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Efficacy of *Aspergillus fumigatus* in cellulase enzyme complex production with bagasse as substrate

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SUMMARY

Concentration (0.1, 0.2, 0.3 and 0.4 per cent) of carbon sources on the 5th, 7th and 9th days of incubation exhibited by *Aspergillus fumigatus* in the presence of bagasse as substrate. Results of the study revealed that among the carbon sources the intracellular exoglucanase and β glucosidase activity were registered at a higher level of 1.913Uml^{-1}and 0.689 Uml^{-1} in 0.4 per cent dextrose. The endoglucanase activity was found to be expressed maximally in 0.4 percent maltose (2.470Uml^{-1}) than the control. Extracellular exoglucanase and β -glucosidase were significantly recorded at maximum level of 2.057 Uml^{-1} and 0.403 Uml^{-1} in 0.4 per cent fructose as carbon source. The endoglucanase activity was very much pronounced (1.620Uml^{-1}) in 0.4 per cent dextrose when compared to the control.

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Key words : Extracellular, Intracellular, Exoglucanase, Endoglucanase and β-glucosidase

Plant cell wall polysaccharides are the most abundant organic compounds found in nature. They make up 90 per cent of the plant cell wall and can be divided into three groups namely cellulose, hemi-cellulose and pectin. Cellulose is indigestible by humans because humans do not produce the enzyme cellulase. Cellulase is produced by grazing animals such as cows (with the aid of the beneficial bacteria that reside in the animals digestive tract), and is the reason why they can get nutrition from plants such as grasses. Cellulose consists of linear β-1, 4-linked d-glucopyranase chains that are condensed by hydrogen bonds into crystalline structures, called micro-fibrils. These micro-fibrils consist of upto 250 glucose chains and are linked by hemicellulose. In addition to this crystalline structure, cellulose contains non-crystalline (amorphous) regions within the micro fibrils. Cellulase refers to a family of enzymes which act in concert to hydrolyze cellulose. Cellulases are widely distributed throughout the biosphere and are manifested mostly in fungal and microbial organisms. Cellulase enzyme complex converts crystalline, amorphous and chemically derived celluloses qualitatively to glucose. Cellulolytic enzymes are generally formed as multi enzyme systems and have classified into three major groups as exoglucanase, endoglucanase and β –glucosidase.

The synergistic action of these three enzymes is required for complete degradation of cellulose. The extracellular production of microbial cellulases depends on a number of factors such as inoculum size, carbon source, pH, temperature, presence of inducers or inhibitors, medium additives, batch size, aeration and growth time (Bisaria and Ghose 1981, Saddler *et al.*, 1987). Many microorganisms, mostly fungi, degrade cellulosic and hemicellulosic materials and produce a complete set of cellulases for the hydrolysis of cellulose and hemicellulose to respective sugars (Coughlam, 1985). Several studies were carried out to produce cellulolytic enzymes from biowaste degradation process by many organisms including fungi such as *Trichoderma, Aspergillus* spp., *Penicillium* (Lakshmikant and Mathur, 1990). Since the production of cellulase enzyme is a major process and economically viable, much work has been done on the production of cellulase from lignocellulosics and major attention has been given to use baggase as substrate.

With this background, the present investigation was carried out to analyze the efficacy of *Aspergillus fumigatus* in the production of cellulase enzyme complex like exo- β- 1,4 glucanase (C_1-cellulase), endo- β-1,4 glucanase (C_x-cellulase) and β-glucosidase (filter paper activity) at extracellular and intracellular level at different

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