CLAIMS

1. A method for biomass gasification at a high temperature and an atmospheric pressure by using a gasification island, the method comprising: pre-treating and storing biomass, gasifying the biomass in a gasifier, cooling a crude syngas, washing and removing dust from the crude syngas, and storing fresh syngas;

characterized in that

heat energy for gasifying the biomass in the gasifier is supplied by an external heat source, a reaction temperature in the gasifier is controlled between 1300 and 1750°C, the biomass in the gasifier is transformed into the crude syngas, and a slag is removed from the gasifier in a liquid state;

the crude syngas is cooled by a quench tower and a two-stage waste heat boiler, where a sensible heat is recovered;

the crude syngas after cooling is washed and treated by electric dust precipitation, and the obtained clean and fresh syngas is stored by a gas storage tank; and

the whole gasification island is operated at a negative pressure or at a positive pressure of between 0 and 50 KPa;

the gasifier is an atmospheric fixed bed gasifier, an operating pressure thereof is between 0 and 50 KPa, and a temperature of a gasification zone is between 1300and 1750°C;

a gasification medium is selected from the group consisting of air, oxygen-enriched air, pure oxygen, water vapor, or a mixture thereof;

a temperature of a bottom of the gasifier is controlled between 1450 and 1750°C whereby realizing the slag removal in the liquid state;

slag removal from the gasifier adopts continuous slag removal or intermittent slag removal, the continuous slag removal is adopted when the raw material has a high ash content, and the intermittent slag removal is adopted when the raw material has a low ash content;

a temperature of an upper part of the gasifier is controlled between 800 and 1450°C, a flow velocity of the crude syngas therein is controlled between 0.5 and 2.0 m/s; and

the crude syngas is introduced out of the gasifier via the upper part thereof, the flow velocity of the crude syngas at an outlet of the gasifier is controlled between 8 and 20 m/s, and the dust content in the crude syngas is <20 g/Nm^3.

2. The method of claim 1, **characterized in that** the method comprises the following steps:

1) breaking the collected biomass, feeding the biomass to the gasifier while providing the external heat source and an oxidant to the gasifier, controlling an operating temperature of the gasifier at between 1300 and 1750°C, allowing the biomass to fully contact with the oxidant so that desiccation, volatile matter precipitation, pyrolysis, and gasification reaction occur, respectively, whereby yielding the crude syngas and an ash;

2) introducing the crude syngas to the quench tower and the two-stage waste heat boiler to decrease the temperature of the crude syngas to between 85 and 200°C and to recover the sensible heat; and

3) washing the crude syngas after sensible heat recovery and removing the dust therefrom to obtain the clean and fresh syngas having both a dust content and a tar content of < 10 mg/Nm^3 and a temperature of < 45°C; and transporting the

clean and fresh syngas to the gas storage tank for storage or directly to a downstream process for use.

3. The method of claim 2, **characterized in that** in step 1), the external heat source is supplied by a plasma torch generator, a microwave plasma generator, or a laser thermal generator.

~~4. The method of claim 1 or 2, **characterized in that**~~

~~the gasifier is an atmospheric fixed bed gasifier, an operating pressure thereof is between 0 and 50 KPa, and a temperature of a gasification zone is between 1300and 1750°C;~~

~~a gasification medium is selected from the group consisting of air, oxygen-enriched air, pure oxygen, water vapor, or a mixture thereof;~~

~~a temperature of a bottom of the gasifier is controlled between 1450and 1750°C whereby realizing the slag removal in the liquid state;~~

~~slag removal from the gasifier adoptscontinuous slag removal or intermittent slag removal,the continuous slag removal is adopted when the raw material has a high ash content, and the intermittent slag removal is adopted when the raw material has a low ash content;~~

~~a temperature of an upper part of the gasifier is controlled between 800and 1450°C, a flow velocity of the crude syngas therein is controlled between 0.5 and 2.0 m/s; and~~

~~the crude syngas is introduced out of the gasifier via the upper part thereof,the flow velocity of the crude syngas at an outlet of the gasifier is controlled between 8 and 20 m/s, and the dust content in the crude syngas is <20 g/Nm^3.~~

~~5.~~4. The method of claim 1 or 2, **characterized in that** the crude syngas is cooled as follows:

the crude syngas is introduced from the gasifier through a water-cooling pipe to the quench tower, where the crude syngas is cooled to a temperature of 850°C below by spray water, a water-cooling bundle, or a vapor-cooling bundle, and a molten slag carried by the crude syngas is cured and separated;

the crude syngas having the temperature of 850°C below after treated by the quench tower is transported to a first-stage waste heat boiler for recovering waste heat, the temperature of the crude syngas is decreased to above a condensation point of a heavy tar, and a flow velocity of the crude syngas in the first-stage waste heat boiler is controlled between 7 and 20 m/s; and

the crude syngas from the first-stage waste heat boiler is transported to the second-stage waste heat boiler for recovering the waste heat, the crude syngas is continued being cooled and the temperature of the crude syngas is decreased to between 85 and 200°C, and the flow velocity of the crude syngas in the second-stage waste heat boiler is controlled between 7 and 20 m/s.

~~6.~~5. The method of claim ~~5~~4, **characterized in that** the crude syngas enters the first-stage waste heat boiler for recovering the waste heat, and the temperature of the crude syngas is decrease to between 350 and 450°C.

~~7.~~6. The method of claim 1 or 2, **characterized in that** the crude syngas is washed as follows:

the crude syngas after the heat recovery having the dust content of ≤ 20g/Nm^3 is transported through a pipe to a scrubbing-cooling tower or a Venturi scrubber for further decreasing the temperature of the crude syngas and removing the dust there from ~~;~~the temperature of the crude syngas after washing is decreased to between 15 and 55°C and the wash water is circulated for use;

a filter is disposed on a water circulating pipe to remove pollutants carried by the circulating wash water~~;~~ pollutants are discharged in time according to water quality of the circulating wash water, and fresh circulating water is supplemented;

the circulating water is cooled by a mechanical draft hollow cooling tower; and

a filter residue after curing is returned to the gasifier as a bed layer or is transported to an ash library along with the molten slag, thereby realizing a comprehensive utilization.

~~8.~~7. The method of claim 1 or 2, **characterized in that** the dust removal of the crude syngas is conducted as follows:

the crude syngas from the scrubbing-cooling tower or the Venturi scrubber is introduced to a wet electric dust collector, where the dust and other impurities in the crude syngas is removed under the action of a high voltage electric field produced therein; and

the fresh syngas from the wet electric dust collector is transported by a coal gas booster fan to the gas storage tank or directly supplied to devices of the subsequent process as a feed gas.

~~9.~~8. The method of claim 1 or 2, **characterized in that**

the high temperature molten slag produced in the gasifier is granulated and used as a building material for comprehensive utilization; and

the ash from the cooling and washing units are cured and used as a bed layer of the gasifier for recycling.