Solid Waste Management through Mushroom Cultivation – An Eco Friendly Approach

Mary Josephine

***Abstract*—**Waste of certain process can be the input source of other sectors in order to reduce environmental pollution. Today there are more and more solid wastes are generated, but only very small amount of those are recycled. So, the threatening of environmental pressure to public health is very serious. The methods considered for the treatment of solid waste are biogas tanks or processing to make animal feed and fertilizer, however, they did not perform well. An alternative approach is growing mushrooms on waste residues. This is regarded as an environmental friendly solution with potential economical benefit. The substrate producers do their best to produce quality substrate at low cost. Apart from other methods, this can be achieved by employing biologically degradable wastes used as the resource material component of the substrate. Mushroom growing is a significant tool for the restoration, replenishment and remediation of Earth's overburdened ecosphere. One of the rational methods of waste utilization involves locally available wastes. The present study aims to find out the yield of mushroom grown on locally available waste for free and to conserve our environment by recycling wastes.

***Keywords*—**Biodegradable, environment, Mushroom, remediation.

I. Introduction

INADEQUATE regional food supplies, diminishing quality of health, and increasing environmental deteriorations are three key underlying problems affecting the future well-being of humankind. The magnitude of these problems is set to increase as the world's population continues to grow. The three facets of Applied Mushroom Biology combined offer partial but meaningful solutions through (1) the generation of relatively cheap source of high quality food protein using degradable cellulosic wastes (2) the provision of health-enhancing dietary supplements/mushroom nutraceuticals (Mushroom Biotechnology), and (3) the bioconversion/bioremediation of environmental adulterants and maintenance of balanced ecosystems and producing manures from spent mushroom combined with degradable waste. With the growing awareness for nutritive and quality food by growing health conscious population, the demand for food including mushrooms is quickly rising and will continue to rise with increase in global population which will be 8.3 million by 2025 and expandable income. The mushroom cultivation has grown up in almost all the parts of the world and during last three decades, the world mushroom production achieved the growth rate of about 10%. Globally, China is the leading producer of mushrooms with more than 70% of the total global production, which is attributed to community, based farming as well as diversification of mushrooms. In India, owing to varied agro-climate and abundance of farm waste, different types of temperate, tropical and subtropical mushrooms are cultivated throughout the country. It is estimated that India is generating 600 million MT of agricultural waste besides, fruit and vegetable residue, coir dust, husk, dried leaves, pruning, coffee husk, tea waste which has potential to be recycled as substrate for mushroom production leading to nutritious food as well as organic manure for crops. Hence the present study aims to produce single celled protein by utilizing degradable waste for growing mushrooms with the following objectives.

- To analyze the yield of mushroom using various categories of refuse
- Zero waste management concepts by recycling the different organic waste to grow mushroom
- Self employments especially for Women
- Solution for malnutrition problem through nutritive mushroom

Mary Josephine is with University Grants Commission, New Delhi, India (Phone: 011-23236350; Fax: 011-23239659; www.ugc.ac.in; e-mail: mary_josephine47@yahoo.com).

II. Review of Literature

Cultivation of this Mushroom is very simple and low cost production technology, which gives consistent growth with high biological efficiency. Different species of *Pleurotus* can grow well in variable temperature conditions; hence they are ideally suited for cultivation throughout the year in various regions of tropical country like India. In the recent times, the cultivation of *Pleurotus* sp. had excelled next to *Agaricus bisporus* (Lange) Sýng throughout the world in terms of yield and production [1]. These studies mainly concentrated on the cultivation on wastes of forest and agricultural plants. Almost, all the available, lignocellulosic substances are likely be used as substrate for *Pleurotus* sp. Cultivation with slightly variation in the range and combination of the substrates in different part of world based on their availability in abundant and being cheaper in the respective region [4]. Most of these studies focused on the higher yield and quality of fruiting bodies of *Pleurotus* sp. with respect to cultivation times. The present study deals with the cultivation of *P. florida* on some common and abundantly available waste available for conversion in food which otherwise is left for natural degradation. The cultivation of edible mushrooms offers one of the most feasible and economic method for the bioconversion of agro-lignocellulosic wastes In Nigeria edible mushrooms are highly priced, not only as food but also in traditional medicine [5]. Mushroom appears in traditional Yoruba art work in form of drawings on their" tie and dye" (adire) material of their traditional costume and mushroom also feature in Yoruba folklore and mythology [6]. Several authors like [7], [2] and [3] have shown in their various works that edible mushrooms are rich in ascorbic acid, amino acids, protein, minerals, glycogen, sugar and that protein is their most abundant nutrient, and also mushrooms are sought for because of their toughness, meaty taste, desirable flavor and medicinal value.

III. Materials and Methods

A. Culture and Cultivation

The pure cultures of Calocybe indica will be obtained from Tamilnadu Agricultural University, Coimbatore. The cultures were maintained on 2% malt extract agar slants at 4ºC. Sub culturing were done after every 15 days.

B. Spawn Preparation

Spawn will be prepared in polythene packets. Sorghum whole grains are boiled in water bath for 10-15min. at the ratio of 1:1 (Sorghum grains: water) and mixed with 4% (w/w) $CaCO_3$ and 2% (w/w) $CaSO_4$. Sorghum grains then will be packed (250g) in polythene bags (of 200x300mm size) and will be sterilized in an autoclave at 121ºC, for 30min. After sterilization, the bags will be inoculated with actively growing mycelium of the Calocybe from malt extract slants and incubated (at 27 ± 2ºC) for mycelial growth without any light for 10-15 days until the mycelium fully covered the grains.

C. Cultivation

The agro waste paddy straw, bagasse, coir pith and grass were collected and are used for filling the bags. The substrates will be chopped to 2-3cm pieces and soaked in water over night to moisten it and excess water was drained off. After soaking, the substrate was steam sterilized at 121ºC for 20min in an autoclave. The polythene bags of the size 35 x 45cm are filled with sterilized substrates and each bag is filled with 1kg dry substrate and the spawn will be added at the rate of 2% of the wet weight basis of substrate. After inoculation the bag will be kept in house where the temperature and humidity are maintained around 25ºC and 80 to 90% respectively with sufficient light and ventilation for 20 days. The spawn run will be completed within 18 days. The polythene bags will be tear-off following the spawn run. Formation of fruit bodies is evident within 3-4 days after removal of poly bags. The bed will be maintained up to the harvest of the third flush, which will be completed in 35 days after spawning. A small layer of substrate is scrapped off from all the side of the beds after each harvest.

Fig. 1 Fruit body of *Calocybe indica*

D. Moisture Content

The moisture content of mushroom will also be expressed in percentage.

IV. Results and Discussion

Mushrooms were grown on Paddy straw, sugarcane, bagasse, oir pith and grass. To find out the comparative yield of all he substrata mushroom was grown separately in different substrata. Among the selected substrata mushroom grown on paddy straw was found to be high in moisture, carbohydrate and fiber, and the protein content was found to be high in grass when compared with the other selected substrata. The fiber content was found to be same in all the selected substrata and was found in between 30-35%. The results proved that any biodegradable waste can be used as substrata for growing mushroom. The present study proved almost all the substrata showed has same nutritive values and can be grown on locally available waste for free and to conserve our environment by recycling the spent substrata and can be used as manure.

TABLE I
Biochemical Composition and Nutritional Analysis of *C. indica* Grown on Various Substrates

Substrates	Moisture (%)	Protein (g/100g)	Fat (g/100g)	Carbohydrate (g/100g)	Fibre (g/100g)	Ash (g/100g)
Paddy straw	88	28	0.6	60	35	7
Sugarcane Bagasse	79	25	0.8	58	30	8
Coir pith	80	30	1	55	32	7
Grass	78	30	0.5	55	30	6

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