Impact of Environmental Stress on Bioactive Compounds in Shiitake Mushrooms

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Background

Shiitake mushrooms (*Lentinula edodes*), a popular edible mushroom from East Asia, are appreciated for their nutritional value, rich aroma,

Methodology



distinctive taste, and beneficial effects on human health.

When exposed to harsh environmental conditions, mushrooms produce diverse bioactive compounds, known as secondary metabolites, which help them adapt and survive in changing environments. [1]

These compounds not only enhance the mushroom's resilience but also provide nutritional, organoleptic, and medicinal value to humans.

Research question

How does environmental stress affect the concentration and composition of bioactive compounds in shiitake mushrooms?



Analysis

SPME (DVB/CAR/PDMS) coupled with gas chromatography-mass spectrometry (HS-SPME-GC-MS).

Extraction of samples with hexane-ethanol mixture using a Soxhlet extractor, then analyzed by GC-MS.

Identification of compounds was done by comparing their spectra with those in the NIST Mass Spectral Library. Non-relevant compounds were excluded.

Preliminary results

Tab. 1: Chemical composition of shiitake samples affected by environmental stress

		formula	area			
	compuna		cold stress	control	heat stress	properties
SPME (DVB/CAR/PDMS)-GC-MS analysis	2-Methylpropanal	C4H8O	9.2	11	-	flavor - malt, pungent, green odour [2]
	2-Methylpropanol (syn. isobutanol)	C4H10O	1.7	2.02	2.67	flavor - nutty [3]
	3-Methylbutanal (syn. Isovaleraldehyde)	C5H10O	12.58	17.91	10.57	flavor - pungent, roasted, nutty, apple-like, malty odour [4, 5, 6]
	2-Methylbutanal	C5H10O	6.35	7.03	3.23	flavor - cocoa, almond [2]
	2-Methylbutanol	C5H12O	6.51	7.18	11.57	flavor - spicy characteristic and repellent odor, nutty [7, 8]
	Pentanol	C5H12O	0.21	-	0.35	flavor - sweet, balsamic, fruity, menthol, toffee [5, 9]
	Hexanal	C6H12O	0.97	2.04	1.36	antimicrobial [10]
	Diacetone alcohol	C6H12O2	2.68	3.7	4.22	volatile compound with mild, pleasant odor
	3-Hydroxy-3-methylbutanoic acid	C5H10O3	1.28	1.65	0.35	volatile compound
Soxhlet extraction + GC-MS analysis	Ethyl palmitate	C18H36O2	1.95	0.84	0.82	anti-inflammatory [11]
	Linoleic acid	C20H36O2	17.75	2.51	26.8	essential omega-6 fatty acid, cardiovascular health, neuroprotective, anti-inflammatory [12, 13]
	Ergosterol	C28H44O	41.95	69.62	44.99	provitamin D2 [14]
	Ethyl iso-allocholate	C26H44O5	2.64	5.5	3.87	Anti-microbial, anti-cancer, anti-arthritic, anti-asthma, diuretic, anti-inflammatory [15]





Results indicate that environmental stress impacts the concentration and composition of bioactive compounds.



Stress conditions mainly affected amounts of essential omega-6 fatty acid (linoleic acid) and ergosterol - provitamin D2. The results will be subject to further investigation.



This study contributes to a better understanding of environmental impacts on shiitake mushroom biochemistry and may help optimize cultivation conditions to maximize the production of desirable compounds, thereby improving its sensory and nutritional properties.

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