**New Development for Ethanol Production from Lignocellulosic Materials in Fludized Bed Reactor.**

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**Highlights**

* Sugarcane bagasse is a feasible carbon source for bioprocess
* Fluidized bed reactor can be used for chemical and biochemical process
* Bioprocess conducted in Fed-batch configuration is a potential method

**1. Introduction**

Due to environmental and political problems regarding the imminent scarcity of fossil fuels, different approaches for biofuels production have been gained great importance in the global scenario. Thus, various agroindustry residues, such as bagasse, bark, grains, straw, among others, are used as raw material for the production of 2G ethanol. Among them, sugarcane bagasse has presented greater advantages due it is available in abundance in countries such as Brazil, India, China and others [1]. Additionally, new studies must be developed in order to produce biomolecules from lignocellulosic materials, since the processes of pretreatment, saccharification and fermentation are still stages that still needs to be optimized, aiming the scale-up and industrial production. Within this context, i.e., the use of fluidized bed reactor (FBR) in chemical and biochemical processes is a potential approach for the conduction of methods applied to scale-up. When compared to the stirred tank reactor, the most commonly used reactor, the fluidized bed reactor has advantages such as: no requirement to use mechanical impellers for agitation, ease control of homogenization by insertion of air or fluid recirculation, and hence, increase of the contact surface between the catalyst and fluid [2]. Taking this into account, we present a new development for ethanol production from lignocellulosic material in fludized bed reactor. Ethanol production was evaluated by conducting saccharification stage in fed-feed process by inserting with alkaline pre-treated sugarcane bagasse, in order to obtain fermentable sugars, followed by and subsequent fermentation, carried out in simultaneous sacharification and fermentation configuration (SSF) in all process conducted in FBR.

**2. Methods**

Sugarcane bagasse was conducted to alkaline hydrolysis in a fluidized bed reactor (a column reactor from Bioengineering AG - PID Fermenter AWS, Wald, Switzerland- with 540 mm x 55 mm column, with central vertical tube of 9 mm inner diameter) where 30 g of sugarcane bagasse was mixed with 700 mL of 0.5M NaOH alkaline solution at 90 ° C for 120 min in a non-pressurized fluidized bed reactor system, homogenized by insertion of air in 0.3 min-1. After the hydrolysis process, the remaining solid fraction of pre-treated sugar cane bagasse was washed and used in the subsequent saccharification step. In other similar fluidized bed reactor, homogenized by aeration of 0.3 min-1, sacharification step was conducted at 50ºC by mixing of 700 ml of Citrate buffer (50 mM, pH 4.8), 0.3 ml of twin and 20 FPU of cellulase enzyme complex (Cellulase CP CONC-Dyadic) and 10g of alkaline pretreated sugarcane bagasse, obtained in last step. At every period of hours, 10g of alkaline pre-treated bagasse was added, until the total of 50g was reached. After 48 hours of saccharification, the pH of the medium was adjusted to 5.5 with addition of NaOH solution, and subsequently added 5 g/L of ammonium sulfate, 3 g/L of yeast extract and 3 g/L of extract of malt, according to nutritional medium proposed by Antunes et al. [3]. To the supplemented medium, 0.5 g/L of *Scheffersomyces shehatae* UMFG-HM 52.2 cellular solution was added (wild Brazilian sugars pentose convert yeast). The fermentations were conducted for 72 h in the same fluidized bed reactor, by the aeration of 0.3 min-1, at 30 ° C. Samples were collected periodically for analysis of biomass, fermentable sugars and ethanol.

**3. Results and discussion**

Figure 1 shows the consumption profile of fermentable sugars (glucose and xylose) obtained by means of enzymatic hydrolysis operated in batch fed alkaline pre-treated sugar cane bagasse and followed used in the conversion of ethanol to a fluidized bed reactor using yeast *Scheffersomyces shehatae* UFMG-HM 52.2.



**Figure 1.** Ethanol production from fermentable sugars of sugarcane bagasse in fluidized by using the yeast *Scheffersomyces shehatae* UFMG-HM 52.2

After conducting 48 h of enzymatic hydrolysis carried out in fed-batch configuration, around 22 g/L and 8 g/L of xylose were observed as available fermentable sugars. From this time, with addition of the microorganism, total consumption of fermentable sugars, with the highest production of ethanol (6.775 g / L) were verified in the followed 48 hours of fermentation (96h of total process), showing ethanol yield (YP/S) of 0.26 g/g and volumetric productivity of 0.14 g/Lh .

**4. Conclusions**

The potential use of column reactors applied to the stages of pre-treatment of vegetal biomass and fermentation of fermentable sugars was norteworthy, as well as the indication for further of studies of process optimization.

**References**

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