Name of the Theme: Life Sciences & Agricultural Sciences

Production of xylanase by *Pycnoporus* sp. in submerged fermentation using wildly growing non-food plant biomass as substrate

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ABSTRACT

Xylanase (EC 3.2.1.x) catalyzes the hydrolysis of 1, 4-β-D-xylosidic linkage of the xylan, which is the most abundant and principal type of plant cell wall polysaccharide, hemicellulose. Xylanases are produced by a wide variety of microorganisms, among which the white-rot fungi are the most potent producers than yeast and bacteria. In the present day, the demand for xylanase is rising because of its potential applications in the clarification of fruit juices, pre-bleaching of pulp, improving the digestibility of animal feed stocks, bioconversion of lignocellulosic material and agro-wastes to fermentable products, including ethanol and xylitol production. The relatively high cost of enzyme production has hindered the industrial application of xylanases. The cost of carbon source plays another major role in the economics of xylanase production. Xylanases of fungi are usually inducible enzymes secreted into media containing pure xylan or xylan-rich residues. The high xylan content of plant biomass makes them accessible and cheap sources of inducers to be mainly applied in great volumes of fermentation, such as those of industrial bioreactors. Moreover, white-rot fungi are effective organisms in lignocelluloses degradation. In this work, the main proposal was incorporated in the nutrient medium plant biomass decomposed to soluble hemicellulose-rich compounds (liquor/hydrolysate) through treatment of plant biomass in autohydrolysis process, as a strategy to increase xylanase production. The application of this plant biomass hydrolysate as the carbon source for industrial xylanase production are scarce and not comprehensively studied and reported in submerged fermentation (SmF) by white-rot fungi. Being the simple, non-toxic and cost-effective carbon source to yield xylanase, the replacement of xylan as the substrate with hydrolysate of plant biomass in SmF is of great interest particularly in industrial production.

In the present investigation the production extracellular xylanase by a newly isolated white-rot fungus *Pycnoporus* sp. on the low-cost aquatic and terrestrial weed plant biomass hydrolysate was studied in submerged fermentation. Six wildly growing non-food plant biomass Benghal day flower *(Commelina benghalensis*), Bermuda grass *(Cynodon dactylon*), Water hyacinth (*Eichornia crassipes*), Congress grass (*Parthenium hysterophorus*), Water lettuce (*Pistia stratiotes*), and Green foxtail millet (*Setaria viridis*) were evaluated in SmF for xylanase production. The medium containing pure xylan was also examined for xylanase production in

SmF to compare the ability of xylanse production by this white-rot fungus using cheap plant biomass and costly pure xylan as the sole carbon source. In all the experiments, temperature and pH were kept constant at 25±2^{o}C and 5.5 respectively and the fermentation was carried under static conditions for 7 to 14 days of incubation period. The best xylanase activity was obtained when pure xylan was used as the sole carbon source. The plant biomass of *Setaria viridis* was shown to be the best inducer for xylanase production followed by *Cynodon dactylon* and *Parthenium hysterophorus.* In aquatic plant biomass of *Eichornia crassipes* and *Pistia stratiotes*, this fungus showed moderate levels of xylanase activity. *Pycnopors* sp. produced very minimum quantities of xylanase when *Commelina benghalensis* biomass was used as carbon source. It was also observed that this white-rot fungus produced very negligible amount of cellulase activity.

Key words: Xylanase, xylan, inducible enzyme, autohydrolysis process, hydrolysate, white-rot fungus, plant biomass, submerged fermentation.