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Short Communication

Pretreatment of *Agave americana* stalk for enzymatic saccharification

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HIGHLIGHTS

- *Agave americana* stalk was pretreated with dilute acid, sulfite (SPORL) and alkali.
- The enzymatic hydrolysability of the pretreated agave stalk was evaluated.
- SPORL pretreatment gave the highest substrate and sugar recovery yield.
- NaOH pretreated stalk had low lignin and hemicellulose and high cellulase affinity.
- NaOH pretreated stalk had better hydrolysability under the conditions investigated.

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ABSTRACT

Agave americana is one of commonly grown agave species but currently less valuable because its large flower stalk cannot be used for producing alcoholic beverage. In the present study, the stalk was pretreated with dilute acid (DA), sulfite (SPORL), and sodium hydroxide (NaOH) to preliminarily assess its potential as feedstock for bioethanol production. The changes of cell wall components during the pretreatments, enzymatic digestibility of the pretreated stalks, and the adsorption of cellulases on the substrates were investigated. Results indicated that the pretreatments significantly improved the enzymatic digestibility of the agave stalk. SPORL pretreatment gave higher substrate and sugar yields, while NaOH pretreated stalk had better digestibility under the investigated conditions. The better hydrolysability of NaOH-pretreated stalk was attributed to low lignin and hemicellulose content and high affinity to cellulases.

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1. Introduction

Agave is usually thrived in semi-arid regions such as Mexico, Australia, and Africa. Commonly grown species include *Agave americana*, *Agave attenuate,* and *Agave tequilana.* Attractively, the annual biomass productivity of agave is 10–34 Mg/ha, which is much higher than that of switchgrass (~15 Mg/ha) and poplar (~11 Mg/ha) (Garcia-Moya et al., 2011). Agave is currently known for its applications in the production of alcoholic beverages such as tequila and mescal from the fructose-rich sugars extracted from either the agave piñas (stem and basal of the leaves) or leaves (Botello-Alvarez et al., 2011). However, these fermentable sugars only represent approximately 24–27% of the total carbohydrates available in the agave (Martinez-Torres et al., 2011). The residual parts of the agave plant, such as roots, stalks, and the bagasse from beverages production, are currently not used in the industry. These parts of the plant represent almost 50% of the plant weight, and are basically lignocellulosic biomass with high carbohydrates but low lignin content (Nuñez et al., 2011), which could be a good feedstock for biofuel production.

Different from other agave species, *A. americana* has a large asparagus-like flower stalk, but no piñas. Because of no piñas (a reservoir of fructans), the *A. americana* is commercially less valuable for the production of alcoholic beverages, compared to other agave species such as *A. tequilana* and *A. attenuate*, although its leaves can be used for pulque (a beer-like drink) production. From this point of view, *A. americana* is more suitable as the feedstock for biofuel production.

To the best of our knowledge, there is no report of using *A. americana* flower stalk for bioethanol production. Therefore, the objective of this study is to preliminarily assess the viability of *A. americana* stalk for bioethanol production. To this end, three representative pretreatment technologies including dilute acid (DA), sulfite (SPORL) (Wang et al., 2009), and alkali (NaOH) methods were compared for the pretreatment of the stalk of *A. americana*. The pretreated stalk was evaluated in terms of enzymatic saccharification. In addition, the interactions (adsorption) between the pretreated agave stalks and cellulases were investigated.

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