

Analysis of effect on harmful microorganism death rate according to ultraviolet irradiation and sterilization condition of substrate for cultivation of Oyster mushroom

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Abstract

Mycelial growth of Oyster mushroom is very important. Because the management of careless mycelial growth can be caused contamination and low yield of fruit body. To reduce contamination, it is necessary to maintain clean cooling room, inoculation room and cultivation room. First of all, we investigate death rate of microorganism according to ultraviolet(uv) irradiation in cooling room, inoculation room and contamination rate according to sterilization condition of substrate. Though contamination rates according to sterilization conditions were not showed big differences, the amount of electricity-used was the lowest at 121°C for 90 minute. As results of UV irradiation time effect on death rate of microorganism, density of bacteria was not detected after UV irradiation for 6 hours by using UV lamp(40watt) in the room of 56m³. However the death rate of fungi is not big in the same UV irradiation conditions.

Key words Contamination, Sterilization, Ultraviolet irradiation

Objective

- ◆ Analysis of microorganism death rate according to irradiation condition of ultraviolet in cooling room and inoculation room for mushroom
- ◆ Analysis of contamination rate according to sterilization condition

Material and Methods

- ◆ Media of microorganism : PDAsm(for Fungi), NA^{chx}(for Bacteria)
- ◆ Condition of UV irradiation : 2, 4, 6hr on 1.5m, 2.5m, 3.5m, individually
※ UV-c lamp(40watt, 254nm)/ 56m³
- ◆ Sterilization condition : 2, 4, 6hr at 101°C, 105°C, 109°C, individually

Results

Tab.1 The CFU of dropped organism from the air according to UV irradiation times and distances

Dropped organism in air	Distances from UV lamp	Cooling room			Inoculation room		
		control (0hr)	UV-6hr	UV-12hr	control (0hr)	UV-6hr	UV-12hr
		(CFU/Plate)					
Bacteria	1.5m	3.6	0.5	0.4	1.3	0.4	0.1
	2.5m	1.9	0.3	0.2	2.0	0.5	0.4
	3.5m	2.5	1.0	1.1	3.5	1.3	0.5
Fungi	1.5m	0.3	0	0	0	0	0
	2.5m	0.2	0.2	0	0.2	0.3	0
	3.5m	0.3	0.2	0.3	0.3	0	0.1

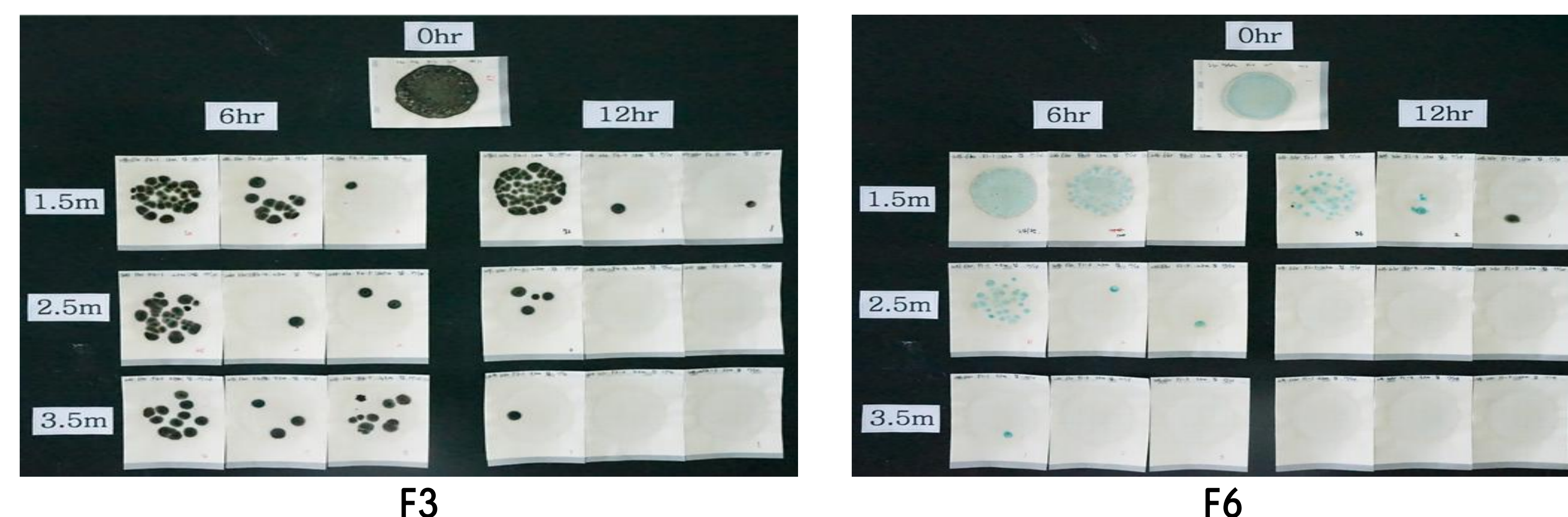


Fig.1 The Death rate of fungi according to UV irradiation in inoculation room

Tab.2 The death rate of cultured contamination organism according to UV irradiation times and distances - Cooling room (CFU/Plate)

Contamination organism	Distances from UV lamp	Cooling room				
		Control (0hr)	UV-6hr		UV-12hr	
		CFU/ml	CFU/ml	Death rate (%)	CFU/ml	Death rate (%)
Bacterial B4	1.5m	2.3 × 10 ⁶	1.1 × 10 ⁴	99.5	1.8 × 10 ²	99.9
	2.5m		3.1 × 10 ²	99.9	2.3 × 10 ²	99.9
	3.5m		2.6 × 10 ²	99.9	0	100
F1	1.5m	1.3 × 10 ⁹	1.4 × 10 ⁴	99.9	5.3 × 10 ³	99.9
	2.5m		7.0 × 10 ²	99.9	3.8 × 10 ³	99.9
	3.5m		3.7 × 10 ¹	99.9	0	100
F3	1.5m	4.2 × 10 ³	6.5 × 10 ²	84.5	5.7 × 10 ²	86.4
	2.5m		3.5 × 10 ²	91.7	5.7 × 10 ¹	98.6
	3.5m		1.4 × 10 ²	96.7	1.3 × 10 ¹	99.7
F6	1.5m	3.8 × 10 ⁶	3.6 × 10 ³	99.9	1.8 × 10 ³	99.9
	2.5m		4.8 × 10 ²	99.9	7.1 × 10 ¹	99.9
	3.5m		1.5 × 10 ²	99.9	1.7 × 10 ¹	99.9

- Inoculation room (CFU/Plate)

Contamination organism	Distances from UV lamp	Inoculation room				
		control(0hr)	UV-6hr		UV-12hr	
		CFU/ml	CFU/ml	Death rate (%)	CFU/ml	Death rate (%)
Bacteria B4	1.5m	2.1 × 10 ⁶	1.8 × 10 ⁴	99.2	4.7 × 10 ¹	99.9
	2.5m		0	100	0	100
	3.5m		1.3 × 10 ¹	99.9	0.3 × 10 ¹	100
F1	1.5m	9.4 × 10 ⁷	3.8 × 10 ³	99.9	2.0 × 10 ²	99.9
	2.5m		1.5 × 10 ²	99.9	0	100
	3.5m		2.7 × 10 ¹	99.9	0	100
F3	1.5m	4.8 × 10 ³	2.3 × 10 ²	95.2	2.5 × 10 ²	94.8
	2.5m		1.3 × 10 ²	97.3	1.3 × 10 ¹	99.7
	3.5m		1.2 × 10 ²	97.5	0.7 × 10 ¹	99.9
F6	1.5m	4.7 × 10 ⁶	2.1 × 10 ³	99.5	2.0 × 10 ³	99.5
	2.5m		2.0 × 10 ²	99.9	4.3 × 10 ¹	99.9
	3.5m		1.2 × 10 ²	99.9	0.7 × 10 ¹	99.9

※ B4: *Staphylococcus* spp., F1: *Penicillium* spp., F3: *Cladosporium* spp., F6: *Trichoderma* spp.

Tab.3 The contamination rate and amount of electricity-used according to sterilization condition of substrate

Condition of sterilization	121°C, 90min (control)	101°C			105°C			109°C		
		2hr	4hr	6hr	2hr	4hr	6hr	2hr	4hr	6hr
Contamination rate (%)	0	0.6	0.3	0	0	0	0	0	0	0
Amount of electricity-used(kwh)	4.1	5.4	6.8	9.0	3.8	5.0	5.9	4.1	5.6	6.6

Conclusions

- ◆ The amount of electricity-used and was the lowest at 121°C for 90 minute
- ◆ The UV irradiation is necessary during 12 hours for clean inoculation and cooling room.

Acknowledgement

