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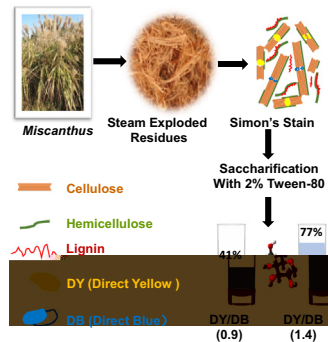
# -80 Miscanthus

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## HIGHLIGHTS

- Miscanthus
- 2% -80
- 77%
- 14.8-
- 10
- $p < 0.05$
- 0.01
- Miscanthus

## GRAPHICAL ABSTRACT



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## ABSTRACT

Miscanthus  
 17% 40% (%  
 2% -80  
 7  
 10  
 77%  
 14.8-  
 Miscanthus  
 $p < 0.05$  0.01  
 Miscanthus  
 © 2017

## 1. Introduction

\*  
 430070,  
 E-mail addresses: 2007  
 URL: // ( )  
 // /10.1016/ .2017.04.114  
 0960-8524/© 2017

2013).  
 ( , 2011),  
 ( )  
 ( )  
 ( , 2014; , 2015, 2014; , 2015; , 2013),  
 ( , 2013);  
 2015).  
 ( , 2011).  
 ( , 2012).  
 ( , 1988; , 1994).  
 ( , 2010; , 2009; 2013),  
 ( )  
 ( , 1950)  
 ( , 1953;  
 2005).  
 ( , 2001; , 2008; , 2009, 2015, 2016; , 2013, 2015).  
 ( ~1 )  
 ( ~5 36 )  
 ( , 2001; , 2008; , 2009, 2015, 2016; , 2013, 2015).  
 ( , 2016).  
 ( , 2010).  
 ( , 2014)  
 ( , 2015).  
 ( , 2016).  
 Miscanthus  
 ( , 2012).

*Miscanthus*  
 ( , 2012; , 2012; , 2013, 2014 , ; , 2013; , 2015),  
*Miscanthus*  
*Miscanthus*  
 ( )  
 (6.4 500 )  
 -80  
 15 ( 15)  
 ( / )  
 11 ( 11)  
 20  
*Miscanthus*  
**2. Materials and methods**  
 2.1. Plant samples  
 5/6- *Miscanthus*  
 50 ° , 40  
 2.2. Plant wall polymer extraction  
 (2000)  
 (2013).  
 2.3. Colorimetric assay of hexoses and pentoses  
 ( -1100 )  
 / 2 4  
 ( , 1988),  
 ( , 1962).  
 ( )  
 620  
 660  
 2.4. Total lignin and monolignol assay  
 ( , 2008).  
 (2014 ).  
 18 ( (4.6 × 250 , 5 μ )  
 -20  
 280 3 : 2 : (25:74:1, / / )  
 ( : 1.1 / ) ,  
 20 μ .

## 2.5. Hemicelluloses monosaccharide determination by GC-MS

... ( ) myo- ...  
 ... 1- ...  
 ... ( ), ... ( ), ... ( ), ... ( ),  
 ... ( ), ... ( ),  
 ... (2010)  
 ... (2012).  
 ... 70 ... 50 500 m/z  
 ... 0.45 ... 0.999

## 2.6. Cellulose crystalline index (CrI) detection

... ( ) ... (2013).  
 / ... ( )  
 ...  

$$= 100 \times (I_{200} - I_{110}) / I_{200}$$
 ... (1959);  $I_{200}$   
 $I_{200}$  ( $I_{200}, \theta = 22.5^\circ$ ),  
 $I_{110}$  ( $I_{110}, \theta = 18.5^\circ$ )  
 200 110 ... 0.05 0.15

## 2.7. Measurement of degree of polymerization (DP) of cellulose

... (0.2 1 ) Miscanthus  
 ... 4 ... 1.0 /  
 (10 ) 25° 1 ... (2810×g)  
 5 ... 4 ... 7.0.  
 ... 10 8% ... 2  
 (8 ... 2 ... 100  
 1.5 ... ) 25° 72 ( ... 2,  
 12 ).  
 ... 7.0,  
 ... ( , 1984)  
 ( ... , 2015).  
 25 0.5°

## 2.8. Steam explosion pretreatment

Miscanthus  
 (2.5 , 180 )  
 ( ... -200, ... )  
 ... (2015).  
 ( ) Miscanthus

2.11. Statistical calculation of correlation coefficients

Miscanthus (, 2012; , 2013).

3. Results and discussion

3.1. Distinct wall polymer extraction from steam explosion pretreatment in ten Miscanthus accessions

Miscanthus (, 1).  
 26.64% 41.45%, 22.89%  
 32.11% 19.99% 24.79%,  
 Miscanthus  
 (, 2015), 52% 67%  
 Miscanthus  
 16% 42%  
 (, 1). 17% 71%  $p < 0.05$  0.01.  
 Miscanthus  
 42% 6  
 71%, 9  
 Miscanthus (, 2015).

3.2. Varied biomass enzymatic saccharification of Miscanthus samples enhanced by Tween-80

(, )  
 (%),  
 (, 2012; , 2016).  
 Miscanthus  
 5% 15% (%),  
 (, 1),  
 17% 40% (, 1),  
 2.3 7.0  
 2% -80  
 41% 77% (, 1),  
 5.3 (2) 14.8 (7)  
 (, 1), 10  
 -80,  
 Miscanthus  
 -80, Miscanthus  
 (,  
 Miscanthus  
 (, 2016; , 2008).

Table 1

	Miscanthus									
(%)	1	2	3	4	5	6	7	8	9	10
	34.32 ± 0.96	35.57 ± 1.59	41.45 ± 1.07	38.94 ± 1.70	35.47 ± 0.52	38.33 ± 0.73	37.29 ± 0.21	27.07 ± 1.50	26.64 ± 0.60	35.18 ± 1.17
	38.71 ± 2.65	45.35 ± 0.65	43.06 ± 1.83	45.42 ± 0.33	40.22 ± 1.23	41.32 ± 0.47	43.58 ± 0.35	43.75 ± 2.77	45.64 ± 1.24	42.38 ± 0.87
	30.65 ± 0.81	26.69 ± 0.77	31.97 ± 0.48	24.78 ± 0.76	32.11 ± 0.59	27.21 ± 0.80	27.70 ± 1.13	29.90 ± 0.02	24.77 ± 0.30	22.89 ± 0.88
	14.44 ± 0.80	12.65 ± 0.28	13.36 ± 0.26	11.47 ± 0.26	11.70 ± 0.22	10.36 ± 0.06	10.84 ± 0.13	9.87 ± 0.19	10.31 ± 0.25	11.08 ± 0.24
	-52.89%	-52.60%	-58.21%	-53.71%	-63.56%	-61.93%	-60.87%	-66.99%	-58.38%	-51.59%
	24.79 ± 0.30	24.14 ± 0.25	24.21 ± 1.43	24.13 ± 0.23	23.44 ± 0.62	22.53 ± 0.35	23.31 ± 0.21	21.60 ± 0.53	19.99 ± 0.60	20.46 ± 0.36
	20.73 ± 0.34	18.45 ± 0.73	17.41 ± 0.42	16.45 ± 0.58	19.01 ± 0.09	15.86 ± 0.44	17.17 ± 0.93	16.21 ± 1.16	17.62 ± 1.18	17.16 ± 0.83
	-16.38%	-23.57%	-28.09%	-31.83%	-18.90%	-42.06%	-26.34%	-24.95%		

$p < 0.05$  ( = 3).

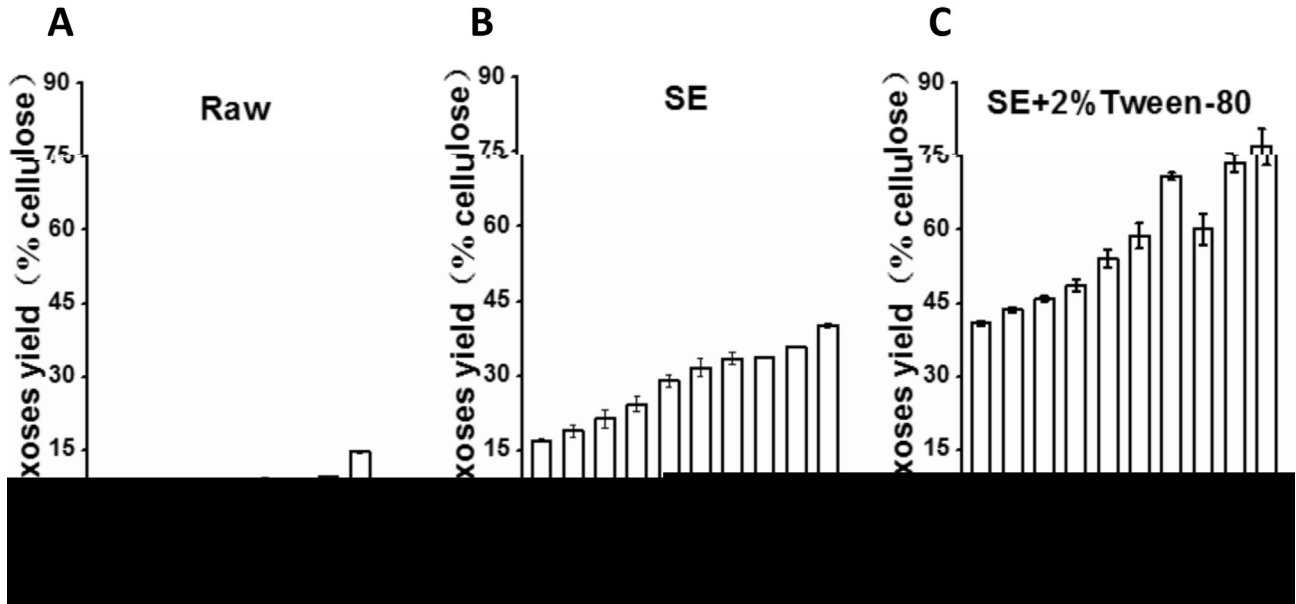


Fig. 1. Xoses yield (% cellulose) of *Miscanthus* samples under different treatments: (A) Raw, (B) SE, and (C) SE+2% Tween-80. Each treatment was performed in triplicate (n = 3).

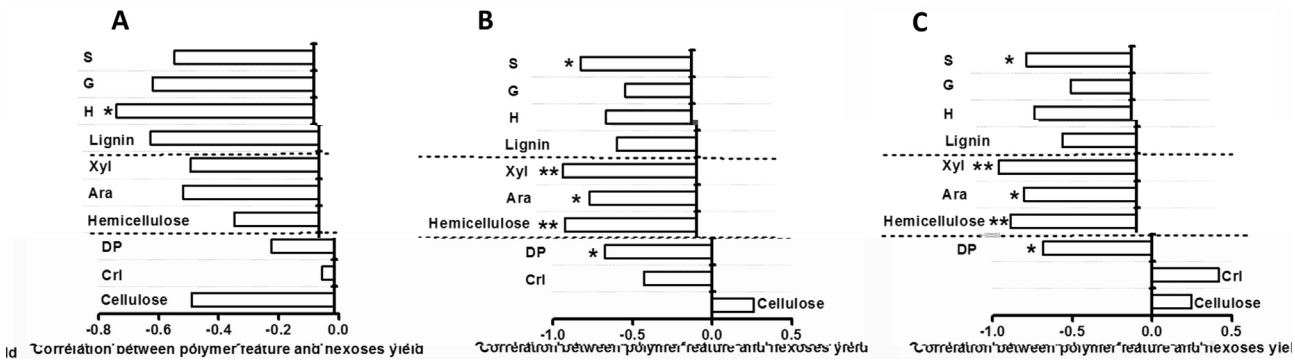


Fig. 2. Correlation between polymer feature and xoses yield of *Miscanthus* samples under different treatments: (A) Raw, (B) SE, and (C) SE+2% Tween-80. \* p < 0.05, \*\* p < 0.01 (n = 10).

3.3. Negative impacts of lignocellulose features on biomass enzymatic saccharification

(Sun et al., 2015; Sun et al., 2014; Sun et al., 2016).

Under the SE treatment, the xoses yield of *Miscanthus* samples was significantly increased (p < 0.05) by the addition of 2% Tween-80 (Sun et al., 2016).

*Miscanthus* samples under different treatments: (A) Raw, (B) SE, and (C) SE+2% Tween-80. Each treatment was performed in triplicate (n = 3).

hus (Sun et al., 2016; Sun et al., 2015).

*Miscanthus* samples under different treatments: (A) Raw, (B) SE, and (C) SE+2% Tween-80. Each treatment was performed in triplicate (n = 3).

p < 0.05 11 *Miscanthus*

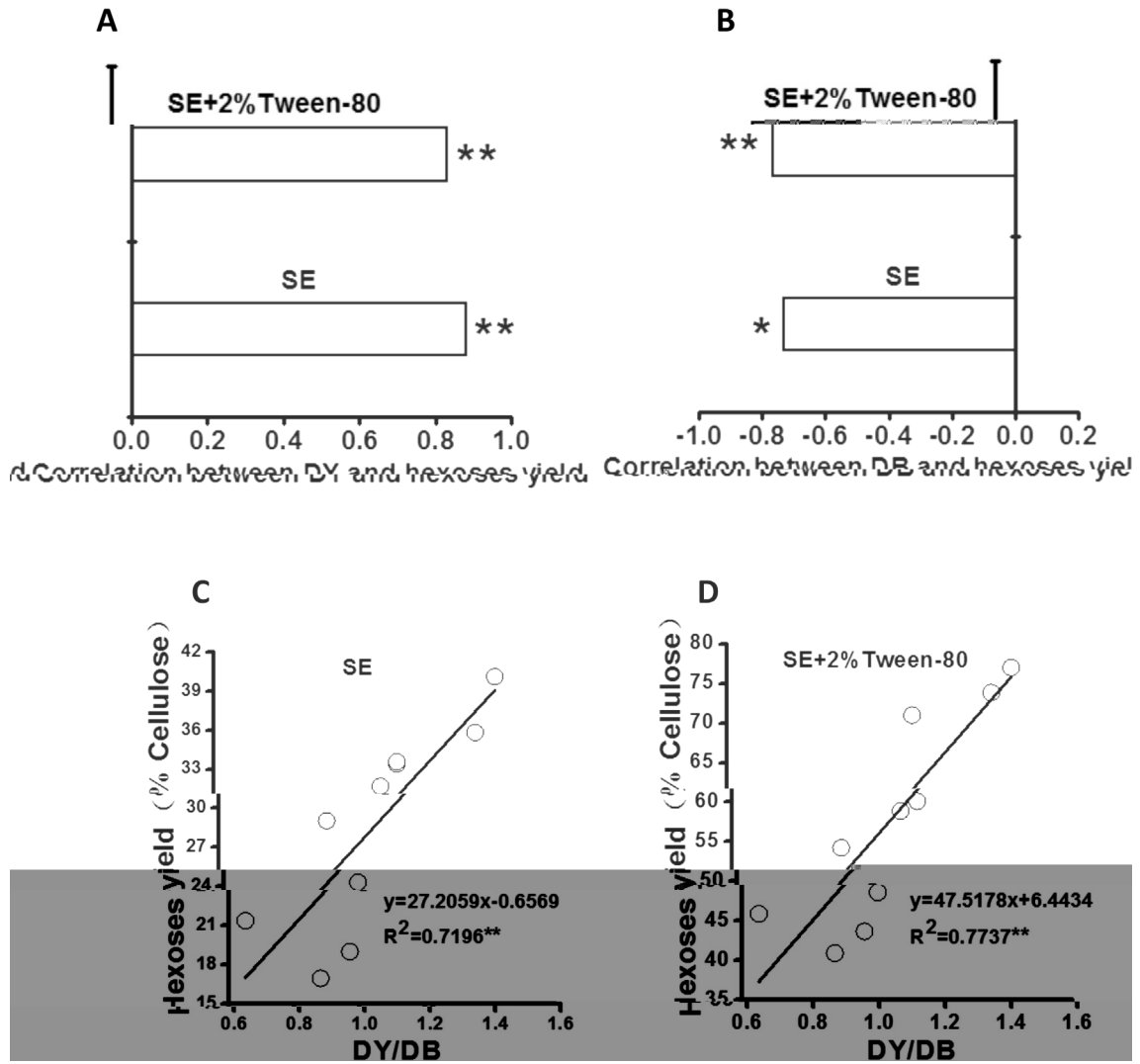


Fig. 3. Correlation analysis of hexoses yield with DY and DB. (A) Correlation between DY and hexoses yield. (B) Correlation between DB and hexoses yield. (C) Scatter plot of Hexoses yield (% Cellulose) vs. DY/DB. (D) Scatter plot of Hexoses yield (% Cellulose) vs. DY/DB. Miscanthus 2% Tween-80. \*\*  $p < 0.05$ , \*  $p < 0.01$  ( $n = 10$ ).

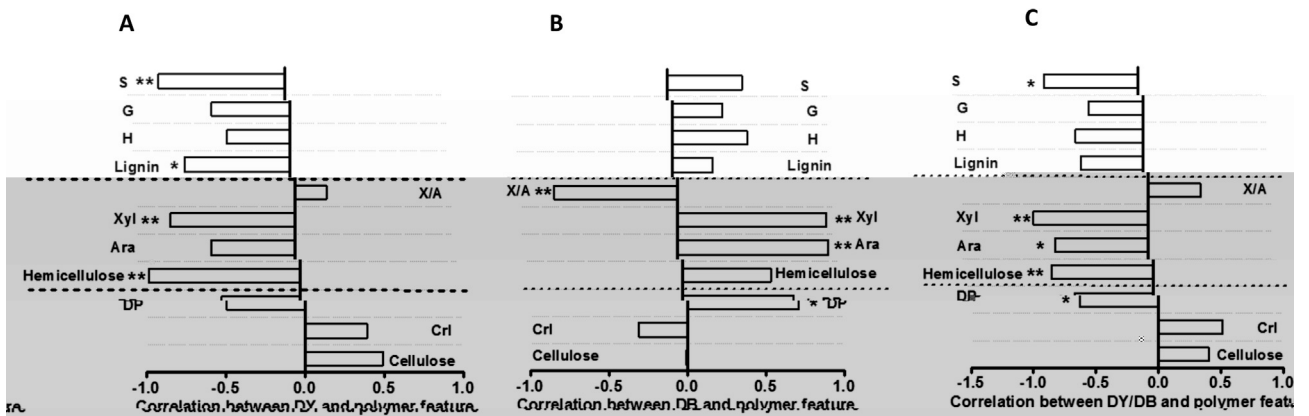
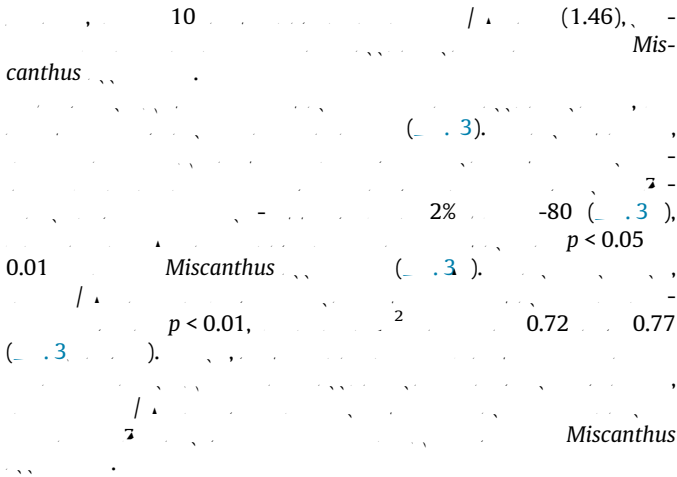


Fig. 4. Correlation analysis of polymer features with DY and DB. (A) Correlation between DY and polymer feature. (B) Correlation between DB and polymer feature. (C) Correlation between DY/DB and polymer feature. Miscanthus 2% Tween-80. \*\*  $p < 0.05$ , \*  $p < 0.01$  ( $n = 10$ ).

(2001). The effect of lignin on the digestibility of forage is controversial (Liu et al., 2013). Miscanthus 2% Tween-80 (DY/DB = 0.65/1.46) (Table 3).



3.5. Mechanisms that link wall polymer feature, lignocellulose porosity and biomass saccharification

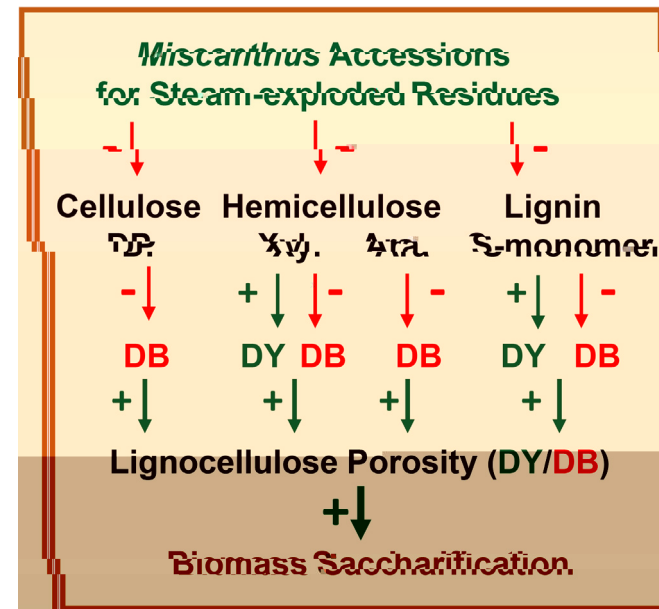
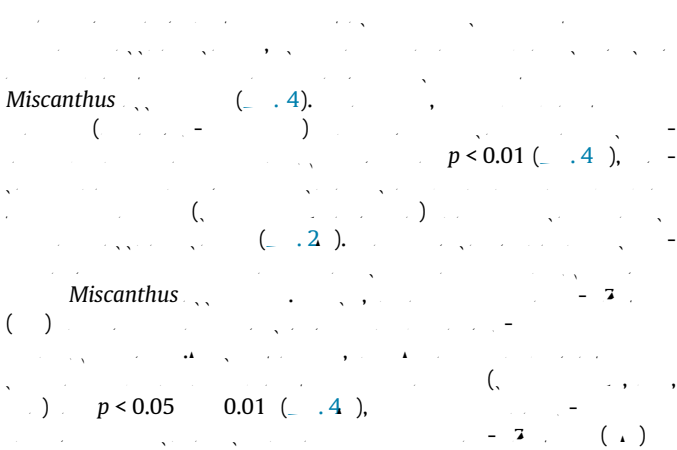
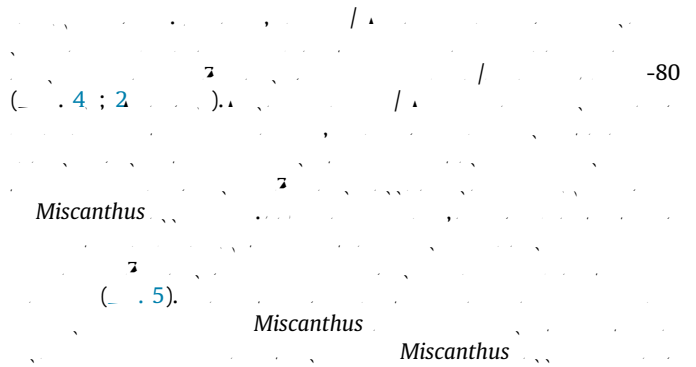
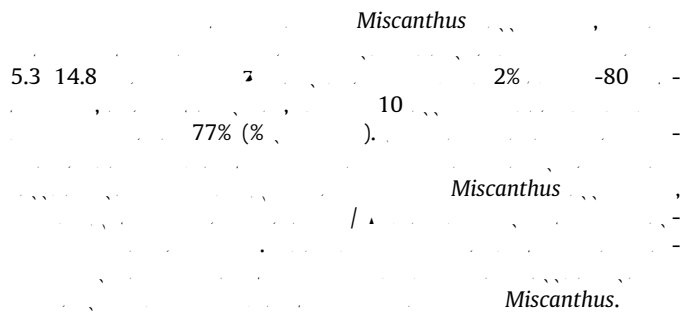


Fig. 5. Miscanthus accessions for steam-exploded residues. Cellulose, Hemicellulose, and Lignin values are shown for three accessions. Statistical significance is indicated by asterisks and p-values.



4. Conclusion



Acknowledgements

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Appendix A. Supplementary data

Supplementary data to this article can be found online at: <http://dx.doi.org/10.1016/j.biortech.2017.04.114>.

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2012. 110.

190 197.

1962.

( ), 1.

477 512.

1994.

*Trichoderma reesei*. 265, 524

528.

2012.

67, 60 67.

2001.

17, 1049

1054.

1988.

95 97.

2012.

*Miscanthus*.

121, 274 281.

2015.

*G. barbadense* *G. hirsutum*.

181, 224 230.

2014.

9,

108449.

2016. -80

175, 82 90.

2005.

87, 41 45.

2009.

48, 3713 3729.

2013.

130, 629 637.

2014.

*Miscanthus*.

169, 447 456.

2014.

*Miscanthus*. 9, 105115.

2014.

167,

14 23.

2015.

13, 514 525.

2013.

144, 467 476.

2015.

*Populus*. 17, 4239 4246.

1953.

149 154.

2016.

203, 325 333.

2000.

*Arabidopsis*

1984.

211, 406 414.

26, 1219 1222.

1959.

29, 786 794.

2015.

*Miscanthus*

183, 248 254.

1950.

312 314.

2008.

/ -510-42618.

2011.

*Populus*

108, 6300 6305.

1988.

32, 698 706.

2016.

34, 997 1017.

2016.

11, 2124 2137.

2014.

162, 175 183.

2013.

6, 183.

2011.

53, 143 150.

2012.

*Miscanthus*.

1995.

5, 58 70.

78, 175 180.

2013.

*Miscanthus*.

2013.

130, 30 37.

2013.

104,

1036 1044.

2008.

3817 3828.

99,