

Design and Implementation of Large-scaled and Self-unloaded Solar Energy Biomass Fermentation Device

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Abstract. A new type of large-scaled and homothermal solar energy biomass fermentation device,which can unload itself without dynamic,is introduced in this paper.With homothermal solar technology,It guarantees homothermal fermentation and improves the rate of methane gas.With streamlined pool and lifting system of heavy hammer,it overcomes the problem of discharge difficulty.Non-power is realized by using lifting system of heavy hammer.In other words,heavy hammer don't use other power equipment in the process of lifting.

Introduction

Fermentation of biomass production is gradually changing from the original small-sized production model to current large-scaled and centralized production in our country.In the production process,except for traditional geothermal energy fermentation,solar homothermal fermentation technology is in its infancy.Existing biomass fermentation production plant are mostly small production plant,which built on ground below and use flat-bottomed pool. There are many drawbacks of this biomass fermentation tank: Firstly, the ground temperature cannot be kept constant, and cannot guarantee the productivity of biomass fermentation.Secondly, In feeding and discharging,it not only needs manual work and more difficult operation, but also exists the danger of staff suffocation operating into the pool.Thirdly,the interval of feeding and discharging is too lasting,and the efficiency of fermentation pool is too low. There are many difficulties about existing large-scaled fermentation production plant of biomass,such as discharge difficulty, single form of installation.

Introduction of Large-scaled and Self-unloaded Biomass Fermentation Device

Purpose of design of large-scaled and self-unloaded biomass fermentation device is kept constant reaction temperature of biomass fermentation, which commonly uses homo-thermal solar energy biomass fermentation device.In order to solve the problems of discharge difficulty and clean and healthy production process,it is necessary to using non-powered and self-unloaded discharging mode. It uses large tank of 1000m³ to Satisfy the processing of larger amounts of biological pitchforks, large-scale centralized bio-gas production.

Structure of Large-scaled and Self-unloaded Biomass Fermentation Device

The device mainly consists of solar panels,storage tank of hot water, heat-transferring coil,temperature sensor, automatic control switch, hammer,lifting system of hammer and so on.

A cylinder-and-cone design is used in the device, and a streamlined design is used in upper and lower interface. Feeding tank, solar panels,storage tank of hot water, hammer lifters are equipped outside of the reactor.The cylinder-shaped design is adopted in upper part of the device.Spiral heat ex-changer coil is set on the part near cylinder wall of bucket.The half-cone-type design design is adopted in bottom of the device,bio-gas discharging is controlled with lifting system of heavy

hammer, maximum diameter of which is slightly larger than the diameter of the discharging port. Design capacity is 1000m³. The material of biomass reactor choose double-glazed steel, inner diameter 9m, high 16m.

Structure of large-scaled and self-unloaded biomass fermentation device is shown in Fig.1, The appearance of device at eye level and overlooking level are shown in Fig.2 and Fig.3 respectively. In Fig.1, No.1 is filling pocket, No.2 is feeding port, No.3 is bio-gas pot, No.4 is discharge port, No.5 is solar panels, No.6 is hot water tank, No.7 is temperature and pressure sensors, No.8 is lifting installation of heavy hammer, No.9 is gas-guide tube, No.10 is heat-transferring coil, No.11 is hammer.

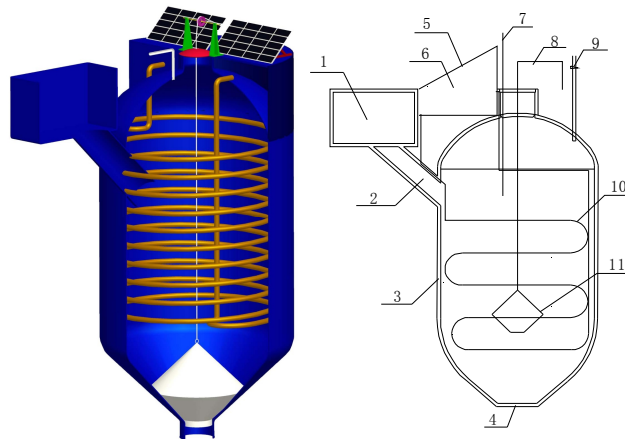


Fig.1 structure diagram of large-scaled and self-unloaded biomass fermentation device

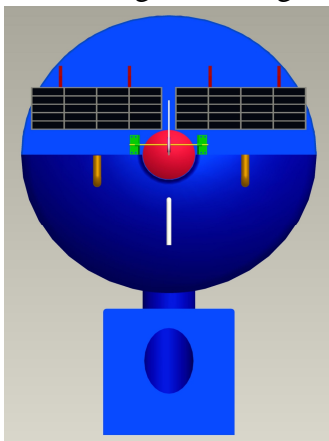


Fig. 2 The appearance of fermentation device at eye level

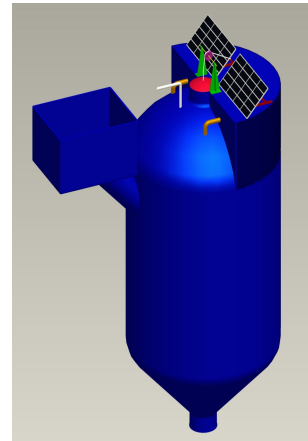


Fig.3 The overlooking appearance of fermentation device

Working principle of Large-scaled and Self-unloaded Biomass Fermentation Device

This device is mainly used for large-scale production of bio-gas concentrated biomass reaction, and it can be buried underground or fixed on ground surface with fixtures. The working principle of the device is shown in Fig.1. The feed is feeding from filling pocket 1 and is entering into bio-gas pot 3 through feeding port 2. When charges, heavy hammer 11 is dropping with the control of lifting installation of heavy hammer 8, and blocking off the discharge port 4. During the reaction, if the temperature is below the set value, the temperature sensor 7 passes on the signal to the controlling host, Water in storage water tank 6 is heated using solar through temperature control system, then heated water is flowing along the heat exchange coil 10, then the reactants in bio-gas digester are heated. Produced bio-gas is discharged into the external gas storage device along with the guide tube 8. After reaction, the heavy hammer is pulled up by lifting installation of heavy hammer. In this way, bio-gas residue is discharged off along with discharge port 4. In this way, discharge difficulty and non-maintaining constant temperature are worked out.

Thermostatic solar system works as follows: The water inside the tank is kept at a higher temperature, by the way of solar panels converting solar energy into heat energy. Temperature sensor collects temperature data inside the digester and transmits them to the host of temperature control

system, and then on-off of the throttle is motor-controlled through the microcontroller operation. Thereby, the temperature in bio-gas digester is controlled. When the reaction temperature is lower than a suitable fermentation temperature, bio-gas fermentation temperature is improved through the hot water circulation system starting the automatic start control switch. When the temperature reaches the natural fermentation suitable temperature, the hot water circulation systems will be stopped [1].

The main program flow chart of temperature control system of homothermal solar is shown in Fig.4.

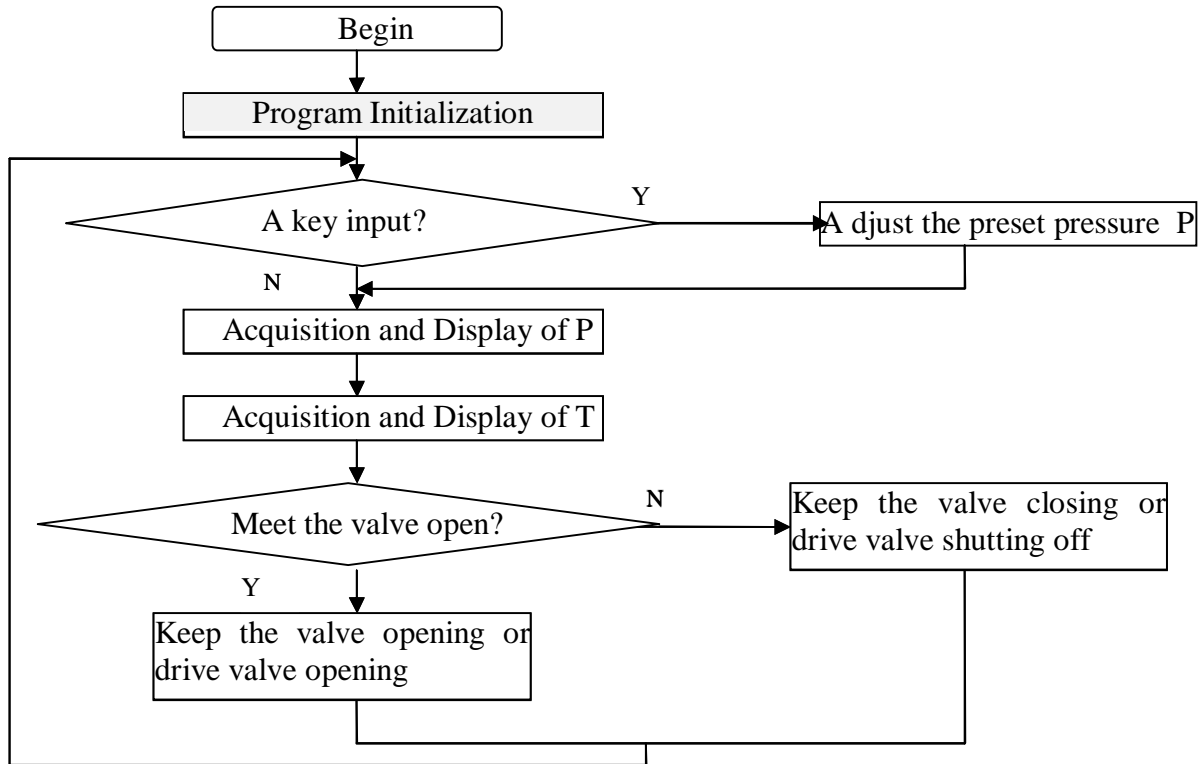
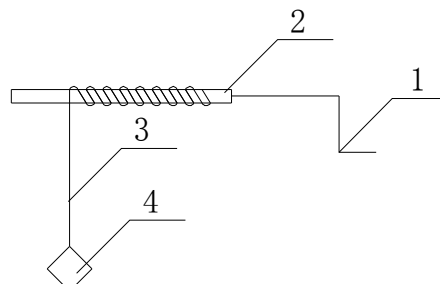


Fig. 4 The main program flow chart of temperature control system of homothermal solar

The working principle of lifting system of heavy hammer is shown in Fig.5. Under the control of heavy hammer lifter, the heavy hammer is dropped down and blocked off discharge port. Single-rope winding and non-powered lifting device pulls up the heavy hammer. In other words, heavy hammer don't use other power equipment in the process of lifting. Bio-gas will be discharged along with the discharge port in the self-gravity.



1.rolling bar 2. roping rod 3. lifting rope 4. hammer

Fig.5 The working principle of lifting system of heavy hammer of large-scaled and self-unloaded biomass fermentation device

Advantages of Large-scaled and Self-unloaded Biomass Fermentation Device

Solar homothermal control system

The water in the tank is heated using solar panels absorbing solar energy, the energy is converted from solar energy to heat energy of water. The radiating of hot water is going on through

heat-transferring coil, and exchanges heat with the reactants in the reaction, so that the reaction was carried out at a constant temperature reaction conditions to the higher reaction rate.

Streamlined design

The associative place of upper and lower portions of biomass reactor adopts streamlined design. Upper dome and central cylinder phase adopts the streamlined design for easy airflow export, the lower cylinder cone bio-gas digesters, which is associative place of cylinder and cone, adopts with a streamlined interface design for convenient unloading.

Unloading conveniently

The design of lifting of heavy hammer and plugging system is adopted in this device. Thus it not only can make sure feeding and discharging convenient, but also can implement non-power. In other words, heavy hammer don't use other power equipment in the process of lifting. It achieves the effect of energy saving.

Design of large poll body

The designed capacity is 1000m³. Design capacity is 1000m³. The material of biomass reactor choose double-glazed steel, inner diameter 9m, height 16m. It meets the needs of producing bio-gas with large-scale biomass.

Application and Promotion

Our country is an agricultural producing countries, the source of raw materials of manufacture bio-gas are abundant using biomass reaction device. As a new clean energy, bio-gas is gradually widening large scale, instead of coal and other non-renewable energy sources. Therefore bio-gas production will be gradually developing. At present, large-scale bio-gas production equipment is relatively few, and there are drawbacks of difficult feeding and discharging management, difficult temperature control and high energy consumption. So a kind of biomass bio-gas production device of low energy consumption, convenient feeding and discharging management and homiothermism. This design solves all of the above problems, and has wide application prospects.

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