TITLE OF THE INVENTION

WASTE TREATMENT METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a waste treatment method.

2. Description of the Related Art

[0002] In gasifying and melting furnaces that treat wastes, coke made from coal is fed together with the waste. The fed coke reaches the bottom of the furnace and burns, forming a fire grate by the gaps between pieces of coke. The waste fed into the gasifying and melting furnace is pyrolyzed and gasified by the high heat and high-temperature gas from coke combustion, and ashes resulting from the pyrolysis and the gasification reach the bottom of the furnace. The ashes having reached the bottom of the furnace are melted by the heat from the coke combustion, resulting in generation of melted slag and melted metal. The melted slag and melted metal descend through the gaps in the fire grate formed by the coke and are discharged through a slag discharge port.

[0003] In contrast to such a treatment method using coke, there is an invention to treat wastes using biomass instead of coke in gasifying and melting furnaces in order to reduce carbon dioxide emission from the operation of the

gasifying and melting furnaces. For example, a waste melting treatment method disclosed in Patent Document 1 uses biomass briquette made by pressure-molding a biomass material and biomass charcoal made by carbonizing a biomass material instead of coke. In this melting treatment method, the biomass charcoal forms a fire grate and serves as a heat source for melting the ashes. Additionally, in this melting treatment method, the amount of biomass charcoal input is the minimum amount required to form at least the fire grate, and the heat quantity to melt the ashes is supplemented by the heat quantity from combustion of the biomass briquette.

PRIOR-ART DOCUMENT

PATENT DOCUMENT

[0004]

Patent Document 1: Japanese Patent NO. 6168287

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0005] When biomass charcoal is used in a gasifying and melting furnace, a large amount of biomass charcoal is used. However, since it is difficult to secure a large amount of the same kind of biomass charcoal, gasifying and melting furnaces that treat wastes use products of multiple biomass charcoal factories. When using the products from multiple biomass charcoal factories, the properties of the

biomass charcoals vary depending on the factory that produces the biomass charcoal. The amount of biomass charcoal consumed to treat the waste varies greatly depending on the properties of the biomass charcoal, and therefore the consumption may increase significantly depending on the biomass charcoal used.

[0006] The present invention has been made in view of the above and has an object to melt wastes with less biomass charcoal consumption.

[0007] A waste treatment method according to an aspect of the present invention of melting ashes generated in a melting furnace when at least pyrolysis and gasification for waste are performed in the melting furnace, includes: feeding a first biomass charcoal, and a second biomass charcoal into the melting furnace, consumption of the second biomass charcoal required for treating the waste exceeding consumption of the first biomass charcoal required for treating the waste; forming a fire grate with the first biomass charcoal in the melting furnace to burn the first biomass charcoal; burning the second biomass charcoal in the fire grate or an upper surface of the fire grate; and melting the ashes with a heat generated when the first biomass charcoal and the second biomass charcoal are burned. Further, a ratio of a weight of the first biomass charcoal to a total weight of a weight of the fed first

biomass charcoal and a weight of the fed second biomass charcoal is 30 wt% or more.

[0008] In the waste treatment method according to the present invention, the first biomass charcoal may include several kinds of pieces of biomass charcoal each kind having different consumption required for waste treatment.

[0009] In the waste treatment method according to the present invention, the first biomass charcoal may have apparent density of 0.9 g/cm^3 or more, a weight of 60g or more per piece of the first biomass charcoal, a volatile matter of 7 wt%(dry basis) or less, and lower calorific value of 26 MJ/kg or more.

[0010] In the waste treatment method according to the present invention, the second biomass charcoal may include several kinds of pieces of biomass charcoal each kind having different consumption required for waste treatment.

EFFECT OF THE INVENTION

[0011] By the present invention, the waste can be melted with less biomass charcoal consumption, which is advantageous.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. 1 is a diagram illustrating a structure of a gasifying and melting furnace 1 according to an embodiment of the present invention;

FIG. 2 is a graph expressing a result of measuring biomass charcoal consumption; and

FIG. 3 is a graph expressing a result of measuring biomass charcoal consumption.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] An embodiment of the present invention will hereinafter be described in detail based on the drawings. The present invention is not limited by the embodiment described below. It should be noted that the drawings are schematic and the relationship between the dimensions of the respective elements may differ from that in the reality.

[0014] Embodiment

FIG. 1 is a diagram illustrating a structure of a gasifying and melting furnace 1 according to an embodiment of the present invention. The gasifying and melting furnace 1 is a shaft furnace type gasifying and melting furnace. In this embodiment, two kinds of biomass charcoals are fed into the gasifying and melting furnace 1 together with waste, and by the heat from the combustion of the fed biomass charcoals, the waste is gasified and melted.

[0015] Above the gasifying and melting furnace 1, a supply device that supplies a waste 33, such as a municipal waste, a first biomass charcoal 31, a second biomass charcoal 32, and limestone 34 is provided. In FIG. 1, the supply device is not illustrated. The limestone 34 is used as a component adjusting material for the slag generated in the gasifying and melting furnace 1.

[0016] The gasifying and melting furnace 1 has an feeding port 2 at an upper part of the furnace. The waste 33, the first biomass charcoal 31, the second biomass charcoal 32, and the limestone 34 are transported from the supply device with a conveyer and fed into the furnace from the feeding port 2. In FIG. 1, the conveyer is not illustrated. The first biomass charcoal 31 and the second biomass charcoal 32 may be put in separate hoppers, each fed in a predetermined quantity and input into the supply device. Alternatively, the first biomass charcoal 31 and the second biomass charcoal 32 may be mixed in advance and put in one hopper, fed from one place, and input into the supply device.

[0017] A gas outlet 3 is provided at the side of the upper part of the furnace of the gasifying and melting furnace 1. The gas outlet 3 is an outlet for discharging the gas generated in the furnace to a secondary combustion chamber 10. The secondary combustion chamber 10 is connected to the gas outlet 3. The secondary combustion chamber 10 is equipped with a air inlet 11 for blowing air for secondary combustion. In the secondary combustion chamber 10, combustible gas generated by pyrolysis and gasification of the waste 33 is burned in the gasifying and melting furnace 1.

[0018] A boiler 12 is provided adjacent to the secondary

combustion chamber 10. The boiler 12 recovers the heat generated by combustion of the combustible gas in the secondary combustion chamber 10. The exhaust gas, from which heat has been recovered in the boiler 12, is sent to an exhaust gas treatment device connected to the boiler 12. In FIG. 1, the exhaust gas treatment device is not illustrated.

[0019] In the gasifying and melting furnace 1, the interior space is roughly divided into three regions in a vertical direction. Specifically, the interior space is broadly divided into, from the bottom, a lower shaft part 21, a middle shaft part 22, and a freeboard part 23.

[0020] The lower shaft part 21 is a region where the first biomass charcoal 31 and the second biomass charcoal 32, which are fed and deposited in the furnace, are burned to form a high-temperature combustion zone. On the high-temperature combustion zone formed in the lower shaft part 21, the waste 33 fed into the furnace is deposited to form a waste layer. The furnace wall of the lower shaft part 21 is equipped with a main tuyere 5. The main tuyere 5 is a tuyere into which oxygen-enriched air is blown to form the high-temperature combustion zone. The lower shaft part 21 has a slag discharge port 4. The slag discharge port 4 is an outlet for discharging the slag resulting from the melting of the ashes in the waste 33, and the melted metal

in the waste 33.

[0021] The middle shaft part 22 exists above the lower shaft part 21. The middle shaft part 22 is a region where the waste 33 in the waste layer formed on the high-temperature combustion zone is pyrolyzed. The furnace wall of the middle shaft part 22 is equipped with a secondary tuyere 6. The secondary tuyere 6 is a tuyere into which air is blown to perform pyrolysis and combustion while letting the fed and deposited waste 33 flow gently.

[0022] The freeboard part 23 exists above the middle shaft part 22. The freeboard part 23 is a region where some of the combustible gas generated by the combustion of the waste 33 is burned. The furnace wall of the freeboard part 23 is equipped with a tertiary tuyere 7. Through the tertiary tuyere 7, air is blown in to burn some of the combustible gas generated by the pyrolysis of the waste 33 and maintain the inside of the furnace at a predetermined temperature.

[0023] Next, the first biomass charcoal 31 and the second biomass charcoal 32, which are fed into the gasifying and melting furnace 1 together with the waste 33, are described. In the present invention, the first biomass charcoal 31 and the second biomass charcoal 32 are fed into the gasifying and melting furnace 1 instead of the coke.

[0024] In the present invention, the first biomass

charcoal 31 and the second biomass charcoal 32, which are examples of biomass charcoal, are carbonized products made from press-molding biomass. Examples of the press-molding method include extrusion molding and press-molding after filling a mold. Various kinds of raw materials exist for the first biomass charcoal 31 and the second biomass charcoal 32, but the present invention has no particular limitations regarding the biomass raw materials, and any kind can be used. Biomass prior to carbonization may be cut into the appropriate size, or crushed and molded.

[0025] The first biomass charcoal 31 and the second biomass charcoal 32 serve as a heat source to melt the ashes generated by pyrolysis and gasification of the waste 33. The first biomass charcoal 31 and the second biomass charcoal 32 form a fire grate at the bottom of the furnace. In other words, in the present invention, the use of the first biomass charcoal 31 and the second biomass charcoal 32 ensures the function of the fire grate and the function of the heat source for melting the ashes, enabling the melting and gasification treatment of the waste 33 without the use of coke.

[0026] In a case where the weight of the coke consumed to treat 1000 kg of the waste 33 is 100%, for example, the weight of the first biomass charcoal 31 consumed to treat 1000 kg of the waste 33 is less than 100%. In other words,

one example of the first biomass charcoal 31 is a biomass charcoal that is consumed less than the coke in treating the waste 33. The shape of the first biomass charcoal 31 is, for example, cylindrical, but may alternatively be spherical or rectangular parallelepiped.

[0027] In order to replace the coke to form the fire grate with the first biomass charcoal 31, the first biomass charcoal 31 preferably has the following properties. Specifically, the first biomass charcoal 31 preferably has an apparent density of 0.9 g/cm^3 or more, and desirably 1.0 g/cm^3 or more. The first biomass charcoal 31 preferably has a weight of 60 g or more, desirably 90 g or more, per piece. The first biomass charcoal 31 preferably has a volatile matter of 7 wt%(dry basis) or less. The first biomass charcoal 31 preferably has a lower calorific value of 26 MJ/kg or more. The first biomass charcoal 31 with these properties is produced by performing a long carbonization process on biomass and finally attaining high temperature, and is denser and stronger than the charcoal produced under low temperature and short time conditions. The first biomass charcoal 31, which has large apparent density and large weight, quickly descends in the furnace to reach the bottom of the furnace, and since the first biomass charcoal 31 is burned less in the process to the bottom of the furnace, the fire grate can be formed well.

The first biomass charcoal 31 burns slowly and remains in the furnace for a long time, thus reducing the amount of input to form the fire grate of the same capacity. Therefore, for the first biomass charcoal 31, the amount per unit time to be fed to maintain the region where the ashes are melted can be reduced.

[0028] In a case where the weight of the coke used to treat 1000 kg of the waste 33 is 100%, for example, the weight of the second biomass charcoal 32 consumed to treat 1000 kg of the waste 33 is 100% or more. In other words, an example of the second biomass charcoal 32 is a biomass charcoal whose consumption when treating the waste 33 is more than or equal to the consumption of the coke. The shape of the second biomass charcoal 32 may also be spherical, cylindrical, or rectangular parallelepiped, for example. As the second biomass charcoal 32, for example, a biomass charcoal that does not have the properties required as the first biomass charcoal 31 described above can be used. The second biomass charcoal 32 is burned together with the first biomass charcoal 31 to serve as a heat source for melting the ashes. The second biomass charcoal 32 is not required to have high strength if the second biomass charcoal 32 only serves as a heat source to melt the ashes after reaching the lower shaft part 21.

[0029] In the present invention, the first biomass

charcoal 31 and the second biomass charcoal 32 are fed at a predetermined ratio so that the total weight of the first biomass charcoal 31 fed into the furnace and the second biomass charcoal 32 fed into the furnace becomes less than the weight of the coke in the case where only the coke is fed. For example, when the first biomass charcoal 31 and the second biomass charcoal 32 are mixed and fed into the furnace, the mixing ratio of the first biomass charcoal 31 is preferably 30% or more, desirably 40% or more, and more desirably 50%. The mixing ratio of the first biomass charcoal 31 is the ratio of the weight of the first biomass charcoal 31 to the total of the weight of the first biomass charcoal 31 that is fed and the weight of the second biomass charcoal 32 that is fed. Here, when the first biomass charcoal 31 and the second biomass charcoal 32 are mixed and used, the total amount of biomass charcoals required to melt the ashes is less than the simple average of the amounts of the biomass charcoals respectively used alone that is weighted by the mixing ratio. If the mixing ratio of the first biomass charcoal 31 is 50% or more, the operation at the weight equal to that when only the first biomass charcoal 31 is fed into the furnace is possible. As long as the mixing ratio of the first biomass charcoal 31 is 30% or more, a plurality of kinds of second biomass charcoals 32 with different properties may be mixed and fed

into the gasifying and melting furnace 1. As for the first biomass charcoal 31, a plurality of kinds of first biomass charcoals 31 with different properties may be mixed and fed into the gasifying and melting furnace 1, as long as the mixing ratio is 30% or more.

[0030] Next, the gasifying and melting treatment of the waste 33 in the gasifying and melting furnace 1 is described. The waste 33, the first biomass charcoal 31, the second biomass charcoal 32, and the limestone 34 supplied from the supply device are each fed into the furnace through the feeding port 2 by a predetermined amount. Oxygen-enriched air is blown into the furnace from the main tuyere 5. Air is also blown into the furnace through the secondary tuyere 6 and the tertiary tuyere 7.

[0031] The waste 33 fed from the feeding port 2 is deposited on the middle shaft part 22 in the furnace to form a waste layer. This waste layer is dried and then pyrolyzed by the high-temperature gas rising from the high-temperature combustion zone in the lower shaft part 21 and the air blown in from the secondary tuyere 6. Some of the combustible gas generated by the pyrolysis of the waste 33 is burned in the freeboard part 23 by air blown in from the tertiary tuyere 7 to maintain a temperature of 850°C or higher, and is treated to decompose the harmful gas and the tar content before being sent to the secondary combustion

chamber 10 located outside the furnace. In the secondary combustion chamber 10, air is blown in from the air inlet 11 and the combustible gas supplied from the gas outlet 3 is burned. The heat generated by combustion of the combustible gases in the secondary combustion chamber 10 is recovered by the boiler 12.

[0032] The first biomass charcoal 31 descends into the lower shaft part 21 and the gaps between the first biomass charcoals 31 form a fire grate that allows the passage of air and liquid. The second biomass charcoal 32 descends into the lower shaft part 21 and reaches and burns on the fire grate formed by the first biomass charcoal 31. The second biomass charcoal 32 has a weaker fire grate forming capability than the first biomass charcoal 31; therefore, the second biomass charcoal 32 enters the fire grate but is consumed by combustion before reaching the bottom of the fire grate. The layer of the fire grate formed by the first biomass charcoal 31 has its upper surface above the main tuyere 5. Oxygen-enriched air blown in from the main tuyere 5 rises through the gap between the first biomass charcoals 31 and burns the first biomass charcoal 31 and the second biomass charcoal 32. The combustion of the first biomass charcoal 31 and the second biomass charcoal 32 forms a high-temperature combustion zone that serves as a heat source for melting the ashes and unburned materials

in the waste 33.

[0033] The combustion gas generated by the combustion of the first biomass charcoal 31 and the second biomass charcoal 32 rises to the waste layer to pyrolyze and gasify the waste 33. The ashes of the waste 33 pyrolyzed and gasified in the waste layer in the middle shaft part 22 descends and reaches the lower shaft part 21 where the high-temperature combustion zone is formed. In the lower shaft part 21, the first biomass charcoal 31 and the second biomass charcoal 32 burn, and the heat from this combustion turns the ashes into the melted slag and melted metal. The melted slag and melted metal are discharged from the slag discharge port 4 by descending through the gap between the first biomass charcoals 31 forming the fire grate. The slag and the metal discharged outside the furnace are supplied to a water granulation device outside the furnace to be cooled and solidified for recovery.

[0034] Example

The inventor of the present invention conducted operation tests using the gasifying and melting furnace 1 illustrated in FIG. 1. In the operation tests, the properties of biomass charcoals A-F fed into the gasifying and melting furnace 1 were measured. Table 1 shows the properties of the biomass charcoals A-F. In the operation tests, for the biomass charcoals A-F with the properties

shown in Table 1, the consumption per 1000 kg of the waste when only each of the biomass charcoals was fed into the gasifying and melting furnace 1 was measured. As for the consumption per 1000 kg of the waste when only each biomass charcoal is fed, in a case where the weight of the coke when only the coke is fed into the gasifying and melting furnace 1 is 100%, the weight of the biomass charcoal fed to treat 1000 kg of the waste 33 is expressed as a relative value to the weight of the coke.

[0035]

Table 1

	Biomass charcoals						Coke
	A	B	C	D	E	F	
Apparent density [g/cm^3]	1.02	1.00	0.90	0.88	0.93	0.92	1.0
Weight per piece [g]	100	91	60	85	40	90	30–150
Volatile matter [wt%(dry basis)]	6	4	7	8	8	17	1
Lower calorific value [MJ/kg]	26	28	30	28	30	25	27
Consumption per 1000 kg of waste [%]	82	87	98	130	174	–	100

[0036] The consumption of the biomass charcoal A, the biomass charcoal B, and the biomass charcoal C with the properties shown in Table 1 is less than 100% per 1000 kg of the waste and the biomass charcoal A, the biomass charcoal B, and the biomass charcoal C correspond to the first biomass charcoal 31. The properties of the biomass charcoal A, the biomass charcoal B, and the biomass

charcoal C match the properties of the first biomass charcoal 31 described above.

[0037] The consumption of the biomass charcoal D and the biomass charcoal E, whose properties are shown in Table 1, is 100% or more per 1000 kg of the waste and the biomass charcoal D and the biomass charcoal E correspond to the second biomass charcoal 32. The consumption of the biomass charcoal F per 1000 kg of the waste was unmeasurable because the biomass charcoal F was easily broken in the furnace and the high-temperature combustion zone was not formed sufficiently, interrupting the discharge of the melted slag from the slag discharge port 4, so that the gasifying and melting furnace 1 failed to keep operating. The biomass charcoal F also corresponds to the second biomass charcoal 32.

[0038] In the operation tests, the first biomass charcoal 31 and the second biomass charcoal 32 were fed into the gasifying and melting furnace 1 while varying the ratio therebetween, and the total consumption of the first biomass charcoal 31 and the second biomass charcoal 32 was measured. FIG. 2 is a graph expressing a result of measuring the total consumption of the biomass charcoal B corresponding to the first biomass charcoal 31 and the biomass charcoal D corresponding to the second biomass charcoal 32 when the biomass charcoal B and the biomass

charcoal D were fed into the gasifying and melting furnace 1 while varying the mixing ratio therebetween. As for the measured consumption, in a case where the weight of the coke when only the coke is fed into the gasifying and melting furnace 1 is 100%, the total weight of the biomass charcoal B and the biomass charcoal D when the biomass charcoal B and the biomass charcoal D are fed into the furnace is expressed as a relative value to the weight of the coke. In the graph in FIG. 2, the horizontal axis represents the mixing ratio of the biomass charcoal B that is fed, and the vertical axis represents the total consumption of the biomass charcoal B and the biomass charcoal D relative to the coke.

[0039] As expressed in FIG. 2, when the mixing ratio of the biomass charcoal B, which is the first biomass charcoal 31, is 30% or more, the total consumption of the biomass charcoal B, which is the first biomass charcoal 31, and the biomass charcoal D, which is the second biomass charcoal 32, is less than the consumption of the coke when only the coke is fed into the gasifying and melting furnace 1. That is, when the mixing ratio of the first biomass charcoal 31 is 30% or more, the first biomass charcoal 31 and the second biomass charcoal 32 to be fed into the furnace are smaller in weight than the coke in treating the waste 33. The total consumption of the biomass charcoal B, which is

the first biomass charcoal 31, and the biomass charcoal D, which is the second biomass charcoal 32, is below the simple average, that is, the straight line connecting the points where the mixing ratio of the biomass charcoal B is 0% and 100% in FIG. 2. In the case where the mixing ratio of the biomass charcoal B is 30%, the consumption when simply weighted by the mixing ratio is 87% x 0.3 + 130% x 0.7 = 117%, but according to FIG. 2, it is 101%, exhibiting a significant reduction effect by 10% or more. When the mixing ratio of the biomass charcoal B, which is the first biomass charcoal 31, was 50% or more, the total consumption of the biomass charcoal B, which is the first biomass charcoal 31, and the biomass charcoal D, which is the second biomass charcoal 32, did not increase significantly from the consumption when only the biomass charcoal B was fed into the gasifying and melting furnace 1, and the increase was less than 4%. When the mixing ratio of the biomass charcoal B was 40%, the increase was 8%, and when the mixing ratio of the biomass charcoal B was 30%, the increase was 16%.

[0040] FIG. 3 is a graph expressing a result of measuring the total consumption of the biomass charcoal C, which corresponds to the first biomass charcoal 31, and the biomass charcoal F, which corresponds to the second biomass charcoal 32, when the biomass charcoal C and the biomass

charcoal F are fed into the gasifying and melting furnace 1 while varying the mixing ratio therebetween. As for the measured consumption, in the case where the weight of the coke when only the coke is fed into the gasifying and melting furnace 1 is 100%, the total weight of the biomass charcoal C and the biomass charcoal F when the biomass charcoal C and the biomass charcoal F are fed into the furnace is expressed as a relative value to the weight of the coke. In the graph in FIG. 3, the horizontal axis represents the mixing ratio of the biomass charcoal C that is fed, and the vertical axis represents the total consumption of the biomass charcoal C and the biomass charcoal F relative to the coke. When the mixing ratio of the biomass charcoal C, which is the first biomass charcoal 31, was 50% or more, the total consumption of the biomass charcoal C, which is the first biomass charcoal 31, and the biomass charcoal F, which is the second biomass charcoal 32, did not increase significantly from the consumption when only the biomass charcoal C was fed into the gasifying and melting furnace 1, and the increase was less than 10%. When the mixing ratio of the biomass charcoal C was 40%, the increase was 22%, and when the mixing ratio of the biomass charcoal B was 30%, the increase was 39%. In a region where the mixing ratio of the biomass charcoal C was less than 30%, however, continuing the operation was

impossible.

[0041] As expressed in FIG. 3, when the mixing ratio of the biomass charcoal C, which is the first biomass charcoal 31, is 30% or more, the total consumption of the biomass charcoal C, which is the first biomass charcoal 31, and the biomass charcoal F, which is the second biomass charcoal 32, may be more than or equal to the consumption of the coke when only the coke is fed into the gasifying and melting furnace 1. In this case, as expressed in FIG. 3, if the mixing ratio of the biomass charcoal C, which is the first biomass charcoal 31, is 50% or more, the total consumption of the biomass charcoal C, which is the first biomass charcoal 31, and the biomass charcoal F, which is the second biomass charcoal 32, is less than the consumption of the coke when only the coke is fed into the gasifying and melting furnace 1. Even in the case where the biomass charcoal B and the biomass charcoal D are mixed, when the mixing ratio of the biomass charcoal B, which is the first biomass charcoal 31, is 50% or more as expressed in FIG. 2, the total consumption of the biomass charcoal B, which is the first biomass charcoal 31, and the biomass charcoal D, which is the second biomass charcoal 32, is less than the consumption of the coke when only the coke is fed into the gasifying and melting furnace 1. That is, even if the kind of the first biomass charcoal 31 and

the kind of the second biomass charcoal 32 are changed, the waste 33 can be treated with less consumption than the coke when the mixing ratio of the first biomass charcoal 31 is 50% or more. When the first biomass charcoal 31 is mixed by 50% or more, the influence of the second biomass charcoal 32 is less likely to appear, allowing operation with the consumption close to that of the first biomass charcoal 31 regardless of the kind of the second biomass charcoal 32.

[0042] Thus, in the present invention, the consumption of the first biomass charcoal 31 that forms the fire grate can be reduced by mixing and feeding the first biomass charcoal 31 and the second biomass charcoal 32. In the present invention, the heat quantity that cannot be covered by the first biomass charcoal 31 as the heat quantity to melt the ashes can be compensated by the second biomass charcoal 32. In other words, in the present invention, while the heat quantity to melt the ashes is secured by the first biomass charcoal 31 and the second biomass charcoal 32, the consumption of the first biomass charcoal 31 can be reduced to form the fire grate. In addition, in the present invention, since the first biomass charcoal 31 and the second biomass charcoal 32 are used to melt and treat the waste 33 with less consumption than the coke, carbon dioxide emission can be reduced and operating costs of the

gasifying and melting furnace 1 can be lowered, resulting in stable operation.

[0043] When only one kind of biomass charcoal is fed into the gasifying and melting furnace 1, the consumption varies by changing the kind of biomass charcoal. For example, when only one kind of biomass charcoal is fed during the operation of the gasifying and melting furnace 1, and the biomass charcoal to be fed is changed from the biomass charcoal B to the biomass charcoal E, the consumption of biomass charcoal will increase significantly. On the other hand, by mixing the first biomass charcoal 31 and the second biomass charcoal 32 at a predetermined ratio, the consumption can be reduced compared to when only the coke is fed into the furnace, even if the kinds of the first biomass charcoal 31 and the second biomass charcoal 32 are changed. In addition, since the operation can continue with the consumption similar to that when only the first biomass charcoal 31 is used, fluctuations in consumption caused by feeding only one kind of biomass charcoal and changing the kind thereof can be suppressed.

[0044] Furthermore, in the present invention, even if the first biomass charcoal 31 and the second biomass charcoal 32 are mixed and fed, the consumption thereof in the operation is not simply the average of the consumption

when only the first biomass charcoal 31 is used and the consumption when only the second biomass charcoal 32 is used, but is close to the consumption when only the first biomass charcoal 31 is fed. Accordingly, the increase in consumption of the fuel when the second biomass charcoal 32 is fed can be suppressed, and by the use of the secured biomass charcoal, the amount of treating the waste 33 can be maximized. When the second biomass charcoal 32, which is consumed more when used alone, is used together with the first biomass charcoal 31, which is consumed less, the waste 33 can be treated with the consumption of the second biomass charcoal 32 reduced to be similar to that of the first biomass charcoal 31.

[0045] If only the biomass charcoal containing a volatile matter in a large quantity, such as the biomass charcoal F, is fed into the furnace, the high-temperature combustion zone is not formed sufficiently; therefore, the melted slag is not discharged from the slag discharge port 4 and the gasifying and melting furnace 1 cannot operate. However, in the present invention, the biomass charcoal F is mixed with the first biomass charcoal 31 and used, so that the waste 33 can be treated.

[0046] If only the second biomass charcoal 32, which is consumed more relative to the coke to treat the waste 33, is fed in a large quantity, more heat than required to melt

the ashes will be generated, resulting in wasteful consumption of valuable biomass energy. If only the second biomass charcoal 32, which is consumed more relative to the coke to treat the waste 33, is fed in a large quantity, the entire quantity is not converted into heat due to combustion, and the biomass charcoal is gasified while absorbing heat by the reaction between biomass charcoal and carbon dioxide with high temperature. Therefore, the biomass energy is not used to melt the ashes and is wasted. On the other hand, in the present invention, the first biomass charcoal 31, which is consumed less relative to the coke to treat the waste 33, is mixed and fed into the furnace; therefore, the feeding of the second biomass charcoal 32 in a large quantity is unnecessary. Moreover, by improving the consumption efficiency of the second biomass charcoal, more heat than required to melt the ashes will not be generated and wasting of heat can be prevented.

[0047] The first biomass charcoal 31 is not limited to the biomass charcoal that is consumed less than the coke to treat the waste 33, and may be, for example, the biomass charcoal that is consumed less than the second biomass charcoal 32 to treat the waste 33. Additionally, the second biomass charcoal 32 is not limited to the biomass charcoal that is consumed more than or equal to the coke to treat the waste 33 and may be, for example, the biomass

charcoal that is consumed more than the first biomass charcoal 31 to treat the waste 33.

[0048] When three or more kinds of biomass charcoals are fed into the furnace, the biomass charcoal that is consumed the least when used alone to treat the waste 33 may be specified as the first biomass charcoal 31 and the other biomass charcoals may be specified as the second biomass charcoal 32.

[0049] In the present invention, a mixture of a plurality of kinds of biomass charcoals that meet a certain criterion may be specified as the first biomass charcoal 31 to be fed into the furnace. A mixture of a plurality of kinds of biomass charcoals with an apparent density of 0.9 g/cm^3 or more, a weight of 60 g or more per piece, a volatile matter of 7 wt%(dry basis) or less, and a lower calorific value of 26 MJ/kg or more may be specified as the first biomass charcoal 31 to be fed into the furnace. For example, a mixture of two of the aforementioned biomass charcoals A, B, and C may be fed into the furnace as the first biomass charcoal 31, or a mixture of all three may be fed into the furnace as the first biomass charcoal 31. The biomass charcoal whose properties are a little out of the properties with an apparent density of 0.9 g/cm^3 or more, a weight of 60 g or more per piece, a volatile matter of 7 wt%(dry basis) or less, and a lower calorific value of 26

MJ/kg or more may be included in the first biomass charcoal 31.

[0050] In the present invention, a mixture of a plurality of kinds of biomass charcoals that do not meet the following conditions may be specified as the second biomass charcoal 32 to be fed into the furnace: an apparent density of 0.9 g/cm^3 or more, a weight of 60 g or more per piece, a volatile matter of 7 wt%(dry basis) or less, and a lower calorific value of 26 MJ/kg or more. For example, a mixture of two of the aforementioned biomass charcoals D, E, and F may be fed into the furnace as the second biomass charcoal 32, or a mixture of all three may be fed into the furnace as the second biomass charcoal 32.

[0051] In the embodiment described above, the gasifying and melting furnace 1 is configured to pyrolyze, burn, and gasify the waste 33, but the gasifying and melting furnace 1 is not limited to this configuration. For example, the gasifying and melting furnace 1 may be configured with the waste layer lowered and the secondary tuyere 6 protruding above the waste layer. In this configuration of the gasifying and melting furnace 1, the waste layer is not fluidized by the air blown in from the secondary tuyere 6; therefore, the waste 33 is pyrolyzed and gasified by the high-temperature gas rising from the lower shaft part 21, and is not burned. Some of the combustible gas produced by

the pyrolysis of waste 33 is burned by the air blown in through the secondary tuyere 6. Instead of the configuration of lowering the waste layer, the secondary tuyere 6 may be omitted. In this configuration, the waste layer is not fluidized either by the air blown in from the secondary tuyere 6; therefore, the waste 33 is pyrolyzed and gasified by the high-temperature gas rising from the lower shaft part 21, and is not burned.

What is claimed is:

1. A waste treatment method of melting ashes generated in a melting furnace when at least pyrolysis and gasification for waste are performed in the melting furnace, the method comprising:

feeding a first biomass charcoal, and a second biomass charcoal into the melting furnace, consumption of the second biomass charcoal required for treating the waste exceeding consumption of the first biomass charcoal required for treating the waste;

forming a fire grate with the first biomass charcoal in the melting furnace to burn the first biomass charcoal;

burning the second biomass charcoal in the fire grate or an upper surface of the fire grate; and

melting the ashes with a heat generated when the first biomass charcoal and the second biomass charcoal are burned, wherein

a ratio of a weight of the first biomass charcoal to a total weight of a weight of the fed first biomass charcoal and a weight of the fed second biomass charcoal is 30 wt% or more.

2. The waste treatment method according to claim 1, wherein the first biomass charcoal comprises several kinds of pieces of biomass charcoal each kind having different consumption required for waste treatment.

3. The waste treatment method according to claim 1 or claim 2, wherein the first biomass charcoal has apparent density of 0.9 g/cm^3 or more, a weight of 60g or more per piece of the first biomass charcoal, a volatile matter of 7 wt%(dry basis) or less, and lower calorific value of 26

MJ/kg or more.

4. The waste treatment method according to claim 1 or claim 2, wherein the second biomass charcoal comprises several kinds of pieces of biomass charcoal each kind having different consumption required for waste treatment.