Potential of a new seed propagated elephant grass cultivar for bioenergy purposes

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Abstract

Biomass can be a great ally to mitigate climate change through reduction of CO_2 emissions of the energy sector. Locally developed cultivars can play a key role at improving sustainability of plantations and bioenergy industry, such as the first worldwide elephant grass that is seed cultivated. PCEA (*P. purpureum* x *P. purpureum*) represents an exciting potential for bioenergy generation, including biofuels, since it is a fast-growing with the highest yield in the field among established elephant grass cultivar in Brazil. In that context, the aim of this work was to run a full characterization of the new PCEA, in addition to an alkaline pretreatment of the biomass to evaluate lignocellulosic potential, considering increase and security of biofuel offer of strategic importance to the bioenergy sector in Brazil. To that, PCEA was initially characterized for the proximate and elemental analyses by following ASTM protocols, untreated and pre-treated PCEA samples were compositionally analyzed followed NREL LAP procedures. The experimental design of the alkaline pretreatment approached three factors: NaOH %w/v ranging from 1.0 to 3.0 varying on 0.5 %w/v, Temperature (T) from 80 to 120 varying on 20 °C and Reaction Time (RT) from 15 to 35 min varying on 5 min each. The accessed heating value of PCEA was 17.87 MJ kg^{-1}, fixed carbon content of 19.40 %wt., 5.20% wt. ash and 75.40 %wt of volatile combustible matter, which suggests potential to generate biofuels through thermochemical routes such as fast pyrolysis. In addition, the effect of the factors was evaluated considering the response variables of biomass recovery, cellulose and hemicellulose yields, in addition to lignin removal. The untreated biomass of PCEA presented 31.79±1.55 %wt. of cellulose, 15.51±0.70 %wt. of hemicellulose and 18.23±0.45 %wt. lignin and 20.54±0.11 %wt. extractives. The optimal condition of the experimental set up was established considering efficiency in means of maximal lignin removal without degradation of cellulose, which was achieved at 100 ºC, 25 RT and 3 %w/v NaOH with 99.03 %wt. recovery of cellulose and 73.76 %wt. of lignin removal. These results suggest an exciting potential of the new PCEA for bioenergy applications, such as lignocellulosic bioethanol production via alkaline pretreatment to be further explored by the Brazilian energy sector. However, further studies should be carried out to explore other uses and conversion of this new PCEA biomass to bioenergy, such as thermochemical conversion routes.

Keywords: *Pennisetum purpureum*, biomass, biofuel, chemical pretreatment, alkaline pretreatment, cellulose, hemicellulose