表一　舞菇金屬蛋白酶性質（Mizuno and Zhuang,1995）

Table 1 Properties of metal protease of *Grifola frondosa*

分子量	22,000(由凝膠過濾法或 SDS 電泳法分析) 21,000(胺基酸分析法)
等電點	pI=7.5
N 末端胺基酸;含有金屬	Thr;Zn 1 原子/mol
pH 安定性	pH3-10(4℃,8hr)，最適 pH 值為 10
抑制劑	EDTA,Dithiothreitol,1,10-phenanthanthroline
活性化有效的金屬	Mn,Zn,Cu,Co
耐熱性	50-60℃，3hr 處理，活性不下降;在 70℃下，3hr 後下降為 75%;而 80℃下 3hr 則降為 50%。

表二　由舞菇菌絲體萃取得的抗腫瘤活性多醣(Source: 水野和川合,1999)

Table 2 The anti-tumor activity polysaccharides extract from mycelium of *Grifola frondosa* .

多醣組分	收率 (%)	多糖 (%)	蛋白質(%)	構成糖 (mol 比)	投藥量 (μg×5)	腫瘤抑制率(%)	腫瘤完全退縮率(隻/隻)
熱水提取					400	24	1/10
LMFW	14.9	73	9	Glc	4000	4	0/10
冷鹼提取					400	77	3/10
LMCA	6.3	41	28	Glc	4000	100	9/9
熱鹼提取					400	71	3/10
LMHA	4.5	47	26	Glc，Man (1：0.05)	4000	99	6/10

表三　由舞菇子實體萃取所得的抗腫瘤活性多醣(Source: 水野和川合,1999)

Table 3 The anti-tumor activity polysaccharides extract from fruit body of *Grifola frondosa* .

活性多醣組成分	化學結構	分子量	$[\alpha]_D$	IR (cm^{-1})	投藥量 (mg/kg) *1, ip	腫瘤抑制率(%)	腫瘤完全退縮率(隻/隻)	ID_{50} (mg/kg, 小白鼠)
水溶性多醣								
FI_0-a-β_1	β-(1→3)-D-葡聚醣	100 萬	+9°	890	20	86	4/5	5.8
FA-1a-β_1	酸性β-(1→3)-D-葡聚醣	50 萬	+5°	890	40	100	5/5	12.9
水不溶性多醣								
FI 1-3	酸性木聚醣	5 萬	+56°	890	10	21	1/5	23.8
					100	100	5/5	
FIII-1a	酸性雜多醣	10-25 萬	+76°	—	10	31	1/5	
					100	68	3/5	16.1
FIII-2a	雜多醣-蛋白質複合體	100 萬	+58°	—	10	13	1/5	
					100	100	5/5	38.5
FIII-2b	雜多醣-蛋白質複合體	7-10 萬	+43°	—	10	36	1/5	
					100	100	5/5	13.9
FIII-2c	雜多醣-蛋白質複合體	2-5 萬	-11°	—	10	54	3/5	9.3
					100	100	5/5	

表四　不同的碳源對於舞菇菌體生長及多醣體含量之影響

Table 4　Effect of different carbon sources on mycelium dry weight and polysaccharide content in the fermentation of *Grifola frondosa.*

Group	Mycelium dry weight (mg/mL)	EPS (mg/mL)	IPS (mg/mL)
Glucose	1.13±0.15[a]	2.53 ±0.49[b]	0.29±0.01[b]
Fructose	0.80±0.17[b]	0.70±0.01[c]	0.25±0.08[b]
Sucrose	1.13±0.17[a]	0.47±0.04[d]	0.01±0.00[c]
Corn starch	0.83±0.06[ab]	6.70±0.32[a]	0.51±0.05[a]

Each value is expressed as mean±standard deriation (n=3)
Values followed by different letters in the same column are significantly different (P<0.05)

EPS:Exo-polysaccharide
IPS:Intra-polysaccharide

表五　不同的氮源對於舞菇菌絲乾重及多醣體含量之影響

Table 5　Effect of different nitrogen sources on mycelium dry weight and polysaccharide content in the fermentation of *Grifola frondosa.*

Group	Mycelium dry weight (mg/mL)	EPS (mg/mL)	IPS (mg/mL)
Yeast extract	1.05±0.21[b]	6.32 ±0.04[b]	0.60±0.16[b]
Malt extract	0.83±0.06[b]	5.63±0.63[b]	0.86±0.05[a]
Corn steep powder	1.33±0.21[a]	7.40±0.06[a]	0.86±0.05[a]

Each value is expressed as mean±standard deriation (n=3)
Values followed by different letters in the same column are significantly different ($P<0.05$)

EPS:Exo-polysaccharide
IPS:Intra-polysaccharide

表六　不同的初始碳源濃度對於舞菇菌體生長及多醣體含量之影響
Table6 Effect of different initial carbon sources concentration on mycelium dry weight and polysaccharide content in the fermentation of *Grifola frondosa.*

Group	Mycelium dry weight (mg/mL)	EPS (mg/mL)	IPS (mg/mL)
20g/L	1.57±0.06^{ab}	3.79 ±0.06^{B}	0.25±0.07^{b}
30g/L	1.70±0.26^{a}	7.74±0.94^{a}	1.12±0.11^{a}
40g/L	1.26±0.23^{b}	6.96±1.65^{a}	0.95±0.16^{a}

Each value is expressed as mean±standard deriation (n=3)
Values followed by different letters in the same column are significantly different (P<0.05)

EPS:Exo-polysaccharide
IPS:Intra-polysaccharide

表七　不同的初始 pH 值對於舞菇菌體生長及多醣體含量之影響
Table 7　Effect of different initial pH on mycelium growth and polysaccharide content in the fermentation of *Grifola frondosa.*

Group	Mycelium dry weight (mg/mL)	IPS (mg/mL)	EPS (mg/mL)
Unadjest pH	1.17±0.12[b]	0.55±0.21[b]	6.36 ±0.76[b]
pH=4	1.30±0.28[b]	0.51±0.04[b]	6.95±1.49[b]
pH=5	1.23±0.25[b]	1.35±0.49[a]	7.68±3.94[b]
pH=6	1.93±0.21[a]	1.28±0.14[a]	10.69±1.57[a]

Each value is expressed as mean±standard deriation (n=3)
Values followed by different letters in the same column are significantly different ($P<0.05$)

EPS:Exo-polysaccharide
IPS:Intra-polysaccharide

表八　不同通氣量對攪拌式發酵槽中舞菇之菌體濃度、多醣產量、及多醣所含 β-1→3-glucans 量的影響

Table 8　Effect of different aeration rate on mycelium dry weight、polysaccharide and β-1→3-glucans contents in the fermentation of *Grifola frondosa* with the stirred tank fermentor.

Group	Mycelium dry weight (mg/mL)	IPS (mg/mL)	EPS (mg/mL)	Intra-β-1→3-glucans (μg/mL LE)	Exo-β-1→3-glucans (μg/mL LE)
0.5vvm	1.10±0.26[a]	1.35±0.48[a]	12.43±1.94[ab]	5.45±1.47[b]	53.94±6.15[c]
1.0vvm	1.43±0.45[a]	1.49±0.07[a]	14.25±5.52[a]	10.45±3.24[a]	67.72±10.00[b]
1.5vvm	1.20±0.26[a]	0.90±0.21[a]	7.09±0.54[b]	4.74±0.65[b]	111.90±35.22[a]

Each value is expressed as mean±standard deriation (n=3)
Values followed by different letters in the same column are significantly different (P<0.05)

EPS:Exo-polysaccharide
IPS:Intra-polysaccharide

表九　不同通氣量在氣舉式發酵槽中培養舞菇對菌體濃度、多醣體產量及多醣中 β-1→3-glucans 含量的影響

Table 9　Effect of different aeration rate on mycelium dry weight、polysaccharide and β-1→3-glucans contents in the fermentation of *Grifola frondosa* with air-lift fermentor.

Group	Mycelium dry weight (mg/mL)	IPS (mg/mL)	EPS (mg/mL)	Intra-β-1→3-glucans (μg/mL LE)	Exo-β-1→3-glucans (μg/mL LE)
0.5vvm	1.33±0.21[a]	0.59±0.45[b]	12.69±0.62[a]	4.68±0.27[b]	39.94±9.97[a]
1.0vvm	1.03±0.40[a]	1.41±0.05[a]	9.29±0.72[b]	7.56±0.83[b]	34.93±12.85[a]
1.5vvm	1.30±0.26[a]	0.68±0.10[b]	9.33±1.70[b]	11.56±3.03[a]	40.14±10.07[a]

Each value is expressed as mean±standard deriation (n=3)
Values followed by different letters in the same column are significantly different (P<0.05)

EPS:Exo-polysaccharide
IPS:Intra-polysaccharide

表十一　在攪拌式發酵槽中不同通氣量對舞菇之多醣體分子量之影響

Table 11 Effect of aeration rate on the molecular weight of polysaccharide from the fermentation of *Grifola frondosa* with stirred tank fermentor.

	TIME	0.5 vvm	1.0 vvm	1.5 vvm
IPS(Da)	DAY3	$3.6x10^4$ $5.0x10^5$	$4.7x10^5$	$5.3x10^3$ $4.8x10^5$
	DAY7	$4.4x10^5$	$1.2x10^5$	$1.7x10^5$
EPS(Da)	DAY3	$1.3x10^6$	2.210^5 $3.3x10^6$	$4.1x10^3$ $4.6x10^4$ $4.2x10^5$
	DAY7	$6.6x10^3$ $2.0x10^6$	$2.4x10^4$ $1.6x10^5$	$1.5x10^4$ $2.9x10^5$ $4.2x10^5$

IPS:Intra-polysaccharide
EPS:Exo-polysaccharide

表十一　氣舉式發酵槽中不同通氣量對舞菇之多醣體分子量分佈之影響

Table 11 Effect of aeration rate on the molecular weight of polysaccharide from the fermentation of *Grifola frondosa* with air-lift fermentor.

	培養時間	0.5 vvm	1.0 vvm	1.5 vvm
IPS(Da)	DAY3	$3.3x10^4$	$3.6x10^4$ $5.0x10^5$	$9.6x10^3$
	DAY7	$3.9x10^5$	$4.2x10^5$	$1.1x10^4$
EPS(Da)	DAY3	$1.4x10^5$	$1.3x10^6$	$1.9x10^4$ $6.3x10^5$
	DAY7	$1.6x10^3$ $3.1x10^4$ $3.5x10^5$	$6.6x10^3$	$2.9x10^3$

IPS:Intra-polysaccharide
EPS:Exo-polysaccharide