

AMINO-ACID COMPOSITION OF PROTEIN FRACTIONS FROM FERMENTED FEED

Zh. Tashpulatov, B. G. Baibaev,
and T. S. Shul'man

UDC 582.28:581.19

*The possibility of preparing feed from wheat straw via fermentation by cellulolytic enzymes from the fungus *Trichoderma harzianum* is demonstrated. The water- and salt-soluble fractions of the fermented feed contain the largest quantity of essential amino acids (22.93%). The predominant essential amino acids are lysine, leucine, methionine, and threonine. The total essential amino acids in the water- and salt-soluble fractions represent 31.44% of the total amount of protein in the fermented feed.*

Key words: *Trichoderma harzianum*, fermented feed, protein, amino acids.

Microscopic fungi that produce cellulase are currently of great interest owing to the shortage of plant protein. They can be used to produce fermented feed of high protein content for livestock from agricultural plant waste that contains cellulose [1-3].

Our research showed that fermentation of wheat straw by cellulolytic enzymes of the fungus *Trichoderma harzianum* for 60 days decreases the amount of cellulose from 38.23 to 30.22%; increases the amount of protein from 3.74 to 8.25%, and increases the sugar content from 1 to 3.68%. The lactic-acid content is 0.66%; free acetic acid, 0.64%; bound acetic acid, 0.18%. Butyric acid is not found. Thus, fermentation of wheat straw with assistance of cellulolytic fungal enzymes produces feed of high protein content with good organoleptic properties, the smell of bread dough and sauerkraut and a softened structure.

The compositions of the protein fractions of fermented feed from wheat straw are listed in Table 1. The total essential amino acids in the albumin fraction is 16.09%; globulin, 6.84%; prolamin, 2.52%; glutelin, 6.53% of the total amount of protein in the fermented feed. The albumin fraction is the most balanced in amino-acid composition. The predominant essential amino acids in it are lysine, threonine, cysteine + methionine, and valine.

The lowest quantity of essential amino acids occurs in the prolamin fraction: lysine, 0.21%; cysteine + methionine, 0.24%; isoleucine, 0.22%; leucine, 0.28% of the total amount of protein in the fermented feed.

The quantity of nonessential amino acids in protein of the fermented feed in the albumin fraction is 13.36%; globulin, 8.08%; prolamin, 3.84%; glutelin, 8.7% of the total protein content in the fermented feed.

A study of the amino-acid composition of the starting wheat-straw feed showed that the quantity of essential amino acids in the albumin fraction is 7.82%; globulin, 3.62%; prolamin, 1.23%; glutelin, 4.94% of the total protein content in the fermented feed. The predominant essential amino acids in the albumin fraction of the starting feed are valine, isoleucine, leucine, and tyrosine + phenylalanine.

The amount of protoplasmic water- and salt-soluble proteins (albumin and globulin) in the fermented feed is 2.5 times greater than the amount in the starting feed and represents 57.67% of the total protein content in the fermented feed.

Thus, feed from wheat straw that is fermented by the cellulolytically active fungus *T. harzianum* typically is valuable and has balanced proteins with predominance of water- and salt-soluble protein fractions with balanced amino-acid compositions.

TABLE 1. Amino-Acid Composition of Protein Fractions from Fermented (a) and Starting (b) Wheat-Straw Feed

Amino acid	Protein fraction, %							
	albumin		globulin		prolamin		glutelin	
	a	b	a	b	a	b	a	b
Lysine	2.25	0.76	0.71	0.44	0.21	0.12	0.71	0.08
Histidine	1.74	1.04	0.44	0.16	0.24	0.08	0.98	0.48
Arginine	1.24	0.88	0.74	0.22	0.34	0.11	1.44	0.76
Asparagic	4.54	1.02	1.02	0.96	0.84	0.26	0.98	1.06
Threonine	2.02	1.34	1.02	0.58	0.62	0.33	0.24	0.74
Serine	0.86	1.78	0.84	0.32	0.44	0.18	0.95	1.02
Glutamic	5.04	3.22	2.02	2.04	0.96	0.56	1.85	2.18
Proline	1.04	0.34	0.56	0.22	0.26	0.11	1.03	0.42
Glycine	4.22	1.14	1.02	0.75	0.32	0.24	0.93	0.45
Alanine	3.34	1.02	1.42	0.54	0.44	0.11	0.54	1.04
Valine	3.24	1.42	1.24	0.42	0.32	0.08	0.77	1.03
Cysteine + methionine	3.04	0.84	0.44	0.16	0.24	0.06	1.94	0.47
Leucine	1.56	0.76	1.22	0.78	0.28	0.32	1.04	0.84
Isoleucine	1.46	1.04	0.92	0.36	0.22	0.07	1.18	1.56
Tyrosine + phenylalanine	2.52	1.66	1.31	0.88	0.62	0.26	0.62	0.22
Total amino acids	39.45	18.24	14.92	8.83	6.36	2.88	15.24	12.35
Essential	16.09	7.82	6.84	3.62	2.52	1.23	6.53	7.41

EXPERIMENTAL

The fungus *T. harzianum* was cultured for three days at 28°C on wheat bran moistened with tapwater.

Wheat straw was fermented under laboratory conditions in 3-l glass jars. Ground wheat straw was treated with 5% fungal biomass [4, 5] and moistened to 60%. The fermented mass was compacted. The jars were hermetically sealed with polyethylene lids, sealed with paraffin, and kept for 60 days at room temperature.

The amino-acid composition of the protein fractions was found using common literature methods [6, 7]. The amino acids were quantified in an AAA-881 amino-acid analyzer.

REFERENCES

1. V. G. Babitskaya and I. V. Stakheev, *Mikol. Fitopatol.*, **19**, No. 1, 229 (1985).
2. S. N. Kushnir, E. P. Tyurina, A. V. Al'tman, et al., *Izv. Akad. Nauk Mold., Ser. Biol. Nauk*, No. 1, 37 (1988).
3. A. G. Lobanok, V. G. Babitskaya, and Zh. N. Bogdanovskaya, *Microbial Synthesis from Cellulose: Protein and Other Valuable Products* [in Russian], Nauka i Tekhnika, Minsk (1988).
4. N. A. Lukashik and V. A. Tashchilina, *Zootechnical Analysis of Feeds* [in Russian], Rossel'khozizdat, Moscow (1968), p. 106.
5. O. A. Aibazov, *Enzymatic Treatment of Straw* [in Russian], Rossel'khozizdat, Moscow (1984).
6. V. V. Tkachenko, A. A. Makhov, and A. V. Tkachenko, *Izv. Akad. Nauk Belarus, Ser. Biol. Nauk*, No. 2, 285 (1969).
7. *Methods of Experimental Mycology, Handbook* [in Russian], Naukova Dumka, Kiev (1982), p. 225.