COMPOSTING

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Abstract: The paper explains the process of compost as a natural organic fertilizer. According to analyzes on the municipal waste is between 30-40% of the components of organic waste. The best solution is composting, a natural process of decomposition of organic waste.

Key words: compost, composting, waste, pollution

1. INTRODUCTION

Composting is defined as the treatment of biodegradable waste under the action of microorganisms, in order to create compost, in the presence of oxygen and under controlled conditions. The biodegradable waste includes wet and solid organic matter, food waste, garden waste, paper, cardboard. Compost as a product is similar to humus, there is no unpleasant odor and can be used as a means of enriching the soil or as a fertilizer. Composting is based on the natural process of decomposition of organic matter by microorganisms. Decomposition occurs when air and moisture are brought to the organic matter. In nature, this case occurs on forest soil. The difference between composting and natural decomposition of waste is that the composting process is controlled.
Compostable can be all biodegradable waste from kitchen, garden, orchard, waste and residues of fruits and vegetables, coffee and tea deposits, mowed grass, dry branches. The compost does not include newspaper and color magazines, metal, plastic, meat, medicines, ash from coal, southern bark, walnut leaves, glass. In the process of converting biodegradable waste into compost, water and oxygen are consumed, and heat is released.

The composting process takes place under the influence of microorganisms occurring in nature and naturally propagating on a mixture of organic waste, if it is kept moist in the presence of air. The composting process is followed by the release of water vapor, heat and carbon dioxide. As the temperature of the compost mixture increases, the microbiological population in the compost mixture is affected, so instead of the mesophilic (active at a temperature of up to 45 ° C), the dominant thermophilic bacteria (active at a temperature above 45 ° C) become.

The composting process can be divided into 4 phases:

1) the initial phase (mesophilic bacteria are active);
2) the temperature rise phase (thermophilic bacteria are active);
3) maximum phase (active are thermophilic bacteria);

4) cooling (compost stabilization).

In the initial phase of mesophilic bacteria, yeast and other fungi, they quickly dissolve fats, proteins and carbohydrates. When the temperature reaches 40 to 50 ° C, almost all organisms that started the composting process are dead and their place is occupied by thermophilic bacteria that can grow and radiate heat at a further temperature rise up to 70 ° C. At compost temperatures from 60 to 70 ° C all pathogenic organisms are destroyed for several hours. When thermophilic bacteria consume food (organic material that is composted), they stop producing heat and compost cooling. By composting the compost, a new series of microorganisms grows on food residues including dead bacteria, giving the compost a final trait.

The final product of composting is a biologically stable residue - compost (Figure 1), black, similar to humus, which in nature results from similar biological processes in the soil, decomposition of plant and animal remains.

Figure 1. Prepared compost

2. COMPOSITION PROCESS

Composting is a controlled process of degradation of biodegradable waste, which means that certain conditions, variables and composting parameters must be controlled, such as:
1. humidity of the compost pile;
2. the visibility of the compost pile;
3. temperature of the compost pile;
4. the size of the composting particles;
5. ratio of nitrogen and carbon in the compost pile;
6. pH of the compost pile;
7. The presence of oxygen (aeration).

Humidity of the compost pile

Moisture in the compost mass plays an important role in the metabolism of microorganisms, and indirectly participates in the supply of oxygen materials. Microorganisms can only use those organic molecules that are dissolved in water. The moisture content of 40-60% provides adequate moisture without preventing aeration. If the moisture content drops below 40%, the bacterial activity will be slowed down and completely interrupted if it falls below 15%. If the bundle is too dry, it is necessary to add water or dry the damp material and add it to the compost pile or increase the content of the high-moist components.

On the other hand, if the moisture content exceeds 60%, the rinsing elements are flushed out, the air volume is reduced, an unpleasant smell is created (due to anaerobic catches) and the decomposition process slows down. When it comes to this condition, the crowd should be mixed. This allows the normalization of air circulation, the material becomes more fragile for better drainage and air drying. Adding dry material such as straw, turf or mature compost can fix this problem with excessive moisture. The humidity of the compost pile can be determined experimentally and by calculation.

Transparency of compost piles

Good airiness contributes to better warming and faster degradation of organic material. The compost should not have an impermeable substrate (concrete, brick, asphalt, wood ...), and the compost pile agrees so that a layer of large material is first placed, e.g. branch and branch. This ensures the flow of air in the very foundation of the pile. If we use a container for composting (eg a wooden chest or an old metal barrel, etc.), it must have air vents. The necessary transparency and looseness of the compost pile is ensured by mixing a larger and smaller, woody and soft (kitchen) and dry and wet material.

The crushing of the compost pile also contributes to better airflow. If we have collected a variety of biomaterials and made a bunch of careful mixing of materials, reversal is not necessary, but it is useful. We turn back to the crowd after three months, or at the latest when we notice that it is visibly shaken. When reversing, we take care that the material that was at the bottom of the crowd comes to the top, and the one who was on the side of the crowd comes in the middle and vice versa. So we will thoroughly mix and ventilate all the material, and by the way we can moisten it if necessary.

Temperature of compost pile

Heat develops due to the activity of microorganisms on the decomposition of organic material. There is a relationship between temperature and oxygen that is consumed. The higher the temperature, the higher the consumption of oxygen, and thus the decomposition is faster. An increase in temperature resulting from microbiological activity can be noticed within a few hours after the formation of the pile.

The temperature of the pile between 32 and 60 ° C indicates a faster compost process. A temperature above 60 ° C reduces the activity of many useful organisms. Therefore, the optimal composting range is 32 and 60 ° C. The temperature of the compost material characteristically follows the flow of rapid increase of 55-60 ° C and remains so high, near the thermophilic level, for several weeks. The temperature gradually drops to 38 ° C in order to ultimately fall to the ambient air temperature. The characteristic flow of temperature change during the time of reflection and the type of decomposition and stabilization with the progression of the composting process is shown in Figure 2.

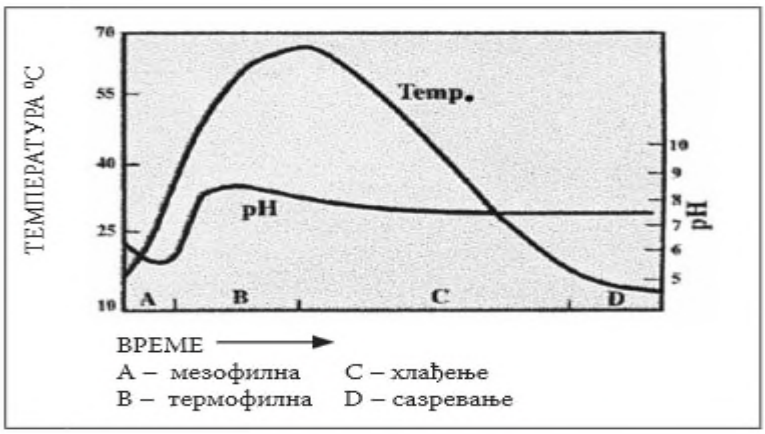

Figure 2. Change of temperature and pH values during times

The size of the composting particles.

Microbiological activity takes place on the surface of the particles of the composting material. The surface of the compostable material can be increased by splitting into smaller parts. Increasing the surface allows micro-organisms to burn more materials, to proliferate faster and create higher heat. The smaller the particles, the greater the biological activity and the rate of composting.
Some materials, e.g. The shavings should not be crushed. Today, there are various devices that can sift or cut off the compost material before depositing on a compost pile.

The ratio of carbon and nitrogen to compost piles

Carbon (C) and Nitrogen (N) are integral parts of organic waste that can easily disrupt the composting process if they are in insufficient or excessive quantities, or when the C / N ratio is unfavorable. Micro-organisms in the compost use carbon as an energy source, while nitrogen is used to synthesize proteins. The ratio of these two elements to the weight should be approximately 30 parts of carbon per 1 part of the nitrogen. The C / N ratio within the range 25: 1 to 40: 1 results in an efficient compost process. Shrug and straw are a good source of carbon. Other sources of carbon are urban waste and chopped paper and boxes. Most mussels are good sources of nitrogen, and Table 1 and 2 give a list of C / N relationships for materials that are often found on compost piles on farms.

Table 1. The ratio of carbon and nitrogen in certain materials

Material	C/N relationship
Chicken pastry	13 – 18 : 1
Household waste	12 – 20 : 1
Svinsky manger	15 – 25 : 1
Beef manure	20 : 1
Rubber and wood waste	100 – 500 : 1
Paper	150 – 200 : 1
Straw	40 – 100 : 1
Greenery	30 – 80 : 1
Mahovina	18 – 36 : 1
Horse manger	30 – 60 : 1

Table 2. Display of the amount of nitrogen in dry matter and the ratio of carbon and nitrogen

Материјал	% азота у тежини суве материје	C/N однос
Покошена трава	2,15	20
Лишће	0,5–1,0	40–80
Струготина	0,11	511
Дрво (боровина)	0,07	723
Воћни отпад	1,25	35
Папир	0,25	170
Домаћинство – отпаци	–	15
Стајњак	1,0	20

It is generally known that large, dried material contains very little nitrogen. For example, wooden waste atheroses are of high carbon content. On the other hand, green material, such as leaves and manure, contains relatively high nitrogen percentages. Proper mixing of carbon and nitrogen helps to ensure sufficiently high composting temperatures in order for the process to take place efficiently.

pH of the compost pile

Composting can be efficiently carried out at different rN values, without seriously threatening the process. The optimum rN value for microbial activity is between 6.5 and 7.5. The compost process itself leads to major changes in material and rN values. For example, the release of organic acids can temporarily or locally reduce rN and thus increase acidity. On the other hand, the production of ammonia from nitrogen compounds can increase rN, i.e. Increases the alkalinity of the material during initial composting stages. But regardless of the measurement of the rN values in the starting material, composting will always end the product with a stable rN which will usually be neutral. Figure 2 shows how the rN value changes during the composting process.

Presence of oxygen (aeration)

Aerials achieve enrichment with fresh air by the center of the compost pile, where oxygen is missing. Rapid aerobic decomposition occurs only in the presence of a sufficient amount of oxygen. Aeration is done naturally when the air is heated by the activity of the microbus rising through the crowd, and it replaces a slightly cooler fresh air from the environment. Initial mixing of the material usually entices enough air to start composting. The need for oxygen is higher in the first few weeks.
The movement of air through the compost is influenced by the porosity and humidity of the material. If the pile is mixed, overturned, there is an increased aeration in the compost pile, and therefore a larger microbiological activity that leads to the desired goal - faster composting.

3. COMPOSITION TECHNIQUES

There are many different composting techniques. The choice of the composting technique depends on the length of the composting process itself, which can last from two months to two years. Composting techniques are:
A passive load method;
2. Method of composting in a row;
3. Static pile method with forced ventilation;
4. Method of closed systems.

A passive pile method

The payi pile method is the simplest method of composting and the lack of a lot of workforce and technology. Compost materials form a composting batch which is rarely mixed, most often once a year, and the composting process itself lasts for more than a year.

Compost method in a row

The piles in turn are elongated composting bundles that are often overturned to maintain aerobic compost conditions. Frequent overturning ensures the decomposition of compost material because the cooler outer layers are moved to the inner parts where they are exposed to higher temperature and microbiological activity. The pile method in turn results in the duration of the compost process of about three months of the day. Compost piles in the mouth have an elongated shape due to machines that mix the material (Figure 3).

Figure 3. Machine for overtaking compost piles sorted in kind

Static gomial method with forced ventilation

Static piles with forced ventilation is a composting method where the material is deposited on grids, or perforated pipes, fans are pumped or retracted through the pipes, and thus through the compost material. This ensures the ventilation of the compost heap, which reduces, or even completely eliminates, the need to overturn the compost pile. With this method, compost is finished in only three to six months.

Method of closed systems

Closed systems are a group of methods from concrete tunnel for composting to rotating steel drums. The disadvantage of these systems is high initial costs and maintenance.

The rotary drum system (Fig. 4) is based on the transfer of material to achieve mixing. The drums are long cylinders, which slowly rotate, usually 10 rpm. The oxygen is brought under pressure from the outer pump system, through the nozzles into the drum. By moving the material, the distribution of oxygen per drum is allowed. Compost material is sufficient to hold only 1 to 6 days in drums, but complete stabilization of compost material is not possible during this time period, further composting and maturation of 1 to 3 months is necessary.

Figure 4. Rotating compost drum

4. ECOLOGICAL ASPECTS OF COMPOSITION

Water quality - water used to maintain optimal humidity during the composting process can contain harmful substances, especially if municipal waste is composted. Problems with water can be eliminated by using composted compost using drainage systems and the flow water must be purified.

Air Quality - Possible problems of air pollution coagulation can be unpleasant smells and dust during dry summer periods. The problem of unpleasant smells can be solved with a green belt by laying around the compost.

Noise - noise is generated by trucks, which transport to plants and equipment used for composting. Mills and other grinding machines create the highest noise that can be prevented by setting up a noise reduction device and a green belt around the compost.

Pests - are small animals, or insects that can transmit infections and can be prevented by keeping the compost process clean.

Fire - if the compost material is dried and becomes too hot, self-inflammation may occur. Such cases have minimal probability because the compost material must be mixed and maintained in a humid.

Compost is used to improve plant growth. Compost enriches soil and reduces erosion and outflow of nutrients from the soil, ensures soil compaction and helps control the disease and pests that endanger plants. Compost can be used for afforestation, wetland restoration and revitalization, compost is also a habitat for insects and reptiles that live in earth like rainwater.

New composting technology, known as compost bioremediation, is now used to restore contaminated soil, to control odors, to degrade volatile organic compounds.

5. CONCLUSION

Due to increasing quantities and health hazards, waste is considered one of the most significant ecological problems in the modern world. Man, by his actions, is a decisive factor in changing the environment. By polluting the environment and by the consumption of natural resources, man disturbs the natural balance and does not understand that it will damage himself. The waste is boomerang - when it is thrown, it returns through contaminated water, air and soil, and thus also affects the health of people. Therefore, it is important to understand the problem of waste and how to treat it, i.e. reductions starting from the manufacturers themselves to the end users.

Composting is just one way of treating and reusing organic waste that occupies the bulk of the body of our landfills. Through the work, the process of composting is explained, all the way to the production of finished compost, ie, natural organic fertilizer. Economic and environmental aspects of using it are also given.

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