Comparative study of steam explosion and acid solution pretreatments in enzymatic saccharification of sugarcane bagasse for bioethanol production

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The recalcitrance structure of lignocellulosic biomass and releasing the locked polysaccharides is one of the most important research priorities for the emerging cellulosic ethanol. Thus, this work had objective to evaluate the effect of diluted sulphuric acid and steam explosion pretreatments on the enzymatic conversion of cellulose from sugarcane bagasse. The raw bagasse, was pretreated with steam aiming to separate the polioses present in the biomass. The steam explosion pretreatment was performed in pilot scale (190 °C/15 min), followed by sudden despressurization. On the other hand, the diluted acid pretreatment was performed in pilot scale used H_2SO_4 1.0% (m/v) (120 °C/10 min), followed by sudden depressurization. Both pretreated materials were delignificated with NaOH 1.0% (m/v), 1:20 solid to liquid ratio, 100 °C for 1h. The pretreated and delignificated materials were subjected to enzymatic saccharification of cellulose fraction using a commercial cellulose preparation (Celluclast 1.5 L), in an enzyme/substrate ratio of 15 FPU/g dry bagasse, supplemented with β-glucosidase (Novozym 188) in an enzyme/substrate ratio of 10 UI/g dry bagasse, 1:10 solid to liquid ratio, 100 rpm, 45 °C for 72h. The morphological and carbohydrates analysis were made by Scanning Eletronic Microscopy and HPLC, respectively. The results show that for the bagasse pretreated for steam explosion, followed by delignification, 60.3% of cellulose was recovered, with 96.6% solubilization of polioses and 92.3% removal of lignin, obtaining an enzymatic conversion of 90%. Already for the bagasse pretreated for diluted acid and delignificated, 56.2% of cellulose was recovered, 93.2% of polioses was solubilized and 90.2% of lignin removed, obtaining an enzymatic conversion of 79%. It can be concluded that the bagasse pretreated by steam explosion is much more likely to removing polioses and lignin than the bagasse pretreated by diluted acid, which justifies the increase of enzymatic conversion of cellulose into glucose.

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