Discussion on Intelligent Disposal System of High-fat Food Waste

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Abstract. Food waste contains high organic matter and high fat. Discomfort in handling will cause environmental pollution and ultimately affect people's lives. For a diet characteristic of high starch and high fat in the northwest region, a system that can effectively dispose of kitchen waste is designed. The kitchen waste first needs to pass through the filter of the pre-treatment device and crush it to obtain proper disposal and become particle size. The control system is transferred to the solid-liquid separation device, and the separated liquid is transported to the oil-water separation device through the liquid delivery pipe. The oil-water liquid can be heated by a clean energy heating box, and the PLC control system is used to complete the final oil-water separation. The food waste disposal system designed in this paper can efficiently separate the oil and water, thereby quickly removing the high starch and high oil components in the food waste. And make full use of a series of green and clean energy such as solar energy to keep running, relatively high degree of automation, simple operation and maintenance, and powerful practicability.

Keywords: high starch; high fat; kitchen waste; intelligent processing system

Food waste has high organic matter and moisture content, as well as grease and salt. If it is simply broken and then directly discharged to the sewer, the pressure in the pipeline will increase, which will not only block the sewer, but also the water. The sewers will be corroded by these substances, increasing the pressure on the sewage treatment plant. Food waste is a core component of the organic phase of municipal waste, and it is also a kind of precious organic resource. Food waste is easy to rot and ferment, and it also emits odor. Once unreasonable methods are adopted, it will cause environmental pollution and harm people's normal life. Food waste contains high organic matter and high fat, so it is a relatively high resource waste. The reasonable disposal of kitchen waste can prevent waste oil from returning to the table, ensure food hygiene and safety and people’s health, and can use its oil and other organic matter to reduce environmental pollution caused by kitchen waste and turn "waste" into "Treasures" enable food waste to develop toward "resources, harmlessness, and reduction".

For the food waste in the Great Bay Area of Zhejiang province, because of its high starch, high fat, high flour and high chili powder characteristics, it often pollutes the environment, resulting in more
malodorous substances. For such a kind of food waste, because starch can embed grease, the current food waste disposal device does not handle the oil and water separation in place, and the separation efficiency is low. If it cannot be separated, it will be collected and transported. There will be many problems such as food hygiene and safety hazards. This article takes the kitchen waste generated on the campus of Huzhou Vocational and Technical College as an example, and analyzes the high starch, high fat, high flour, and high chili powder and other characteristics of the kitchen waste in the region, and analyzes the college campus kitchen waste disposal system.

1. The characteristics of food waste
Through a one-week observation and investigation of the student canteen of Huzhou Vocational and Technical College, Huzhou city it is found that the amount of kitchen waste generated and the eating habits of students are related to the ratio of men to women. The amount of kitchen waste is more than that of boys. This is due to the gender characteristics of girls. The college canteen also chooses effective countermeasures such as the supply of food for girls according to the quantity, which can reduce the amount of kitchen waste from the source. After sampling the school food waste, it can be seen that the composition of school food waste is mainly leftover staple food and leftover vegetables, as well as residues such as bones and meat, animal and vegetable oils. It also contains plastic bags and plastic supplies that have been used for food. Napkins, etc., among which the remaining staple food, leftover vegetables and flesh, animal and vegetable oils and other food residues are relatively large, mainly the organic matter studied in this article.

2. Food waste treatment process
Kitchen garbage with high starch and high fat is filtered and crushed to remove suspended pollutants and obtain a suitable particle size, and then the garbage is discharged into a solid-liquid separation device. The solid-liquid separation device separates the solid and liquid in the kitchen waste by gravity separation. The separated kitchen waste is sent to the kitchen waste collection box by gravity, which can be processed by composting, anaerobic fermentation, pyrolysis and other processing methods. Complete resource recovery. The separated kitchen liquid enters the oil-water separation device, and the hot air is processed by a high-temperature axial fan through the heating box.

3. Food waste disposal system
The high starch and high oil kitchen waste treatment system includes: pre-treatment device, solid-liquid separation device, oil-water separation device, heating box, PLC, as shown in Figure 1, Name of each part table 1.

| No | 1 | 2 | 3       | 4     | 5             | 6        | 7     | 8     |
|----|----|----|---------|-------|---------------|----------|-------|-------|
| parts | Crusher | Filter | Infrared detector | PLC | Discharge valve | Conveying pipe | Solid-liquid separation device | Heating tank |
| No | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| parts | Solid collection tank | Liquid conveying pipe | Liquid container | Stirrer | Oil scraper | Kitchen oil collection box | Waste water collection Header | heating box |
| No | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| parts | solar panel | battery | cooling fan | axial fan | temperature controller | material conveyor | air outlet | oil outlet |
| No | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| parts | water waste chute sliding crank liquid solenoid drive |
The food waste pretreatment device mainly includes crusher, filter, infrared detector, discharge valve and conveying pipe. The main function is to remove large pieces of high starch kitchen waste through the filter, and obtain the appropriate particle size through the crusher. When the waste in the crusher reaches a certain amount, the waste is discharged into the solid-liquid separation device through the conveying pipe.

(2) Solid-liquid separation device
The food waste solid-liquid separation device mainly includes a material conveyor and a food waste collection box. The main function is to separate solids and liquids in food waste through gravity separation. The separated kitchen solid waste enters the solid collection box through the material conveyor, and the separated liquid is transported to the oil-water separation device through the liquid delivery pipe.

(3) Oil-water separation device
The kitchen waste oil-water separation device mainly includes heating tank, liquid conveying pipe, liquid container, agitator, oil scraper, kitchen oil collection box, waste water collection box, material conveyor, air outlet, water outlet, waste water outlet valve, sliding Slot, slider, crank connecting rod mechanism, liquid level sensor, solenoid valve, drive motor. Its main function is to transport the separated liquid to the liquid container of the oil-water separation device through the liquid conveying pipe, heat the oil-water waste liquid, stir with a stirrer, and heat the liquid while stirring to achieve uniform heating and melt starch. The grease embedded in the starch is released and rises to the water surface and the grease is continuously scraped toward the oil outlet through the oil scraper, so that the grease flows into the kitchen oil collecting tank. After the liquid in the internal liquid container is separated from the oil and water, the waste water outlet valve is opened, and the waste water is put into the waste water collection tank.

(4) Heating box
The kitchen waste heating box mainly includes heating tanks, solar panels, batteries, cooling fans, axial fans, temperature controllers, and air outlets. Its main function is to blow the heat generated by the heating box into the liquid container through the air outlet through the axial flow fan to heat the oil and water waste liquid. The temperature in the heating box can be controlled by a temperature controller. Usually, the temperature is controlled between 40 and 80°C, which ensures the rapid dissolution of starch and protects the heating box from damage.

(5) PLC control system
The kitchen waste PLC control system is connected with the infrared detector of the pretreatment device, the solenoid valve, the liquid level sensor of the oil-water separation device and the drive motor. The main functions are two aspects. One is that when the garbage in the crusher reaches a certain amount, the infrared detector sends a signal to the PLC, and the PLC controls the action of the discharge valve, and discharges the waste to the solid-liquid separation device through the conveying pipe, and then the PLC controls Discharge valve 5 is closed. The second is that when the liquid level in the liquid container reaches the oil outlet, the liquid level sensor sends a signal to the PLC, the PLC controls the solenoid valve to close, stops the liquid inlet, and controls the drive motor of the crank connecting rod mechanism to open, and the slider is on the crank connecting rod. Driven by the mechanism, it reciprocates in the chute, and the oil scraper reciprocates with the slider to continuously scrape the grease toward the oil outlet, so that the grease flows into the kitchen oil collection tank, when the liquid level drops below the oil outlet ,The PLC receives the signal from the liquid level sensor, controls the drive motor of the crank connecting rod mechanism to close, the oil scraper stops scraping oil, and controls the solenoid valve to open.

4. The advantages of food waste treatment system
The food waste disposal system is an equipment that effectively separates, removes and treats grease in high starch and high fat food waste. The heating box generates high temperature, and the axial flow fan blows hot air into the liquid container of the oil-water separator. Inside, the liquid in it is heated, and the liquid is heated evenly and efficiently while feeding. Starch is dissolved by heating and releases the oil embedded in it. After the grease is released, it rises above the water surface, which facilitates the separation of oil and water. Improve the separation effect of grease and water; in addition, the cooling fan strengthens the convection, on the one hand, it is beneficial to blow hot air into the liquid container; on the other hand, it is beneficial to the ventilation and heat dissipation of the heating box and protects the heating box.

The kitchen waste treatment system introduces a heating box into the oil-water separation device to adjust the temperature of the oil-water separation, and adopts a temperature controller to control the temperature and improve the efficiency of the oil-water separation. The utility model of the system adopts hot air heating method, which is more safe and reliable.

The food waste treatment system is designed with a simple oil-water separation device. It uses a stirrer and a heating box to cooperate, and heats while stirring. This method can quickly dissolve the starch and allow the fat to rise quickly, further improving The separation efficiency of the oil and water itself makes the separation more thorough; the oil scraper uses continuous movement to continuously scrape the grease out of the oil port, so that the grease can be separated on the water surface.

This food waste treatment system can complete intelligent control. When the infrared detector detects that there is a large amount of food waste in the crusher, it sends a signal to the PLC. The PLC can complete the control of the discharge valve action, and can also The waste is discharged to the solid-liquid separation device, which greatly improves the utilization and work efficiency of the equipment itself; when the liquid level sensor detects that the liquid level in the liquid container can be raised to a specified height, it can send relevant signals to the PLC, and the PLC controls the crank The driving motor of the linkage mechanism completes the control of the liquid inlet, and the oil scraper works; the use of intelligent control can achieve energy-saving effects, and the energy can be
used reasonably. The kitchen waste disposal system is relatively highly automated, easy to use, and easy to operate and maintain, with strong practicability.

5. Conclusion
This food waste treatment system is an intelligent, high degreasing and separation efficiency, and resource utilization. It can effectively separate oil and water for the high starch and high fat food waste in the northwestern region. Can remove high starch, high fat food in food waste. At the same time, it makes full use of solar energy and other green clean energy to maintain operation, with high degree of automation, simple operation and maintenance, and strong practicability.

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