

Comprehensive Analysis of Solid Fungi Starter by Manufacturing Conditions

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Table S1. Enzyme activity properties for various SSFS.

Strain ¹	Drying condition	Liquid starter (v/w)(%)	Enzyme activity (Unit/g)		
			α -amylase	Glucoamylase	Protease
AO 81-2	L.T. ² 35°C 24 h	1	481.0 ± 10.7	1081.8 ± 63.2	13,572.2 ± 1024.9
		3	583.9 ± 21.8	1158.0 ± 71.7	10,790.4 ± 697.1
		5	520.8 ± 13.4	857.2 ± 76.3	8314.8 ± 1,179.3
	H.T. 45°C 18 h	1	579.2 ± 14.1	869.6 ± 18.3	14,158.9 ± 1,373.4
		3	618.3 ± 17.3	933.4 ± 48.6	11,259.7 ± 1,014.3
		5	563.2 ± 25.9	791.3 ± 92.4	8933.4 ± 976.8
AO 82-3	L.T. 35°C 24 h	1	758.5 ± 23.9	1442.4 ± 104.2	16,426.6 ± 451.3
		3	858.6 ± 26.4	1611.4 ± 99.9	14,860.8 ± 292.9
		5	803.1 ± 31.3	1487.7 ± 111.4	13,196.4 ± 178.2
	H.T. 45°C 18 h	1	758.8 ± 21.4	1223.9 ± 93.7	17,651.8 ± 414.9
		3	847.7 ± 24.4	1578.4 ± 99.1	16,396.3 ± 527.6
		5	812.4 ± 20.7	1467.1 ± 72.9	14,749.6 ± 378.9
AO 2-6	L.T. 35°C 24 h	1	560.3 ± 15.5	871.9 ± 43.8	15,568.6 ± 803.2
		3	594.1 ± 19.7	990.2 ± 120.8	16,523.4 ± 1338.64
		5	685.9 ± 33.7	1285.8 ± 192.4	15,463.2 ± 1,177.9
	H.T. 45°C 18 h	1	523.6 ± 41.9	840.7 ± 34.9	14,991.7 ± 1,445.7
		3	560.3 ± 42.6	916.7 ± 136.8	15,596.2 ± 1,070.9
		5	615.5 ± 53.9	1158.2 ± 151.7	14,236.1 ± 827.4
AN IF13-3	L.T. 35°C 24 h	1	100.3 ± 15.7	2899.2 ± 18.2	22,648.0 ± 2,011.9
		3	148.7 ± 8.4	3072.3 ± 51.2	16,523.4 ± 1,338.6
		5	183.1 ± 34.8	2755.6 ± 38.1	15,468.4 ± 1,492.9
	H.T. 45°C 18 h	1	117.6 ± 26.2	1961.6 ± 28.7	21,743.8 ± 1,485.9
		3	134.5 ± 31.6	2328.4 ± 63.1	15,596.2 ± 1,070.9
		5	146.7 ± 40.9	2169.8 ± 31.5	15,631.8 ± 2,923.6
AN 4-3-2	L.T. 35°C 24 h	1	102.7 ± 6.1	2682.8 ± 24.2	27,668.8 ± 644.8
		3	156.9 ± 27.7	2862.1 ± 48.2	27,210.7 ± 1,830.4
		5	132.8 ± 40.9	2491.2 ± 36.4	21,161.6 ± 1,070.9
	H.T. 45°C 18 h	1	151.3 ± 62.4	2155.3 ± 23.9	26,757.9 ± 1,295.4
		3	67.2 ± 24.1	1759.7 ± 22.8	22,541.0 ± 2,147.2
		5	105.3 ± 25.6	2015.2 ± 23.1	22,186.2 ± 966.7

¹ AO, *A. oryzae*; AN, *A. niger*. ² L.T., low-temperature blast drying; H.T., high-temperature hot air drying condition. Value are mean ± SD (n = 3).

Table S2. Free amino acid content of SSFS (AO 81-2) by manufacturing conditions.

Compound	Treatment	AO 81-2 ¹					
		L.T. drying ²			H.T. drying		
		1%	3%	5%	1%	3%	5%
Phosphoserine		92.0±7.1 ^a	92.1±11.1 ^a	95.9±5.0 ^a	93.9±4.8 ^a	100.8±5.8 ^a	90.4±4.1 ^a
Taurine		61.9±5.4 ^a	58.5±10.5 ^{ab}	56.8±1.9 ^{ab}	63.5±2.7 ^a	50.6±2.0 ^b	55.1±2.5 ^{ab}
Aspartic acid		862.8±81.0 ^a	782.2±186.2 ^a	802.4±77.0 ^a	820.9±105.6 ^a	766.4±78.0 ^a	725.8±86.9 ^a
Threonine		393.7±37.0 ^a	337.7±80.4 ^a	359.8±35.4 ^a	354.9±44.8 ^a	346.9±33.9 ^a	333.8±37.8 ^a
Serine		353.5±31.7 ^a	324.8±74.6 ^a	336.9±31.6 ^a	344.0±41.7 ^a	326.7±30.0 ^a	319.9±36.0 ^a
Glutamic acid		1953.8±193.5 ^a	1678.0±387.1 ^a	1719.6±172.6 ^a	1869.9±248.2 ^a	1580.1±164.8 ^a	1591.7±196.2 ^a
Glycine		330.9±29.8 ^a	277.2±62.6 ^{ab}	295.1±28.5 ^{ab}	288.8±34.3 ^{ab}	271.8±23.9 ^{ab}	253.9±26.1 ^b
Alanine		579.0±445 ^a	533.9±115.6 ^a	588.7±48.3 ^a	589.8±67.9 ^a	566.1±49.2 ^a	571.2±58.9 ^a
Valine		492.1±39.8 ^a	448.3±101.0 ^a	476.4±42.9 ^a	482.8±61.0 ^a	458.0±44.7 ^a	446.6±53.5 ^a
Cystine		88.5±9.4 ^a	74.4±13.0 ^{ab}	72.1±4.5 ^{ab}	70.9±11.5 ^{ab}	68.7±8.1 ^b	57.6±11.2 ^b
Methionine		163.5±24.6 ^a	146.9±38.7 ^a	153.8±20.8 ^a	162.1±29.7 ^a	148.7±24.9 ^a	151.3±28.1 ^a
Cystathioneine		33.9±5.9 ^a	33.6±5.8 ^a	30.9±1.8 ^a	33.3±6.1 ^a	33.6±3.9 ^a	35.0±8.8 ^a
Isoleucine		365.9±36.2 ^a	341.2±80.1 ^a	355.4±35.3 ^a	358.2±49.8 ^a	349.3±40.0 ^a	341.4±47.0 ^a
Leucine		752.3±75.4 ^a	669.8±163.4 ^a	704.4±74.5 ^a	719.1±101.6 ^a	677.2±78.2 ^a	661.2±91.3 ^a
Tyrosine		203.1±42.2 ^a	192.1±58.0 ^a	192.0±28.8 ^a	185.1±39.8 ^a	184.7±39.5 ^a	171.8±47.4 ^a
Phenylalanine		442.9±55.8 ^a	402.9±103.6 ^a	395.8±42.8 ^a	419.4±66.0 ^a	388.5±57.4 ^a	356.7±65.5 ^a
β-Alanine		19.2±14.6 ^a	24.1±17.1 ^a	35.7±6.3 ^a	15.4±0.0 ^a	32.8±0.0 ^a	31.6±0.0 ^a
β-Amino isobutyric acid		19.9±16.5 ^a	22.0±15.2 ^a	26.1±13.3 ^a	10.4±0.1 ^a	19.7±15.1 ^a	20.2±11.1 ^a
γ-Amino-n-butryric acid		19.3±10.8 ^a	39.7±16.1 ^a	28.9±14.2 ^a	18.3±13.3 ^a	25.0±18.0 ^a	24.8±17.8 ^a
Ethanol amine		13.6±1.8 ^a	11.4±3.8 ^a	13.4±3.5 ^a	12.5±1.5 ^a	13.1±1.4 ^a	13.3±2.6 ^a
Ornithine		36.0±2.7 ^d	47.0±9.8 ^{cd}	57.2±4.0 ^{bc}	46.6±4.3 ^{cd}	66.2±5.5 ^{ab}	76.6±8.0 ^a
Lysine		351.5±34.8 ^a	356.8±87.9 ^a	363.6±34.5 ^a	350.2±47.7 ^a	359.9±34.5 ^a	357.8±44.8 ^a
Histidine		160.8±17.9 ^a	146.1±35.6 ^a	146.7±16.3 ^a	147.8±20.6 ^a	138.8±14.9 ^a	128.5±16.6 ^a
Arginine		678.1±77.3 ^a	661.3±166.3 ^a	621.0±71.8 ^a	646.3±102.4 ^a	574.5±74.4 ^a	528.5±80.7 ^a
Hydroxy proline		765.5±46.0 ^a	646.1±146.8 ^a	693.3±60.0 ^a	690.0±98.0 ^a	700.7±23.4 ^a	674.8±19.9 ^a
Proline		488.9±33.9 ^a	422.2±64.4 ^a	450.1±15.1 ^a	454.5±19.8 ^a	431.1±24.1 ^a	428.4±21.6 ^a
Total free amino acid		9722.7±975.7	8770.1±2,054.6	9072.0±890.7	9248.7±1,223.3	8680.1±895.6	8447.9±1,024.3

¹ AO, *A. oryzae*; ² L.T., low-temperature blast drying; H.T., high- temperature hot air drying condition.

Value are mean ± SD (n = 3), different letters within the same row differ significantly ($p<0.05$) by duncan's multiple range test.

Table S3. Free amino acid content of SSFS (AO 82-3) by manufacturing conditions.

Compound	Treatment	AO 82-3 ¹					
		L.T. drying ²			H.T. drying		
		1%	3%	5%	1%	3%	5%
Phosphoserine		190.9±6.3 ^a	164.3±22.9 ^b	149.9±4.9 ^{bc}	198.9±5.6 ^a	107.6±9.2 ^d	133.8±4.8 ^c
Taurine		58.7±2.7 ^b	56.1±4.2 ^b	59.2±5.9 ^b	55.1±2.0 ^b	67.1±5.6 ^a	54.5±4.5 ^b
Aspartic acid		944.8±88.4 ^a	752.1±223.6 ^{abc}	779.8±81.0 ^{abc}	635.2±64.3 ^c	865.0±85.6 ^{ab}	698.3±71.6 ^{bc}
Threonine		421.8±34.4 ^{ab}	355.2±82.6 ^{bcd}	386.9±40.3 ^{abc}	293.7±29.4 ^d	454.8±48.4 ^a	316.9±32.3 ^{cd}
Serine		391.1±33.9 ^a	321.8±82.5 ^{abc}	353.9±35.0 ^{ab}	261.0±25.5 ^c	401.8±7.9 ^a	295.8±29.0 ^{bc}
Glutamic acid		1939.9±187.5 ^a	1541.9±450.5 ^{abc}	1593.9±165.3 ^{abc}	1238.6±132.0 ^c	1768.7±185.1 ^{ab}	1465.3±144.7 ^{bc}
Glycine		353.3±33.6 ^{ab}	292.8±77.3 ^{bcd}	329.3±31.3 ^{abc}	242.0±22.8 ^d	389.9±38.8 ^a	263.0±26.2 ^{cd}
Alanine		637.3±55.3 ^a	523.2±138.0 ^{ab}	528.2±47.7 ^{ab}	461.5±39.0 ^b	496.7±42.4 ^b	496.1±47.9 ^b
Valine		541.1±50.4 ^a	428.6±133.1 ^{ab}	435.6±48.4 ^{ab}	375.1±35.5 ^b	456.8±56.1 ^{ab}	404.0±44.2 ^b
Cystine		85.4±11.8 ^b	69.5±22.2 ^b	83.0±14.3 ^b	64.3±9.1 ^b	113.4±15.5 ^a	61.5±16.2 ^b
Methionine		184.2±28.7 ^a	147.9±48.6 ^a	162.3±30.0 ^a	138.7±22.9 ^a	173.3±26.3 ^a	140.9±32.5 ^a
Cystathioneine		31.7±6.7 ^a	19.5±17.6 ^a	29.1±10.8 ^a	32.9±5.5 ^a	21.2±18.6 ^a	24.8±14.6 ^a
Isoleucine		403.9±41.8 ^a	319.0±96.9 ^{ab}	335.6±42.2 ^{ab}	293.6±35.4 ^b	331.0±34.1 ^{ab}	302.7±48.3 ^{ab}
rLeucine		784.0±79.0 ^a	628.4±183.7 ^{ab}	662.1±81.1 ^{ab}	536.6±61.6 ^b	680.9±70.4 ^{ab}	599.3±79.8 ^{ab}
Tyrosine		231.1±41.3 ^a	178.2±56.7 ^a	197.0±50.7 ^a	177.8±38.8 ^a	189.2±27.6 ^a	175.5±52.1 ^a
Phenylalanine		460.0±55.8 ^a	353.8±121.3 ^{ab}	370.4±65.7 ^{ab}	20.5±46.7 ^b	390.7±44.1 ^{ab}	339.9±61.6 ^{ab}
β-Alanine		36.9±0.0 ^a	31.6±0.0 ^a	30.0±0.0 ^a	37.2±0.0 ^a	31.9±0.0 ^a	17.4±22.8 ^a
β-Amino isobutyric acid		18.3±16.1 ^a	15.5±15.0 ^a	15.2±12.6 ^a	21.9±21.2 ^a	10.7±12.1 ^a	17.6±15.3 ^a
γ-Amino-n-butryic acid		35.4±25.9 ^a	31.5±27.6 ^a	29.3±30.0 ^a	34.6±24.7 ^a	26.8±22.9 ^a	25.3±20.4 ^a
Ethanol amine		15.3±2.3 ^a	15.4±2.5 ^a	15.1±1.4 ^a	13.3±2.8 ^a	15.3±1.7 ^a	13.2±1.0 ^a
Ornithine		68.9±4.4 ^b	73.8±6.0 ^{ab}	80.2±7.1 ^a	71.4±6.4 ^{ab}	64.6±5.3 ^b	66.3±5.9 ^b
Lysine		436.3±42.2 ^a	375.0±84.0 ^{ab}	380.4±39.4 ^{ab}	341.1±34.8 ^{ab}	414.9±42.2 ^{ab}	329.4±33.6 ^b
Histidine		174.6±16.9 ^a	137.9±42.8 ^{ab}	144.7±15.4 ^{ab}	118.2±12.5 ^b	167.7±17.6 ^a	124.6±13.9 ^b
Arginine		752.1±90.0 ^a	561.1±226.5 ^{ab}	523.1±73.2 ^b	509.8±67.1 ^b	591.2±73.9 ^{ab}	515.3±70.0 ^b
Hydroxy proline		866.5±21.7 ^a	676.3±156.5 ^{bc}	756.7±73.2 ^{ab}	569.4±36.7 ^c	882.6±94.7 ^a	629.1±85.5 ^{bc}
Proline		499.7±21.4 ^a	401.4±81.6 ^{bc}	409.8±18.4 ^{bc}	347.5±16.7 ^c	428.5±17.6 ^b	381.3±19.3 ^{bc}
Total free amino acid		10,563.2±99.5	8471.9±2,404.1	8840.7±1,025.4	7390.1±798.9	9542.3±1,033.7	7892.0±998.2

¹ AO, *A. oryzae*; ² L.T., low-temperature blast drying; H.T., high- temperature hot air drying condition.

Value are mean ± SD (n = 3), different letters within the same row differ significantly ($p<0.05$) by duncan's multiple range test.

Table S4. Free amino acid content of SSFS (AO 2-6) by manufacturing conditions.

Compound	Treatment	AO 2-6 ¹					
		L.T. drying ²			H.T. drying		
		1%	3%	5%	1%	3%	5%
Phosphoserine		99.6±5.7 ^{ab}	61.8±13.8 ^c	85.6±3.7 ^b	89.0±1.9 ^{ab}	100.3±8.2 ^a	101.4±7.0 ^a
Taurine		59.3±3.3 ^a	43.3±5.4 ^b	50.9±4.0 ^{ab}	59.5±6.6 ^a	57.9±4.0 ^a	54.5±6.0 ^a
Aspartic acid		725.1±68.1 ^a	359.8±39.7 ^c	558.1±60.3 ^b	772.6±79.1 ^a	730.5±49.6 ^a	700.9±70.5 ^a
Threonine		316.3±28.5 ^b	136.4±14.1 ^d	225.3±24.0 ^c	408.1±43.7 ^a	343.5±23.8 ^b	305.6±29.8 ^b
Serine		294.8±27.0 ^b	90.7±7.6 ^d	214.7±22.0 ^c	347.7±34.3 ^a	267.3±17.7 ^b	261.9±25.6 ^b
Glutamic acid		1558.6±148.8 ^{ab}	731.5±46.7 ^d	1138.0±116.3 ^c	1673.5±175.3 ^a	1563.8±108.7 ^{ab}	1410.3±135.3 ^b
Glycine		250.9±22.9 ^{bc}	45.1±3.6 ^e	144.1±12.3 ^d	330.5±31.8 ^a	262.8±17.0 ^b	219.6±18.9 ^c
Alanine		507.0±43.7 ^a	451.5±46.0 ^a	450.1±44.2 ^a	485.8±44.6 ^a	509.7±28.4 ^a	518.7±44.7 ^a
Valine		422.7±40.0 ^a	284.1±33.7 ^b	348.6±42.2 ^{ab}	419.3±61.8 ^a	420.9±27.1 ^a	416.7±41.5 ^a
Cystine		73.3±10.3 ^{ab}	N.D.	47.4±12.5 ^b	97.2±27.3 ^a	65.0±5.8 ^b	62.5±12.8 ^b
Methionine		137.2±22.6 ^{ab}	44.7±8.9 ^c	98.0±20.8 ^b	149.1±37.9 ^a	125.7±16.1 ^{ab}	124.5±23.3 ^{ab}
Cystathioneine		35.3±6.5 ^{ab}	8.7±2.1 ^b	34.0±7.0 ^{ab}	14.5±25.2 ^{ab}	20.1±17.8 ^{ab}	37.6±9.8 ^a
Isoleucine		331.5±35.3 ^a	195.7±30.4 ^b	273.4±39.3 ^a	309.9±50.4 ^a	316.2±23.3 ^a	329.1±39.4 ^a
Leucine		638.7±67.8 ^a	380.9±55.2 ^c	505.2±65.3 ^b	654.3±85.8 ^a	620.2±42.7 ^{ab}	613.5±72.0 ^{ab}
Tyrosine		188.8±41.5 ^a	81.0±21.1 ^b	152.0±38.7 ^a	173.3±44.3 ^a	145.7±18.4 ^b	180.6±46.5 ^a
Phenylalanine		370.7±52.4 ^a	212.3±47.1 ^b	289.3±52.8 ^{ab}	365.3±58.0 ^a	362.4±33.6 ^a	354.8±59.1 ^a
β-Alanine		46.2±0.0 ^a	22.8±14.1 ^a	34.9±0.0 ^a	30.5±0.3 ^a	16.5±0.0 ^a	49.3±0.0 ^a
β-Amino isobutyric acid		37.7±52.6 ^a	12.3±3.6 ^a	20.9±20.1 ^a	17.1±11.1 ^a	10.7±1.8 ^a	40.3±55.2 ^a
γ-Amino-n-butryric acid		21.0±17.9 ^a	48.9±64.3 ^a	23.2±25.2 ^a	20.2±16.3 ^a	11.2±10.8 ^a	31.3±29.8 ^a
Ethanol amine		13.3±0.8 ^a	9.6±3.8 ^a	16.6±9.4 ^a	16.8±2.2 ^a	14.6±0.8 ^a	22.0±11.8 ^a
Ornithine		51.3±4.2 ^{abc}	19.6±5.4 ^d	48.7±3.8 ^{bc}	58.0±4.9 ^a	44.4±2.6 ^c	56.8±4.9 ^{ab}
Lysine		327.5±31.8 ^a	155.1±4.7 ^c	262.0±27.2 ^b	364.3±38.3 ^a	320.9±23.2 ^a	322.7±33.1 ^a
Histidine		127.9±15.1 ^a	51.4±3.7 ^c	93.1±10.0 ^b	146.0±15.5 ^a	132.6±11.2 ^a	123.6±13.4 ^a
Arginine		563.4±67.7 ^a	383.9±16.1 ^c	438.7±76.2 ^{bc}	532.4±68.7 ^{ab}	522.7±47.7 ^{ab}	508.3±66.0 ^{ab}
Hydroxy proline		618.0±57.9 ^b	284.9±26.5 ^d	457.5±11.2 ^c	785.0±103.4 ^a	693.8±23.1 ^{ab}	599.4±65.0 ^b
Proline		397.4±2.7 ^a	326.2±5.0 ^b	344.3±7.4 ^b	393.4±19.8 ^a	399.2±20.1 ^a	396.3±21.9 ^a
Total free amino acid		8213.4±875.2	4442.4±522.4	6354.3±755.9	8713.3±1,088.7	8078.8±583.6	7842.2±943.2

¹ AO, *A. oryzae*; ² L.T., low-temperature blast drying; H.T., high- temperature hot air drying condition.

³ N.D., Not detected. Value are mean ± SD (n = 3), different letters within the same row differ significantly ($p<0.05$) by duncan's multiple range test.

Table S5. Free amino acid content of SSFS (AN IF 13-3) by manufacturing conditions.

Compound	Treatment	AN IF 13-3 ¹					
		L.T. drying ²			H.T. drying		
		1%	3%	5%	1%	3%	5%
Phosphoserine		116.5±5.3 ^{ab}	107.2±1.3 ^b	101.1±11.3 ^b	141.0±26.1 ^a	141.0±29.1 ^a	112.5±6.5 ^{ab}
Taurine		59.3±7.2 ^a	60.2±3.9 ^a	58.7±8.0 ^a	66.6±13.0 ^a	59.9±2.2 ^a	55.8±0.6 ^a
Aspartic acid		870.1±135.8 ^a	846.4±92.9 ^a	726.7±107.9 ^a	897.0±230.2 ^a	713.7±100.7 ^a	793.0±74.6 ^a
Threonine		439.3±68.3 ^a	386.8±41.4 ^{ab}	322.5±45.3 ^{ab}	419.9±109.7 ^a	289.7±41.1 ^b	389.6±36.9 ^{ab}
Serine		388.5±58.6 ^a	364.6±40.4 ^a	299.4±41.0 ^a	387.6±98.8 ^a	278.3±39.9 ^a	350.8±33.7 ^a
Glutamic acid		1931.8±299.0 ^a	1952.1±219.5 ^a	1680.7±248.7 ^a	2043.6±529.5 ^a	1684.0±260.0 ^a	1758.3±162.5 ^a
Glycine		350.2±53.2 ^a	317.9±33.2 ^{ab}	255.1±35.6 ^{bc}	332.9±86.2 ^{ab}	174.4±22.1 ^c	310.9±29.3 ^{ab}
Alanine		603.4±91.4 ^a	592.6±58.3 ^a	538.5±76.9 ^a	654.9±173.2 ^a	621.3±80.7 ^a	573.4±44.9 ^a
Valine		515.2±83.2 ^a	499.6±50.6 ^a	448.8±68.2 ^a	551.2±150.9 ^a	483.3±61.4 ^a	481.8±43.2 ^a
Cystine		90.2±17.8 ^a	81.8±15.6 ^a	69.5±14.7 ^a	79.6±23.6 ^a	58.7±7.9 ^a	81.7±12.1 ^a
Methionine		180.8±40.5 ^a	166.9±30.0 ^a	149.3±33.7 ^a	189.7±64.0 ^a	152.6±26.8 ^a	169.3±28.4 ^a
Cystathioneine		32.4±10.6 ^a	35.8±10.8 ^a	34.1±9.6 ^a	29.7±19.3 ^a	39.9±6.4 ^a	34.8±7.6 ^a
Isoleucine		383.0±65.2 ^a	368.4±43.0 ^a	329.9±54.2 ^a	399.4±117.5 ^a	349.1±49.9 ^a	358.3±36.7 ^a
Leucine		760.9±130.4 ^a	744.0±86.2 ^a	651.9±104.7 ^a	790.9±227.1 ^a	682.0±100.0 ^a	698.3±71.8 ^a
Tyrosine		202.2±47.4 ^a	178.0±37.5 ^a	157.3±39.5 ^a	162.4±55.3 ^a	161.7±37.1 ^a	172.3±36.8 ^a
Phenylalanine		441.7±80.1 ^a	444.4±65.6 ^a	385.7±72.6 ^a	460.5±129.9 ^a	402.0±69.2 ^a	405.9±52.1 ^a
β-Alanine		43.7±15.3 ^a	26.8±7.6 ^{bc}	N.D. ³	44.9±14.4 ^a	N.D.	33.2±5.1 ^{ab}
β-Amino isobutyric acid		75.8±41.5 ^{ab}	22.7±9.7 ^c	N.D.	88.0±40.7 ^a	11.8±8.9 ^c	39.5±6.2 ^{bc}
γ-Amino-n-butryic acid		39.2±27.6 ^a	19.5±8.9 ^{ab}	7.9±6.9 ^b	37.5±21.9 ^{ab}	12.1±8.0 ^{ab}	14.5±8.0 ^{ab}
Ethanol amine		18.6±1.3 ^a	14.1±0.8 ^{bc}	13.3±2.0 ^{bc}	19.0±4.3 ^a	11.7±1.4 ^c	17.1±0.7 ^{ab}
Ornithine		50.0±7.4 ^a	25.9±3.0 ^b	26.0±3.6 ^b	40.9±11.6 ^a	23.5±2.0 ^b	46.7±3.7 ^a
Lysine		407.6±68.9 ^a	371.9±42.7 ^a	325.4±51.4 ^a	413.8±117.9 ^a	284.5±39.5 ^a	370.6±36.4 ^a
Histidine		172.8±33.3 ^a	162.2±22.4 ^a	133.8±22.3 ^a	179.2±52.3 ^a	125.1±18.1 ^a	153.3±21.0 ^a
Arginine		710.7±133.7 ^a	687.6±87.4 ^a	596.8±108.3 ^a	736.7±216.5 ^a	647.6±101.7 ^a	638.1±71.4 ^a
Hydroxy proline		857.5±99.5 ^a	759.0±71.9 ^{ab}	624.2±74.5 ^{ab}	788.6±232.9 ^{ab}	558.6±97.6 ^b	743.0±64.5 ^{ab}
Proline		502.2±33.8 ^{ab}	480.0±21.6 ^{ab}	430.4±28.5 ^b	536.5±92.2 ^a	483.2±51.8 ^{ab}	479.2±25.7 ^{ab}
Total free amino acid		10,243.5±1,656.4	9716.3±1,106.2	8366.7±1,269.6	10,491.7±2,858.9	8449.6±1,263.8	9281.9±920.3

¹ AN, *A. niger*; ² L.T., low-temperature blast drying; H.T., high- temperature hot air drying condition. ³

N.D., Not detected. Value are mean ± SD (n = 3), different letters within the same row differ significantly ($p<0.05$) by duncan's multiple range test.

Table S6. Free amino acid content of SSFS (AN 4-3-2) by manufacturing conditions.

Compound	Treatment	AN 4-3-2 ¹					
		L.T. drying ²			H.T. drying		
		1%	3%	5%	1%	3%	5%
Phosphoserine		129.8±6.3 ^{ab}	150.9±14.3 ^a	127.3±14.0 ^{ab}	160.8±56.4 ^a	132.4±17.0 ^{ab}	105.0±23.4 ^b
Taurine		58.6±5.3 ^b	55.6±1.7 ^b	59.0±6.4 ^b	62.6±7.4 ^b	63.4±10.3 ^b	79.5±11.5 ^a
Aspartic acid		738.6±98.8 ^a	773.2±84.1 ^a	784.4±80.2 ^a	786.8±179.5 ^a	791.5±149.3 ^a	888.9±165.4 ^a
Threonine		387.0±54.2 ^a	393.8±44.3 ^a	420.5±44.9 ^a	384.5±83.0 ^a	388.4±73.4 ^a	495.8±98.4 ^a
Serine		308.3±37.6 ^a	323.7±33.7 ^a	347.9±30.7 ^a	332.8±75.6 ^a	319.6±54.8 ^a	398.6±67.9 ^a
Glutamic acid		1589.6±209.7 ^a	1753.6±192.0 ^a	1711.1±178.2 ^a	1745.9±396.5 ^a	1781.5±343.2 ^a	1925.4±369.3 ^a
Glycine		305.9±34.2 ^{ab}	296.0±29.4 ^b	327.8±28.0 ^{ab}	318.1±75.4 ^{ab}	303.6±50.3 ^{ab}	400.4±67.1 ^a
Alanine		513.8±61.2 ^a	576.6±54.4 ^a	544.3±51.7 ^a	560.8±122.0 ^a	558.2±99.3 ^a	550.2±98.5 ^a
Valine		451.8±63.8 ^a	495.6±53.8 ^a	473.2±51.8 ^a	480.8±101.7 ^a	476.6±94.4 ^a	504.0±94.7 ^a
Cystine		95.0±15.0 ^a	89.2±12.6 ^a	97.3±10.2 ^a	87.8±17.4 ^a	90.5±20.8 ^a	120.4±26.8 ^a
Methionine		158.7±29.8 ^a	161.7±27.1 ^a	180.7±28.5 ^a	155.2±38.6 ^a	167.9±42.1 ^a	186.6±44.3 ^a
Cystathioneine		35.9±7.9 ^a	37.4±6.4 ^a	32.5±7.0 ^a	38.3±11.5 ^a	34.5±10.7 ^a	36.8±6.6 ^a
Isoleucine		340.0±48.4 ^a	367.9±44.3 ^a	353.9±40.3 ^a	355.5±77.8 ^a	357.1±71.9 ^a	379.8±73.3 ^a
Leucine		652.4±96.0 ^a	714.3±87.3 ^a	689.4±84.5 ^a	691.4±155.8 ^a	701.5±145.9 ^a	743.9±151.4 ^a
Tyrosine		182.3±40.7 ^a	195.1±41.0 ^a	199.2±34.2 ^a	182.2±54.8 ^a	193.6±49.1 ^a	217.1±52.1 ^a
Phenylalanine		387.4±63.7 ^a	419.0±57.5 ^a	400.6±54.1 ^a	408.3±98.0 ^a	418.2±91.7 ^a	443.1±91.6 ^a
β-Alanine		46.7±16.5 ^a	49.6±14.8 ^a	41.9±10.1 ^a	49.1±20.4 ^a	41.0±24.4 ^a	37.9±9.3 ^a
β-Amino isobutyric acid		72.8±37.5 ^a	79.8±41.6 ^a	57.3±24.7 ^a	80.2±46.1 ^a	55.6±45.9 ^a	40.5±20.8 ^a
γ-Amino-n-butryic acid		26.3±19.4 ^a	30.6±23.1 ^a	26.0±19.5 ^a	22.1±16.5 ^a	27.6±19.3 ^a	26.1±14.7 ^a
Ethanol amine		18.4±0.9 ^a	18.6±3.0 ^a	21.1±2.0 ^a	18.0±4.1 ^a	16.4±2.9 ^a	20.7±2.8 ^a
Ornithine		32.1±4.3 ^a	39.4±3.0 ^a	32.3±3.4 ^a	34.2±8.3 ^a	29.9±6.4 ^a	38.7±7.5 ^a
Lysine		375.9±57.4 ^a	365.7±42.5 ^a	395.4±46.9 ^a	381.4±84.4 ^a	376.5±79.3 ^a	446.9±94.9 ^a
Histidine		162.0±27.8 ^a	155.1±16.8 ^a	158.8±17.9 ^a	167.1±42.7 ^a	160.7±32.4 ^a	187.8±43.3 ^a
Arginine		634.8±114.4 ^a	663.9±94.0 ^a	659.2±96.8 ^a	669.4±161.7 ^a	682.2±159.9 ^a	700.8±156.6 ^a
Hydroxy proline		761.4±93.2 ^a	775.1±53.3 ^a	801.4±83.6 ^a	771.5±117.5 ^a	767.9±108.9 ^a	962.7±170.6 ^a
Proline		430.1±15.3 ^a	477.0±31.3 ^a	463.1±10.4 ^a	463.1±99.2 ^a	453.9±48.2 ^a	469.4±40.7 ^a
Total free amino acid		8895.7±1,259.2	9458.6±1,107.5	9405.4±1,060.0	9407.8±2,152.3	9390.4±1,851.4	10,406.9±2,003.3

¹ AN, *A. niger*; ² L.T., low-temperature blast drying; H.T., high- temperature hot air drying condition.

Value are mean ± SD (n = 3), different letters within the same row differ significantly ($p<0.05$) by duncan's multiple range test.