Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Improving alkaline pretreatment method for preparation of whole rice waste biomass feedstock and bioethanol production

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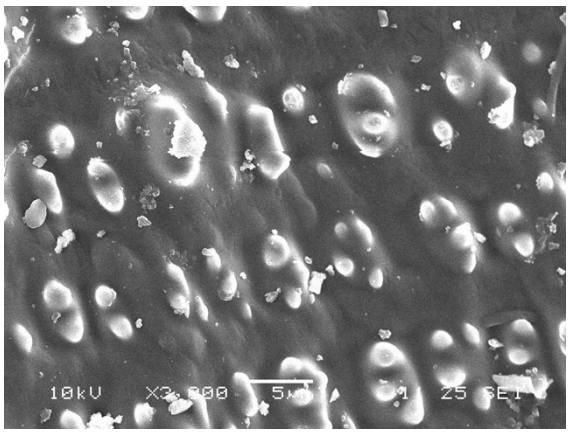
Figure legends:

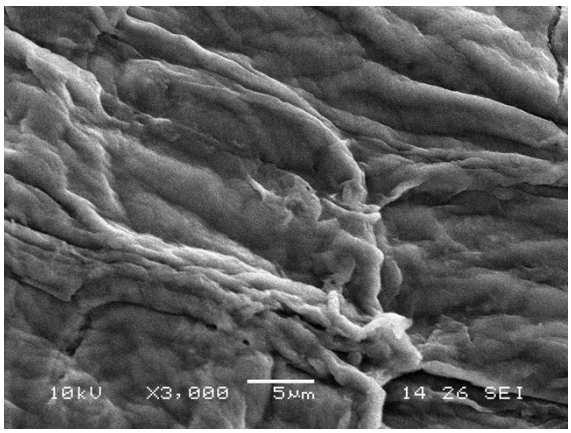
Fig. S1. SEM of RWB biomass (A) control, (B) NaOH (C) H_2O_2, (D) ASC, (E) SB, (F) NaOH+H_2O_2, (G) NaOH+ASC, (H) NaOH+SB,(I) NaOH+ASC+SB.

Fig. S2. Effects of (A) different alkali concentration (0.5–3.0%), (B) incubation temperature (30, 100 and 121^{o}C) and (C) incubation time (0-60 min) on the hydrolysis yield and reducing sugar production.

Fig. S3. Effects of (A) increasing substrate concentration (5–25 g L^{-1}) and (B) increasing enzyme concentration (5–25 FPU g^{-1} of the substrate) on the hydrolysis yield and reducing sugar production.


10kV X3,000 5μm 11 25 SEI

(A)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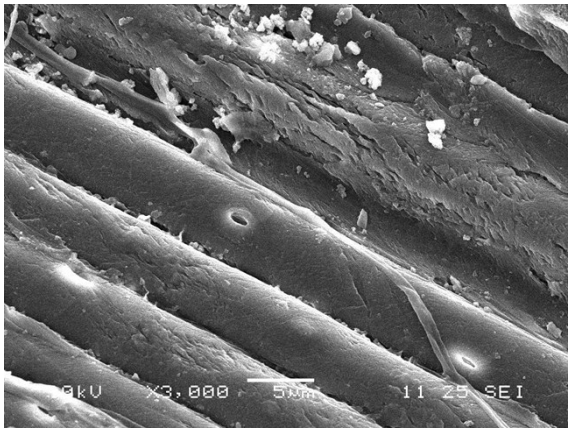
(B)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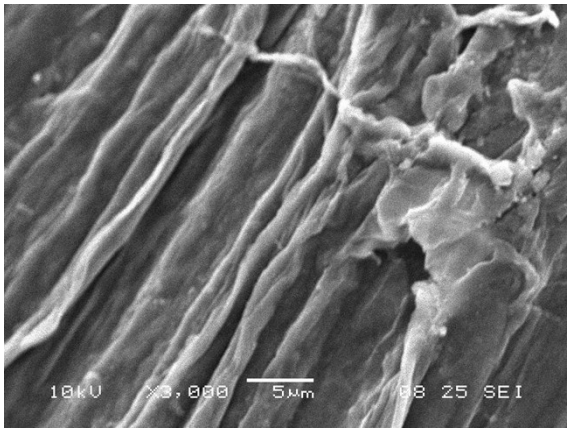
(C)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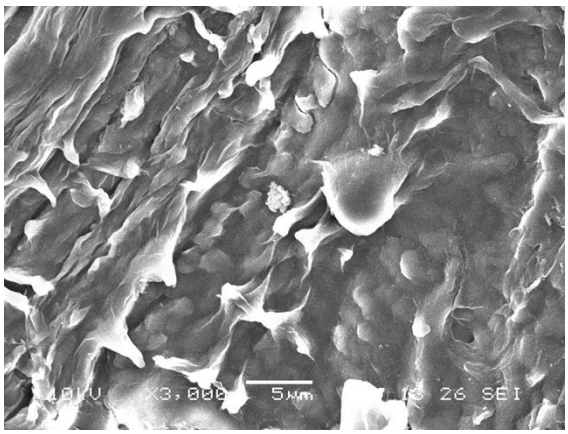
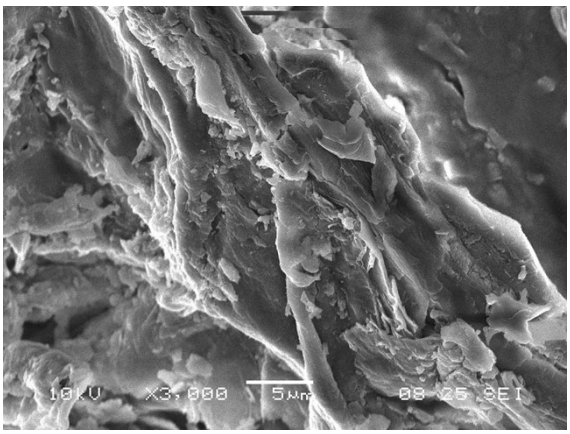
(D)


X3,000 5μm

(E)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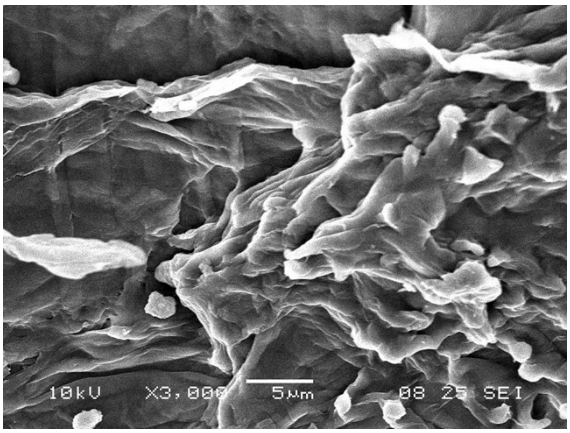
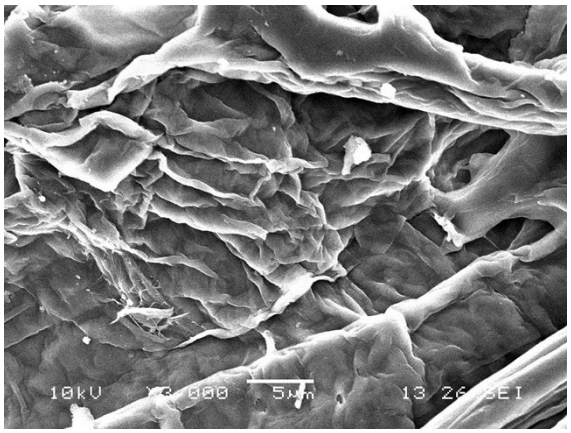
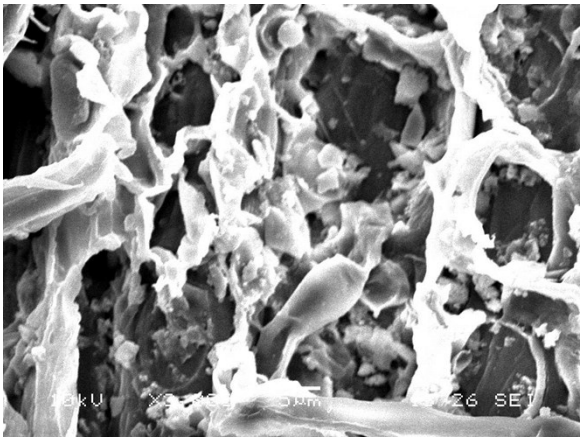
(F)



(G)

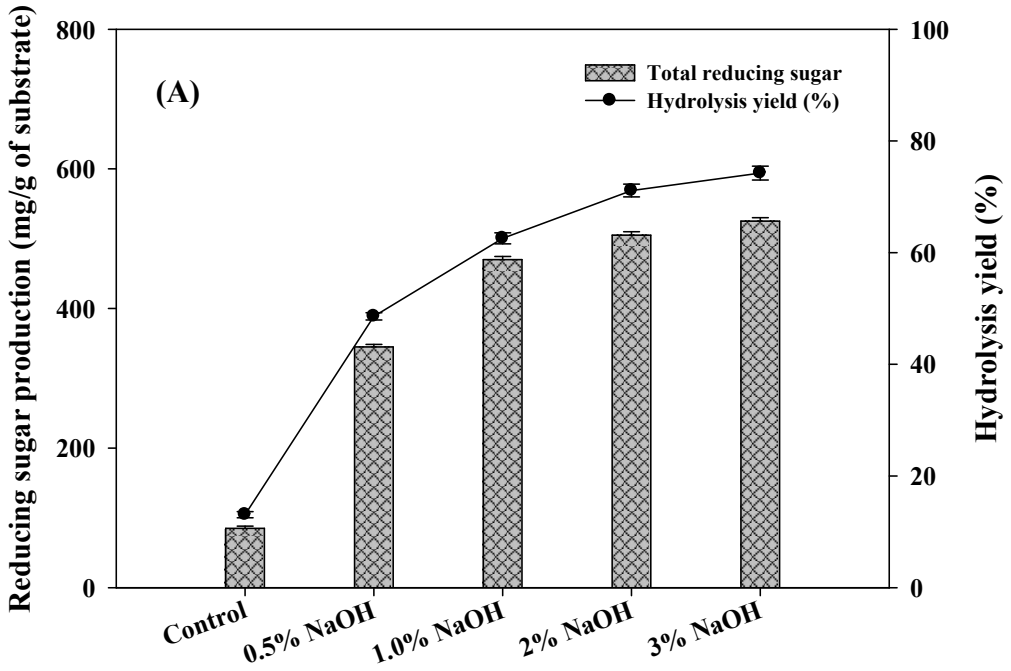


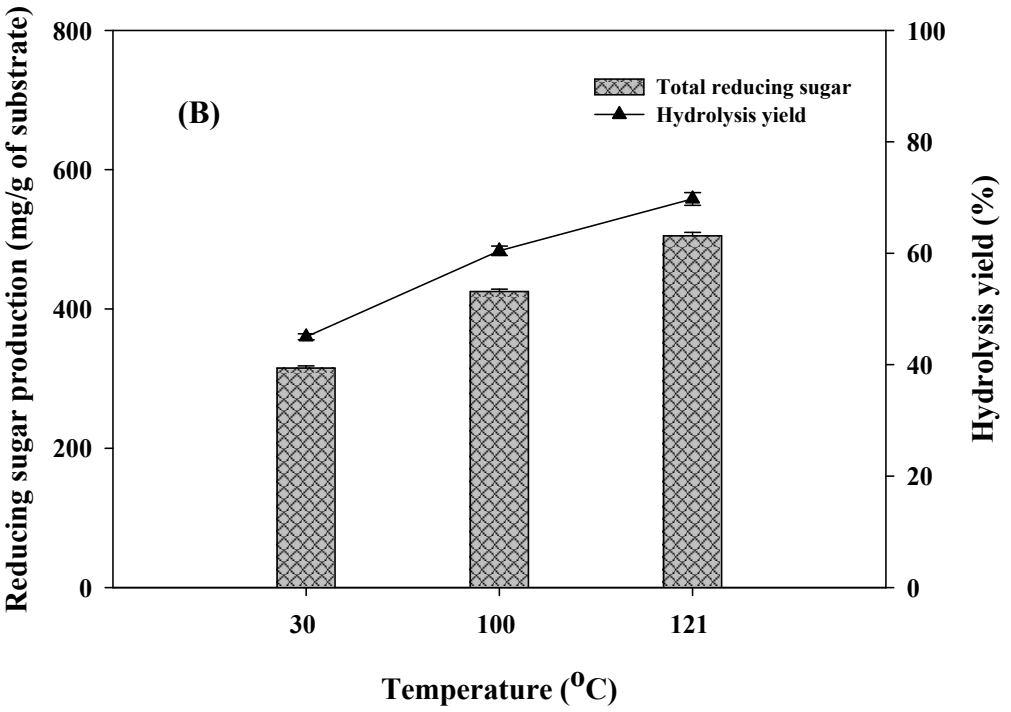
(H)



(I)

Fig. S1.


(A)
Total reducing sugar
Hydrolysis yield (%)
Reducing sugar production (mg/g of substrate)
Hydrolysis yield (%)
800
600
400
200
0
100
80
60
40
20
0
Control
0.5% NaOH
1.0% NaOH
2% NaOH
3% NaOH


(B)
Total reducing sugar
Hydrolysis yield
Reducing sugar production (mg/g of substrate)
Hydrolysis yield (%)
800
600
400
200
0
100
80
60
40
20
0
30
100
121
Temperature (°C)

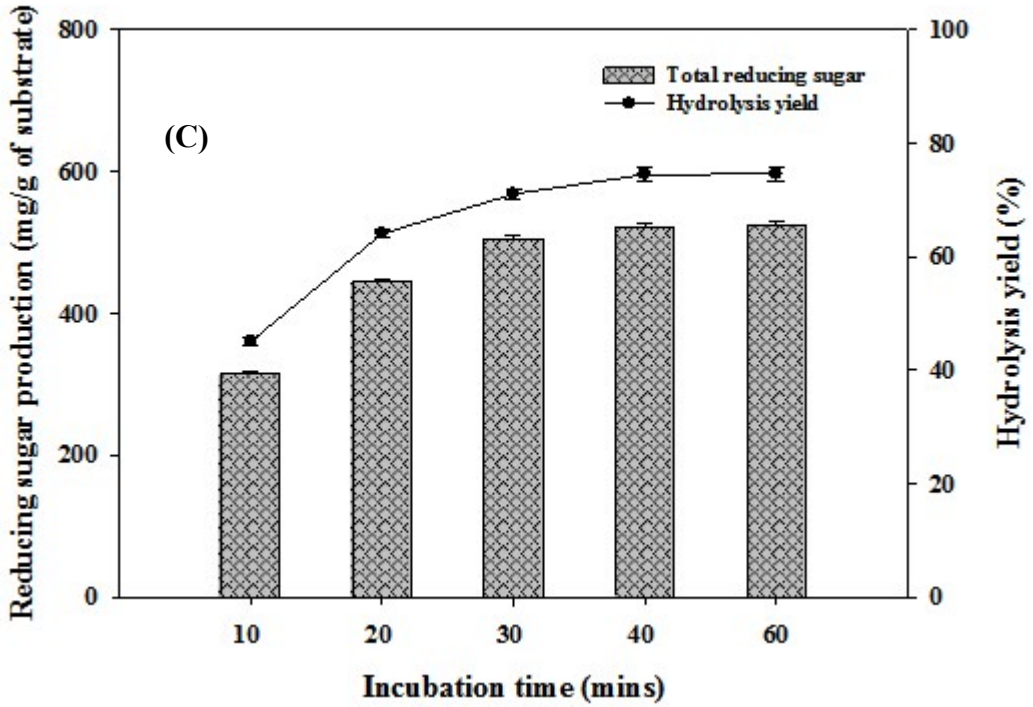
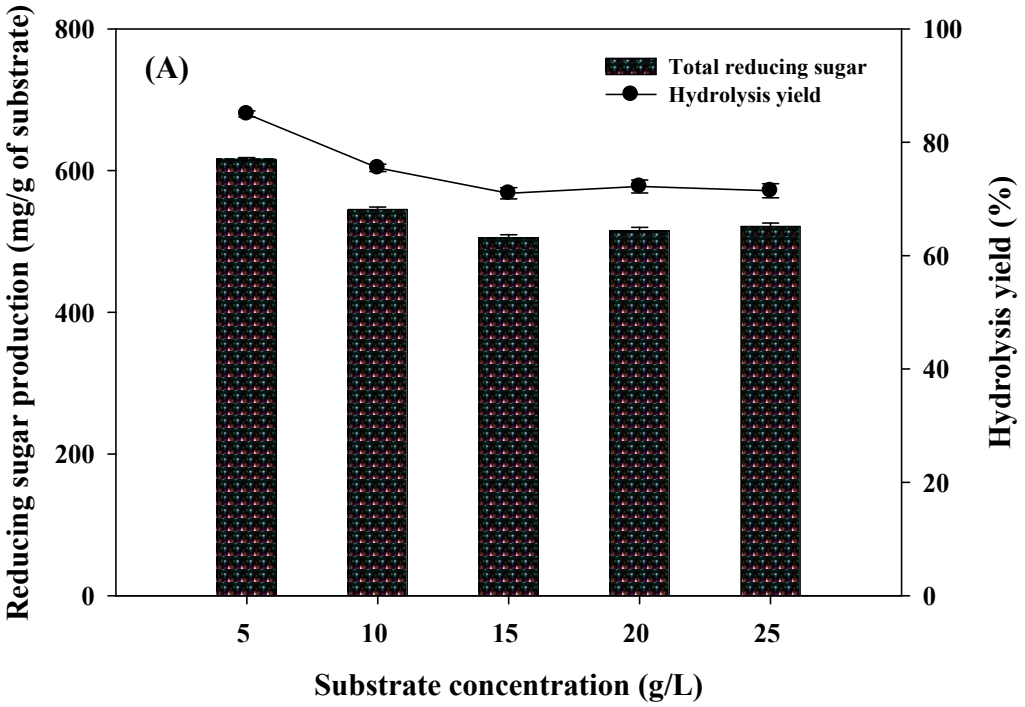

(C)
Total reducing sugar
Hydrolysis yield
Reducing sugar production (mg/g of substrate)
Hydrolysis yield (%)
Incubation time (mins)
0
200
400
600
800
0
20
40
60
80
100
10
20
30
40
60

Fig. S2.


(A)
Total reducing sugar
Hydrolysis yield
Reducing sugar production (mg/g of substrate)
Hydrolysis yield (%)
Substrate concentration (g/L)
0
200
400
600
800
0
20
40
60
80
100
5
10
15
20
25

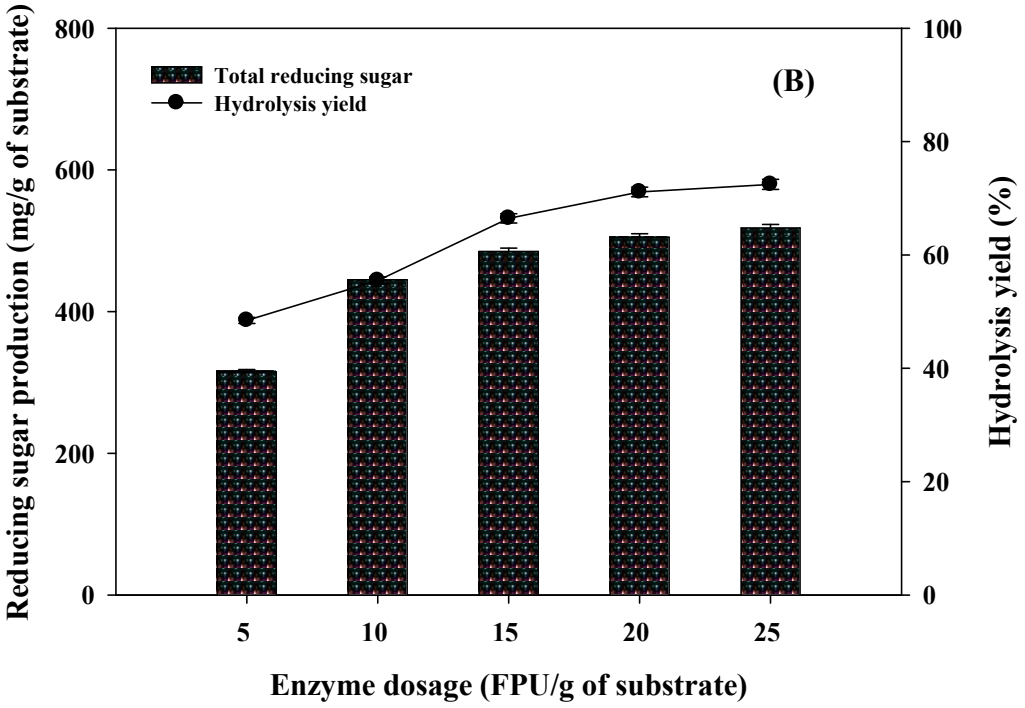

(B)
Total reducing sugar
Hydrolysis yield
Reducing sugar production (mg/g of substrate)
Hydrolysis yield (%)
Enzyme dosage (FPU/g of substrate)
0
200
400
600
800
0
20
40
60
80
100
5
10
15
20
25

Fig. S3.

Table S1. Comparative evaluation of sugar release from pretreatment of conventional lignocellulosic biomass and *RWB*

Lignocellulosic biomass	Pretreatment condition	Enzymes used	TRS yield after EH (mg/g)	References
Lantana camara	3% v/v H_2SO_4, 120 °C for 45 min, further delignification by Na_2SO_3 and $NaClO_2$ before enzymatic hydrolysis	Cellulase from *Trichoderma reesei* (60 FPU g^{-1} biomass) + *β*-glucosidase (Novozyme 188) (180 U g^{-1} biomass)	695	Kuhad et al., 2010
Switchgrass (*Panicum virgatum*)	AFEX (0.9 g g^{-1} ammonia, 0.4 g g^{-1} water, 80 °C, 20 min)	Accelerase® (3.2 FPU g^{-1} biomass)	385	Bals et al., 2010
Water hyacinth	4% H_2SO_4 + autoclaving at 121°C, 75 min	Commercial cellulase (Zytex) 70 FPU g^{-1} biomass	723	Satyanagalakshmi et al., 2011
Shea tree sawdust	Alkaline wet air oxidation	Cellulase (25 FPU g^{-1}) (Zytex) + *β*-glucosidase (12.5 U g^{-1})	131	Ayeni et al., 2013
Shea tree sawdust	Alkaline peroxide assisted wet air oxidation	Cellulase (25 FPU g^{-1}) (Zytex) + *β*-glucosidase (12.5 U g^{-1} of biomass)	274	Ayeni et al., 2013
Lantana camara	Chlorite treatment, 4% (w/v), 30 min	Cellulase (60 FPU g^{-1} biomass) + *β*-glucosidase (Novozyme 188) (180 U g^{-1} biomass)	925	Gupta et al., 2011
Prosopis juliflora	Chlorite treatment, 4% (w/v), 30 min	Cellulase (60 FPU g^{-1} biomass) + *β*-glucosidase (Novozyme 188) (180 U g^{-1} biomass)	864	Gupta et al., 2011
Switch grass	Microwave treatment, 0.1% alkali, 190°C, 30 min	Celluclast 1.5 L (12 FPU g^{-1} biomass) + *β*-gluco-sidase (Novozyme 188) (21 U g^{-1} biomass)	209	Hu and Wen, 2008
Whole rice waste biomass	2% (v/v) NaOH +ASC+ SB, 121°C, 30 min	Commercial cellulase (Sigma) 10 FPU g^{-1} biomass	725	This study

References

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