RESEARCH PAPER:

Xylanase production from *Aspergillus niger* using rice bran as a carbon source

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SUMMARY

The aim of this study is to produce the xylanase enzyme, (which plays a key role in paper and pulp industries) from *Aspergillus niger. Hence* in order to reduce the cost of the substrate for xylanase production, several agricultural residues such as rice bran, saw dust, pine apple fiber, coir pith, and orange peels, sweet lime peels were tested for the maximum xylanase production. Among the tested agricultural residues, rice bran was evolved as the best suitable substrate for maximum xylanase production. All the other agricultural residues were able to produced less amount of xylanase. The production of xylanase by *Aspergillus niger* was examined on rice bran under solid-state fermentation (SSF). The optimum pH and temperature for xylanase production by SSF was 6.5 and 35^{0}C respectively. Time course experiments indicated maximum xylanase production at 144 hours. Amendment of fructose and sodium nitrate in the medium proved suitable for higher xylanase production.

Key words : Solid state fermentation (SSF), Rice bran, Xylanase, pH, Temperature, *Aspergillus niger*

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Large quantities of agricultural residues accumulate every year which result not only in the deterioration of the environment but also in the loss of potentially valuable material which can be processed to yield a number of value added products such as food, fuel ,feed and a variety of chemicals (Someet *et al.*,2001).The increasing energy demands have focused world wide attention on the utilization of renewable resources, particularly agricultural wastes, the major components of which are cellulose , starch, lignin and xylan (Satyanarayana *et al.*,2004).Agricultural residues contain 20-30% hemicellulosic materials which can be utilized by microorganisms. The main carbohydrate constituent of the lignocellulosic material is cellulose,mannan and xylan. Xylan constitutes the major noncellulosic polysaccharides of primary cell wall of grasses and secondary wall of all angiosperms (Asbah *et al*.,2000; Diaz *et al*.,2004).

Xylan is heterogenous polysaccharide consisting of a homopolymeric backbone of1,4-linked –ß-D-xylopyranose units and short chain branches including *O*-acetyl -x -L-arabinofuranosyl,x-glucuronyl residues (Whistler and Richards 1970).The complexity of xylan requires the action of multiple xylanases with overlapping yet different specificities to effect extensive hydrolysis (Dekker and Richards,1976).Xylanases are the key enzymes for break down of xylan since they depolymerise the back bone. Strains of *Aspergillus* are known to produce xylanase on various lignocellulosic substrates (Labeille *et al.*,1999; Gawande and Kamat,2000). Xylanases have been isolated from diverse range of microorganisms including fungi and bacteria (Medeiros *et al*., 2000).Fungal xylanases can be produced using two main methods, solid-state cultivation systems and submerged liquid cultivation systems.

Most research has used submerged culture, which allows control of the degree of aeration, pH and temperature of the medium and the control of other environmental factors required for the optimum growth of microorganisms. However, solid-state fermentation (SSF) has gained renewed interest from researchers in recent years and has often been employed for the production of xylanases because of a number of economic and engineering advantages (Smith *et al.*,1977; Pandey,1994).These include the simplicity of the equipment and the low moisture content, which prevents other microbial contamination. The importance of xylanase (EC3.2.1.8) lies in the recycling of biomass and its wide usage in biotechnology, such as in pulp bleaching, baking industry and manufacturing of animal feed (Viikari *et al.*,1994; Poutaten,1997).Hence, an attempt was made to study the cultural conditions for