

سامية محمد مصطفى



شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم



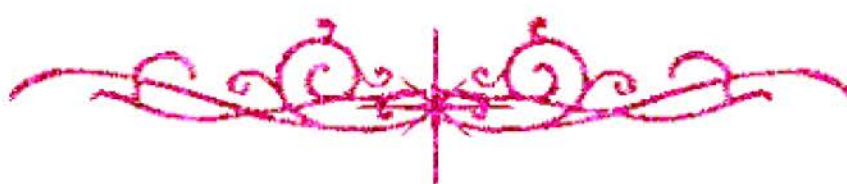
سامية محمد مصطفى



شبكة المعلومات الجامعية



شبكة المعلومات الجامعية التوثيق الالكتروني والميكرو فيلم



سامية محمد مصطفى



شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

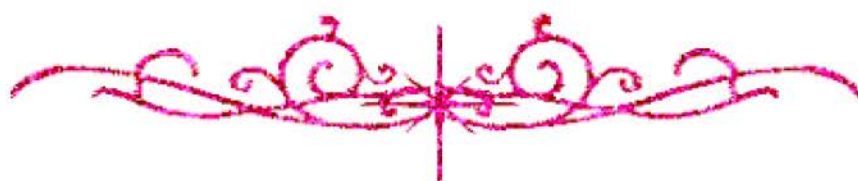
قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات



يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



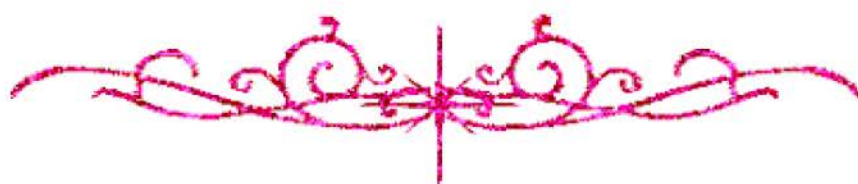
سامية محمد مصطفى



شبكة المعلومات الجامعية



بعض الوثائق الأصلية تالفة



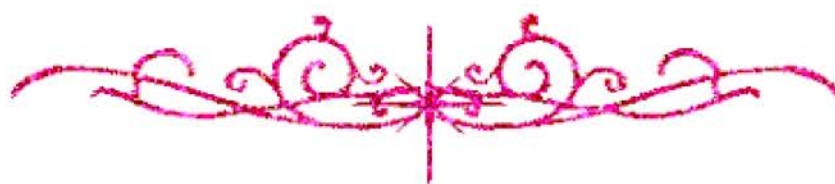
سامية محمد مصطفى



شبكة المعلومات الجامعية



بالرسالة صفحات لم ترد بالأصل



Studies on the bioconversion of some agricultural wastes using *Pleurotus* and *Agaricus* mushrooms

By

Fathy Ragab Hussein Hassan

B.Sc. Food Technology, Cairo University. 1984

M.Sc. Food Technology. Cairo University. 1995

Thesis

Submitted in Partial Fulfillment
of the Requirements for the Degree of Ph.D

In

Food Technology

Food Technology Department

Faculty of Agriculture

Cairo University

2002

B

15 C - C

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

سبحانك لا علم لنا إلا ما علمتنا

إنك أنت العليم الحكيم

صَلَّى اللَّهُ عَلَى مُحَمَّدٍ وَآلِهِ



*To soul of my parents
and
to my family*

APPROVAL SHEET

Studies on the bioconversion of some agricultural wastes using *Pleurotus* and *Agaricus* mushrooms

By

Fathy Ragab Hussein Hassan

B.Sc.(1984) Food Science and Technology Dept.

M.Sc.(1995) Food Science and Technology Dept.

Faculty of Agriculture

Cairo – University

This Thesis for Ph.D Degree has been approved

By

Prof. Dr. : Samir Mahmoud Metwaly

Prof. of Food Sci. & Tech.

Fac. of Agric. Kafer El-Shikh ., Tanta Univ.

Metwally S.M.

Prof. Dr. : Abd El-Rahman Mohamed Khalaf Allah

Prof. of Food Sci. & Tech.

Fac. of Agric. Cairo Univ.

Khalaf Allah A.M.

Prof. Dr. : Nagwa Mohamed Ahmed El-Shimi

Prof. of Food Sci. & Tech.

Fac. of Agric. Cairo Univ.

Nagwa M. El-Shimi

Dr. : Mohamed Hassan Aly Hussein

Assistant Prof. of Food Sci. & Tech.

Fac. of Agric. Cairo Univ.

M. H. Aly

Date : 9 / 5 / 2002

Committee in charge

SUPERVISION SHEET

Studies on the bioconversion of some agricultural wastes using *Pleurotus* and *Agaricus* mushrooms

By

Fathy Ragab Hussein Hassan

B.Sc.(1984) Food Science and Technology Dept.

M.Sc.(1995) Food Science and Technology Dept.

Faculty of Agriculture

Cairo – University

Under Supervision of :

Prof. Dr. : Nagwa Mohamed Ahmed El-Shimi -----

Prof. of Food Sci. & Tech.

Fac. of Agric. Cairo Univ.

Dr. : Mohamed Hassan Aly Hussein -----

Assistant Prof. of Food Sci. & Tech.

Fac. of Agric. Cairo Univ.

Prof. Dr. : Mohamed R. Ahmed Gad -----

Prof. of Food Sci. & Tech.

Food Tech. Res. Inst, Agric. Res. Center.

Acknowledgment

Firstly , all praises are due to Allah, who blessed me with kind Professors and colleagues, and gave me the support to produce this thesis.

I would like to express my appreciation and sincere gratitude to Dr. Nagwa El-Shimi, Professor of Food Technology, Faculty of Agriculture, Cairo University, for her keen supervision, valuable criticism and unlimited help during this study.

Appreciation is also extended to Dr. M.H. Aly Associate Professor of Food Technology in the same Faculty, for his kind, help and encouragement.

My sincere appreciation to Dr. M.R. Gad, Professor of Food Technology, Food Technology Research Institute, Agriculture Research Center, for his continuous guidance and help during this study.

The another feels most deeply indebted to Prof. Dr. Lin Zhanxi, the head Jun -Cao Tech. Inst., Fujian University , China, for his helpful suggestion and valuable guidance .

My thanks are also extended to Prof. Dr Lin Zhanhua, Fujian Agriculture University, China, for his helpful and encouragement.

The author wishes to express most sincere gratitude to the staff members of Asia Pacific Edible Mushroom Training Center (APEMTC), Fujian , China for their help.

Name :Fathy Ragab Hussein Hassan

Degree : Ph.D

Title of Thesis : Studies on the bioconversion of some agricultural wastes using *Pleurotus* and *Agaricus* mushrooms.

Supervisors: Prof. Dr.: Nagwa Mohamed El-Shimi

Dr. Mohamed Hassan Ali

Prof. Dr.: Mohamed R. Ahmed Gad

Department : Food Science and Technology

Branch: Food Technology

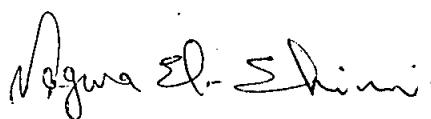
Approval date: / / 2002

ABSTRACT

The suitability of some agricultural wastes such as rice, soy bean, wheat straws as well as sawdust for cultivation of *Pleurotus ostreatus* and *Agaricus bisporus* (white and brown strain) was studied. The highest yield of *P.ostreatus* (490 g/l kg wet medium) was obtained from the medium consists of rice straw + soy bean straw. While the highest yield of *A. bisporus* (white and brown strain) being 228 and 188 g/l kg wet medium, respectively, was obtained from wheat straw medium.

Chemical composition of tested mushrooms showed that the highest values of protein, crude fiber and ash contents were (33.19, 15.28 and 10.11 %), (38.11, 15.50 and 11.21%) and (40.17, 16.77 and 12.91%) for *P.ostreatus* and *A. bisporus*, white and brown strains, in succession. Also, the tested mushrooms contained all essential and non-essential amino acids.

Pleurotus and *Agaricus* mushrooms were preserved by sun and oven drying as well as by canning. Drying process caused a decrease pattern in protein and ether extract as well as microbial count of the tested mushrooms. Among the dried samples, untreated (control) and sulfured samples showed lower color index and recorded higher rehydration ratio and organoleptic scores and were acceptable even after storage up to 12 months, while blanched sample had opposite, corresponding values for all tested mushrooms. Also, canning process caused a decrease in protein, ash and ether extract, while showed an apparent increase in crude fiber. Canned mushrooms sample were acceptable even after storage for one year. Utilization of dried mushrooms powder for supplementation of spaghetti macaroni improved its quality attributes.



CONTENTS

	Page
1-INTRODUCTION -----	1
2-AIM OF INVESTIGATION -----	6
3-REVIEW OF LITERATURE-----	7
3.1 World production of some edible mushrooms -----	7
3.2 Environmental factors affecting mushroom cultivation -----	9
3.2.1 Temperature -----	9
3.2.2 Relative humidity -----	12
3.2.3. Carbon dioxide -----	13
3.2.4 Oxygen -----	16
3.2.5 Light -----	17
3.2.6 pH value -----	18
3.3 Spawn Production -----	20
3.4.Mushroom cultivation -----	24
3.4.1. Substrates -----	24
3.4.1.1 Substrate for oyster Mushroom cultivation -----	24
3.4.1.2 Substrates used for <i>Agaricus</i> Mushrooms cultivation -----	27
3.4.1.3 Chemical composition of some wastes -----	29
3.4.2 Preparation of substrates -----	32
3.4.2.1 Preparation of the substrates for <i>Pleurotus ostreatus</i> (oyster Mushroom) -----	33
3.4.2.2. Preparation of substrates for <i>Agaricus</i> (Button Mushroom)-----	35
A- Composting (phase I) -----	35
B- Pasteurizarion (phase II) -----	38
3.4.2.3 Chemical composition of prepared media for mushroom cultivation-----	41
3.4.3. Inoculation (spawning)-----	42
3.4.3.1 Substrate inoculation with <i>Pleurotus</i> mushroom-----	43
3.4.3.2 Substrate inoculation with <i>Agaricus</i> mushroom-----	44
3.4.4. Spawn run period-----	45
3.4.4.1 Spawn run for oyster mushroom -----	45
3.4.4.2 Spawn run for <i>Agaricus</i> -----	48
3.4.5. Casing -----	50
3.4.6. Fruiting -----	53
3.4.6.1. Fruiting of oyster mushrooms -----	53
3.4.6.2 Fruiting of <i>Agaricus</i> -----	55
3.4.7 Yield of mushrooms -----	56
3.4.7.1 Yield of oyster mushrooms-----	57
3.4.7.2 Yield of button mushromms-----	58

	Page
3.4.8. Morphological properties of <i>Pleurotus</i> and <i>Agaricus</i> mushroom-----	59
3.5. Chemical composition of mushrooms -----	61
3.5.1. Moisture content -----	61
3.5.2. Protein content -----	62
3.5.3 Amino acids -----	64
3.5.4 Total carbohydrates -----	66
3.5.5. Crude fiber -----	67
3.5.6 Ash content -----	69
3.5.7 Minerals -----	70
3.5.8. Ether extract -----	71
3.5.9. Vitamins -----	73
3.6. Preservation of mushrooms -----	74
3.6.1. Preservation of mushrooms by drying -----	75
3.6.1.1. Predrying treatments -----	75
3.6.1.2. Drying methods -----	78
3.6.1.3. Storage of dried mushrooms -----	81
3.6.2 Canning of mushrooms -----	83
3.7 Miscellaneous utilization of mushrooms -----	88
4-MATERIALS AND METHODS -----	91
4-1 Materials -----	91
4-1-1 Mushroom strains-----	91
4-1-2 Substrates used for spawn preparation and cultivation -----	91
4-1-3 Cultivation bags -----	92
4.2. Methods -----	92
4.2.1 Spawn preparation -----	92
4.2.2. Cultivation of oyster mushrooms -----	93
4.2.2.1 Substrate preparation -----	93
4.2.2.2. Substrate inoculation (spawning) -----	94
4.2.2.3.Fruiting and harvesting -----	94
4.2.3Cultivation of button mushroom-----	95
4.2.3.1 Substrate preparation (composting) -----	95
4.2.3.1.1(phase I) -----	95
4.2.3.1.2 (phase II) -----	96
4.2.3.2 Spawning -----	96
4.2.3.3. Casing -----	96
4.2.3.4 Fruiting and harvesting -----	97
4.2.4. Preservation of mushrooms -----	97
4.2.4.1 Drying of mushrooms -----	98
4.2.4.1.1. Sun drying -----	98
4.2.3.1.2. Oven dehydration -----	98

	Page
4.2.4.2 Canning of mushrooms -----	99
4.2.5 Processing of spaghetti fortified mushrooms -----	100
4.2.6 Physical properties determinations -----	101
4.2.6.1. Morphological measurements -----	101
4.2.6.2. Yield and biological efficiency measurements -----	101
4.2.6.3 Drying ratio -----	101
4.2.6.4. Rehydration ratio-----	101
4.2.6.5. Cooking quality of fortified spaghetti -----	102
4.2.7. Chemical analysis -----	103
4.2.7.1. Moisture , crude protein , crude fiber , ash m organic carbon and ether extract -----	103
4.2.7.2. Determination of ascorbic acid -----	103
4.2.7.3. Determination sulfur dioxide -----	103
4.2.7.4 Determination of non enzymatic browning -----	105
4.2.7.5 Determination of minerals -----	105
4.2.7.6.Determination of Amino acids -----	105
4.2.7.7.Determination of tryptophan -----	107
4.2.7.8.Amino acids score-----	108
4.2.8. Microbiological test -----	108
4.2.9. Organoleptic evaluation -----	109
 5- RESULTS AND DISCUSSION -----	 111
5.1 Chemical composition of wastes -----	111
5.2 Chemical composition of different prepared media used for oyster cultivation -----	115
5.3 Effect of composting and pasteurization process on moisture , nitrogen , organic carbon contents and C/N ratio of the substrates- -----	119
5.4 Effect of different media on growth and yield of <i>Pleurotus</i> and <i>Agaricus</i> mushrooms -----	128
5.5. Morphological properties of <i>Pleurotus</i> and <i>Agaricus</i> -----	142
5.6.Chemical composition of mushroom strains-----	145
5.6.1.Moisture content -----	145
5.6.2 Total crude Protein-----	149
5.6.3 Crude fiber -----	151
5.6.4. Ash content -----	153
5.6.5 Ether extract -----	155
5.6.6 Total carbohydrates -----	156