Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 18, Issue 2, 2018
PRINT ISSN 2284-7995, E-ISSN 2285-3952

THE ROLE OF EFFICIENT MICROORGANISMS IN THE PROCESS OF OBTAINING THE BIOCOMPOST

Larisa CREMENEAC, Tatiana BOCLACI

Scientific and Practical Institute of Biotechnologies in Zootechny and Veterinary Medicine, 6525, v. Maximovca, District Anenii Noi, Republic of Moldova, Emails: kremeneak@yandex.ru

Corresponding author: kremeneak@yandex.ru

Abstract

In the article are exposed the results of the study of biochemical quality of biocopmpost obtained by using the effective microorganisms from microbial preparations „Baikal ЭМ-1" and „EM-1", in the process of bioconversion of the organic wastes unfermented. Material for research served unfermented cattle manure and the object of investigation - two preparations of efficient microorganisms „Baikal ЭМ-1" and „EM-1". Analyzing the results obtained in the experiment it was found that in biocompost obtained from the unfermented manure of cattle, subjected to the bioconversion process using preparations „Baikal ЭМ-1" and „EM-1" diminished essentially the content of ammonia, respectively with 79.68% - 70.91% and 85.09% - 70,03%, and increased the total nitrogen, respectively with 147.33% - 105.33% and 162.67% - 128.00% in comparison with the same indicators in manure samples at the initial stage. Consequently, it has been found that use „Baikal ЭМ-1" and „EM-1" preparations has led to substantial changes in content ammonia and total nitrogen, thus improving the quality of the biocompost.

Key words**:** *biocopmpost, effective microorganisms, preparations „Baikal ЭМ-1" and „EM-1", unfermented manure*

INTRODUCTION

Obtaining organic agricultural production is a matter of global importance for society. The global environmental situation, including the regional, has worsened in the last century due to the industrialization and chemicalization of agriculture, the storage, preservation and unreasonable use of organic waste, etc. These have resulted in pollution of the environment and its components. A special role in the improvement of the environmental situation belongs to the technology of bioconversion of organic waste using biological methods (worm cultivation technology) [2, 3] and microbiological (efficient micro-organisms technology - EM). Efficient microorganisms were discovered by Teruo Higa, PhD in agronomy and horticulture professor at Ryukyus University in Okinawa (Japan) in 1980 [12].

According to literary sources, efficient microorganisms live in balance over 80of different species of aerobic and anaerobic microorganisms, where some live with the metabolites of others [12, 14].

Yeast, acido-lactic bacteria, photosynthetic bacteria, nitrogen fixators, actinomycetes form the largest groups of efficient microorganisms that are not genetically modified. What makes efficient microorganisms to be so important are their particular features of regeneration, structuring and antioxidation, which gives them extraordinary effects and a wide and varied range of applications almost unlimited in various fields.

The cycle of nutrition on the earth is a circular chain: earth - plants - animals - man - earth. In the vital processes of this cycle, micro-organisms are of great help, turning substances of different origins into nutrients for plants, animals and humans. Efficient (beneficial) microorganisms are also the basis of all forms of life on earth [12, 13].

It is known that microorganisms are divided into three main categories:

-microorganisms of degradation and degeneration, the metabolites of which are oxidants responsible for putrefaction, decomposition and degeneration. In these processes the free radicals (aggressive

oxygen) are formed which are at the origin of most diseases;
-microorganisms for structuring, regeneration and fermentation, the metabolites of which are antioxidants, which are the basis of soil, water, plant, animal and human health;
- neutral microorganisms, which are the most quantitatively represented. These microorganisms are the followers who behave in the structuring or decomposition elements, following the preponderance of the other two groups.
Efficient microorganisms are used to improve soil quality and produce ecological production [1, 8].
In zootechny, the use of efficient microorganisms allowed remarkable diminution of unpleasant odors, almost complete disappearance of flies, suppression of some diseases, obvious increase of fertility through artificial sowing, increase of meat, milk and eggs quality [7].
Technology of efficient microorganisms opens new perspectives and opportunities for sustainable agriculture. It can become the basis for efficient production of organic production of plant and animal origin.
The purpose of the research included the determination of the role of efficient microorganisms in the process of processing of unfermented organic waste and the objective was to determine the influence of microorganisms on the process of processing of unfermented organic waste and the quality of the compost obtained.

MATERIALS AND METHODS

For the purpose of the research, two concentrated microorganisms "Baikal ЭМ-1" and "EM-1" were purchased, from which were obtained by dilution with unchlorinated and filtered water the basic solutions and their working solutions.
From the concentrated microorganisms „Baikal ЭМ-1"" and „EM-1", diluted in a ratio of 1: 100 using unchlorinated and filtered water, having a temperature of 20-25°C and with the addition of nutrient medium (special molasses), after 7 days, according to the instructions of use, was obtained the basic solution with efficient microorganisms. Subsequently, from the basic solution was obtained the working solution, by diluting 100 ml of the base solution with 10 liters of water. Thus, the working solution was obtained, which was subsequently used for the processing of unfermented cattle manure.
To process 0.5 tons of manure, were used 0.250 liters of base preparation or 50 liters of working solution. The process of manure processing with the preparation „Baikal ЭМ-1" was performed under anaerobic conditions and with the preparation „EM-1" under aerobic conditions. Polyethylene tubing was used to obtain anaerobic conditions. Unfermented cattle manure subjected to bioconversion with the use of efficient microorganisms contained about 30% of cellulose in order to reduce moisture to 50-60%.These requirements were followed in the experiment with both efficient microorganisms (EM) that were subjected to test.
The experiment was organized outdoors. Materials for research have served the unfermented cattle manure and compost obtained in the bioconversion process, which were subjected to biochemical analyzes (active acidity, organic substance, ammonia, total nitrogen content and object of research - two efficient microorganisms preparations „Baikal ЭМ-1" - produced by ООО „ЭМ-ЦЕНТР" (Russia, Ulan-Ude) and „EM-1", produced by JSC "Bioem Techology" (v.Cojusna, R. Moldova).
For the purpose of testing these preparations, an experiment was carried out in which three variants were used for each of the two preparations, including two experimental and one control. In experimental variants, unfermented cattle manure has been subjected to composting with efficient microorganisms of the „Baikal ЭМ-1" and „EM-1" preparations under anaerobic and aerobic conditions. In the control variants unfermented cattle manure was subjected to traditional composting.
The biochemical investigations of unfermented cattle manure and compost obtained after 2 months of microorganism processing have been performed according to

the methods set forth in the Standards [5, 6] and specialized textbooks [9,10,11].

RESULTS AND DISCUSSIONS

According to the results obtained (Table 1) it was found that in the samples of unfermented cattle manure used as a substrate for the production experiment (initial stage) the moisture, dry matter, active acidity and total nitrogen showed non-essential differences between the three variants of the experiment.

During the experiment, observations were made over the processes that took place in the experimental variants. It was found that because of the high temperatures as a result of the manure processing process with preparation „Baikal ЭМ-1" (under anaerobic conditions) and „EM-1" (under aerobic conditions), only a few indicators of the quality of organic waste have changed. At the end of the experiment, the values of unfermented manure did not change essentially, except for the value of ammonia, total nitrogen and ash.

Thus, as demonstrated by the results outlined in Table 1, changes in some of indicators of processed manure using both types of ME preparations took place in relation to the initial stage in both the first and second months of the experiment.

Table 1. The biochemical composition of the nutrient substrate and of the compost obtained in the result of the use of efficient microorganisms of preparation "Baikal- ЭМ -1"

Indicators	Period and variants of the experiment; conditions of fermentation		
	Initial	After a month	After 2 months
	Control	Experiment	Experiment
	Traditional composting (aerobic)	ME „Baikal - ЭМ-1" (anaerobic)	ME „Baikal - ЭМ-1" (anaerobic)
Humidity, %	79.34 ± 1.71	80.40 ± 0.76*	80.63 ± 0.71
Dry substance, %	20.67 ± 1.71	19.60 ± 0.76*	19.37 ± 0.71
Active acidity, u.c	8.52 ± 0,21	6.20 ± 0.00	7.33 ± 0.053
Ammonia,mg/kg	403.00±44.25	81.89 ± 6.83	60.08 ± 19.25
Total nitrogen, %	1.50 ± .0.14	3.71 ± 0.22	3.94 ± 0.13
Ash content, %	14.52 ± 0.88	17.73 ± 1.07	22.00 ± 0.58*
Organic substance, %	42.74 ± 0.44	41.14 ± 0.53	39.00 ± 0.29*

Note: Authenticity: 80.40* - $P \leq 0.001$

After a month of fermentation of the unfermented manure in the samples of the manure subjected to fermentation with the preparation „Baikal EM-1", the amount of moisture, active acidity (pH), total nitrogen and ash increased by 1.36%, 27.23%, 147.33% and 22.11% in comparison to these values in control samples. The quantity of dry substance, active acid (pH), ammonia, and organic substance decreased in comparison to the control variant by 5.18%, 27.23%, 79.68% and 3.74%.

At the end of the experiment, after two months of experimentation, the values of humidity, active acidity, total nitrogen and ash from unfermented manure treated with EM of preparation „Baikal ЭМ-1" increased respectively by 1.63% 97%, 162.67% and 51.52% and those of dry matter, ammonia and organic matter decreased respectively by 6.29%, 85.09% and 8.75%, compared to the initial period (control variant).

Thus, in the process of bioconversion of organic wastes during the various periods (one month and two months), using the preparation with EM „Baikal ЭМ-1", under anaerobic conditions, the total amount of nitrogen, the acidic active and the ashes essentially increased and the amount of ammonia was reduced, thus improving the quality of the obtained compost.

The same legality was also found in the biochemical indicators of unfermented cattle manure subjected to bioconversion using the preparation „EM-1"(Table 2).

According to the results shown in the table it was found that after one month of aerobic experiment, the total nitrogen, active acid and ash increased respectively by 105.33%, 14.67 and 173.21% and essentially diminished

ammonia and organic substance respectively by 70.91% and 29.34%, compared to the initial period. The other indicators did not undergo any non-essential changes.

Table 2.The biochemical composition of the nutrient substrate and of the compost obtained in the result of the use of efficient microorganisms of preparation "EM -1"

Indicators	Period and variants of the experiment; conditions of fermentation		
	Initial	After a month	After 2 months
	Control	Experiment	Experiment
	Traditional composting (aerobic)	EM „EM - 1" (anaerobic)	EM EM-1" (anaerobic)
Humidity, %	79.34 ± 1.71	77.97 ± 0.35*	76.97 ± 2.65
Dry substance, %	20.67 ± 1.71	22.03 ± 0.35*	23.03 ± 2.65
Active acidity, u.c	8.52 ± 0.21	7.27 ± 0.12	7.60 ± 0.00
Ammonia, mg/kg	403.00 ± 44.25	117.25 ± 11.41	120.78 ± 11.89
Total nitrogen, %	1.50 ± 0.14	3.08 ± 0.44	3.42 ± 0.73
Ash content, %	14.52 ± 0.88	39.67 ± 1.43*	33.65 ± 2.01
Organic substance, %	42.74 ± 0.44	30.20 ± 0.72*	33.18 ± 1,14

Note: Authenticity: 77.97*- $P \leq 0.001$

From the exposed ones it was found that after one month from the beginning of the experiment, under the influence of efficient microorganisms, there were changes in the quality of the obtained compost.

By comparing the values of the biochemical indicators of the unfermented manure treated with EM of the preparation „EM-1" at the end of the experiment (after two months), with those of the control variant, that the dry substance, the active acidity, the total nitrogen and the ash increased respectively by 11.42% and 10.80%, 128.00% and 124.86%, and the amount of ammonia and organic substance decreased by 70, 03% and 22.37%. The other indicators have undergone minor changes.

Analyzing the obtained results, it has been found that the use in the process of bioconversion of unfermented cattle manure of preparations with EM „Baikal ЭМ -1" and „EM-1",over two months, have a beneficial effect on the quality of the obtained compost.

CONCLUSIONS

The use of unfermented cattle manure in the bioconversion process of preparations with efficient microorganisms „Baikal ЭМ -1" and „EM-1",over two months, contributed to the increase of acidity, total nitrogen and as hand to the diminution of ammonia and organic substance.

Both preparations with efficient microorganism shave a beneficial effect on the obtained compost substantially increasing the total nitrogen content and diminishing that of ammonia of ammonia and organic substance have essentially changed so improving the quality of the obtained compost.

The technology of using the efficient microorganisms in the process of bioconversion of the organic waste is proposed for the sustainable development of the agriculture and the obtaining of the fertilizers and the ecological agricultural production in the households with different forms of the ownership.

REFERENCES

[1]Blinov, V.A., 2004, Treatment of plant diseases with effective microorganisms.Achievements of ЭМ technology in Russia.Moscow, 50-53.

[2]Cremeneac, L., Boclaci, T., Chiruneț, Z., 2012, Technology of bioconversion of organic wastes and the use of the obtained products. Recommendations. Typography „Print-Caro", Chisinau, 60-62.

[3]Cremeneac, L., Boclaci, T., 2013, General aspect of management of organic waste in sustenable development of agriculture, Scientific bulletin. Series F. Biotechnologies, Volume XVII, Bucharest, 43-49.

[4]Cremeneac, L., Boclaci, T., 2015, The role of worm compost in improving the quality and increasing the productivity of maize. Magazine Moldovan agriculture, No. 1, 26-28.

[5]ГОСТ 26204-84 - 262013-84, 1984, Soils. Methods of analysis, Moscow, 1984.

[6]ГОСТ 26712-94, 1988, Organic fertilizers. Methods of analysis, Moscow, 1988.

[7]Levchenko, I.A., 2002, EM technology and the cultivation of pigs. Journal "The Hope of the Planet", №10, 9-12.
[8]Pakulova, O.K., 2001, Practical recommendations on the use of ЭМ technology in crop production. The journal "The Hope of the Planet", № 3, 8-10.
[9]Petukhova, E.A., et al., 1989, Zootechnical analysis of feeds, Moscow, VO "Agropromizdat", p.240.
[10]Popov, A.V. et al., 1973. Fundamentals of Biological Chemistry and geotechnical analysis, Publisher „Kolos", Moscow, 256-266.
[11]Razumov, V., 1986, Reference of the chemist lab assistant on analysis of feed „Rosselkhozizdat", Moscow, 89-92; 144-148.
[12]Sidorov, Z.N., 2001, Experience in the use of ЭМ technology in pig production. Journal "The Hope of the Planet", №1, 12-17.
[13]Suhammera, S.A., 2006, ЭМ technology - biotechnology of the XXI century. The collection of materials on the practical application of „Baikal ЭМ - 1." Almaty, 78.
[14]Shablin, P.A., 2000, Effective microorganisms - the hope of the planet. Moscow, 70.
[15]Yurchenko, V.A., 2001, Microbiological technologies - an ecological alternative to the chemicalization of agriculture. Journal "The Hope of the Planet", 2001, №3, 3-5.