

# Comparative Study on Quality of Fuel Pellets from Switchgrass Treated with Different White-Rot Fungi

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## SUPPLEMENTARY DATA

Table S1. Actual and coded factor values of the independent variables in the fungal pretreatment.

Code	Actual Value			
$z_j$	Fermentation time, $x_1$ (d)	Fermentation temperature, $x_2$ (°C)	Inoculum concentration, $x_3$ (mL)	Hammer mill screen size, $x_4$ (mm)
1	35	34	15	6.4
0	28	28	10	3.2
-1	21	22	5	1.6

Table S2. Physical and mechanical properties of the fungal-treated switchgrass pellets.

Run	Fermentation temperature (°C)	Fermentation time (d)	Inoculum concentration (mL)	Hammer Mill Screen size (mm)	<i>T. versicolor</i> 52J (TV52J)			<i>T. versicolor</i> m4D (m4D)			<i>Phanerochaete chrysosporium</i> (PC)		
					Pellet unit density (kg/m <sup>3</sup> )	Tensile strength (MPa)	Dimensional stability (%)	Pellet unit density (kg/m <sup>3</sup> )	Tensile strength (MPa)	Dimensional stability (%)	Pellet unit density (kg/m <sup>3</sup> )	Tensile strength (MPa)	Dimensional stability (%)
1	28.0	35.0	5.0	4.0	1154.99	1.414	0.080	1161.49	0.988	0.09	1096.02	2.073	1.43
2	34.0	28.0	10.0	6.4	1176.34	1.54	0.360	1168.08	1.410	0.04	1142.95	2.300	0.73
3	34.0	28.0	15.0	4.0	1148.25	1.53	0.320	1160.78	1.745	0.28	1170.75	1.766	-0.14
4	28.0	28.0	5.0	1.6	1142.13	1.429	0.130	1143.89	1.410	-0.01	1155.32	1.048	0.21
5	34.0	28.0	5.0	4.0	1169.56	1.611	0.210	1165.70	1.291	0.40	1138.91	1.502	0.81
6	34.0	21.0	10.0	4.0	1142.94	1.312	-0.160	1136.00	1.370	1.08	1155.70	1.424	-0.53
7	28.0	28.0	10.0	4.0	1111.67	1.438	0.850	1151.08	0.909	0.51	1056.73	1.780	2.02
8	28.0	21.0	5.0	4.0	1124.51	0.943	0.700	1125.85	1.290	0.32	1130.42	1.340	0.30
9	22.0	35.0	10.0	4.0	1142.82	1.409	0.190	1126.92	1.210	-0.22	1135.10	1.766	0.61
10	28.0	35.0	15.0	4.0	1160.09	2.069	0.380	1132.73	1.409	0.34	1079.18	1.328	-1.32
11	28.0	21.0	15.0	4.0	1146.29	1.353	0.550	1132.09	0.937	0.31	1154.66	1.590	-0.49
12	28.0	21.0	10.0	1.6	1130.70	1.187	0.040	1138.01	1.041	0.08	1157.39	0.916	-0.26
13	28.0	28.0	15.0	1.6	1175.80	0.879	0.230	1131.10	1.375	-0.03	1133.33	1.369	0.71
14	28.0	28.0	10.0	4.0	1143.03	1.605	0.230	1147.10	1.339	-0.01	1061.32	1.816	1.46
15	22.0	28.0	15.0	4.0	1139.78	1.606	0.280	1142.69	1.145	-0.42	1117.71	1.485	-0.65
16	22.0	28.0	5.0	4.0	1128.81	0.925	0.280	1115.04	0.866	0.16	1025.11	1.190	0.23
17	28.0	28.0	10.0	4.0	1151.28	1.297	0.420	1146.68	1.359	0.03	1171.25	1.356	0.06
18	28.0	35.0	10.0	1.6	1158.08	1.783	0.080	1143.77	1.306	-0.02	1040.85	1.290	-1.72
19	28.0	28.0	5.0	6.4	1173.53	1.283	0.370	1127.54	1.359	0.54	1135.61	1.374	1.26
20	22.0	21.0	10.0	4.0	1127.00	1.201	0.220	1122.41	1.156	0.51	1134.94	1.403	0.20
21	28.0	35.0	10.0	6.4	1159.57	1.587	0.250	1163.66	1.353	0.59	1170.22	1.390	-0.35
22	22.0	28.0	10.0	6.4	1144.36	1.019	0.200	1143.92	0.963	0.07	981.93	0.805	2.87
23	28.0	21.0	10.0	6.4	1145.40	0.896	0.020	1132.62	1.129	0.26	1140.28	1.239	0.34
24	28.0	28.0	10.0	4.0	1143.19	1.211	0.150	1136.55	1.224	0.62	1144.86	1.375	1.01
25	34.0	28.0	10.0	1.6	1160.89	1.194	0.040	1161.82	1.088	0.36	1164.19	1.810	0.43
26	28.0	28.0	10.0	4.0	1159.99	1.412	0.690	1149.13	1.030	0.54	1143.89	1.476	1.20
27	28.0	28.0	15.0	6.4	1143.08	1.569	-0.290	1152.45	1.321	0.17	1150.50	1.490	0.29
28	34.0	35.0	10.0	4.0	1159.99	1.484	1.110	1155.55	1.704	0.07	1161.51	2.011	0.74
29	22.0	28.0	10.0	1.6	1148.12	1.109	0.140	1141.28	1.020	0.38	1021.26	1.103	1.32

Table S3. Optimum conditions for producing switchgrass pellets pretreated by the fungal strains used in this study under solid-state fermentation.

Fungal strains	Fermentation time (d)	Fermentation temperature (°C)	Inoculum concentration (mL)	Hammer mill screen size (mm)	Pellet tensile strength (MPa)	Pellet unit density (kg/m <sup>3</sup> )	Dimensional stability (%)
Untreated	—	—	0	3.2	0.751	1068.76	2.03
m4D	35.0	34.0	15.0	6.1	1.761	1157.22	0.246
	30.0	34.0	13.2	6.4	1.539	1165.46	0.335
TV52J	35.0	23.3	15.0	6.4	2.001	1150.57	0.290
	30.0	34.0	8.6	6.4	1.523	1176.35	0.359
PC	35.0	34.0	5.0	6.4	2.252	1187.44	0.428
	21.0	34.0	15.0	4.9	2.029	1164.56	0.754

m4D: *T. versicolor* m4D; PC: *P. chrysosporium*; TV52J: *T. versicolor* 52J.

Table S4. Elemental composition of untreated and fungal-treated switchgrass.

Sample Treatment	Ultimate Analysis (%)						
	C	H	N	S	O	H/C	O/C
Untreated	48.43 ± 0.29	6.01 ± 0.05	0.17 ± 0.06	0.05 ± 0.03	45.33 ± 0.28	0.124	0.94
m4D T1	47.61 ± 0.34	5.86 ± 0.03	0.25 ± 0.16	0.07 ± 0.05	46.21 ± 0.32	0.123	0.97
m4D P1	44.95 ± 1.83	5.54 ± 0.23	0.19 ± 0.25	0.02 ± 0.03	49.3 ± 2.18	0.123	1.10
PC T1	46.26 ± 0.57	5.73 ± 0.06	0.14 ± 0.03	0.03 ± 0.01	45.39 ± 0.65	0.124	0.98
PC P1	44.78 ± 1.41	5.53 ± 0.18	0.17 ± 0.03	0.12 ± 0.03	49.41 ± 1.54	0.123	1.10
TV52J T1	45.89 ± 0.47	5.65 ± 0.06	0.21 ± 0.23	0.12 ± 0.04	48.12 ± 0.51	0.123	1.05
TV52J P1	45.85 ± 0.67	5.65 ± 0.08	0.22 ± 0.13	0.04 ± 0.002	48.24 ± 0.67	0.123	1.05

m4D T1 = *T. versicolor* m4D treated switchgrass with the highest pellet tensile strength.

m4D P1 = *T. versicolor* m4D treated switchgrass with the highest pellet unit density.

PC T1 = *P. chrysosporium* treated switchgrass with the highest pellet tensile strength.

PC P1 = *P. chrysosporium* treated switchgrass with the highest pellet unit density.

TV52J T1 = *T. versicolor* 52J treated switchgrass with the highest pellet tensile strength.

TV52J P1 = *T. versicolor* 52J treated switchgrass with the highest pellet unit density.

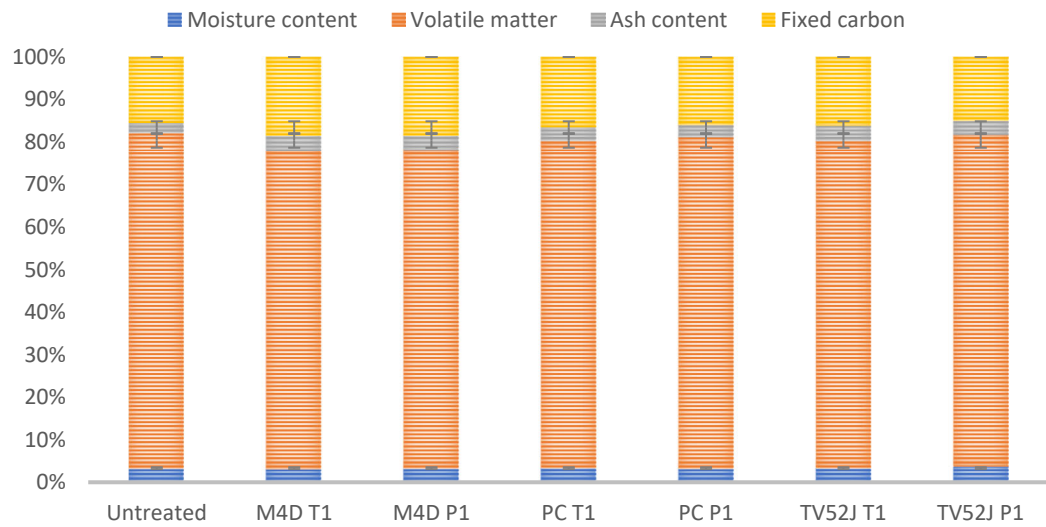


Figure S1. Proximate composition of the untreated and fungal-treated switchgrass. M4D T1 = *T. versicolor* m4D treated switchgrass with the highest pellet tensile strength; m4D P1 = *T. versicolor* m4D treated switchgrass with the highest pellet unit density; PC T1 = *P. chrysosporium* treated switchgrass with the highest pellet tensile strength; PC P1 = *P. chrysosporium* treated switchgrass with the highest pellet unit density; TV52J T1 = *T. versicolor* 52J treated switchgrass with the highest pellet tensile strength; TV52J P1 = *T. versicolor* 52J treated switchgrass with the highest pellet unit density.