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Deep Culturing of the Lentinus Genus (Berk) Sing370 Edible Mushrooms on Lignocellulose Substrate

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Abstract

Shiitake, Lentinus edodes (Berk) Sing., is the second most important cultivated edible mushroom in the world. It has been prized for food because of a delicious flavor and a sweet fragrance. Besides, it possesses medicinal prophylactic.

Characteristics: interference, anti-tumor effect, hypocholesterolemic and antiviral activities. Rich protein biological mass is obtained by deep culturing of Shiitake on lignocellulosic substratum.

Keywords: mushrooms, deep culturing, lignocellulosic substratum, biological mass.

Introduction

Lentinus edodes (Berk) Sing., shiitake, is a wood destructible ilotroph, and one of the perspective species of edible mushrooms to be cultivated.

Siitake is an edible mushroom with unique medicinal prophylactic properties. Its pharmacological effect was described by the famous doctor Vu Shu, who lived as far back as Min epoch (1368–1644). This mushroom is one of the most popular in the East as a traditional source of medical means.

Shiitake is named "Elixir of Life" in China and Japan.

Presently, besides the countries of South-East Asia which have a secular history of cultivation of the mushrooms species of the *Lentinus* genus (Japan – Hokaido, Taiwan, China, Popua New Guinea, Judo – China) [1,9], in many

European countries, in South and North America the investigations on the species of this genus into industrial culture have been carried out [8,10,5].

The presence in their content of a unique complex of unchangeable amino-acids, different from the products of vegetal and animal origin, vitamins of B group (thiamine, riboflavin, niacin) and β-carotene determined the specific functional value of mushrooms of the Lentinus genus as foodstuffs.

Among lipids, which constitute up to 2% of dry weight, there are compounds of natural predominance, particularly triacylglycerine [4]. A significant place in the content of all groups of lipids belongs to the fat acids: linoleic, oleimnic and palmitinic ones [8].

The growing popularity of shiitake in the countries of Europe and America is accounted for by good taste property of the mushroom shiitake, as well as by its medical-prophylactic peculiarities widely advertised [2,3,5,6].

It possesses either interferogenic or antitumor activity, antisclerotic and antiviral action [3]. The antitumour activity of shiitake is linked with the polysaccharide-lentinan.

Lentinan is a substance which fortifies the physiological constitution of the host. Among the metabolites produced by the mushroom shiitake there are substances possessing an expressed oncostatic, antisclerotic, antioxidant action which are able to increase the immunity to the diseases, radiores instance of the organism which contribute to the strengthening of the immune system and to the decrease of the content of cholesterine [1,7,11].

Good results have been obtained on elaborating the native variants of cultivating technology of shiitake with utilization of plant growing characteristic for European countries [7,9].

However, up to date such important problems for cultivating biotechnology of shiitake, concerning its specificity of utilization of different species of lignocellulose substance at the time of obtaining the sowing materials on liquid nutrition media in a deep culture. The aim of the present work was the investigation of this problem.

Materials and Methods

The object of the investigation, culture *Lentinus edodes* (Berk) Sing 370 was obtained from the collection of Chinese Institute of Microbiology (city of Jiangsu). The culture was maintained by the method of rowing on the agar medium. The sowing mycelium was prepared on the liquid nutrition media including lignocellulose waste: sawdust, chopped straw, dry sugar-beet marc.

Cultivation was carried out during 10 days. The criterion for medium quality estimation was the quantity of biomass, obtained by the end of fermentation and the contents of crude protein in it. Cultivation was carried out in a circular shaker (220 g) at a temperature of 26°C. The obtained biomass was separated from the culture liquid by centrifugation and then it was filtered and rinsed twice with distilled water. The biomass was dried at a temperature up to 60°C until the content weight. The biomass was milled in a mixer till powder state and biochemical investigations were accomplished. The total nitrogen was determined by Kieldal's method.

Results and Discussions

Observations of the *Lentinus edodes* 370 (Berk) Sing biomass growing on media different by composition showed the advantage of the medium which included a mixture of sawdust and chopped straw (1:1) as compared with the appearance of the biomass has already been observed in 2–3 days as little fides (0.5–1.0 mm). After 7 days of cultivation the quantity of biomass on this medium constituted 10.7 g/l, and after 14 days it was 14.5 g/l (**Table 3**).

The quality of biomass was higher on medium with sawdust than on medium with chopped straw after 7 days, and after 14 days of cultivates.

Observation after growing and development of the mushroom *Lentinus edodes* 370 on the media including as source of carbon and inductor of celluloses of chopped straw, sawdust and a mixture of straw + sawdust showed that morphological properties are tightly bound with the nature of carbon source. On more favorable medium for the development of *Lentinus edodes* 370 (straw + sawdust) originally the mycelium consists of short, strongly ramifying hyphae being at different stages of development. But already after 2–3 days the hyphae are transformed into spheric forms with different diameters. The less favorable composition of medium (1 and 2) stimulates the growth of the hypha in length, increases the vegetative stage of growth, inhibits the reproduction. It is possible the increase of the necessary for the mushroom for a more tight contact with the substrate with the purpose of its more complete assimilation. Finally also on these media the biomass gains the appearance of little bids of different diameter. Chemical analysis of the mushroom biomass of *Lentinus edodes* 370 grown on the medium with a mixture of the straw and sawdust showed that the nitrogen content in the mushroom biomass on this medium constituted 1.80%, whereas in the variant with the straw and sawdust it was 1.32% and 1.40% respectivety.

Table 1 – Biomass of the mushroom *Lentinus edodes* 370 and its biochemical composition (% absolutely dry mass)

Source of carbon	Days	All biomass	Final pH	Nitrogen	Crude protein N × 6.25
Straw (control)	7	6.5	6.5	1.32	8.25
	14	8.0	4.4	1.38	8.62
Sawdust	7	7.7	4.9	1.40	8.75
	14	8.3	3.3	1.54	9.62
3. Straw + sawdust	7	10.7	4.9	1.80	11.25
	14	14.5	4.6	1.70	10.62

It is known that during the process deep cultivating of the edible basidiomycetes – xilotrophs on lignocellulose substance the main components with the release of carbon dioxide and water [7]. Thus, the nitrogen content per mass unit taking into consideration its losses because of carbon containing components (release of carbon dioxide) increases. The extent of nitrogen and mineral elements accumulation in substrates after fruit formation depends on the intensity of substrate destruction, conditioned in its turn by the availability of its components for mushroom mycelium, and by the peculiarities of its components for mushroom mycelium, and by the peculiarities of its ferment complex, the quantity of nitrogen and ashes elements, carried out with biomasses, which depends both on their content in the medium, and productivity of biomass.

By its content of raw protein the obtained biomasses of mushroom *Lentinus edodes* 370 differ between them. The highest valve was noticed in the biomass of the mushroom grown on medium including mixtures of straw and sawdust.

The obtained preliminary data testify about the fact the growing of comestible mushroom *Lentinus edodes* 370 on liquid nutrition media including lignocellulose wastes as sources of carbon and celluloses inductors is prospective. The obtained mushroom biomass can be successfully utilized but mushroom shiitake allows to obtain high quality sawing mycelium in big quantities during a shorter period of time on solid substrates.

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