range (a minimum value and a maximum value) for the process value
received by an input operation of the operator to the learning model, the
30 learning model outputs a prescribed range (i.e., a lower threshold value and an
upper threshold value) for the moisture content of the refuse 2 corresponding to
the input values. In this way, the lower threshold value and the upper threshold
value for the moisture content of the refuse 2 are determined. The controller 90
controls the spraying device 70 based on the measurement result of the
35 moisture meter 60 so that the moisture content of the refuse 2 falls within a
prescribed range defined by the lower threshold value and the upper threshold
value. Furthermore, when a target range for each of a plurality of process
values is input to the learning model, the learning model outputs a range (a
minimum value and a maximum value) for the moisture content corresponding
40 to each of the input target ranges. That is, a plurality of ranges for the moisture
content are output from the learning model. The threshold value determination
unit 102 identifies a range commonly included in all of the plurality of output

5 ranges as a prescribed range, and determines a lower threshold value and an upper threshold value for the moisture content based on the identified prescribed range.

[0037]

10 According to the configuration described above, the learning model is used to determine such an upper threshold value and a lower threshold value for the moisture content that causes at least one process value to fall within the target range. In this way, the operating status of the refuse combustion power generation system 1 can be automatically made appropriate by controlling the moisture content of the refuse 2.

15 [0038]

Note that in other embodiments, training data input to the learning model may include the supply amount of refuse supplied to the refuse combustion furnace 30. The supply amount of refuse is an example of a parameter correlated with the amount of heat obtained by combustion of the refuse 2, and can be identified based on at least one of the transfer speed of the refuse 2 by the feeder 89 and the stoker speed. In this case, the learning model may learn the relationship among the moisture content of the refuse 2, the supply amount of refuse, and at least one process value. At this time, in addition to the target range of the process value, the target range for the supply amount of refuse is input to the learning model that has completed learning.

25 [0039]

Learning Processing

FIG. 3 is a flowchart illustrating learning processing according to one embodiment of the present disclosure. Learning processing is an example of specific processing for realizing the model creation unit 101 and the threshold value determination unit 102 described above. The learning processing is performed by the controller 90 while the refuse combustion power generation system 1 is in operation under the operation by the operator, for example.

[0040]

35 First, the controller 90 acquires the moisture content of the refuse 2 based on the measurement result of a moisture meter 60B (S11). Subsequently, the controller 90 acquires at least one process value (S13). For example, the controller 90 acquires each of the exhaust gas temperature, the oxygen concentration, the steam flow rate, and the steam pressure as a process value based on the measurement result of the exhaust gas thermometer 4, the oxygen densitometer 5, the steam flow meter 6, and the steam pressure meter 7, respectively.

40

5 [0041]

The controller 90 performs machine learning processing (S15). For example, the controller 90 inputs data in which the moisture content of the refuse 2 acquired in S11 and the at least one process value acquired in S13 are associated with each other as training data to the learning model. Subsequently, 10 the controller 90 determines whether learning is complete (S17). The determination criterion at this time is, for example, whether the supply amount of the refuse 2 has exceeded a prescribed value, whether the rate of change of the moisture content of the refuse 2 falls below a prescribed value, whether the number of times that S15 is performed has exceeded a prescribed number of 15 times, whether the time elapsed since the learning processing is started has exceeded a prescribed time, whether the rated operation time of the refuse combustion power generation system 1 has exceeded a prescribed time, whether an end instruction from the operator has been received, a combination thereof, or the like. For example, the supply amount of the refuse 2 is identified based 20 on the operation amount of at least one of a crane 75 or the stoker 9. Furthermore, the rate of change of the moisture content of the refuse 2 is, for example, the rate of change (absolute value) of representative values of the moisture content measured by the moisture meter 60 over a plurality of times. As a more specific example, a moisture content test, which is a measurement of 25 the moisture content over a certain period of time, is performed a plurality of times, and the maximum value, the minimum value, the deviation between the maximum value and the minimum value, or the like is acquired as a representative value of the moisture content in each moisture content test. When the rate of change indicating the change over time of the acquired 30 representative values of the moisture content falls below a prescribed value, it is determined that learning is complete. Whether learning is complete can also be determined by comparing the number of times that S15 has been performed, the time elapsed since the learning processing is started, and the rated operation time of the refuse combustion power generation system 1 with the above- 35 described prescribed values.

[0042]

The controller 90 repeats S11 to S17 until learning is complete (S17: NO). When it is determined that learning is complete (S17: YES), the controller 90 sets the learning model used in S15 as a learning model that has learned the 40 relationship between the moisture content of the refuse 2 and at least one process value (S19).

5 The controller 90 performing S11 to S19 above functions as an example of the model creation unit 101 described above.
[0043]

Subsequently, the controller 90 determines the lower threshold value and the upper threshold value for the moisture content of the refuse 2 (S21), and
10 ends the learning processing. For example, while the refuse combustion power generation system 1 is in rated operation under the operation by the operator, the controller 90 accepts inputs of target ranges for the process value from the operator. The plurality of received target ranges are input to the learning model set in S19. The learning model outputs a range for the moisture content
15 corresponding to each input, and the controller 90 determines a prescribed range. In this way, the lower threshold value and the upper threshold value for the moisture content of the refuse 2 are determined.

The controller 90 performing S21 functions as an example of the threshold value determination unit 102 described above.
20 [0044]

After the learning processing has ended, the controller 90 performs the above-described spraying processing (see FIG. 2).

Note that the learning processing may be periodically performed while the spraying processing is performed by the controller 90. In this case, the
25 lower threshold value and the upper threshold value for the moisture content of the refuse 2 for keeping the process value within the target range may be periodically updated.

[0045]

Configuration Details Common to Refuse Combustion Systems 10A and 10B
30 (10)

A further detailed configuration of the refuse combustion system 10 will be described with reference to FIGS. 4A and 4B.

FIG. 4A is a configuration diagram conceptually illustrating a refuse combustion system according to one embodiment of the present disclosure.
35 FIG. 4B is a configuration diagram conceptually illustrating a refuse combustion system according to another embodiment of the present disclosure.

In the embodiments illustrated in FIGS. 4A and 4B, refuse supply units 80A and 80B (80) of refuse combustion systems 10A and 10B (10) include refuse hoppers 82A and 82B (82) and refuse pits 85A and 85B (85),
40 respectively. The refuse hopper 82 is configured to be fed with the refuse 2 to be supplied to the refuse combustion furnace 30. In the present example, the above-described feeder 89 is provided at a lower portion of the refuse hopper

5 82 that is in communication with the refuse combustion furnace 30. The refuse pit 85 is configured to store the refuse 2 before the refuse 2 is fed into the refuse hopper 82. The refuse 2 stored in the refuse pit 85 is gathered by a transport vehicle, for example. In the gathered refuse 2, refuse 2 that is relatively wet and refuse 2 that is relatively dry may exist alongside each other.

10 [0046]

Moisture meters 60A and 60B of the refuse combustion systems 10A and 10B (10) include at least one first moisture meters 61A and 61B (61) and at least one second moisture meters 62A and 62B (62), respectively. The first moisture meter 61 is configured to measure the moisture content of the refuse 2 in the refuse hopper 82. The second moisture meter 62 is configured to measure the moisture content of the refuse 2 in the refuse pit 85. The measurement results of the first moisture meter 61 and the second moisture meter 62 are sent to the controllers 90A and 90B (90).

[0047]

20 Furthermore, spraying devices 70A and 70B (70) of the refuse combustion systems 10A and 10B (10) are configured to spray refuse waste water on the refuse 2 in the refuse hopper 82. For example, the refuse waste water is sprayed when the controller 90 transmits a control signal to the spraying device 70 according to measurement results of each of the first moisture meter 61 and the second moisture meter 62.

25 [0048]

Note that in other embodiments, the moisture meter 60 need not include the second moisture meter 62. Furthermore, the moisture meter 60 need not include the first moisture meter 61. In this case, the object to be sprayed with the refuse waste water by the spraying device 70 may be the refuse 2 in the refuse pit 85.

30 [0049]

Configuration Details of Refuse Combustion System 10A (10)

A configuration of the refuse combustion system 10A will be described in detail with reference to FIG. 4A.

In the illustrated embodiment, the refuse waste water pit 35A (35) of the refuse combustion system 10A is configured to recover the refuse waste water separated from each of the refuse 2 in the refuse pit 85A and the refuse 2 in the refuse hopper 82A. As a more specific example, an outflow port 36 for allowing refuse waste water to flow out is provided at a lower portion of the refuse pit 85A and at a lower portion of the refuse hopper 82A, and the refuse

5 waste water flowing out from each outflow port 36 is gathered to the refuse waste water pit 35A.

[0050]

According to the configuration described above, the refuse waste water contained in the refuse 2 stored in the refuse pit 85A and the refuse waste water
10 contained in the refuse 2 stored in the refuse hopper 82A are recovered and sprayed by the spraying device 70A. In this way, the refuse waste water generated in the refuse combustion system 10A is recovered without waste, and is effectively utilized to stabilize the amount of heat generated in the refuse combustion furnace 30.

15 [0051]

In the illustrated embodiment, the refuse combustion system 10A includes the crane 75 for transferring the refuse 2 in the refuse pit 85A to the refuse hopper 82A. The crane 75 of the present example grips and lifts the refuse 2 in the refuse pit 85A and moves to above the refuse hopper 82A.
20 Thereafter, the crane 75 releases the refuse 2, causing the refuse 2 to be fed from above the refuse hopper 82A into the refuse hopper 82A. The crane 75 may operate under operation instructions of the operator, or may automatically operate under the control of the controller 90A.

[0052]

25 The moisture meter 60A of one embodiment includes two first moisture meters 61A. One first moisture meter 61A is an infrared camera provided on an upper portion of the wall of the refuse hopper 82A and measures the moisture content of the surface layer portion of the refuse 2 in the refuse hopper 82A. An image taken by the infrared camera allows distribution of the moisture content
30 in the surface layer portion of the refuse 2 to be determined. The other first moisture meter 61A is a microwave meter provided on a lower portion of the wall of the refuse hopper 82A and measures the moisture content of the refuse 2 carried by the feeder 89 as an example.

[0053]

35 The spraying device 70A of one embodiment includes a spraying nozzle 71A for spraying refuse waste water, and a supply tube 72A for supplying the refuse waste water stored in the refuse waste water pit 35A to the spraying nozzle 71A. The supply tube 72A supplies the refuse waste water that is drawn by a pump, for example, to the spraying nozzle 71A.

40 [0054]

The controller 90A of one embodiment identifies the moisture content of the refuse 2 in the refuse hopper 82A based on the measurement result of each

5 of the two first moisture meters 61A. For example, assigning the measurement
 result of each of the first moisture meter 61A and the second moisture meter
 62A into a prescribed calculation formula allows the moisture content of the
 refuse 2 in the refuse hopper 82A to be identified. When the identified moisture
 content is below the lower threshold value, the controller 90A controls the
 10 spraying device 70A so that the moisture content becomes greater than or equal
 to the lower threshold value. Spraying the refuse waste water increases the
 moisture content of the refuse 2.

[0055]

According to the configuration described above, the spraying device
 15 70A sprays the refuse waste water according to the moisture content of the
 refuse 2 in the refuse hopper 82A measured by the first moisture meter 61A. In
 this way, the difference between the moisture content of the refuse 2 supplied
 to the refuse combustion furnace 30 and the moisture content identified by
 measurement can be reduced. In particular, measuring the moisture content of
 20 separate refuse 2 by the plurality of first moisture meters 61A improves the
 accuracy of the moisture content of the refuse 2 identified by measurement, and
 can further reduce the difference described above. Thus, the refuse combustion
 system 10A can further stabilize the amount of heat obtained from the refuse 2
 to be combusted.

25 [0056]

Furthermore, the object to be sprayed with the refuse waste water by the
 spraying device 70A is the refuse 2 stored in the refuse pit 85A. According to
 the configuration described above, the refuse waste water is sprayed on the
 refuse 2 in the refuse hopper 82A according to the moisture content of the
 30 refuse 2 in the refuse hopper 82A measured by the first moisture meter 61A. In
 this way, the difference between the moisture content of the refuse 2 supplied
 to the refuse combustion furnace 30 and the moisture content measured by the
 first moisture meter 61A can be further reduced compared to a case in which
 the refuse waste water is sprayed on the refuse 2 stored in the refuse pit 85A,
 35 for example. Therefore, the amount of heat obtained by combustion of the
 refuse 2 and the power generating capacity obtained based on the amount of
 heat can be adjusted with high accuracy by controlling the moisture content of
 the refuse 2.

[0057]

40 Note that in other embodiments, the moisture meter 60A need not
 include any one of the two first moisture meters 61A. Furthermore, the
 spraying device 70A may spray the refuse waste water on the refuse 2 in the

5 refuse pit 85A according to an operation instruction from the operator that has confirmed the measurement result of the first moisture meter 61A. Furthermore, the number of the first moisture meters 61A may be three or more. The moisture meter 60A need not include the first moisture meter 61A. [0058]

10 The moisture meter 60A of one embodiment further includes two second moisture meters 62A. One second moisture meter 62A is an infrared camera provided on an upper portion of the wall of the refuse pit 85A and measures the moisture content of the surface layer portion of the refuse 2 in the refuse pit 85A. The other second moisture meter 62A is a microwave meter provided in
15 the crane 75 and measures the moisture content of the refuse 2 gripped by the crane 75. [0059]

The controller 90A of one embodiment controls the spraying device 70A so that refuse waste water is sprayed according to the measurement result of the
20 second moisture meter 62A in addition to the measurement result of the first moisture meter 61A. For example, when the measurement result of the second moisture meter 62A is below the lower threshold value, refuse 2 that is too dry may be supplied to the refuse combustion furnace 30 in the future, and the amount of heat obtained by combustion may become too large. In this case, the
25 spraying device 70A sprays the refuse waste water on the refuse 2 in the refuse hopper 82A according to control signals from the controller 90A, which increases the moisture content of the refuse 2 in the refuse hopper 82A and makes it possible to suppress refuse 2 that is too dry from being supplied in the future. Note that the timing at which the spraying device 70A sprays the refuse
30 waste water may be before the feeding of the refuse 2 by the crane 75, or may be thereafter. [0060]

According to the configuration described above, the spraying device 70A can spray the refuse waste water on the refuse 2 in the refuse hopper 82A
35 according to the moisture content of the refuse 2 in the refuse pit 85A, so the moisture content of the refuse 2 supplied to the refuse combustion furnace 30 can be suppressed from becoming inappropriate in the future. Furthermore, in an embodiment in which the refuse supply unit 80A includes the refuse pit 85A in addition to the refuse hopper 82A, the moisture content of the refuse 2 in the
40 refuse hopper 82A, of which the standby time before being supplied to the refuse combustion furnace 30 is relatively short, falls within a prescribed

5 range. Therefore, it is possible to further stabilize the amount of heat obtained by combustion of the refuse 2.

[0061]

Note that in other embodiments, the second moisture meter 62A provided in the crane 75 may be an infrared camera that measures the moisture
10 content of the surface layer portion of the refuse 2 in the refuse pit 85A. In this case, the operator may control the spraying device 70A. As a more specific example, the operator identifies the distribution of the moisture content of the refuse 2 in the refuse pit 85A from an image taken by the infrared camera when the crane 75 is moved. Thereafter, with the moisture content of the refuse 2 in
15 the refuse hopper 82A understood from the measurement result of the first moisture meter 61A, the operator causes the crane 75 to grip refuse 2 that has a moisture content suitable for feeding to the refuse hopper 82A. In this way, the moisture content of the refuse 2 in the refuse hopper 82A is made appropriate. In this case, the moisture meter 60A need not include the second moisture
20 meter 62A provided in the refuse pit 85A.

Furthermore, the controller 90A may automatically perform the operation of the operator as described above. In this case, the crane 75 automatically operates under the control of the controller 90A.

[0062]

25 Configuration Details of Refuse Combustion System 10B (10)

A configuration of the refuse combustion system 10B will be described with reference to FIG. 4B.

In the illustrated embodiment, in order from the upper side in the vertical direction, the refuse pit 85B (85), a refuse waste water pit 35B (35), the
30 spraying device 70B (70), and the refuse hopper 82B (82) are disposed.

[0063]

A discharge port 88 for discharging the refuse 2 is provided at a lower portion of the refuse pit 85B of the present example. In the refuse hopper 82B, a feed port 38 for receiving the fed refuse 2 is provided.

35 [0064]

The refuse combustion system 10B according to one embodiment includes a feeding device 110 provided below the discharge port 88 of the refuse pit 85B. The feeding device 110 is configured to feed the refuse 2 discharged from the discharge port 88 into the feed port 38 of the refuse hopper
40 82B utilizing the weight of the refuse 2.

[0065]

5 The feeding device 110 of the present example constitutes part of the refuse pit 85B, and temporarily stores the refuse 2 discharged from the discharge port 88. Furthermore, the feeding device 110 is configured to feed the refuse 2 into the refuse hopper 82B according to control signals sent from the controller 90B. A detailed description of the feeding device 110 will be given
10 later (see FIGS. 5A and 5B).
[0066]

 According to the configuration described above, the feeding device 110 can feed the refuse 2 discharged from the discharge port 88 of the refuse pit 85B into the feed port 38 of the refuse hopper 82B utilizing the weight of the
15 refuse 2. Thus, the feeding device 110 can operate with a small amount of power without the need to transport the refuse 2 upward.
[0067]

 The above-described refuse waste water pit 35B is configured to store the refuse waste water at a vertical position between the discharge port 88 and
20 the feed port 38 (more specifically, a vertical position between the feeding device 110 and the feed port 38). The refuse waste water separated from the refuse 2 stored in the refuse pit 85B is stored in the refuse waste water pit 35. Furthermore, the refuse waste water pit 35B includes a drain port 31 configured to drain the refuse waste water. In the refuse waste water pit 35B, there is
25 provided a waste water amount meter 68 for measuring the amount of stored refuse waste water. The waste water amount meter 68 is a water level meter, for example. Furthermore, the spraying device 70B is provided at the underside of the drain port 31, and is configured to spray the refuse waste water on the refuse 2 in the refuse hopper 82B utilizing the weight of the refuse waste water.
30 As an example, a spraying nozzle 71B of the spraying device 70B is connected to the drain port 31 of the refuse waste water pit 35B.
[0068]

 According to the configuration described above, the spraying device 70B can spray the refuse waste water without drawing the refuse waste water.
35 Thus, the spraying device 70B can have a simplified configuration and operate with a small amount of power.
[0069]

 The moisture meter 60B includes the first moisture meter 61B (61) for measuring the moisture content of the refuse 2 in the refuse hopper 82B, and
40 the second moisture meter 62B (62) for measuring the moisture content of the refuse 2 in the refuse pit 85B. The first moisture meter 61B is a microwave meter for detecting the moisture content of the refuse 2 near the feed port 38.

5 The second moisture meter 62B is a microwave meter that measures the moisture content of the refuse 2 stored by the feeding device 110 that constitutes part of the refuse pit 85B.

[0070]

10 Note that in other embodiments, the first moisture meter 61B may be an infrared camera provided on an upper portion of the wall of the refuse pit 85B. Furthermore, the moisture meter 60B need not include the second moisture meter 62B.

[0071]

15 The controller 90B controls the feeding device 110 so that the refuse 2 is fed into the feed port 38 of the refuse hopper 82B when a feeding condition is satisfied. As an example, the feeding condition is a condition in which the moisture content of the refuse 2 measured by the first moisture meter 61B is below the lower threshold value, the moisture content of the refuse 2 measured by the second moisture meter 62B is above a prescribed threshold value greater
20 than or equal to the lower threshold value, and the amount of the refuse waste water stored in the refuse waste water pit 35B is less than or equal to a predetermined amount. Feeding refuse 2 that has a relatively high moisture content from the feeding device 110 into the refuse hopper 82B increases the moisture content of the refuse 2 in the refuse hopper 82B. As an example,
25 whether the amount of refuse waste water stored in the refuse pit 85B is less than or equal to a predetermined amount is determined by the controller 90B based on the measurement result of the waste water amount meter 68.

[0072]

30 According to the configuration described above, even when the refuse waste water stored in the refuse pit 85B is insufficient despite the need to increase the moisture content of the refuse 2 in the refuse hopper 82B, the moisture content of the refuse 2 in the refuse hopper 82B can be made greater than or equal to the lower threshold value by using refuse 2 in the refuse pit 85B having a moisture content above a prescribed threshold value (as a more
35 specific example, the refuse 2 stored in the feeding device 110).

[0073]

40 The controller 90B controls the spraying device 70B so that the refuse waste water stored in the refuse waste water pit 35B is sprayed when a spraying condition is satisfied. As an example, the spraying condition is a condition in which the moisture content of the refuse 2 measured by the first moisture meter 61B is below the lower threshold value, and the amount of the refuse waste water stored in the refuse waste water pit 35B is above a predetermined

5 amount. In this way, the moisture content can be made greater than or equal to the lower threshold value by spraying the refuse waste water even when the moisture content of the refuse 2 in the refuse pit 85B is below the lower threshold value.

[0074]

10 Configuration Details of Feeding Device 110

Specific configurations of feeding devices 110A and 110B (110) will be described with reference to FIGS. 5A and 5B. FIG. 5A is a configuration diagram conceptually illustrating a feeding device according to one embodiment of the present disclosure. FIG. 5B is a configuration diagram
15 conceptually illustrating a feeding device according to another embodiment of the present disclosure.

[0075]

In the embodiments illustrated in FIGS. 5A and 5B, the feeding device 110 includes storage portions 115A and 115B (115) for temporarily storing the
20 refuse 2 discharged from the discharge port 88 of the refuse pit 85B. Note that the upper portion of the storage portion 115 is a retractable door, for example. Furthermore, the storage portion 115 is coupled to the refuse waste water pit 35B, and a lower wall 118 of the storage portion 115 forms the upper wall of the refuse waste water pit 35B. On the lower wall 118 according to one
25 embodiment, there is provided a plurality of holes (not illustrated) through which the refuse waste water can pass.

[0076]

In the embodiment illustrated in FIG. 5A, the storage portion 115A (115) of the feeding device 110A is configured such that the lower wall 118 rotates
30 upon the driving of an actuator. Rotation of the lower wall 118 partially opens the lower portion of the storage portion 115A, causing the refuse 2 to be discharged and drop. Note that the refuse waste water pit 35B may also rotate together with the lower wall 118.

[0077]

35 In the embodiment illustrated in FIG. 5B, a part of the storage portion 115B (115) of the feeding device 110B (110) on one side in the horizontal direction is open. Furthermore, the feeding device 110B includes an extruding portion 112 configured to horizontally move inside the storage portion 115B by the driving of an actuator (not illustrated). The extruding portion 112 that
40 moves causes the refuse 2 stored in the storage portion 115B to be discharged and drop.

[0078]

5 Electrical Configuration of Refuse Combustion Power Generation System 1

FIG. 6 is a block diagram illustrating an electrical configuration of a refuse combustion power generation system according to one embodiment of the present disclosure. FIG. 6 is an example of a block diagram of the refuse combustion power generation system 1 including the refuse combustion system

10 10B.
[0079]

The processor 91, which is a component of the controller 90B (90), is configured to read out a prescribed program stored in a read-only memory (ROM) 92, load the program into a random access memory (RAM) 93, and

15 execute instructions included in the loaded program. The processor 91 is a central processing unit (CPU), a graphics processing unit (GPU), a microprocessor unit (MPU), a digital signal processor (DSP), another type of computing device, or a combination thereof. The processor 91 may be realized by an integrated circuit such as a programmable logic device (PLD), an

20 application-specific integrated circuit (ASIC), a field programmable gate array (FPGA), and a microcontroller unit (MCU). A memory 94 that is electrically connected to the processor 91 stores data to be processed in conjunction with the execution of the program, and a learning model for machine learning. The memory 94 is configured to store data in a non-transitory manner, and is one or

25 a plurality of flash memories as an example.

[0080]

Furthermore, the processor 91 is electrically connected to an input/output interface 95. The input/output interface 95 is electrically connected to each of the exhaust gas thermometer 4, the oxygen densitometer

30 5, the steam flow meter 6, the steam pressure meter 7, the first moisture meter 61B (61), the second moisture meter 62B (62), and the waste water amount meter 68. The measurement result of each of these measuring instruments is sent to the processor 91. The input/output interface 95 is electrically connected to each of the spraying device 70B, the feeding device 110, and the stoker drive

35 unit 3. The processor 91 is configured to send control signals to each of these devices.

[0081]

Spraying Processing According to Other Embodiments

FIG. 7 is a flowchart illustrating spraying processing according to another embodiment of the present disclosure. The spraying processing is processing for keeping the moisture content of the refuse 2 in the refuse supply unit 80 within a prescribed range determined in the learning processing. When

40

5 the moisture content of the refuse 2 falls within the prescribed range, the process value of the refuse combustion power generation system 1 falls within the target range. The spraying processing is performed by the controller 90 (more specifically, the processor 91).

10 In the following description, the spraying processing in the refuse combustion power generation system 1 including the refuse combustion system 10B (see FIG. 4B) is illustrated.
[0082]

First, the controller 90 measures the moisture content of the refuse 2 in the refuse supply unit 80B (S30). For example, the controller 90 acquires the
15 moisture content of the refuse 2 in the refuse hopper 82B based on the measurement result of the first moisture meter 61B, and acquires the moisture content of the refuse 2 in the refuse pit 85B based on the measurement result of the second moisture meter 62B. Subsequently, the controller 90 determines whether the moisture content of the refuse 2 measured by the first moisture
20 meter 61B in S30 (hereinafter also referred to as "first measured value") is below the lower threshold value (S31). When the first measured value is below the lower threshold value (S31: YES), the controller 90 determines whether the amount of the refuse waste water stored in the refuse waste water pit 35B is above a predetermined amount based on the measurement result of the waste
25 water amount meter 68 (S33). When the storage amount of the refuse waste water identified by the measurement result of the waste water amount meter 68 is above the predetermined amount (S33: YES), the spraying condition described above is satisfied. In this case, the controller 90 controls the spraying device 70B so that the refuse waste water is sprayed on the refuse 2 in the
30 refuse pit 85B (S35). In this way, it is possible to suppress the moisture content of the refuse 2 supplied to the refuse combustion furnace 30 from falling below the lower threshold value.
[0083]

When the storage amount of the refuse waste water identified by the
35 measurement result of the waste water amount meter 68 is less than or equal to a predetermined amount (S33: NO), the controller 90 determines whether the moisture content of the refuse 2 measured by the second moisture meter 62B in S30 (hereinafter also referred to as "second measured value") is above a prescribed threshold value (S37). When the second measured value is above the
40 prescribed threshold value (S37: YES), the feeding condition described above is satisfied. In this case, the controller 90 controls the feeding device 110 so that the refuse 2 stored in the feeding device 110 is fed into the feed port 38 of

5 the refuse hopper 82B (S39). In this way, the moisture content of the refuse 2 in the refuse hopper 82B is reduced, and the moisture content of the refuse 2 supplied to the refuse combustion furnace 30 can be suppressed from falling below the lower threshold value.

[0084]

10 When the moisture content of the refuse 2 measured by the second moisture meter 62B is less than or equal to the prescribed threshold value (S37: NO), there is no means left to increase the moisture content of the refuse 2 in the refuse hopper 82B in this example, so the controller 90 ends the spraying processing. At this time, the controller 90 may perform notification processing
15 targeted at the operator. The refuse combustion power generation system 1 may then be switched from automatic operation to manual operation by the operator.

[0085]

When the first measured value is greater than or equal to the lower threshold value (S31: NO), the controller 90 determines whether the first
20 measured value is above the upper threshold value (S41). When the first measured value is less than or equal to the upper threshold value (S41: NO), the controller 90 returns the processing to S30. While the moisture content measured by the first moisture meter 61B is greater than or equal to the lower threshold value and less than or equal to the upper threshold value, the
25 controller 90 repeats S31 and S41.

[0086]

When the first measured value is above the upper threshold value (S41: YES), the controller 90 generates an instruction to increase the stoker speed (S43). Sending the generated instruction (control signal) to the stoker drive unit
30 3 increases the stoker speed. In this way, the amount of heat obtained by combustion of the refuse 2 is suppressed from falling too low.

[0087]

Subsequently, the controller 90 determines whether the second measured value is below the upper threshold value (S45). When the second measured
35 value is below the upper threshold value (S45: YES), the controller 90 executes S39 described above. On the other hand, when the second measured value is greater than or equal to the upper threshold value (S45: NO), the feeding of the refuse 2 by the feeding device 110 may cause an excessive increase in the moisture content of the refuse 2 in the refuse hopper 82B, so the controller 90
40 returns the processing to S30 without performing S39.

[0088]

5 Note that in other embodiments, the above-described spraying processing may be performed in the refuse combustion system 10A. Furthermore, the spraying processing may be performed by manual operation by the operator. In this case, the lower threshold value and the upper threshold value for the moisture content of the refuse 2 may be determined by the
10 operator, and the spraying processing may be performed based on the determined lower threshold value and upper threshold value. That is, the learning model need not be created.

[0089]

Summary

15 The contents of the embodiments described above can be understood as follows, for example.

[0090]

1) A refuse combustion system (10) according to at least one embodiment of the present disclosure includes: a refuse combustion furnace
20 (30); a refuse supply unit (80) configured to supply refuse (2) to the refuse combustion furnace (30); a refuse waste water pit (35) configured to store refuse waste water separated from the refuse (2) in the refuse supply unit (80); a moisture meter (60) configured to measure a moisture content of the refuse (2) in the refuse supply unit (80); a spraying device (70) configured to spray
25 the refuse waste water stored in the refuse waste water pit (35) on the refuse (2); and a controller (90) configured to control the spraying device (70) according to the moisture content of the refuse (2) measured by the moisture meter (60).

[0091]

30 According to the configuration of 1) above, the refuse waste water is sprayed on the refuse (2) in the refuse supply unit (80) according to the moisture content of the refuse (2) measured by the moisture meter (60). In this way, the moisture content of the refuse (2) that has been gathered to the refuse supply unit (80) by, for example, a transport vehicle and is not yet supplied to
35 the refuse combustion furnace (30) can be kept within a prescribed range. Thus, the amount of heat obtained from the combusting refuse (2) is stabilized. Furthermore, the configuration for keeping the moisture content of the refuse waste water in the refuse supply unit (80) within the prescribed range is realized by the moisture meter (60) and the spraying device (70), so the
40 configuration of the refuse combustion system (10) can be simplified. In this manner, a refuse combustion system (10) is realized that stabilizes the amount of heat obtained from the combusted refuse (2) with a simple configuration.

5 [0092]

2) In some embodiments, in the refuse combustion system (10) according to 1) above, the controller (90) is configured to control the spraying device (70) so that, when the moisture content of the refuse (2) measured by the moisture meter (60) is below a lower threshold value, the moisture content
10 becomes greater than or equal to the lower threshold value.

[0093]

According to the configuration of 2) above, the moisture content of the refuse (2) supplied to the refuse combustion furnace (30) can be made greater than or equal to the lower threshold value. Thus, the refuse combustion system
15 (10) can suppress the amount of heat obtained by combustion of the refuse (2) from becoming too large.

[0094]

3) In some embodiments, in the refuse combustion system (10) according to 2) above, the controller (90) is configured to increase the stoker
20 speed of the refuse combustion furnace (30) when the moisture content of the refuse (2) measured by the moisture meter (60) is above an upper threshold value.

[0095]

According to the configuration of 3) above, when the moisture content
25 of the refuse (2) measured by the moisture meter (60) is above the upper threshold value, the amount of the refuse (2) to be combusted increases. Thus, the refuse combustion system (10) can suppress insufficiency of the amount of heat obtained by combustion of the refuse (2).

[0096]

4) In some embodiments, in the refuse combustion system (10) according to any of 1) to 3) above, the refuse supply unit (80) includes a refuse
30 hopper (82) configured to be fed with the refuse (2) to be supplied to the refuse combustion furnace (30), and the moisture meter (60) includes a first moisture meter (61) configured to measure a moisture content of the refuse (2) in the
35 refuse hopper (82).

[0097]

According to the configuration of 4) above, the spraying device (70) sprays the refuse waste water according to the moisture content of the refuse
40 (2) in the refuse hopper (82) measured by the first moisture meter (61). In this way, the difference between the moisture content of the refuse (2) supplied to the refuse combustion furnace (30) and the moisture content identified by

5 measurement can be reduced. Thus, the refuse combustion system (10) can further stabilize the amount of heat obtained by combustion of the refuse (2).
[0098]

5) In some embodiments, in the refuse combustion system (10) according to 4) above, the spraying device (70) is configured to spray the
10 refuse waste water to the refuse (2) in the refuse hopper (82).
[0099]

According to the configuration of 5) above, the refuse waste water is sprayed on the refuse (2) in the refuse hopper (82) according to the moisture content of the refuse (2) in the refuse hopper (82) measured by the first
15 moisture meter (61). In this way, the difference between the moisture content of the refuse (2) supplied to the refuse combustion furnace (30) and the moisture content measured by the first moisture meter (61) can be further reduced.
[0100]

6) In some embodiments, in the refuse combustion system (10) according to 5) above, the refuse supply unit (80) includes a refuse pit (85)
20 configured to store the refuse (2) before the refuse is fed into the refuse hopper (82), and the moisture meter (60) includes a second moisture meter (62) configured to measure a moisture content of the refuse (2) in the refuse pit (85).
25 [0101]

According to the configuration of 6) above, the spraying device (70) can spray the refuse waste water on the refuse (2) in the refuse hopper (82) according to the moisture content of the refuse (2) in the refuse pit (85), so the moisture content of the refuse (2) supplied to the refuse combustion furnace
30 (30) can be suppressed from becoming inappropriate in the future. Furthermore, in an embodiment in which the refuse supply unit (80) includes the refuse pit (85) in addition to the refuse hopper (82), the moisture content of the refuse (2) in the refuse hopper (82), of which the standby time before being supplied to the refuse combustion furnace (30) is relatively short, falls within the
35 prescribed range. Therefore, it is possible to further stabilize the amount of heat obtained by combustion of the refuse (2).
[0102]

7) In some embodiments, in the refuse combustion system (10) according to any of 1) to 6) above, the refuse supply unit (80) includes a refuse
40 hopper (82) configured to be fed with the refuse (2) to be supplied to the refuse combustion furnace (30), and a refuse pit (85) configured to store the refuse (2) before the refuse is fed into the refuse hopper (82), the spraying device (70) is

5 configured to spray the refuse waste water on the refuse (2) in the refuse
hopper (82), and the refuse waste water pit (35) is configured to recover the
refuse waste water separated from each of the refuse (2) in the refuse pit (85)
and the refuse (2) in the refuse hopper (82).

[0103]

10 According to the configuration of 7) above, the refuse waste water
contained in the refuse (2) in the refuse pit (85) and the refuse waste water
contained in the refuse (2) in the refuse hopper (82) are recovered and sprayed
by the spraying device (70). In this way, the refuse waste water generated in the
refuse combustion system (10) is recovered without waste and is effectively
15 utilized to stabilize the amount of heat obtained by combustion of the refuse
(2).

[0104]

8) In some embodiments, in the refuse combustion system (10)
according to any of 1) to 7) above, the refuse supply unit (80) includes a refuse
20 pit (85) configured to store the refuse (2), a refuse hopper (82) configured to be
fed with the refuse (2) to be supplied to the refuse combustion furnace (30),
and a feeding device (110) that is provided below a discharge port (88) of the
refuse pit (85) and that is for feeding the refuse (2) discharged from the
discharge port (88) into a feed port (38) of the refuse hopper (82) utilizing
25 weight of the refuse (2).

[0105]

According to the configuration of 8) above, the feeding device (110) can
feed the refuse (2) discharged from the discharge port (88) of the refuse pit (85)
into the feed port (38) of the refuse hopper (82) utilizing the weight of the
30 refuse (2). Thus, the feeding device (110) can operate with a small amount of
power without the need to transport the refuse (2) upward.

[0106]

9) In some embodiments, in the refuse combustion system (10)
according to 8) above, the refuse waste water pit (35) stores the refuse waste
35 water at a vertical position between the discharge port (88) and the feed port
(38) and includes a drain port (31) configured to drain the refuse waste water,
and the spraying device (70) is provided at the underside of the drain port (31)
and is configured to spray the refuse waste water on the refuse (2) in the refuse
hopper (82) utilizing weight of the refuse waste water.

40 [0107]

According to the configuration of 9) above, the spraying device (70) can
spray the refuse waste water without drawing the refuse waste water. Thus, the

5 spraying device (70) can have a simplified configuration, and operate with a small amount of power.

[0108]

10 10) In some embodiments, in the refuse combustion system (10) according to 8) or 9) above, the moisture meter (60) includes a first moisture meter (61) configured to measure the moisture content of the refuse (2) in the refuse hopper (82) and a second moisture meter (62) configured to measure the moisture content of the refuse (2) in the refuse pit (85), and the controller (90) is configured to control the feeding device (110) to feed the refuse (2) stored in the refuse pit (85) into the feed port (38) of the refuse hopper (82) when the
15 moisture content of the refuse (2) measured by the first moisture meter (61) is below a lower threshold value, the moisture content of the refuse (2) measured by the second moisture meter (62) is above a prescribed threshold value greater than or equal to the lower threshold value, and an amount of the refuse waste water stored in the refuse waste water pit (35) is less than or equal to a
20 predetermined amount.

[0109]

According to the configuration of 10) above, even when the refuse waste water stored in the refuse pit (85) is insufficient despite the need to increase the moisture content of the refuse (2) in the refuse hopper (82), the moisture
25 content of the refuse (2) in the refuse hopper (82) can be made greater than or equal to the lower threshold value by using refuse (2) in the refuse pit (85) having a moisture content above the upper threshold value.

[0110]

30 11) A refuse combustion power generation system (1) according to at least one embodiment of the present disclosure includes: the refuse combustion system (10) according to any of 1) to 10) above; a waste heat boiler (22) configured to use combustion gas generated in the refuse combustion furnace (30) as a heat source; a turbine (24) configured to rotate with steam from the waste heat boiler (22) as a drive source; and a generator (25) configured to
35 generate power by rotation of the turbine (24).

[0111]

According to the configuration of 11) above, for the reasons stated above, a refuse combustion power generation system (1) is realized that stabilizes the amount of heat obtained by combustion of the refuse (2) with a
40 simple configuration. Furthermore, when the amount of heat obtained by combustion of the refuse (2) is stabilized, the amount of steam generated from the waste heat boiler (22) is stabilized, and the rotation of the turbine (24) is

5 stabilized. In this way, power generating capacity of the generator (25) can be stabilized.

[0112]

10 12) In some embodiments, in the refuse combustion power generation system (1) according to 11) above, the controller (90) includes a model creation unit (101) configured to create a learning model that has learned a relationship between the moisture content of the refuse (2) measured by the moisture meter (60) and at least one process value of the refuse combustion power generation system (1), and a threshold value determination unit (102) configured to determine such an upper threshold value and a lower threshold value for the moisture content that causes the at least one process value to fall within a target range based on the learning model created by the model creation unit (101).

[0113]

20 According to the configuration of 12) above, the learning model is used to determine such an upper threshold value and a lower threshold value for the moisture content that causes at least one process value to fall within the target range. In this way, the operation status of the refuse combustion power generation system (1) can be automatically made appropriate by controlling the moisture content of the refuse (2).

[0114]

25 13) A method for treating refuse waste water according to at least one embodiment of the present disclosure is a method for treating refuse waste water in a refuse combustion system (10) including a refuse combustion furnace (30), a refuse supply unit (80) that supplies refuse (2) to the refuse combustion furnace (30), and a refuse waste water pit (35) for storing refuse waste water separated from the refuse (2) in the refuse supply unit (80), and the method includes: measuring a moisture content of the refuse (2) in the refuse supply unit (80) (S1 and S30); and spraying the refuse waste water stored in the refuse waste water pit (35) on the refuse (2) according to the moisture content of the refuse (2) measured in the measuring step (S5 and S35).

35 [0115]

According to the configuration of 13) above, for the reasons stated above, a method for treating refuse waste water is realized that stabilizes the amount of heat obtained by combustion of the refuse (2) with a simple configuration.

40

Reference Signs List

[0116]

- 5 1: Refuse combustion power generation system
 - 10: Refuse combustion system
 - 22: Waste heat boiler
 - 24: Turbine
 - 25: Generator
- 10 30: Combustion furnace
 - 31: Drain port
 - 35: Waste water pit
 - 38: Feed port
 - 60: Moisture meter
- 15 61: First moisture meter
 - 62: Second moisture meter
 - 70: Spraying device
 - 80: Supply unit
 - 82: Refuse hopper
- 20 85: Refuse pit
 - 88: Discharge port
 - 90: Controller
 - 101: Model creation unit
 - 102: Threshold value determination unit
- 25 110: Feeding device

5 Claims

[Claim 1]

A refuse combustion system comprising:
a refuse combustion furnace;
10 a refuse supply unit configured to supply refuse to the refuse combustion furnace;
a refuse waste water pit configured to store refuse waste water separated from the refuse in the refuse supply unit;
a moisture meter configured to measure a moisture content of the refuse
15 in the refuse supply unit;
a spraying device configured to spray the refuse waste water stored in the refuse waste water pit on the refuse; and
a controller configured to control the spraying device according to the moisture content of the refuse measured by the moisture meter.

20

[Claim 2]

The refuse combustion system according to claim 1, wherein the controller is configured to control the spraying device so that, when the moisture content of the refuse measured by the moisture meter is below a lower
25 threshold value, the moisture content becomes greater than or equal to the lower threshold value.

[Claim 3]

The refuse combustion system according to claim 2, wherein the
30 controller is configured to increase a stoker speed of the refuse combustion furnace when the moisture content of the refuse measured by the moisture meter is above an upper threshold value.

[Claim 4]

35 The refuse combustion system according to any one of claims 1 to 3, wherein
the refuse supply unit includes a refuse hopper configured to be fed with the refuse to be supplied to the refuse combustion furnace, and
the moisture meter includes a first moisture meter configured to measure
40 a moisture content of the refuse in the refuse hopper.

[Claim 5]

5 The refuse combustion system according to claim 4, wherein the spraying device is configured to spray the refuse waste water on the refuse in the refuse hopper.

[Claim 6]

10 The refuse combustion system according to claim 5, wherein the refuse supply unit includes a refuse pit configured to store the refuse before the refuse is fed into the refuse hopper, and the moisture meter includes a second moisture meter configured to measure the moisture content of the refuse in the refuse pit.

15

[Claim 7]

 The refuse combustion system according to any one of claims 1 to 6, wherein the refuse supply unit includes
 20 a refuse hopper configured to be fed with the refuse to be supplied to the refuse combustion furnace, and a refuse pit configured to store the refuse before the refuse is fed into the refuse hopper,
 the spraying device is configured to spray the refuse waste water on the
 25 refuse in the refuse hopper, and the refuse waste water pit is configured to recover the refuse waste water separated from each of the refuse in the refuse pit and the refuse in the refuse hopper.

30

[Claim 8]

 The refuse combustion system according to any one of claims 1 to 7, wherein the refuse supply unit includes
 a refuse pit configured to store the refuse,
 35 a refuse hopper configured to be fed with the refuse to be supplied to the refuse combustion furnace, and a feeding device that is provided below a discharge port of the refuse pit and that is configured to feed the refuse discharged from the discharge port into a feed port of the refuse hopper utilizing weight of the refuse.

40

[Claim 9]

 The refuse combustion system according to claim 8, wherein

5 the refuse waste water pit stores the refuse waste water at a vertical position between the discharge port and the feed port and includes a drain port configured to drain the refuse waste water, and
 the spraying device is provided at an underside of the drain port and is configured to spray the refuse waste water on the refuse in the refuse hopper
 10 utilizing weight of the refuse waste water.

[Claim 10]

 The refuse combustion system according to claim 8 or 9, wherein the moisture meter includes
 15 a first moisture meter configured to measure the moisture content of the refuse in the refuse hopper, and
 a second moisture meter configured to measure the moisture content of the refuse in the refuse pit, and
 the controller is configured to control the feeding device to feed the
 20 refuse stored in the refuse pit into the feed port of the refuse hopper when the moisture content of the refuse measured by the first moisture meter is below a lower threshold value,
 the moisture content of the refuse measured by the second moisture meter is above a prescribed threshold value greater than or equal to the lower
 25 threshold value, and
 an amount of the refuse waste water stored in the refuse waste water pit is less than or equal to a predetermined amount.

[Claim 11]

30 A refuse combustion power generation system comprising:
 the refuse combustion system according to any one of claims 1 to 10;
 a waste heat boiler configured to use combustion gas generated in the refuse combustion furnace as a heat source;
 a turbine configured to rotate with steam from the waste heat boiler as a
 35 drive source; and
 a generator configured to generate power by rotation of the turbine.

[Claim 12]

 The refuse combustion power generation system according to claim 11,
 40 wherein
 the controller includes

- 5 a model creation unit configured to create a learning model that has learned a relationship between the moisture content of the refuse measured by the moisture meter and at least one process value of the refuse combustion power generation system, and
- 10 a threshold value determination unit configured to determine such an upper threshold value and a lower threshold value for the moisture content that causes the at least one process value to fall within a target range based on the learning model created by the model creation unit.

[Claim 13]

- 15 A method for treating refuse waste water in a refuse combustion system including a refuse combustion furnace, a refuse supply unit that supplies refuse to the refuse combustion furnace, and a refuse waste water pit for storing refuse waste water separated from the refuse in the refuse supply unit, the method comprising:
- 20 measuring a moisture content of the refuse in the refuse supply unit; and spraying the refuse waste water stored in the refuse waste water pit on the refuse according to the moisture content of the refuse measured in the measuring step.