mentioned internal circulating fluidized-bed gasification system is expected to provide a technology that can pyrolyze the treatment object and recover cracked oil and cracked gas as pyrolysis products from the treatment object.

Citation List

Patent Literature

[0005] Patent document 1: Japanese Patent No. 6933577

Summary

Technical Problem

[0006] However, the cracked oil recovered by the pyrolysis of the treatment object contains a lot of oxygen, and therefore the cracked oil is poor in quality as a chemical feedstock or fuel, making it difficult to use the cracked oil as a basic chemical product or use the cracked oil in engines or high-efficiency power generation equipment. In particular, bio-oil generated by the pyrolysis of biomass has a high oxygen content rate, and a calorific value of the bio-oil is less than half that of petroleum-based fuel oil. Furthermore, water and acid by-products corrode equipment, and can cause fouling of the equipment and catalyst due to increased coke production.

[0007] Therefore, the present disclosure provides a pyrolysis treatment system and a pyrolysis treatment method that can recover high-quality oil from an oxygen-containing treatment object, such as biomass.

Solution to Problem

[0007a] In an aspect, there is provided a pyrolysis treatment system for treating a treatment object containing oxygen, comprising:

a pyrolysis chamber configured to generate pyrolysis gas by pyrolyzing the treatment object;

a hydrogenation reforming device configured to hydrogenate the pyrolysis gas; and

a condenser configured to condense oil component and moisture contained in the hydrotreated pyrolysis gas to recover oil and light gas separately;

a gas separator configured to recover a reducing gas from the light gas; and

a reducing-gas transfer line configured to transfer the reducing gas to at least one of the pyrolysis chamber and the hydrogenation reforming device,

wherein the pyrolysis chamber comprises a pyrolysis chamber of a fluidized-bed furnace,

the fluidized-bed furnace includes the pyrolysis chamber and a medium regeneration chamber through which a fluidized medium circulates, and

the pyrolysis treatment system further comprises a fuel line configured to supply the light gas from which the reducing gas has been removed by the gas separator to the medium regeneration chamber.

[0007b] In another aspect, there is provided a pyrolysis treatment method for treating a treatment object containing oxygen, comprising:

pyrolyzing the treatment object in a pyrolysis chamber to generate pyrolysis gas;

hydrogenating the pyrolysis gas by a hydrogenation reforming device; and

condensing oil component and moisture contained in the hydrogenated pyrolysis gas by a condenser to recover oil and light gas separately;

recovering a reducing gas from the light gas by a gas separator; and

transferring the reducing gas to at least one of the pyrolysis chamber and the hydrogenation reforming device,

wherein the pyrolysis chamber comprises a pyrolysis chamber of a fluidized-bed furnace,

the fluidized-bed furnace includes the pyrolysis chamber and a medium regeneration chamber through which a fluidized medium circulates, and

the pyrolysis treatment method further comprises supplying, to the medium regeneration chamber, the light gas from which the reducing gas has been removed by the gas separator.

[0008] In an example, there is a pyrolysis treatment system for treating a treatment object containing oxygen, comprising: a pyrolysis chamber configured to

generate pyrolysis gas by pyrolyzing the treatment object; a hydrogenation reforming device configured to hydrogenate the pyrolysis gas; and a condenser configured to condense oil component and moisture contained in the hydrotreated pyrolysis gas to recover oil and light gas separately.

[0009] In an example, the pyrolysis treatment system further comprises: a gas separator configured to recover a reducing gas from the light gas; and a reducing-gas

transfer line configured to transfer the reducing gas to at least one of the pyrolysis chamber and the hydrogenation reforming device.

In an example, the pyrolysis chamber comprises a pyrolysis chamber of a fluidized-bed furnace, the fluidized-bed furnace includes the pyrolysis chamber and a medium regeneration chamber through which a fluidized medium circulates, and the pyrolysis treatment system further comprises a fuel line configured to supply the light gas from which the reducing gas has been removed by the gas separator to the medium regeneration chamber.

[0010] In an example, the pyrolysis treatment system further comprises a solid-gas separator disposed between the pyrolysis chamber and the hydrogenation reforming device, the solid-gas separator being configured to separate particles from the pyrolysis gas discharged from the pyrolysis chamber.

In an example, the pyrolysis treatment system further comprises: a heat recovery device configured to supply heat to the pyrolysis chamber; and a fuel line configured to supply, to the heat recovery device, the light gas from which the reducing gas has been removed by the gas separator.

In an example, the condenser includes an oil scrubber and a water scrubber.

In an example, the pyrolysis treatment system further comprises an oil-water separator configured to divide oil-water mixture, discharged from the water scrubber, into oil and water.

[0011] In an example, there is provided a pyrolysis treatment method for treating a treatment object containing oxygen, comprising: pyrolyzing the treatment object in a pyrolysis chamber to generate pyrolysis gas; hydrogenating the pyrolysis gas by a hydrogenation reforming device; and condensing oil component and moisture contained in the hydrogenated pyrolysis gas by a condenser to recover oil and light gas separately.

[0012] In an example, the pyrolysis treatment method further comprises recovering a reducing gas from the light gas by a gas separator; and transferring the reducing gas to at least one of the pyrolysis chamber and the hydrogenation reforming device.

In an example, the pyrolysis chamber comprises a pyrolysis chamber of a fluidized-bed furnace, the fluidized-bed furnace includes the pyrolysis chamber and a medium regeneration chamber through which a fluidized medium circulates, and the pyrolysis treatment method further comprises supplying, to the medium regeneration chamber, the light gas from which the reducing gas has been removed by the gas separator.

[0013] In an example, the pyrolysis treatment method further comprises separating particles from the pyrolysis gas discharged from the pyrolysis chamber by a solid-gas separator disposed between the pyrolysis chamber and the hydrogenation reforming device.

In an example, the pyrolysis treatment method further comprises: supplying the light gas from which the reducing gas has been removed by the gas separator to a heat recovery device to combust the light gas; and supplying heat generated by the combustion of the light gas to the pyrolysis chamber.

In an example, the condenser includes an oil scrubber and a water scrubber.

In an example, the pyrolysis treatment method further comprises dividing oil-water mixture, discharged from the water scrubber, into oil and water.

Advantageous Effects of Disclosure

[0014] The hydrogenation device adds the hydrogen gas to the pyrolysis gas to cause the reaction of the oxygen contained in the pyrolysis gas with the hydrogen. The moisture produced by the hydrogenation is condensed in the condenser. The liquid oil and the water are separated, so that the oil can be recovered. In particular, because the hydrogenation is carried out before the moisture and oil components are condensed, the high heat of the pyrolysis gas coming out of the pyrolysis chamber can be used directly for the hydrogenation of the pyrolysis gas.

Brief Description of Drawings

[0015]

[FIG. 1] FIG. 1 is a block diagram showing an embodiment of a pyrolysis treatment system;

[FIG. 2] FIG. 2 is a block diagram showing another embodiment of a pyrolysis treatment system;

CLAIMS

[Claim 1] A pyrolysis treatment system for treating a treatment object containing oxygen, comprising:

a pyrolysis chamber configured to generate pyrolysis gas by pyrolyzing the treatment object;

a hydrogenation reforming device configured to hydrogenate the pyrolysis gas; and

a condenser configured to condense oil component and moisture contained in the hydrotreated pyrolysis gas to recover oil and light gas separately;

a gas separator configured to recover a reducing gas from the light gas; and

a reducing-gas transfer line configured to transfer the reducing gas to at least one of the pyrolysis chamber and the hydrogenation reforming device,

wherein the pyrolysis chamber comprises a pyrolysis chamber of a fluidized-bed furnace,

the fluidized-bed furnace includes the pyrolysis chamber and a medium regeneration chamber through which a fluidized medium circulates, and

the pyrolysis treatment system further comprises a fuel line configured to supply the light gas from which the reducing gas has been removed by the gas separator to the medium regeneration chamber.

[Claim 2] The pyrolysis treatment system according to claim 1, further comprising a solid-gas separator disposed between the pyrolysis chamber and the hydrogenation reforming device, the solid-gas separator being configured to separate particles from the pyrolysis gas discharged from the pyrolysis chamber.

[Claim 3] The pyrolysis treatment system according to claim 1, wherein the condenser includes an oil scrubber and a water scrubber.

[Claim 4] The pyrolysis treatment system according to claim 3, further comprising an oil-water separator configured to divide oil-water mixture, discharged from the water scrubber, into oil and water.

[Claim 5] A pyrolysis treatment method for treating a treatment object containing oxygen, comprising:

pyrolyzing the treatment object in a pyrolysis chamber to generate pyrolysis gas;

hydrogenating the pyrolysis gas by a hydrogenation reforming device; and

condensing oil component and moisture contained in the hydrogenated pyrolysis gas by a condenser to recover oil and light gas separately;

recovering a reducing gas from the light gas by a gas separator; and

transferring the reducing gas to at least one of the pyrolysis chamber and the hydrogenation reforming device,

wherein the pyrolysis chamber comprises a pyrolysis chamber of a fluidized-bed furnace,

the fluidized-bed furnace includes the pyrolysis chamber and a medium regeneration chamber through which a fluidized medium circulates, and

the pyrolysis treatment method further comprises supplying, to the medium regeneration chamber, the light gas from which the reducing gas has been removed by the gas separator.

[Claim 6] The pyrolysis treatment method according to claim 5, further comprising separating particles from the pyrolysis gas discharged from the pyrolysis chamber by a solid-gas separator disposed between the pyrolysis chamber and the hydrogenation reforming device.

[Claim 7] The pyrolysis treatment method according to claim 5, wherein the condenser includes an oil scrubber and a water scrubber.

[Claim 8] The pyrolysis treatment method according to claim 7, further comprising dividing oil-water mixture, discharged from the water scrubber, into oil and water.