INFLUENCE OF PASTEURIZATION ON DIFFERENT COMPOSTS USED FOR *AGARICUS* SSP. MUSHROOM CULTIVATION ON CHANGING THE AMMONIA CONCENTRATION AND THE pH LEVEL

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Abstract. The mushrooms provide important sources of protein extracted from materials with very low economic value, such as manure, waste from agriculture, forestry, timber industry. It is used with maximum efficiency the created nutrient substrate, which after a crop cycle of 3-5 months can be reused as fertilizer in agriculture (*Agaricus mushrooms, Coprinus, Stropharia*), or as animal feed or as fuel (oyster mushrooms). Ammonia is eliminated during composting and pasteurization and the nitrogen that will remain will become digestible nitrogen protein, which provide the food for the mushrooms mycelium. This paper presents the dynamic of the chemical transformation of compost for *Agaricus* ssp. mushroom growing during the pasteurization process.

Keywords: mushroom, compost, pasteurization, pH, ammonia

INTRODUCTION

The today climate change and those of future, specialists leads to find new sources of food for the growing population. Getting mushrooms throughout the year in intensive mushroom cultivation is an alternative to these objectives.

In addition to their food value, mushrooms constitute a profitable crop, which ensures a high production, is obtained per unit of area used in spaces designed for this purpose. Note there is the fact that for the mushroom growing is not used farmland. The advantages of a mushroom cultures are many, both economic, occupational, medicinal and conversion of ligno cellulose waste.

The compost and the substrate nutrient must be adequate to the *Agaricus ssp.* mushrooms opportunities and enzymatic requirements. Thus, the substrate nutrient must present breakdown or synthetic microbial form assimilated as quickly as possible by mushrooms, having a specific biochemical metabolic requirements of the mushrooms. (ZICARI G., D. RIVETTI, V. SOARDO, E. CERRATO, 2012).

During composting and pasteurization the substrate protein nitrogen is converted into peptides and amino acids, which are absorbed by the cells of mycelia hyphae. From research , it showed that the total nitrogen content between nutrient substrate (up 2.7%), mushroom production and protein content of mushrooms is a direct correlation. (ZICARI G., D. RIVETTI, V. SOARDO, E. CERRATO, 2012).

The compost nutrient transformation in substrate for Agaricus mushrooms is the result of a diverse microbial activity and composting technique of a population of microorganisms based on whether their immersion in order to achieve the best possible nutrient. (BAARS J.P., J.M. HUUB, C. DRIFT, J.M. JOORDENS, SYBREN WIJMENGA, L.D. GRIENSVEN, D. VOGELS, 1996).

MATERIAL AND METHODS

Given that in the experience we made, the culture substrate presents 4 graduations (a1-classic compost, a2- synthetic compost, a3-mixed compost, a4-original compost) to achieve directed composting, were conducted 4 identical tanks to control, perform and record optimal environmental conditions necessary fot the composting and pasteurization process (Fig. 1-6).

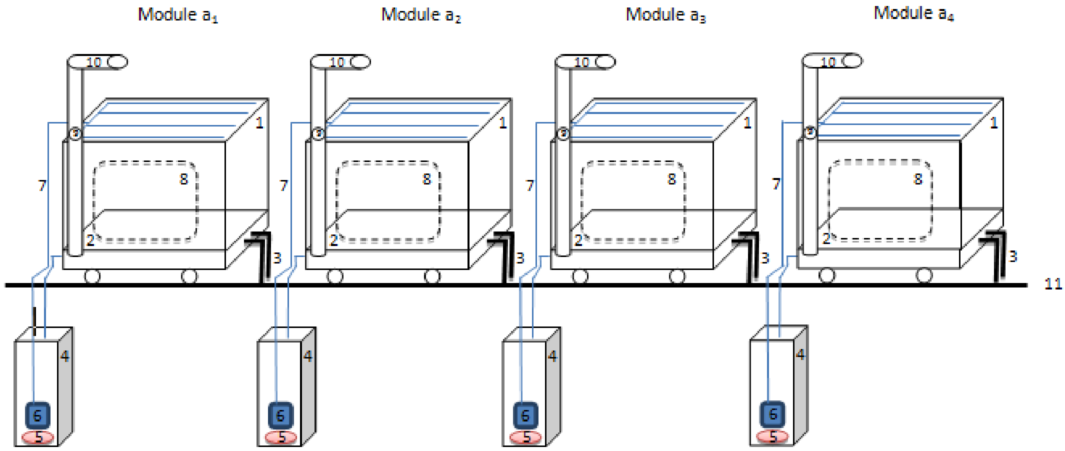


Fig. 1. Sketch for the composting facility - 4 modules:
1 - tank with capacity of 1 m^3 for compost components; 2 – rack for compost; 3 - tank heating system for composting; 4 - tank for the collection and recirculation the water excess; 5 - heating elements for wetting water (purine); 6 – water/purine recirculation pump; 7 - recirculation pipes for wetting water/ purine; 8 - compost discharge door; 9 - air flow control valve for aerobic composting; 10 - air inlet pipe to aerobic composting from the compressor; 11 - ground level.

Fig. 2. Composting facility - 4 modules

Fig. 3. Tank for the collection and recirculation of the water excess

Fig. 4. Compressor for the air flow

Fig. 5. Tank for composting, internal view

Fig. 6. Compost components presoaking

For the experiments we used four recipes of compost, presented in table 1.

Table 1

Recipes for compost used in experience

Type of compost	Components	Quantity for 1 tone of compost
a1 - Classical	Horse manure (horse manure and wheat bedding straw 70-75%) Gypsum (calcium sulphate) Superphosphate Ammonium sulfate	500 kg 25 kg 7 kg 7 kg
a2 - Synthetic	Wheat straw Poultry litter Gypsum (calcium sulphate) Urea	350 kg 150 kg 20 kg 7 kg
a3 - Mix	Horse manure (horse manure and wheat bedding straw 70-75%) Poultry litter Wheat straw Gypsum (calcium sulphate) Urea	250 kg 100 kg 150 kg 24 kg 2 kg
a4 - Original	shredded reed Horse manure (horse manure and wheat bedding straw 70-75%) Poultry litter Gypsum (calcium sulphate) Urea	100 kg 200 kg 150 kg 24 kg 2 kg

Each type of compost was prepared in a composting tank, respecting the proportions of raw and auxiliary materials.

The compost pasteurization was achieved by raising the temperature of compost at 58-60 °C for a period of about 8 hours, then lowering the temperature of the compost at 50 °C by mixing fresh air and continued cooling to 45 °C. The temperature of 45 °C was maintained until the ammonia content of the compost has not fallen below 0.05% and the pH has stabilized in the range of 7.3-7.5.

The physico-chemical properties of the compost during pasteurization was determined in six different days.

RESULTS AND DICUSSIONS

The physico-chemical properties of the mixture at the beginning of pasteurization for each experimental variant are presented in table 2. The dynamics of the physic-chemical properties of the compost during the pasteurization process are presented in table 3.

Table 2

Physic-chemical characteristics of the mixture at the beginning of pasteurization

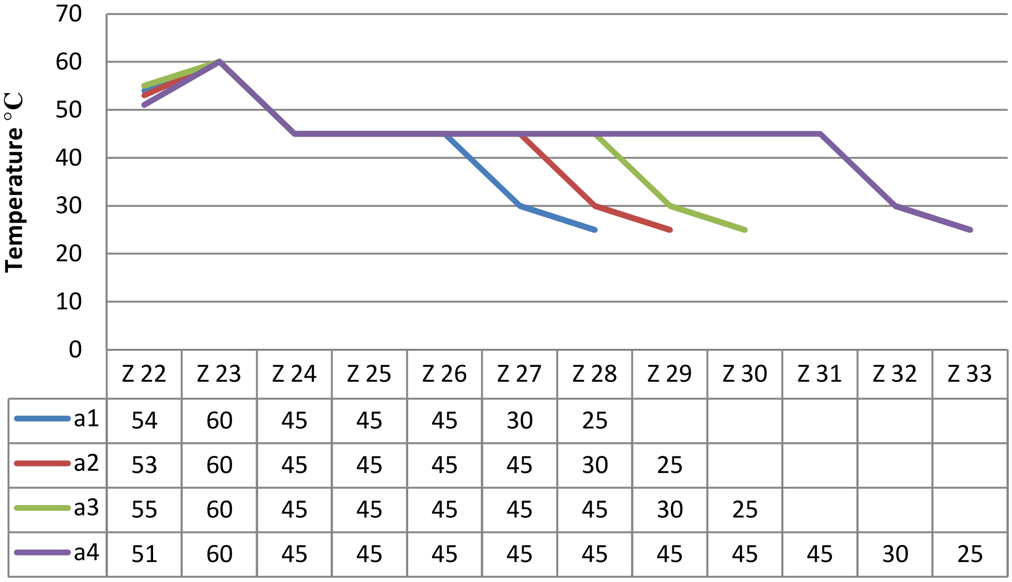
Type of compost	Determinated element							
	Water content	Organic matter/d.m.	Nitrogen /d.m.	Calcium	Magnesium	Ammonia (NH_3)	pH	Electrical conductivity (EC)dS/m^2
Classical	69%	55%	1.7%	90mg/l	4mg/l	0.2%	8.11	2.92
Synthetic	71%	53%	1.8%	80mg/l	4.85mg/l	0.25%	8.24	2.98
Mixt	68%	56%	1.7%	82mg/l	3.7 mg/l	0.21%	7.98	2.83
Original	67%	56%	1.8%	79mg/l	4.1 mg/l	0.29%	8.12	2.93

Table 3

The dynamics of the physico-chemical properties of the compost during pasteurization

Determinated element	Pasteurization duration (days)						
	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
CLASSICAL COMPOST – a_1							
H_2O%	69%	68%	68%	67%	66%	66%	65%
pH	8.11	8.21	8.05	7.63	7.45	7.31	7.21
Total nitrogen (d.m.)	1.7%	1.7%	1.85%	2%	2.2%	2.3%	2.4%
NH_4 mg/100g (d.m.)	220	200	175	125	82	54	30
SYNTHETIC COMPOST – a_2							
H_2O%	71%	71%	69%	65%	64%	63%	63%
pH	8.24	8.14	7.98	7.71	7.42	7.39	7.32
Total nitrogen (d.m.)	1.8%	1.9%	1.9%	2.2%	2.4%	2.5%	2.6%
NH_4 mg/100g (d.m.)	270	250	189	150	98	52	32
MIXT COMPOST – a_3							
H_2O%	68%	68%	67%	66%	66%	65%	64%
pH	7.98	7.88	7.70	7.54	7.44	7.39	7.35
Total nitrogen (d.m.)	1.7%	1.8%	1.8%	2.0%	2.2%	2.3%	2.4%
NH_4 mg/100g (d.m.)	230	220	171	110	85	62	45
ORIGINAL COMPOST – a_4							
H_2O%	67%	67%	66%	65%	64%	64%	63%
pH	8.12	8.01	7.91	7.82	7.66	7.59	7.5
Total nitrogen (d.m.)	1.8%	1.8%	1.9%	1.9%	2%	2%	2.1%
NH_4 mg/100g (d.m.)	342	320	280	210	165	89	54

The variation of compost temperature during the pasteurization, 22-33 days, is presented in figure 7. The physic-chemical properties of the mixture after the pasteurization, for each experimental variant are presented in table 4. Taking into account the unilateral influence of pasteurization day on the *Agarius* ssp. compost pH value, we can be seen as it recorded a difference of 0.5 pH/day being very significant positive, to the average taken as controls (Table 5) which registered value 7.71 pH.



	Z 22	Z 23	Z 24	Z 25	Z 26	Z 27	Z 28	Z 29	Z 30	Z 31	Z 32	Z 33
a1	54	60	45	45	45	30	25					
a2	53	60	45	45	45	45	30	25				
a3	55	60	45	45	45	45	45	30	25			
a4	51	60	45	45	45	45	45	45	45	45	30	25

Fig. 7. The variation of compost temperature during the pasteurization

Table 4

Physic-chemical characteristics of the mixture after the pasteurization

Type of compost	Determinate element							
	Water content	Organic matter/d.m.	Nitrogen /d.m.	Calcium	Magnesium	Ammonia (NH_3)	pH	Electrical conductivity (EC)dS/m^2
Classical	65%	51%	2.4%	87mg/l	3.8mg/l	0.03%	7.21	2.32
Synthetic	63%	49%	2.6%	78mg/l	4.7mg/l	0.032%	7.32	2.48
Mixt	64%	52%	2.4%	78mg/l	3.2 mg/l	0.045%	7.35	2.53
Original	63%	51%	2.1%	75mg/l	3.8 mg/l	0.054%	7.5	2.63

Table 5

Unilateral recipe influence of pasteurization day on the *Agarius* ssp. compost pH value

Day	pH		Difference ±D mm/day	Significationof difference
	Value	%		
Z0	7.71	100	0.00	Mt
Z1	8.21	106.5	0.50	***
Z2	8.09	104.9	0.38	***
Z3	7.87	102.1	0.16	**
Z4	7.69	99.8	-0.01	-
Z5	7.48	97.0	-0.23	000
Z6	7.36	95.4	-0.35	000
Z7	7.26	94.2	-0.45	000

DL (p 5%)	0.10
DL (p 1%)	0.14
DL (p 0.1%)	0.20

CONCLUSIONS

The compost for mushrooms, made for semi-intensive and intensive culture system was subjected to directed and controlled pasteurization or fermentation, in order to overcome the compost, of pests that: nematodes, mites and eggs and larvae.

In pasteurization process, due to higher temperatures and intense ventilation conditions, occurs and finish composting in order to transform it into nutrient substrate for mushrooms.

Physico-chemical changes that occur in the substrate during pasteurization are due to total nitrogen content and ammonia nitrogen, pH and humidity.

Total nitrogen content increases until the end of compost pasteurization and therefore should not present. Before pasteurization the total nitrogen content exceeding 3% d.m., the optimum limit being at 2.4% d.m. because it can become harmful at higher concentrations.

The ammonia decreases significantly limits up to 0.03%, as it will adversely affect mycelium growth. If the amount of ammonia nitrogen greater than 0.16%, it creates the conditions for the emergence of various substrate Saprophytic mushroom competitors, which can compromise the entire culture.

The compost moisture due to existing ventilation decreases by about 6%.

The pH of compost falls also during pasteurization.

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