DESCRIPTION

A new technology for transformation of organic waste into organic fertilizer: high-efficient organic waste digester technology consisting of fermentation and pasteurization processes.

TECHNICAL FIELD

The present invention is a method and a system with equipment for transforming oganic waste and to organic fertilizer using the thermophilic aerobic microbial organisms technology with Enzyme catalysis at high temperature. It is not only an eco-friendly microbial digesting technology for comprehensive environmental treatment of intensive livestock farms, but also an eco-friendly organic waste renewable technology of converting animal manure waste into organic fertilizer production.

BACKGROUND

With the accelerating process of urbanization in many countries, urban residents' needs for livestock farming and crop are growing rapidly; But we also continue to produce a lot of organic waste, which will seriously pollute our environment with improper disposal; Such as emissions of intensive farms' poultry manure waste, oil extraction plants waste after, agricultural waste and food waste in cities have became an important part of environmental pollution with a significant increase, which cannot be ignored; With a great economic development, intensive farming is increasing at a higher level. Meanwhile the development of intensive pig farming was limited seriously by the environmental pollution from animals' manure waste, which are causing more and more soil, water and air pollution issues; Therefore, a large number of farming manure waste discharge not only constitutes a serious environmental pollution, but also constraints their own development of large-scale livestock farming.

General intensive farms and plantations for organic waste processing usually have three ways: One is the degradation of aerobic composting process, which is the process to put the animal manure waste in large storage silos or composting tanks with adding microbial agents sometimes, and then compost for about 45 days to reach maturity into organic fertilizer. This way not only needs large spaces and a long process time, but also prone to foul odors and breeds mosquitoes, which is easy to produce secondary pollution on the surrounding environment; The second is anaerobic biogas process, which use organic waste through anaerobic digestion to produce biogas; Due to anaerobic methane fermentation requirements, such as certain relatively stable organic matter content, temperature and pH conditions, the fermentation time is long (25-40 days), which requires a large capacity of fermentation equipment and a large process space with more one-time investment. Meanwhile, the biogas fermentation will produce large amounts of biogas slurry and sewage, which are low nutrient and not suitable for long-term irrigation and fertilization of farmland, discharging directly would

seriously pollute rivers, farmlands and surface water bodies, which will produce secondary pollution. The third is drying organic waste into organic fertilizers directly by high-temperature drying equipment. Such organic fertilizers are low in nutrient, at the same time, the organic matter usually fails to totally decompose and will cause 'burning roots' phenomenon of planting with a long-term application, affecting the production of crops and plantation badly!

SUMMARY OF THE INVENTION

The purpose of the invention is to overcome the lack of technology to efficiently transform organic waste to high quality organic fertilizer with the use of microorganisms in a controlled heated environment. This helps to protect environment by reducing the usage of chemical fertilizers, and to promote eco-environmentally friendly agricultural development; This invention uses the thermophilic aerobic fermentation skill with kinetic energy and efficient combination of microbial and enzyme catalytic technology by the scientific design, which can quickly and efficiently transform organic waste into high-quality organic fertilizer within less than 22 hours. This method not only improves the efficiency of converting organic waste into organic fertilizer, saves energy and protects the environment, but also solves the problem of environmental pollution without secondary pollution at the same time.

The present invention is achieved by the following technical solutions:

First, combine the organic waste (such as animal manure, sawdust, food waste, straw debris etc,) in accordance to a certain proportion of mixing, so that carbon nitrogen ratio of combination feedstock can be controlled in 20-28: 1, and to adjust the mixture moisture in 50-65 %, and then to add a certain percentage of high-efficient microorganisms and enzymes fermentation agent to the mixed feedstock, and then to put them into the specially designed high-efficient digester and fermenting for less than 22 hours at a controlled heated environment, including a special pasteurization for 0.5-3 hour, Finally to dry and to form the fermented feedstock into organic fertilizer granules or powders automatically.

The following experiments show that this technology can be used efficiently to transform organic waste into high-quality organic fertilizer within less than 22 hours:

The following organic wastes were used as the feedstock: chicken manure waste (moisture 20%), sawdust (moisture 10%), and high-efficient microorganisms and enzymes fermentation agent. They were fermented and pasteurized in the high-efficient digester for 12 hours, 18 hours, 22 hours respectively, and then the results were tested by AVA Singapore.

Table 1 chicken manure and sawdust mixture were fermented for 12 hours, and then to show the result of organic fertilizer nutrients report (from AVA, Singapore)

name	Time(hour)	organic matter%	N%	P(As P2O5)%	K(As K2O)%
Chicken manure organic fertilizer	12	50.3	1.77	3.21	2.82

Table 2 chicken manure and sawdust mixture were fermented for 18 hours, and then to show the result of organic fertilizer nutrients report (from MARDI, Malaysia)

name	Time(hour)	organic matter%	N%	P(As P2O5)%	K(As K2O)%
Chicken manure organic fertilizer	18	48.1	1.61	2.82	3.26

Table 3 chicken manure and sawdust mixture were fermented for 22 hours, and then to show the result of organic fertilizer nutrients report (from MARDI, Malaysia)

Name	Time(hour)	organic matter%	N%	P(As P2O5)%	K(As K2O)%
Chicken manure organic fertilizer	22	47.5	1.75	2.82	3.12

This experimental feedstock is chicken manure and wood sawdust according to carbon and nitrogen ratio of 20-30: 1, by adding high efficient microorganism and enzyme fermentation agent in the digester, and then make a transformation process for 12, 18 and 22 hours separately. The reports from table1 to table 3 show that the organic fertilizer after less than 22

hours of fermentation in the specially designed digester and enzyme catalyst has achieved a high organic matter content ratio and is rich in nutrient value (NPK nutrition).

The present invention provides the following advantageous effects:

1. Greatly shorten the fermentation time of composting animal manure and other organic waste from the traditional 30-40 days to less than 22 hours; the ability of livestock waste environmental treatment and efficiency of waste recycling are significantly improved.

2. The specially designed digester system uses self-developed high efficient microorganisms and enzymes fermentation agent. The organic fertilizer produced has a high and balance nutrient value which is rich in organic matters. This improves soil permeability and water retention capacity greatly.

3. The fermentation temperature is controlled particularly by using a PLC with heaters to provide just sufficient heating at specific time; thus reducing power energy consumption.

4. The digester system uses continuous aeration process during the fermentation process which does not produce new malodorous gases and liquids; thus without causing secondary pollution;

5.After aeration fermentation process, the digester system uses pasteurizing process to completely kill harmful bacteria, parasites, eggs and weed seeds, and retain beneficial soil microorganisms, improve the safety and effectiveness of the use of organic fertilizers;

6. The range of feedstock is very broad, including but not limited to animal manure waste, plant and crop waste, food waste, municipal sludge and other organic waste. The high efficient digester system provides the solution to the problem of environmental pollution of organic waste, protects the environment and provides a sustainable use of resources.

CLAIMS

1. A technology and a system with equipment for transforming organic waste to the organic fertilizer using the thermophilic aerobic micro-organisms technology with enzymes catalysis at high-temperature. Organic waste is mixed with a complex microbial enzyme fermentation agent according to the proportion of scientific compatibility, and then fermenting for less than 22 hours with aerating at a controlled heated environment, including a special pasteurization process for 0.5-3 hour.

2. A process as claimed in claim 1, wherein said the organic waste is selected from the group consisting of animal manure waste, food waste, wood waste, agricultural waste, plant waste and city sludge.

3. A process as claimed in claim 1, wherein said the thermophilic aerobic micro-organisms are selected from at least one or more of the following micro-organisms: Clostridium stercorarium sp, Chaetomium thermophilum sp, Geobacillus sp, Actinomadura sp, Thermomonospora sp, Myceliophthora thermophila sp, Phanerochaete chrysosporium , Aspergillus niger , Thermoactinomyces vulgaris sp, Bacillus sp, Streptomyces thermogriseus sp, and Streptomyces cinnamoneus , Photosynthetic bacteria and Nitrobacteria.

4. A process as claimed in claim 1, wherein said the thermophilic enzymes are selected from one or more of following enzymes: Cellulase, Lipase, Pectinase, Protease, trypsin, amylase, Glucanase, Phytase, Hemicellulase, Laccase, Mn Peroxidase and Lignin Peroxidase.

5. A process as claimed in claim 1, wherein said complex fermentation agent is made from thermophilic aerobic micro-organisms in claim 3 and thermophilic enzymes in claim 4.

6. A process as claimed in claim 1, wherein said the proportion of scientific combination includes that moisture of organic waste combination feedstock is 50% to 65% and carbon/nitrogen ratio of organic waste combination feedstock is 20:1 to 28:1.

7. A process as claimed in claim 1, wherein said the high-efficient digester is fully automatic and able to complete the fermentation, pasteurization and aeration processed all in one equipment and is made from one or both of stainless steel 304 and stainless steel 316.

8. A process as claimed in claim 1, wherein said heater is PLC controlled to minimize energy consumption.

9. A fermentation process as claimed in claim 1, wherein said the temperature of the high-efficient digester fermentation process is within the range from 60°C to 80°C.

10. A pasteurization process as claimed in claim 1, wherein said the special pasteurization duration and temperature is 0.5-3 hours at 80°C to 95°C.