Life Science Informatics Publications

Research Journal of Life Sciences, Bioinformatics, Pharmaceutical and Chemical Sciences

Journal Home page http://www.rjlbpcs.com/

RJLBPCS

ISSN 2454-6348

Original Research Article **DOI: 10.26479/2019.0501.41**

EVALUATION OF MINERAL AND ORGANIC COMPOSITION OF MUSHROOM SOUP

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ABSTRACT: Mushrooms are considered to be a potential reservoir of pharmaceutically important compounds responsible for wide range of therapeutic activities such as antimicrobial, cardiovascular and antitumour activities. Therefore progress in cultivation of mushroom can be considered as a boon towards food, medicine and employment development. In our study we have evaluated the inorganic and organic content analysis of a formulated mushroom soup sample by instrumentation techniques such as titrimetric, spectrophotometric, atomic absorption spectra (AAS) and thermo gravimetric analysis methods and also optimized the thermal death time (TDT) to increase the shelf life of the prepared food sample. Our data revealed that the mushroom soup sample contains high content of carbohydrate (67.62%) protein (13.20%) and ash content (6.36%). Vitamin C content was 22.54mg/100gm. The metal content analysis showed high content of calcium (320 mg/100 gm), magnesium (280 mg/100gm), sodium (251mg/100gm), iron (200 mg/100gm) and potassium (50 mg/100gm), and the contents of toxic metals are lower than the permissible limit which indicates substrate bed was pollution free.

KEYWORDS: Mushrooms, Minerals content, Organic content, Thermal Death Time (TDT).

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1.INTRODUCTION

Mushrooms have not only gained importance due to their immense food value but also due to their role at maintaining the balance in ecosystem by biodegradation of agricultural lingo-cellulosic waste

material. There is a recent interest among scientists upon mushrooms because of the presence of many such bioactive components which posses many therapeutic properties. Therefore it is also considered to be as 'therapeutic food'[1]. The medicinal properties of mushrooms may be attributed to their chemical composition. They are rich sources of protein, minerals, vitamins and many other essential amino acids [2]. Though nutritional analysis of many mushroom species had been carried out throughout the world but the data differs due to various factors such as strain difference, the composition of the growth substrate, developmental stages and time of harvesting and the part of the fruiting body that has been used for analysis [3]. Essential minerals content like sodium, potassium, calcium, iron, copper, zinc, magnesium and manganese are evaluated and concentration of toxic metals like cadmium, nickel, barium and mercury are also evaluated as an index of environmental pollution. The daily intake of these toxic metals can lead to excessive toxicity [4]. Literature surveys have also reported that the concentration of mineral present in macrofungus depends on factors like pattern of the ecosystem and physiology of the mushroom species [5]. Higher accumulating species are also used as bioindicators and their fruiting body can differentiate between polluted and unpolluted areas [6]**.** In our study we have evaluated the essential, toxic metals content and the organic content such as the carbohydrate, dietary fibre, protein, vitamin C, fat and cholesterol content of mushroom soup powder sample prepared at Ramkrishna Mission Ashram, Medical Plant Division, Narendrapur Unit. We have also tried to optimize the thermal death time (TDT) of the powder soup to increase the shelf life of the prepared food sample.

2. MATERIALS AND METHODS

Mushrooms species used

Pleurotus ostreatus, *P. sajor –caju*, *P. florida*, *Calocybe indica* and *Volvariella volvaceae*. Shade dried powdered mushroom samples present in the soup sample were used for analysis.

Analysis Techniques applied

The essential, toxic metals content and organic contents were analysed by instrumentation techniques such as titrimetric, spectrophotometric, atomic absorption spectra (AAS) and thermo gravimetric analysis methods [7].

Calculation of Thermal Death Time (TDT)

It is a process to calculate the heat resistance of microorganisms. It is the time required at a particular temperature to destroy one log cycle of target organisms. 5 g of powdered mushroom soup sample (before reconstitution) was mixed with 20mL of normal saline solution and was exposed to 65° C for varying intervals of time such as 15, 20, 25, 30, 35, 40, 45 and 50 minutes. Then 100µL of suspension was cultured on sterile Mueller Hinton agar plates and the colony forming units (CFU/mL) were recorded [8].

3. RESULTS AND DISCUSSION

Table 1: Organic Content analysis of the Mushroom soup sample

Sl. No.	Parameters	Results
1.	Moisture Content	9.5 %
2.	Ash Content	6.36%
3.	Total Carbohydrate Content	67.62%
4.	Dietary fibre content	2.1%
5.	Protein Content	13.20%
6.	Vitamin C (in mg/100gm)	22.54
7.	Fat content	1.22%
8.	Cholesterol (in mg/100gm)	Nil
9.	Energy value in Kcals/gm	334.38

Table 2: Essential Minerals content analysis of the Mushroom soup sample

Sl. No.	Parameters	Results (in mg/100gm)
1.	Sodium (Na)	251
2.	Potassium (K)	50
3.	Calcium (Ca)	320
4.	Iron (Fe)	200
5.	Magnesium (Mg)	280

Table 3: Toxic metals content analysis of the Mushroom soup sample

Sl. No.	Parameters	Results (mg/100gm)	Safe Limit (mg/100gm)
1.	Cadmium (Cd)	< 0.005	0.1
2.	Nickel (Ni)	0.0133	0.15
3.	Copper (Cu)	0.0001	2.0
4.	Chromium (Cr)	0.0019	2.5

The safe limits of heavy metals were given according to the guidelines of **Indian Standards** [9]**.**

Table 4: Thermal Death Time (TDT) Analysis

Sl. No.	Temperature (° C)	Time (in minutes)	Growth (CFU/mL)
1.	65	15	Uncountable growth
2.	65	20	Uncountable growth
3.	65	25	115 x 10^3
4.	65	30	50 x 10^2
5.	65	35	22 x 10^1
6.	65	40	70
7.	65	45	Nil
8.	65	50	Nil

The data shows that the mushroom soup sample contains high content of carbohydrate (67.62%), protein (13.20%) and ash content (6.36%). Vitamin C content is 22.54mg/100gm. The metal content analysis showed high content of sodium (251mg/100gm), potassium (50 mg/100gm), magnesium (280 mg/100gm), calcium (320 mg/100gm) and iron (200 mg/100gm) and the content of toxic metals such as Cadmium (< 0.005 mg/100gm**),** Nickel (0.0133 mg/100gm**),** Copper (0.0001 mg/100gm**),** Chromium (0.0019 mg/100gm**)** are lower than the permissible limit. The TDT was 65° C for 45 minutes. The organic and inorganic composition of edible mushrooms determines their nutritional efficacy. According to previous literature reports mushrooms are rich in protein, dietary fibre and mineral content but low in fat content. In our data we have found that the mushroom soup sample contains high content of carbohydrate, protein and ash content (Table 1). Mushrooms are considered to be repertoire of complex polysaccharides having antitumor and immunomodulating properties. The carbohydrates present in various mushrooms which are associated with important biological activities are: glucose, xylose, mannitol, fucose, mannose, fructose, rhamnose sucrose, maltose and trehalose [10, 11, 12, 13]. Lectins, immunomodulatory proteins of fungus, ribosome inactivating proteins, proteins showing antimicrobial activities ribonucleases and laccases have many such interesting biological activities which bind to cell surface carbohydrates. Therapeutic properties as revealed by mushroom protein lectin are especially antitumoral, and antimicrobial activities [14, 15]. Literature surveys have also revealed that the macro minerals which are commonly present in mushrooms are phosphorus, sodium, potassium, iron and zinc [16]. Our study has shown that the mushroom soup sample contains high content of sodium, potassium, magnesium and iron and the content of toxic metals are lower than the permissible limit which ensures no pollution of the substrate bed (Table 2, 3). Sodium and potassium plays an important role in maintaining the body ionic balance, metabolite transportation and tissue excitability [17]. Similarly lack of magnesium concentration causes abnormal irritability of muscles and excess content of this metal causes depression of Central Nervous System (CNS) [18]. Calcium and iron are required for healthy bones and blood respectively [19]. The thermal death time analysis shows that the mushroom soup sample when treated at 65° C for 45 minutes, the CFU/mL was nil therefore the sample contains no live forms of microorganisms (Table 4). Therefore, development of suitable formulations by mixing several mushroom components is becoming common and will be beneficial to mankind in near future [20].

4. CONCLUSION

The mushroom soup may act as good supplementary health food as it contains all the vital nutrient and minerals. The organic and inorganic content values of the prepared food sample add to the safe consumption to the populations dependent on cereal diet.

ACKNOWLEDGEMENT

The authors would like to acknowledge Mitra S. K. Pvt. Ltd. for all the instrumental analysis of the formulated soup sample.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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