Enhancing the Feasability of Bioethanol Production Using Agriculturally Produced Waste Products

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The growing popularity of bioethanol in the fuel industry emphasizes the importance of creating an efficient but inexpensive system for large-scale ethanol production by yeast. Recently, there has been much controversy regarding the use of food products for bioethanol production due to food shortage issues in certain parts of the world. This project examined the usage of agricultural waste products such as sugar cane bagasse and banana pseudostem as potential biomass sources due to their high lignocellulose content. Lignocellulose is a complex carbohydrate primarily composed of two polysaccharides: xylan, which hydrolyzes into five-carbon sugars called xyloses, and cellulose, which hydrolyzes into glucose sugars. However, a potential obstacle is that most yeast strands are not able to break down xylan because they lack essential enzymes like xylanase. A culture of yeast was tested to produce xylanase, suggesting its ability to utilize xylan for bioethanol production. However enzyme assays indicated its rate of xylan fermentation was extremely low compared to cellulose fermentation, meaning potential bioethanol production would also be minimal. In order to speed the co-fermentation rate of xylan and cellulose, the scientist next aimed at provoking greater xylanase activity within the culture. Results suggested a media with constrained nutrient availability provoked the culture to metabolically adapt by increasing its enzyme activity. This is significant because it demonstrates the possibility of speeding the rate of xylan fermentation, and more importantly the rate at which agricultural waste products can be fermented for bioethanol production.

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