

ANALYSIS OF WASTE PROCESSING TECHNOLOGIES BY COMPOSTING METHOD

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Regular technological operations with chicken manure are currently developed in Ukraine: quarantine, disinfection and processing [1]. Different methods are used for decontamination of manure: biothermal, thermal, chemical, physical and others. The most common methods of utilization or recycling of poultry waste [1,2]:

- removal to the fields (chicken manure must be defended for 2-3 years in closed containers before it can be used as fertilizer);

- composting in burts (high quality biohumus is formed);

- vermicomposting;

- thermal drying (from 65 to 1000 °C) to obtain powder;

- processing by granulation method;

- production of balanced compositions of organo-mineral fertilizers,

- processing into feed (dried chicken manure is used as a feed additive for cattle);

- anaerobic fermentation and biofermentation using aerobic meso- and thermophilic bacteria to produce biogas)

Currently, about 50% of the Netherlands's bioenergy plants are unprofitable. For the production of 1 kW / h you need to spend 22 eurocents per 1 kW / h, and for the production of biomethane - 75 eurocents per 1 m³. In Ukraine, these figures, respectively, 13,5 and 40 eurocents - direct combustion of manure for thermal energy. Thus, we can conclude that in general, the methods of disposal are divided into two main - the production of organic fertilizers and energy production. The above engineering solutions are quite energy-intensive, require improvement and careful compliance with the conditions of the process, in some cases - significant investments. This encourages the search for new environmentally friendly technologies for processing chicken manure.

Generally, the main way to preserve nutrients in chicken manure for a long time is composting using natural sorbents. Given the specifics of the poultry farm: poultry species (laying hens or broilers), the method of keeping (litter or litter) production of organic fertilizers can be carried out in the following ways [2]:

1. Passive composting - manure is mixed or stacked in layers with one of the components (% of total weight) - peat (25-30%), straw (15-20%), sawdust (30-50%). The organic mixture in the field is formed in stacks up to 2,5 m high. Within 3-6 months, organic fertilizer is formed, more than 6 months - pure humus is formed. However, native manure has unsatisfactory physical and mechanical characteristics - it is loose, easily clumps, poorly transported, packaged and evenly distributed for feeding. The most valuable product becomes when it is thermally dried.

Significant disadvantages of this type of processing are [3,4]:

- long period of "deactivation" of waste (from 2 to 3 years);
- the need for constant increase in area;
- significant the likelihood of harmful substances entering the atmosphere, land and water;
- high risk of preserving pathogenic microflora;
- the inability to produce a marketable product with stable characteristics.

2. Intensive composting occurs for 6-7 days due to the activity of mesophilic and thermophilic microorganisms and the addition of fermenters. As a rule, such fertilizer is sold to consumers.

Proper storage and processing of poultry waste increases the efficiency of their use as organic fertilizers. Therefore, for fermentation and storage, manure should be placed in manure storages or burrs. The use of a special room for manure processing has advantages over open areas. This allows you to automate special equipment [3], organize supply and exhaust ventilation, which will reduce environmental and sanitary hazards to the environment and employees of the enterprise.

According to the method of keeping chickens and the technology of manure removal from poultry houses, manure storages can be ground, deepened (1,5-2 m) or semi-deepened. The bottom and walls of the manure storage are made of concrete or lined with panels. Manure storage for liquid manure is arranged with a depth of up to 2,5 m from reinforced concrete structures. The size of the manure storage depends on the number of animals, the amount of manure and its shelf life (usually 2-3 years).

A significant contribution to the study of the composting process was made by such scientists as Vlasyuk P.A. The study of the factors influencing this process was carried out by: the influence of aeration - V. Yemtsev and E. Mishustin; by the activity of microorganisms - V. Kovalenko and I. Petrenko, by the influence of compost humidity - V. Afanasiev and V. Miller.

The sides are formed 1-2,5 m high, up to 3-3,5 m wide and up to 50 m long. There are two methods of composting: layer-by-layer and focal. The surface of a collar is periodically moistened (40 l/t in several receptions). The amount of water required to balance the humidity should be 150-250 l/t of raw material to ensure optimal humidity of the processed raw material at the level of 55-65% [3]. In the process of composting, a rather complex system is formed between manure, microorganisms, moisture and oxygen in

the soil. Microorganisms (bacteria, actinomycetes, fungi, yeast) in the process of their life consume organic waste, releasing heat, water, methane and carbon dioxide, humus, including humic acids. Therefore, as a rule, there is a need for pre-application in the composition of the litter and the top layer of adsorbent materials such as straw or peat (up to 50 cm).

Temperature is an indicator of the phases of the composting process. In burts, thermal processes occur in mesophilic (40-45 °C) or thermophilic (55-65 °C) regimes, which is insufficient for complete destruction of pathogenic microflora. The first phase - the formation of a compost pile - microorganisms form the conditions for their existence. During the second phase (1-2 weeks) the population of mesophilic microorganisms grows rapidly, so the temperature inside the burt rises to 40-45 °C. With increasing temperature to 55-65 °C, a thermophilic population of microorganisms is actively developing. It was found that in the process of composting the number of microorganisms exceeds similar indicators by 10 - 20, and sometimes by 50 times [4].

Above 60 °C the bulk of pathogenic microorganisms dies, and above 70 °C the activity of thermophilic microorganisms' ceases. Therefore, the temperature decreases again to 45 °C - the attenuation phase. The balance ratio between nitrogen and carbon should be C: N = 1: (25-30). At lower nitrogen concentrations, microbial metabolism is also reduced. Excess nitrogen produces ammonia and other gases that are released into the atmosphere, causing an unpleasant odor. As the pH value > 7 increases, nitrogen losses in the form of ammonia increase. At the end of the composting process, pH = 8,0-9,0. Optimal for the preservation of nitrogen in biomass is its humidity in the range of 50-70%. The high temperature of biomass also contributes to the release of ammonia into the atmosphere [4].

The last phase - the maturation phase - can last several months.

The method of obtaining straw-last compost of prolonged action [5] includes mixing the filler, namely straw with a moisture content of 64% with bird droppings with a moisture content of 76%, in a ratio of 1: 2 and subsequent composting for 30 days.

Method of obtaining organic fertilizer from bird droppings by Sadchenko S.I., Panukarenko S.V. is that the mixing of bird droppings with a humidity of 90% with a filler (straw, sawdust) in a high-speed mixer-aerator at a weight ratio of 1:3, composting is carried out for 21 days [4]. The duration of composting is reduced due to the intensive enrichment of the mixture with oxygen. The disadvantage is the reduced nitrogen content due to ammonia emissions, which leads to air pollution, as well as the existence of pathogenic microflora. The disadvantages are the significant loss (up to 30-60%) of nitrogen during gas emissions. Also, in fact, the temperature of the mass of manure inside the burt does not rise above 36-38 °C due to the influence of different weather conditions and insufficient aeration, which leads to incomplete disinfection from pathogenic microflora.

To speed up the process and improve the conditions for the formation of compost, research has been conducted in recent decades on the use of vermiculture, which is quite fully described in [5].

Peat, sand, and after fermentation - settlement of the finished substrate by worms. months) at a temperature of $+ 16 \div 24$ °C, uncontrollability of microbiological processes, the complexity of the implementation of the technological stage of separation of worms from compost [6].

Another common method of recycling to obtain a non-commercial product is composting in piles using trowels (Komtech, Amkodor and others). Due to the nature of production and storage, it is also almost impossible to obtain commercial organic fertilizer with this method.

The most effective type of manure composting is accelerated aerobic fermentation in closed chambers [7]. This type of processing is low-cost (each chamber is equipped with only two low-power electric fans that operate periodically) and does not require the participation of qualified personnel. Aerobic fermentation allows you to create a marketable product in a clearly defined time (from 3 to 10 days) and the predicted quality, which is extremely important for the subsequent sale of products.

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