Supplementary data 1 Destabilization of SCB

To analyse the actual changes in morphology of recovered solids, SEM analysis was carried out. As can be seen in Fig. S.1, the ultrasound treated biomass showed complex structure; while the enzymatic hydrolysis and ultrasound assisted enzymatic hydrolysis produced the porous biomass, which means that the unhydrolysed cellulose and lignin still exist as a solid matter. The crystallinity index for pretreated SCB, ultrasound treatment, enzymatic hydrolysis and ultrasound assisted hydrolysis were 51.6, 39.6, 32.0 and 23.9%, respectively, which clearly indicate the reduction of crystallinity of SCB. As can be seen in Fig. S.2a, the broad diffraction pattern was observed in pretreated SCB, which is due to the presence of more crystalline cellulose. Although, the ultrasound treatment (without enzyme) does not reduce the cellulose, it reduced the crystallinity markedly, which confirm the influence of ultrasound on cellulose structure. The In order to understand the chemical changes in SCB after treatments, FTIR was analysed (Fig. S.2b). As can be seen in spectra, the band attributed to the presence of cellulose, hemicelluloses and lignin. The predominant band at 3321 represents the O-H stretching vibration and hydrogen bond in phenolic structure. A sharp band at 2895 cm^{-1} is due to presence of C-H stretching vibration of methyl and methylene group. The absorption peak at 1732 cm^{-1} represents the stretching of carbonyl groups C-O in acetyl group attached to hemicelluloses. The behavior of the spectra between 1516 cm^{-1} and 1603 cm^{-1} region shows the C-H bond deformation and aromatic ring vibration of lignin. Enhanced absorption spectrum at 1240 cm^{-1} belongs to C-O stretching vibration in lignin and ester groups. The relative absorbance of the bands of primary and secondary OH groups at 1028 cm^{-1} and 1154 cm^{-1} of enzymatically hydrolysed SCB is higher than others, which indicates the presence of unhydrolysed cellulose. Moreover, the peak at 901 cm^{-1} is associated with β-glycosidic linkage of cellulose which signifies the presence of cellulose in enzymatically treated SCB.[46,47]

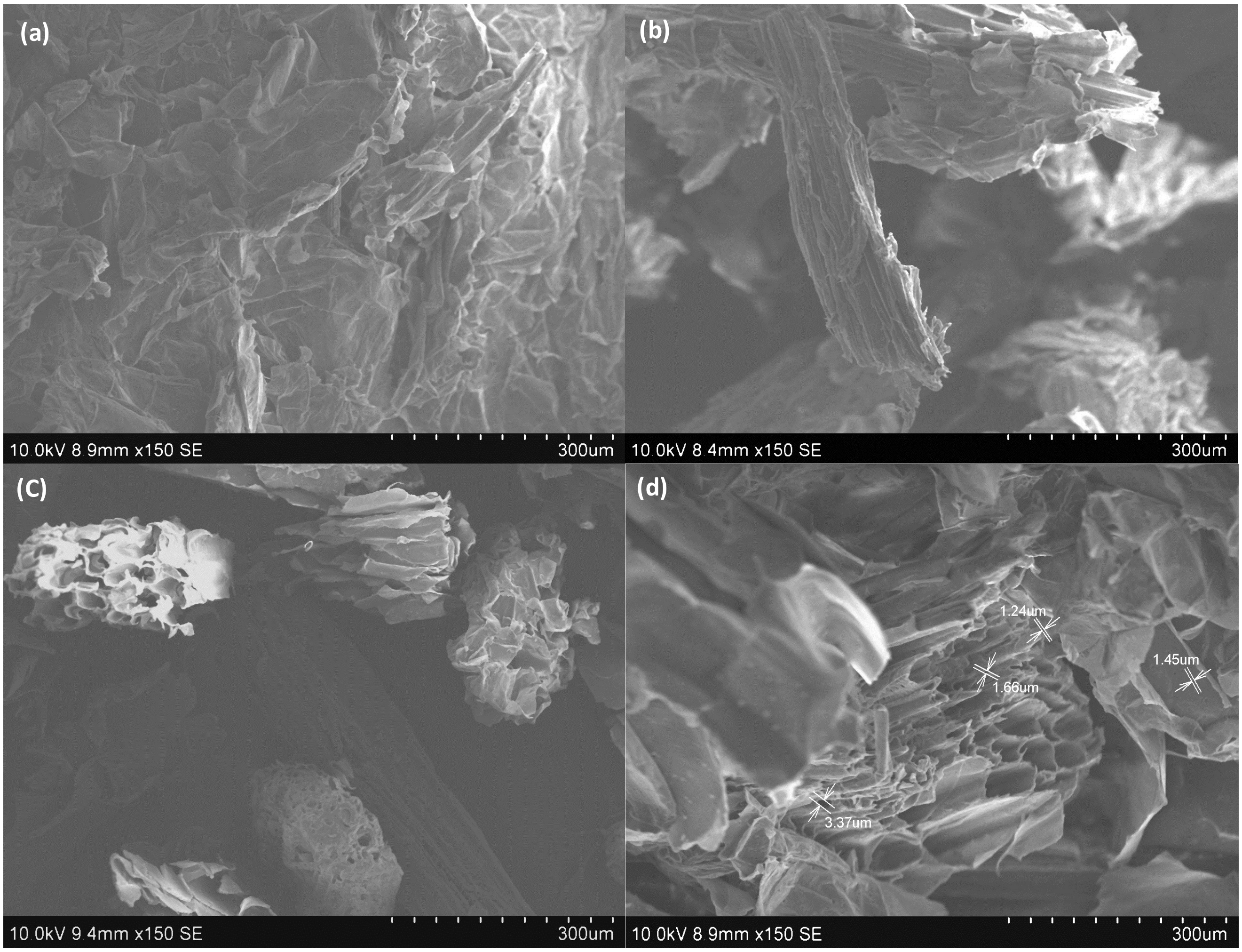
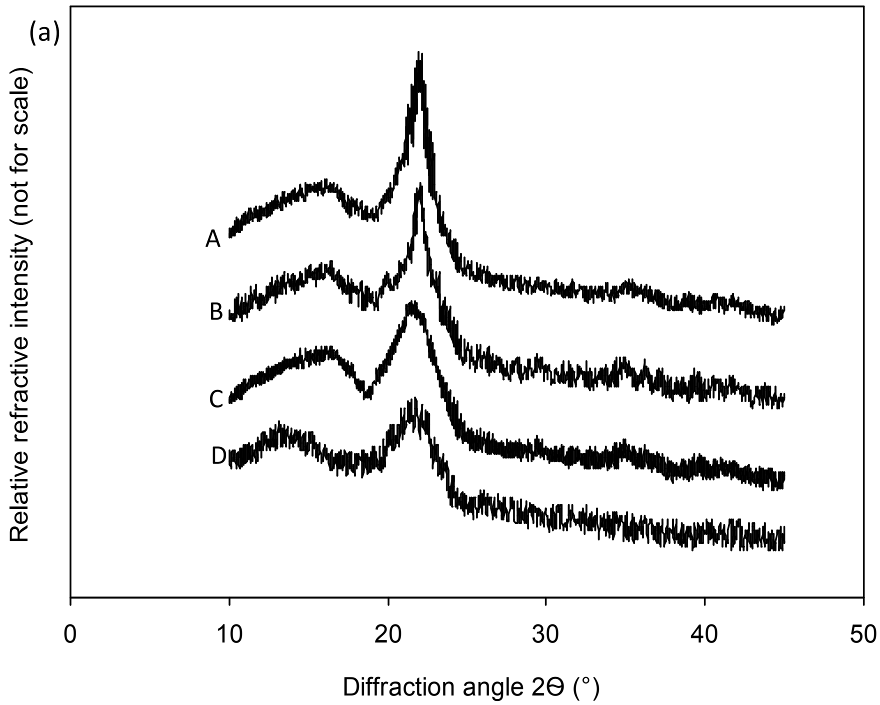


Fig. S1 Scanning electron microscopic images of SCB (a) pretreated, (b) ultrasound treated, (c) enzymatically hydrolysed (d) ultrasound-assisted enzymatically hydrolysed.



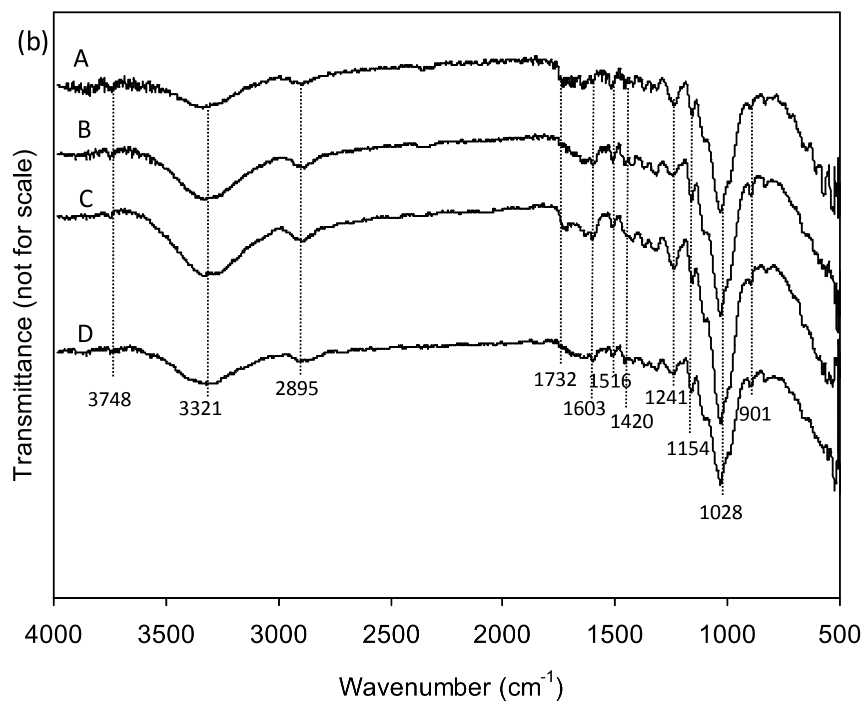


Fig. S2 XRD pattern (a) and FTIR spectrum (b) of SCB at different conditions. A: pretreated SCB; B: ultrasound treated SCB; C: enzymatically hydrolysed SCB; D: ultrasound assisted enzymatically hydrolysed SCB.

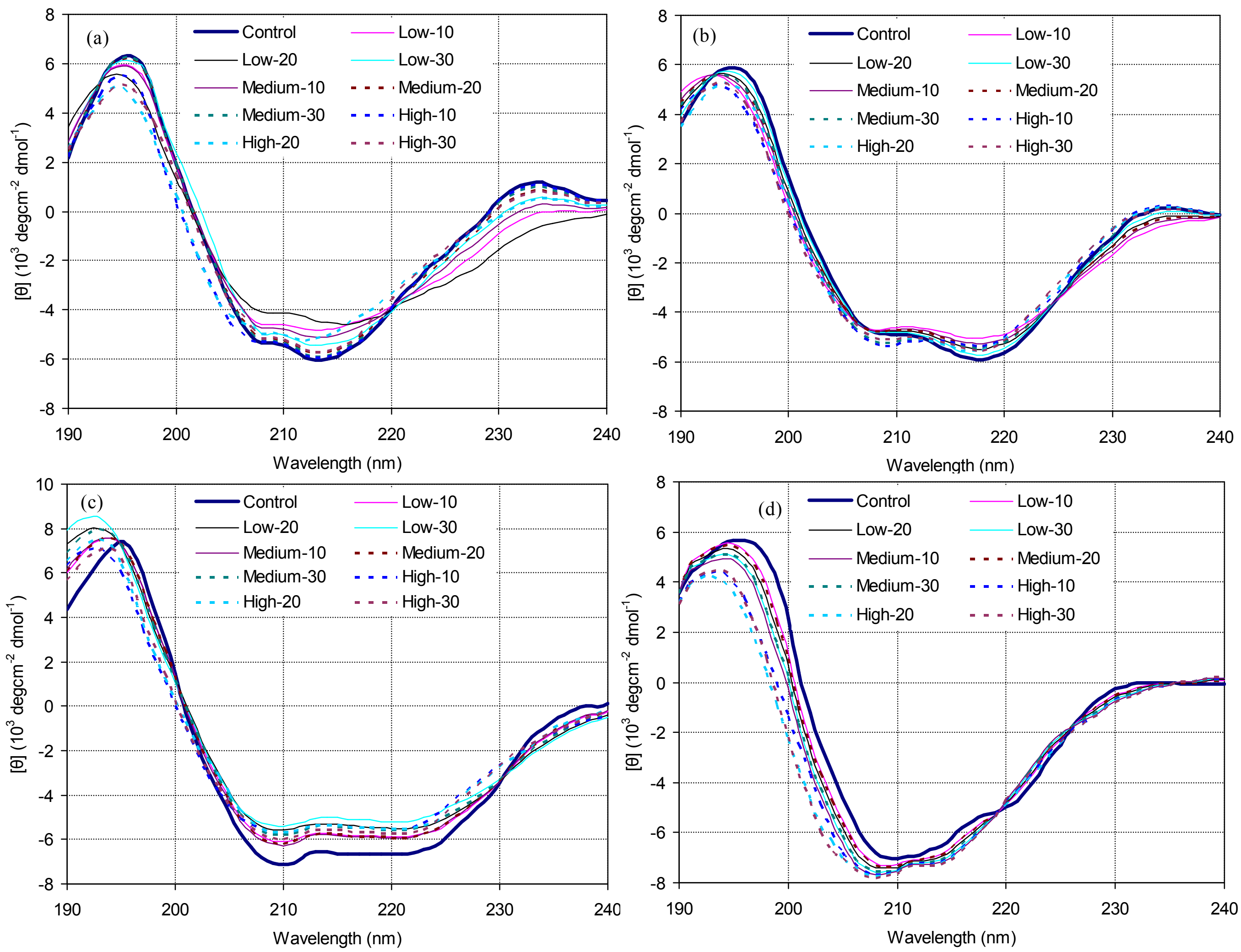


Fig. S3 Circular dichroism spectrum of endoglucanase I (a), cellobiohydrolaseI (b), β-glucosidase (c) and xylanase (d).

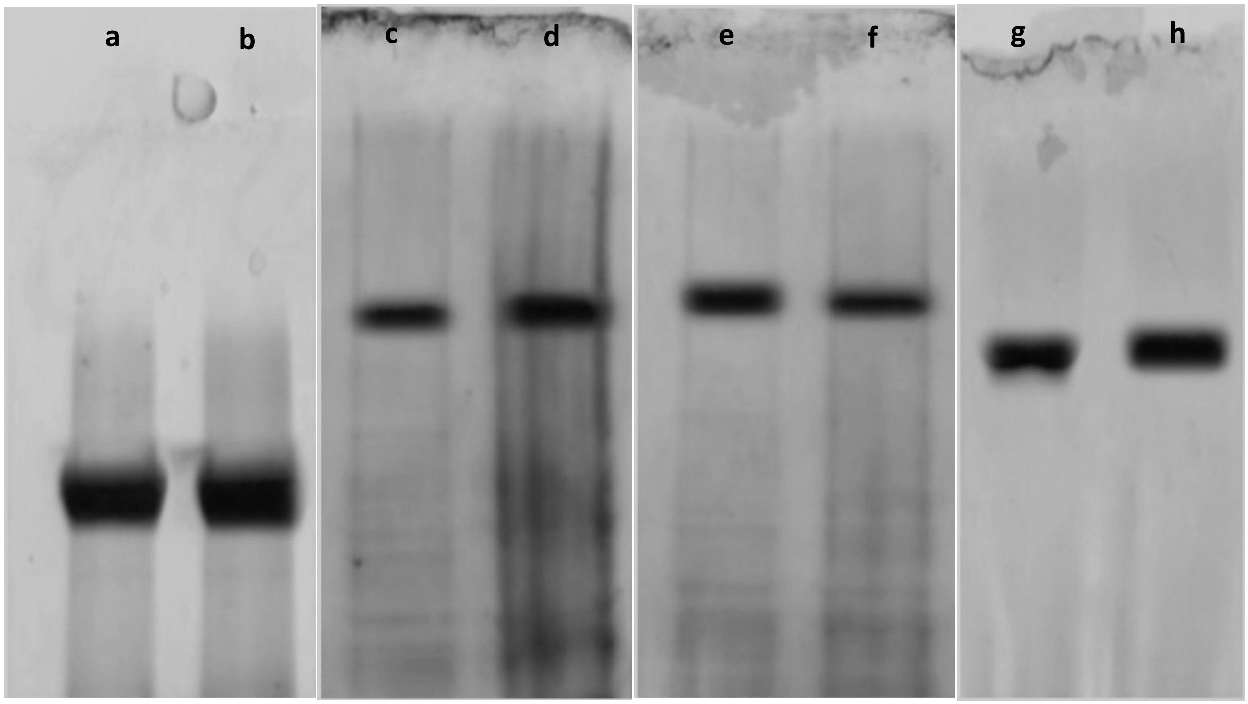


Fig. S4 Native electrophoresis of cellulase and xylanase indicates the absence of aggregates. Lane (a) native endoglucanase, (b) ultrasound treated endoglucanase, (c) native cellobiohydrolase, (d) ultrasound treated cellobiohydrolase, (e) native β-glucosidase, (f) ultrasound treated β-glucosidase, (g) native xylanase, (h) ultrasound treated xylanase (conditions: 60% amplitude, 30 seconds for every 30 min and total 12 h treatment).

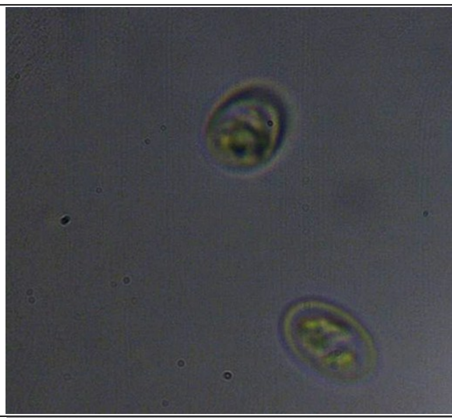
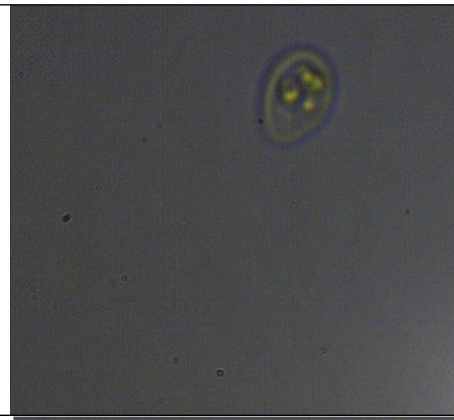
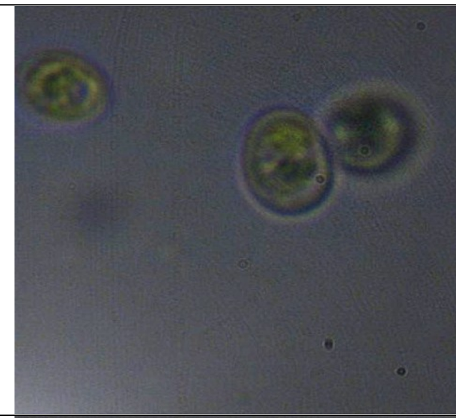
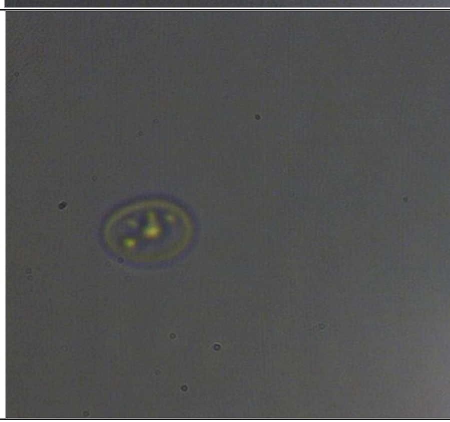
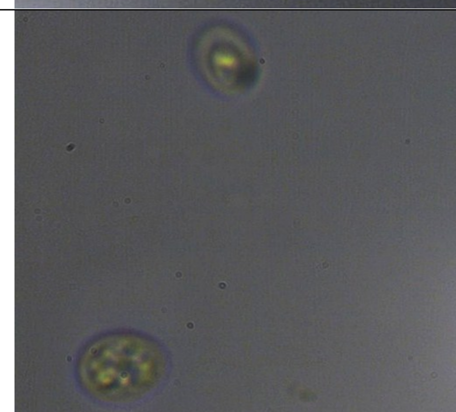
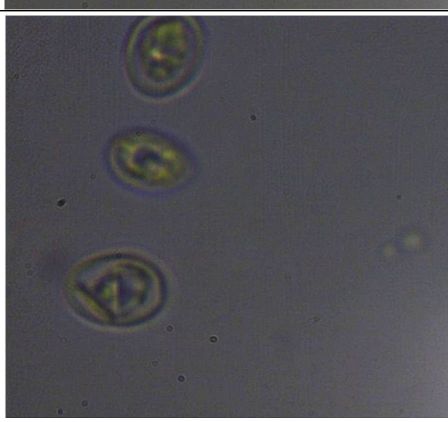
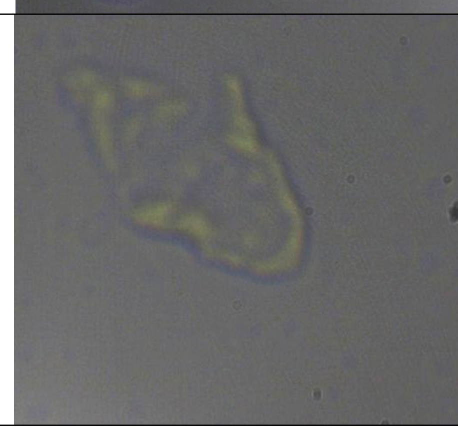
Conditions	Low power	Medium power	High power
10 seconds			
20 seconds			
30 seconds			

Fig. S5 Effect of ultrasound on *S. cerevisiae* morphology during ultrasound assisted simultaneous saccharification and fermentation

Table S1 Comparative analysis of saccharification and fermentation processes with literature review.

raw material	enzyme/microorganism	sugar or ethanol yield	Reference
	enzymatic hydrolysis		
sugarcane bagasse	commercial enzyme (Environmental Biotechnologies, Inc) :25 FPU/g	41-67% theoretical	Kaar *et al.* [59]
cotton stalks	cellulase from *T.reesei* (celluclast 1.5L) and β –glucosidase from *A.niger* (Novozym 188):40 FPU/g	60.8% cellulose conversion	Silverstein *et al.*[60]
water-hyacinth	cellulase from *T.reesei* and β-glucosidase from *A.niger*: 12 FPU/g	71% theoretical	Aswathy *et al.*[11]
rice straw	cellulase from *Trametes hirsuta*: 37.5FPU/g	88% saccharification	Jeya *et al.*[61]
micro-crystalline cellulose	cellulase from *T. reesei* (Beijing Solarbio Ltd. China): 8 mg/mL	95.48% theoretical	Yang *et al.*[35]
Saccharum spontaneum	cellulase from *Aspergillus oryzae*: 15 FPU/g	89.38% theoretical	Chandel *et al.*[62]
rice straw	cellulase (Genencor Spezyme CP): 20 FPU/g	93.1% glucose conversion	Chen *et al.*[63]
cassava stem	cellulase and β –glucosidase (Novozymes): 20 FPU/g	70% saccharification	Han *et al.*[64]
sugarcane bagasse	cellulase from *Aspergillus oryzae* P21C3 and (celluclast 1.5L, Novozyme): 10 FPU/g	50.8% theoretical	Braga *et al.*[3]
sugarcane bagasse	cellulase from *T. reesei*	sugar yield of 229 g/kg	Gasparotto *et al.*[65]
sugarcane bagasse	cellulase and *β*-glucosidase (Sisco Research Laboratory (SRL), India)	73.03% theoretical	This study
sugarcane bagasse	cellulase and β-glucosidase from *T.reesei*: 30 FPU/g (without ultrasound)	78% saccharificatoin	This study
sugarcane bagasse	cellulase and β-glucosidase from *T.reesei* 30 FPU/g (with ultrasound)	92 % saccharification	This study

simultaneous saccharification and fermentation				
sugarcane bagasse	cellulase from *Penicillium chrysosporium* BCC4504 and *Aspergillus flavus* BCC7179	*P. stipitis*	52.9% theoretical	Buaban *et al.*[55]
corn stover	cellulase and xylanse (Genencor): 15FPU/g	Recombinant *Escherichia coli* K011 and *S.cerevisiae* D5A	84% theoretical	Li *et al.*[66]
rice straw	commercial cellulase (celluclast 1.5L, Novozymes), xylanase (Novozymes), glycosidase (Novozyme): 12FPU/g	*S.cerevisiae* NBRC 0224 and *P.stipitis* NBRC 10063	74% theoretical	Park *et al.*[67]
Saccharum spontaneum	commercial cellulase (Genencor Inc.,): CMCase U/g	*S.cerevisiae*	69% theoretical	Scordia *et al.*[68]
sugarcane bagasse	cellulase (Spezyme-CP) and β – glucosidase (Novozym): 10 FPU/g	*S.cerevisiae* ATCC 96581	18-28% theoretical	Ewanick and Bura, [69]
corn stover	cellulase from *T.reesei* (Celluclast 1.5L, Novozym) and β –glucosidase from *Aspergillus niger* (Novozym): 10 FPU/g	*S.cervisiae* CET-1170	89.1% glucan conversion	Buruiana *et al.*[70]
oil palm fronds	cellulase from *T.reesei* (Celluclast 1.5L, Novozym) and Novozym β – glucosidase from *Aspergillus niger* (with ultrasound): 15 FPU/g	*S.cerevisiae*	57% theoretical	Ofori-Boateng and Lee, [21]
Parthenium hysterophorus	cellulase and β-glucosidase (50 FPU/g)	*S. cerevisiae* MTCC 170	0.27 g/g biomass	Singh *et al.*[71]
sugarcane bagasse	cellulase and *β*-glucosidase (Sisco Research Laboratory (SRL), India)	*S. cerevisiae*	63.73% theoretical	This study
sugarcane	Cellulase and β-glucosidase	*S. cerevisiae*	71% theoretical	This study

bagasse	from *T.reesei* (without ultrasound): 30 FPU/g			
sugarcane bagasse	Cellulase and β-glucosidase from *T.reesei* : 30 FPU/g (with ultrasound)	*S.cerevisiae*	90% theoretical	This study