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Mushroom antimicrobials for food safety: An Overview

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Abstract

The interest in innovating and evolving natural antimicrobials has significantly accelerated due to consumer preferences for foods that are independent of chemical preservatives while still microbiologically safe. One of the better origins of natural antimicrobials is some mushrooms (fungi) as numerous of them not only have nutraceutical capacities but also retain antimicrobial effects. This review reviews the obtainable facts on mushroom antimicrobials for food safety control. It includes available resources, extraction procedures, antimicrobial effects, and the status of their usages to food safety. The review indicates that there are great possible benefits to be built up from mushroom antimicrobials in food yield, processing, and conservation as a biosolution to catch the boosting demands for food grade and safety.

Keywords: mushroom, nutritive, antimicrobials, food safety, natural preservatives.

INTRODUCTION

Mushrooms are any of colorful fast-growing, frequently woodcolonizin fleshy fungi, belonging to Basidiomycetes, a subdivision belonging to the division Eumycota, described by the conformation of basidiospores. They can live as independent saprophytes or in association with other plants. Although some of these macrofungi are eatable, with largely desirable culinary, nutritive, and remedial characteristics, numerous mushrooms are toxic or not satisfactory. Mushrooms have evolved and/ or acclimated their metabolism in their territory for survival and for competing with other organisms. Multiple secondary or specific metabolites produced in the life cycle of mushrooms have been discovered and proved to possess antimicrobial, antioxidation, and anti-inflammation action in extension to their nutritive and culinary effect [1]. Numerous wild mushrooms have been considered to possess antimicrobial effect and are too frequently utilized as

bioresources for relating antimicrobials than are developed mushrooms. Because of public wellness risks by foodborne pathogens, food safety as a universal issue has been challenging the food processing and preserving technologies in recent days. In addition to the good nutritive and culinary effect of mushrooms, their antimicrobial action turn additionally and more charismatic to people who are looking for natural results to meet the critical requirement for food safety [2] Still, compared to the skilled quantity of facts on mushroom culture and nutrition, the reports on mushroom antimicrobial effect, specifically on their emplIt summarizes the obtainable data on mushroom antimicrobials with a focus on their possible usages in food safety operation. It especially focuses on sources, extraction processes for mushroom antimicrobials, antimicrobial effects of mushrooms against foodborne microorganisms, the diversity of mushroom antimicrobial metabolites, and the situation of usages of mushroom antimicrobials for food security ambitions.

Sources of Mushroom Antimicrobials

Although numerous breeds of mushrooms have been discovered, exclusively 2000 among 140000 identified mushroom category are safe as food (Balakumar and others 2011), and only 158 species from genera have been honored to have antimicrobial effect. To develope new origins of mushroom antimicrobials, an original webbing process for mushroom category with antimicrobial effect is frequently grounded on the ecology of the area where the mushrooms cultivate or on original application of the mushrooms [3, 4, 5].

Table 1–Mushroom genera with antimicrobial properties

S.no	Genus (main species)	Extraction solvents	References
1.	Agaricus (A. arvensis, A. bisporus, A. blazei, A. brasiliensis, A. campestris, A. devoniensis, A. gennadii, A. silvicola, A. nigrecentulus)	Water, methanol, ethanol, and ethyl acetate DCM- MeOH (1:1, v/v)	[6]
2.	*Agrocybe* (*A. aegerita, A. perfecta*)	*Ethanol, ethylacetate, and culture filtration*	[7]
3.	*Amanita* (*A. caesarea, A. castanopsidis, A. cokeri*	Water and methanol	[4]
4.	Armillaria (A. mellea)	Methanol and ethanol	[4]
5.	*Astraeus*(*A. hygrometricus*)	Methanol	[8]
6.	Auricularia (A. auricula-judae, A. polytricha	Water, ethanol, and chloroform	[9]
7.	Boletus (B. edulis	Water and ethanol	[10]
8.	*Calocybe* (*C. indica*)	Methanol	[8]
9.	*Cantharellus*(*C. cibarius, C.*	Water, methanol, and ethanol	[11]

	heinemannianus		
10.	*Daedalea* (*D. elegans*)	Methanol	[7]
11.	*Daldinia* (*D. concentrica*)	Methanol	[12]
12.	Entoloma (E.lividum)	Cultural filtration	[7]
13.	*Flammulina* (*F. velutipes*)	*Flammulina* (*F. velutipes*) Methanol	[13]
14.	*Ganoderma (G. applanatum, G. australe, G. carnosum, G. lucidum, G. pfeifferi, G. sinense)*	Water, ethyl alcohol, methanol, and acetone	[14]
15.	Hericium (H. erinaceus)	Methanol	[15]
16.	*Hygrophorus* (*H. agathosmus*)	Methanol and chloroform	[4]
17.	*Irpex* (*I. lacteus*)	Ethyl alcohol	[3]
18.	*Laetiporus* (*L. sulphureus*)	Ethanol	[16]
19.	*Lentinus (L. edodes, L. conatus, L. cladopus, L. squarrosulus)*	Water, methanol, ethanol, and chloroform, Culture filtration	[13]
20.	*Macrolepiota* (*M. procera*	Methanol and ethyl acetate	[2]
21.	*Morchella* (*M. deliciosa*) Culture filtration	*Morchella* (*M. deliciosa*) Culture filtration	[17]
22.	*Nothopanus* (*N. hygrophanus*)	Ethyl acetate	[3]
23.	Oudemansiella (O. mucida, O. canarii)	Methanol and ethyl acetate	[3]
24.	*Panus* (*P. tigrinus, P. fulvus*)	Methanol and ethanol	[18]
25.	*Piptoporus* (*P. betulinus*)	Methanol and chloroform	[19]
26.	*Ramaria* (*R. flava, R. formosa, R. botrytis*)	Methanol	[20]
27.	*Rhizopogon* (*R. roseolus*)	Water, methanol, ethanol, diethyl ether; Ethyl acetate and N-hexane	[4]
28.	*Sarcodon* (*S. imbricatus*)	Ethanol, chloroform, ethyl acetate, Acetone and dichloromethane	[4]
29.	Stereum (S. ostrea	Water, ethanol, and culture filtration	[21,22]

30.	*Termitomyces* (*T. clypeatus, T. eurhizus, T. microcarpus*	Methanol	[23]
31.	*Trametes (T. versicolor, T. Saepiara, T. strumosa)*	Ethanol	[4]
32.	*Volvariella* (*V. vulvae*)	Water, methanol, and ethanol	[23,24]

Table 2–Antimicrobial compounds from mushrooms

Chemical group	**Active compounds**	**Antimicrobial property**	**Mushrooms**	**References**
Phenolics	*p*-Anisaldehyde Phenylacetic acid Protocatechuic acid Vanillic acid	Antibacterial and ,antifungal Antifungal Antibacterial Antibacterial	Pleurotus ostreatus *Clitocybe nebularis* *A. bisporus* *Auricularia auricula-judae*	[25] [26] [27] [27]
Terpenoids	Terpene		*Pleurotus*	[28]
Sesquiterpenoids	Sesquiterpenoids Enokipodins A-D	Gram-positive bacterial	*Lentinus connatus*, *Dictyophora* *Flammulina velutipes*	[28] [29]
Steroids	Other triterpenes	Antibacterial	*Fomitopsis pinicola* *Ganoderma*	[30]
Polyketides	Merulinic acids A-C	Antimicrobial	*Merulius tremellosus*	[31]
Fatty acids	Palmitic acid	Antibacteria	Ganoderma applanatum	[32]
Proteins	Lentin	Antifungal	Antifungal	[33]
Enzymes	Ribonuclease	Antibacterail and antifungal	P. sajor-caju, Dictyophora indusiata	[33] [34]
Sulfur heterocyclics	Lenthionine	Antibacterial and antifungal	L. edodes	[35]
Quinazoline compounds	Dictyoquinazols A-C		D. indusiata	[36]

Alkaloid	Sinensines A-E		G. sinense	[37]

Conclusion

Mushroom constituents are growing hyping interest in their usages as antimicrobials agents in food safety. Although there are relatively numerous eatable mushrooms, the number of mushroom species that have been linked with antimicrobial effect is relatively small. Only 158 species from 88 mushroom genera have been described to retain antimicrobial effects against major foodborne pathogens. The most common mushrooms families with antimicrobial parcels involve Lentinus, Pleurotus, Dictyophora, Cordyceps, Ganoderma, and Tremella. The antimicrobial action of mushrooms is substantially concluded from their derivative metabolites with inhibitory effect against targeted microorganisms. Some nutritious metabolites, such as polysaccharides, proteins, and enzymes, have also been produced to own antimicrobial effects. Since multiple mushrooms have been ingested safely for times, there's a expressive better in using these multifunctional mushroom antimicrobials as choices to presently utilized antibiotics and artificial food preservatives. To dilate their usages and to maximize the advantages of mushroom antimicrobials, innovational projects and approaches require to be evolved for their mass yield and improving their effectiveness in food processing and food conservation.

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