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The effect of heat treatment on enhancing cellulolytic microbial activity on sugarcane bagasse

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The global energy demand continues to grow while the available fossil fuel resources are limited. Second generation biofuel production using lignocellulosic biomass like sugarcane bagasse is discussed broadly nowadays. Complex polysaccharide structure of sugarcane bagasse needs to go through multiple steps to convert it to ethanol such as pre-treatment, enzymatic degradation of cellulose to glucose (saccharification), fermentation of sugars to ethanol. From those, saccharification is very important. The aim of this study was to compare the effect of heat treatment on sugarcane bagasse as a pre-treatment method facilitating cellulase activity of cellulolytic microorganisms. The microorganisms were isolated from environment and some microorganisms were obtained from NIFS Bioenergy Laboratory culture collection. Isolated fungi were screened for their cellulolytic enzyme production potential. The most efficient enzyme producer-isolates were used to hydrolyse both non heat-treated-sugarcane bagasse as well as heat treated sugarcane bagasse at 100°C for one hour. Total cellulase assays were conducted for the crude enzyme extracts after the incubation period to determine total cellulase activities.

The results showed that *Aspergillus niger* (Fk) had given the highest total cellulase activity (0.5191 FPU/ml) on non-heat treated sugarcane bagasse. Moreover, the same *A. niger* (Fk) isolate showed the highest cellulase activity (0.8765 FPU/ml) on heat-treated bagasse. It was approximately a 70% increment of enzyme activity leading to increased release of fermentable sugars. Providing a heat treatment to sugarcane bagasse before inoculating cellulolytic microorganisms is positively affecting the total cellulase activity of *Aspergillus niger* on hydrolysing sugarcane bagasse. The heat needed for treatment of sugarcane bagasse can be obtained from hot vinasse which is also a factory effluent generated in sugarcane industry.

Keywords: *Aspergillus niger*, cellulolytic enzymes, heat treatment, saccharification, sugarcane bagasse