CLAIMS

1. A process for manufacturing a low-sulfur residual marine fuel oil, comprising:

producing high-temperature upgraded oil-gas by chemical upgrading of low-quality heavy component, reacting the high-temperature upgraded oil-gas by contacting and mixing with a blending component under high temperature conditions, homogenizing and stabilizing the mixture resulted from the reaction, and then separating the light component from the mixture, thereby obtaining the low-sulfur residual marine fuel oil; wherein the high-temperature upgraded oil-gas is a gas-liquid mixture at a temperature of 360°C or higher and the reaction temperature of the reaction is 80°C or higher.

2. The process according to claim 1, wherein the process further comprises further adding the blending component to the mixture after the light component is separated.

3. The process according to claim 1, wherein the process further comprises adding an auxiliary agent into the blending component to further improve the quality of the low-sulfur marine fuel oil.

4. The process according to any one of claims 1 to 3, wherein the low-quality heavy component includes one or more of residual oil, catalytic slurry, coking wax oil, ethylene tar, and deoiled asphalt.

5. The process according to any one of claims 1 to 3, wherein the chemical upgrading includes one or more of visbreaking, hydrogen donor thermal cracking, hydrogen presence thermal cracking, fluidized thermal conversion, delayed coking, and heavy oil hydroconversion.

6. The process according to claim 5, wherein the heavy oil hydroconversion comprises one or more of fixed bed, suspended bed, boiling bed, and moving bed heavy oil hydrogenation processes.

7. The process according to claim 5, wherein the fluidized thermal conversion comprises one or more of fluidized coking, flexicoking, fluidized catalytic cracking, and circulating fluidized bed processes.

~~8. The process according to any one of claims 1 to 3, wherein the high-temperature upgraded oil-gas is a gas-liquid mixture at a temperature of 360°C or higher.~~

~~9~~8. The process according to any one of claims 1-3, wherein the blending component includes one or more of catalytic diesel, catalytic slurry, hydrotreated residual oil, coking diesel, coking wax oil, ethylene tar, and straight-run diesel.

~~10~~9. The process according to any one of claims 1 to 3, wherein the amount of the blending component used is 3 to 100% of the mass of the high-temperature upgraded oil-gas.

~~11. The process according to any one of claims 1 to 3, wherein the reaction temperature of the reaction is 80°C or higher.~~

~~12~~10. The process according to claim 1~~11~~, wherein the reaction temperature of the reaction is 120°C or higher.

~~13~~11. The process according to any one of claims 1 to 3, wherein the blending component is injected at one or more positions of the oil-gas outlet of the chemical upgrading unit used for chemical upgrading, the inlet of the homogenization and stabilization unit used for homogenization and stabilization, and the oil-gas transportation pipeline connecting the oil-gas outlet and the inlet of the homogenization and stabilization unit, and the high-temperature upgraded oil-gas is reacted by contacting and mixing with the blending component under high temperature conditions.

~~14~~12. The process according to any one of claims 1 to 3, wherein the low-sulfur residual marine fuel oil has a sulfur content of less than 0.5%, and a kinematic viscosity of less than 500 mm^2/s at 50°C.

~~15~~13. A system for manufacturing a low-sulfur residual marine fuel oil, comprising: a chemical upgrading unit, a homogenization and stabilization unit and/or a product storage tank, wherein at least one injection port is provided between the oil-gas outlet of the chemical upgrading unit and the inlet of the homogenization and stabilization unit, the injection port being used for injecting a blending component and reacting the high-temperature upgraded oil-gas by contacting and mixing with the blending component, and the mixture resulted from the reaction being fed through an oil-gas transportation pipeline into the homogenization and stabilization unit or the product storage tank;

and/or a mixing segment is provided in an oil-gas transportation pipeline between

the oil-gas outlet of the chemical upgrading unit and the inlet of the homogenization and stabilization unit, wherein the high-temperature upgraded oil-gas is reacted by the contacting and mixing with the blending component in the mixing segment, and the resultant mixture is fed through the oil-gas transportation pipeline into the homogenization and stabilization unit or the product storage tank;

when the system includes the chemical upgrading unit, the homogenization and stabilization unit, and the product storage tank, the outlet of the homogenization and stabilization unit is connected to the inlet of the product storage tank through an oil-gas transportation pipeline; wherein the high-temperature upgraded oil-gas is a gas-liquid mixture at a temperature of 360°C or higher.

~~16~~14. The system according to claim ~~15~~13, wherein when the system includes the chemical upgrading unit, the homogenization and stabilization unit, and the product storage tank, at least one injection port is provided between the outlet of the homogenization and stabilization unit and the inlet of the product storage tank, and the injection port is used for injecting a blending component;

and/or a mixing segment is provided in the oil-gas transportation pipeline between the outlet of the homogenization and stabilization unit and the inlet of the product storage tank.

~~17~~15. The system according to claim ~~15~~ 13 or 14~~16~~, wherein the homogenization and stabilization unit comprises one or more of a fractionation tower, a flash tower, and a degassing tank.

~~18~~16. The system according to claim ~~15~~ 13 or ~~16~~14, wherein the chemical upgrading unit includes one or more of a visbreaking reactor, a hydrogen donor thermal cracking reactor, a hydrogen presence thermal cracking reactor, a fluidized thermal conversion reactor, a delayed coking reactor, and a heavy oil hydroconversion reactor.

~~19~~17. The system according to claim ~~18~~16, wherein the heavy oil hydroconversion reactor includes one or more of a fixed bed heavy oil hydroconversion reactor, a suspended bed heavy oil hydroconversion reactor, a boiling bed heavy oil hydroconversion reactor, and a moving bed heavy oil hydroconversion reactor.

~~20~~18. The system according to claim 16~~18~~, wherein the fluidized thermal conversion reactor includes one or more of a fluidized coking reactor, a flexicoking reactor, a

fluidized catalytic cracking reactor, and a circulating fluidized bed reactor.