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-80 *Miscanthus*

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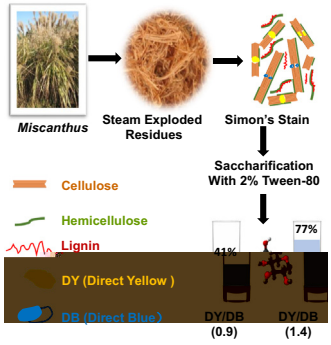
HIGHLIGHTS

- *Miscanthus*
- ( )
- 2% -80
- _

GRAPHICAL ABSTRACT



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ABSTRACT

Miscanthus
17% 40% (%)
( ) 2% -80 7
14.8- 10
77% *Miscanthus*
$p < 0.05$ 0.01
(/)
Miscanthus

1. Introduction

*
430070,
E-mail addresses: 2007 ( ).
URL: :// ( ).

:// /10.1016/ .2017.04.114
0960-8524/

; (., 2013). (, 2011), ( ) ( ) (., 2014; ., 2015, 2014 ; ., 2015; ., 2013), (., 2013; ., 2015). (., 2014 , ; ., 2011). (, 2010; ., 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). -80 (., 2016). *Miscanthus* (., 2012). *Miscanthus* (., 2012; ., 2012; ., 2013, 2014 , ; ., 2013; ., 2015), *Miscanthus* . , *Miscanthus* , ( ) . -80 - , (6.4 500). , 11 (11) 15 (15) , (/) , *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 × ($I_{200} - I$)/I_{200} (., 1959); I_{200}
200 (I_{200}, θ = 22.5°),
I (I , θ = 18.5°)
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 , 6 42% 9 71%, (., 2015). *Miscanthus* , .

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

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

Table 1 (%) *Miscanthus* .

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**
		27.65%		16.64%			16.87%	61.62%	71.32%	20.47%
	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%		

( ) ± (= 3). * ** t- $p < 0.05$ 0.01 (= 3).

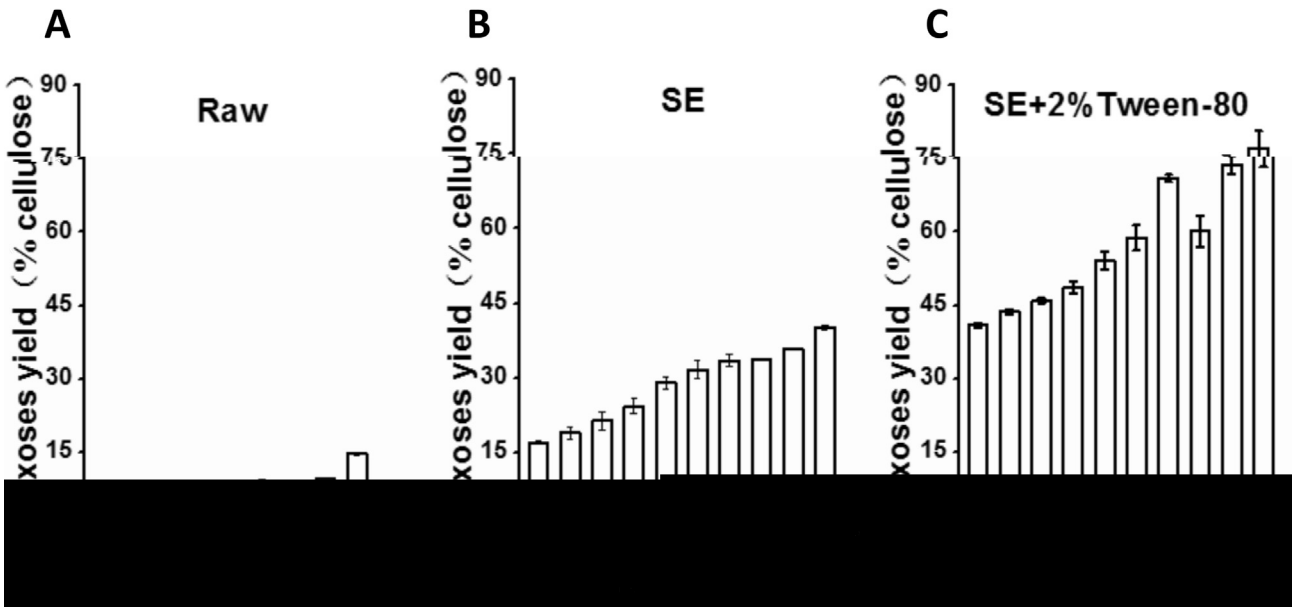

Fig. 1. (%) 7 *Miscanthus* : ( ) , ( ) - ( ) ( ) - 2% -80; (= 3).

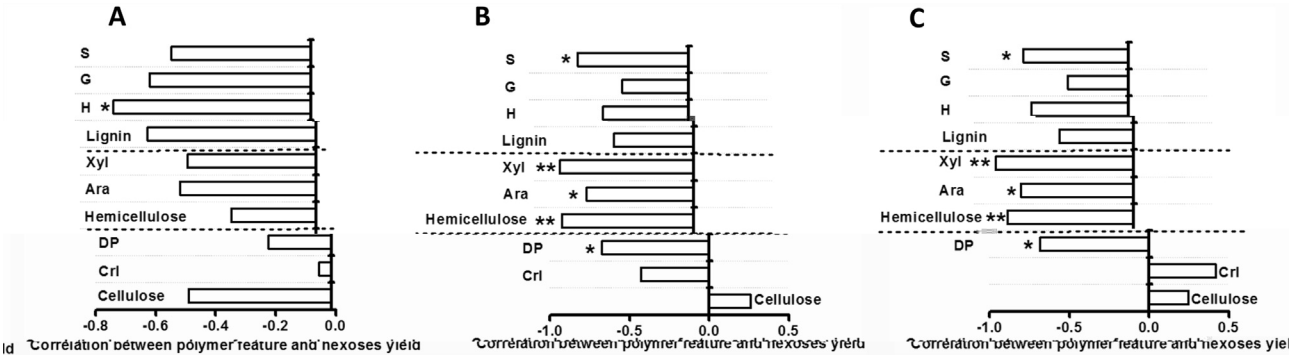

Fig. 2. 7 *Miscanthus* : ( ) , ( ) ( ) - 2% -80; * ** *p* < 0.05 0.01 (= 10).

3.3. Negative impacts of lignocellulose features on biomass enzymatic saccharification

Miscanthus ( ) ( ) (2). , *Miscanthus* (., 2016; ., 2016; ., 2015). - 7 *Miscanthus* - (. 2). - (. 2). , - *p* < 0.05 0.01 , , - (. 2),

( ) (,) (., 2015; ., 2014 ; ., 2016). , 7 - 2% -80 (. 2), (., 2016). -

3.4. Positive effect of lignocellulose porosity on biomass enzymatic digestibility

Miscanthus (3). , ( ) : 15 - 7 11 - 7 . *Miscanthus* -

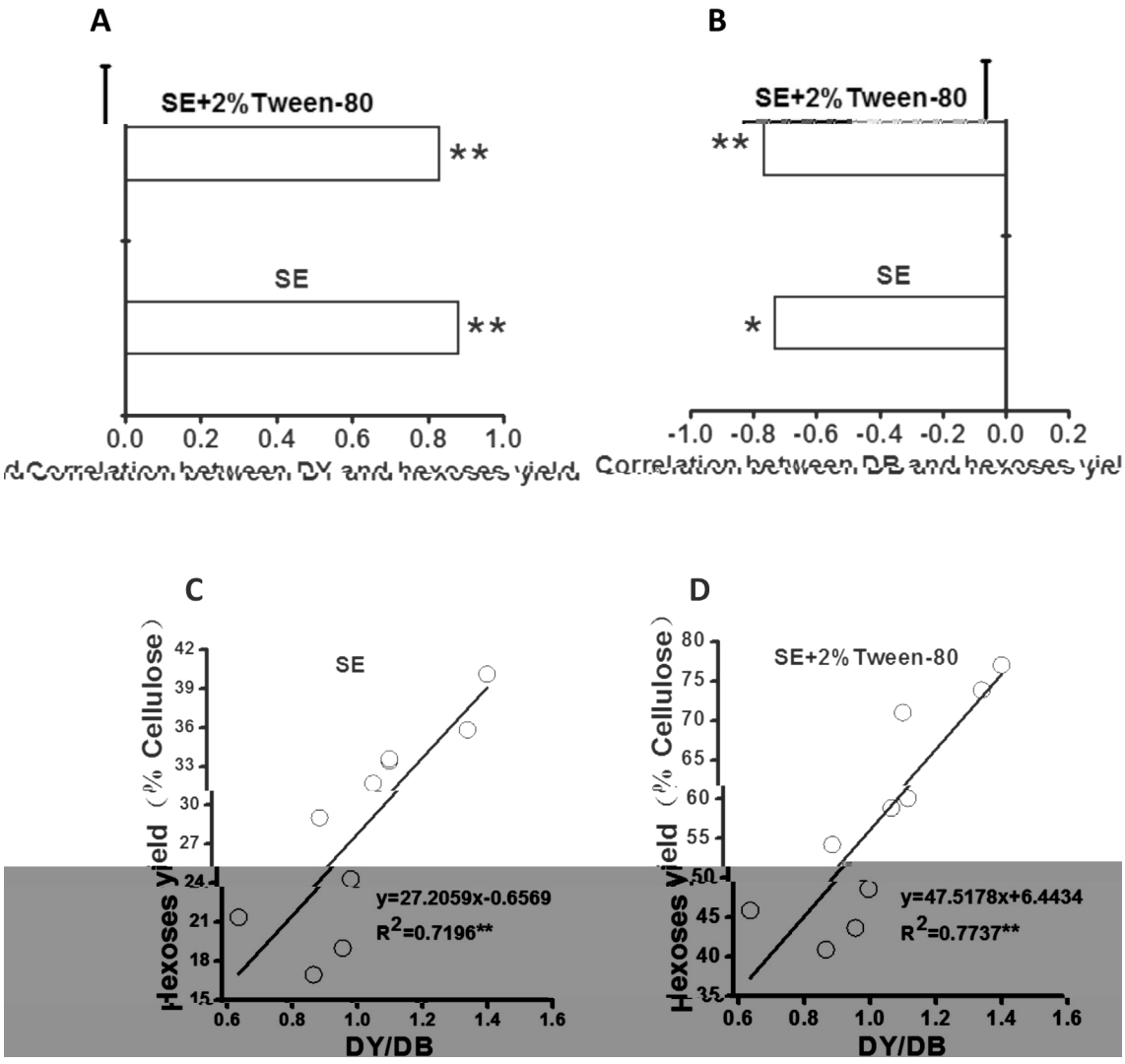

Fig. 3. *Miscanthus* : ( ) ( ) / (,) (%) 2% -80; * ** *p* < 0.05 0.01 (= 10).

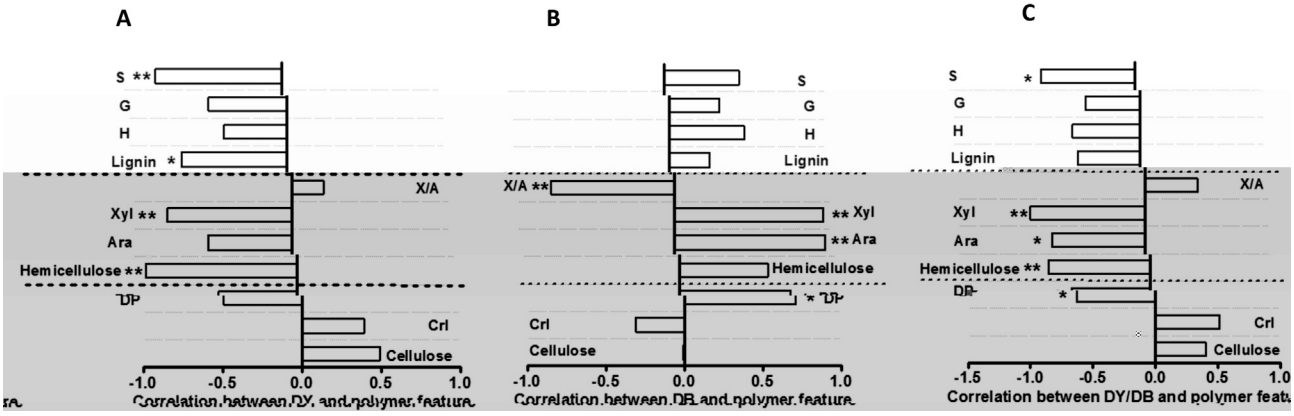

Fig. 4. *Miscanthus* : ( ) ( ) / ( ) ; * ** *p* < 0.05 0.01 (= 10).

(2001). (., 2013). , *Miscanthus* (/) / 0.65 1.46 (3).

, 10 / (1.46), -
Miscanthus .
(. 3).
-
2% -80 (. 3),
$p < 0.05$
0.01 *Miscanthus* (. 3).
/ -
$p < 0.01$, ^{2} 0.72 0.77
(. 3).
/
Miscanthus

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

Miscanthus (. 4).
(-)
$p < 0.01$ (. 4),
( )
(. 2).
Miscanthus .
( )
) $p < 0.05$ 0.01 (. 4),
- ( )

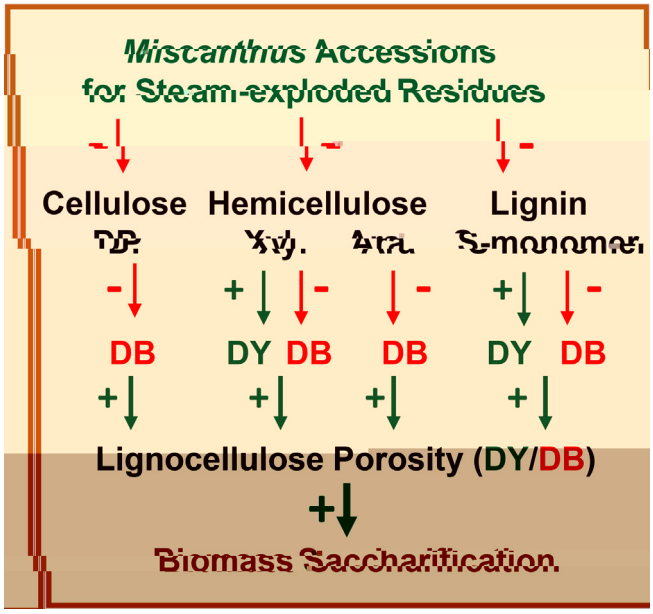

Fig. 5.
Miscanthus : + –
Miscanthus .

. , / -80
(. 4 ; 2). / ,
Miscanthus .
(. 5).
Miscanthus
Miscanthus

4. Conclusion

Miscanthus ,
5.3 14.8 2% -80 -
, , 10
77% (%).
Miscanthus ,
/ -
Miscanthus.

Acknowledgements

(2016 0800804),
(2662015 018), 111
(08032).

Appendix A. Supplementary data

, ://. /10.1016/. .2017.04.
114.

References

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: . 101, 4851 4861.
., 2012. *Miscanthus*: -
6, 580 598.
., 2001. - -
. 65, 191 200.
., 2008.
1:
. 24, 1178 1185.
., 2009.
. 31,
1217 1222.
., 2015.
. 185, 302 307.
., 2016.
. 199, 135 141.
., 2010.
. 28, 556 562.

., 2012.
. 110, 190 197.
., 1962.
(.), . 1. . 477 512.
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., 2005. . 87, 41 45.
., 2009. . 48, 3713 3729.
., 2013. / 2 4 *Miscanthus*. . 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. . 28, 149 154.
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2015. - *Miscanthus* . 183, 248 254.
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., 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. 2 4 *Miscanthus*. 5, 58 70.
., 1995. . 78, 175 180.
., 2013. 2 4 *Miscanthus*. . 130, 30 37.
., 2013. . 104, 1036 1044.
., 2008. . 99, 3817 3828.