Abstract No: BS-28

Optimization of production of extracellular amylases by *Aspergillus niger* by solid state fermentation of microbial digestion of ground nut shell substrate

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Amylase has found its applications in a range of industries including food, brewing, distilling, textile, paper and pharmaceuticals and in the bioconversion of solid waste. Amylase has been reported to be produced by plants, animals and microorganisms, although microbial amylase production has been reported to be the most effective. In the current work, amylase was produced by *Aspergillus niger* under solid state fermentation using ground nut shell as the carbon source. Initially, conditions were optimized to improve the microbial digestion of ground nut shell. For that, digestion was carried out using a mixed culture of *Saccharomyces cerevisae* and *Peniciliiunm* sp., with and without a mineral salt solution, varying pH (4 to 7), the incubation period (1-7 days), amount of carbon source (2.00 to 6.00g), moisture content (10.00 to 30.00mL), with surfactants (between 20 and 80) and addition of nitrogen sources [$(NH_4)_2SO_4$, NH_4NO_3, NH_4Cl, $NaNO_3$ and $(NH_4)_3PO_4$]. Results revealed that maximum digestion can be achieved with optimized conditions, on the 4th day of incubation in 4.00 mL of mineral salt solution (pH 5) with 4.00 g of carbon source, between 80 (0.05%) and NH_4NO_3 (0.50 g). The digestion of ground nut shells was more effective in optimized conditions as there was significant growth of *S. cerevisae* and *Peniciliiunm* sp. Minerals that are required for microbial growth was provided by mineral salt solution. Surfactants increase the secretion of the enzymes by increasing the cell membrane permeability. As *Penicillium* sp. grows at pH 3 - 4.5 and *S. cerevisiae*, an acidophilic organism, grows better under acidic conditions (pH 4 to 6), the medium pH was in between pH 4 to 7. Digestion of ground nut shells was measured using DNS assay. After digesting the ground nut shells by *S. cerevisae* and *Peniciliiunm* sp. under optimized conditions the samples were inoculated with *A. niger* in the presence of organic N sources (peptone, glycine, urea and yeast extract). Statistical analysis was done by calculating mean enzyme activity. The maximum enzyme activity was obtained on the 5th day with yeast extract (0.50 g). The average enzyme activity was 31.35 U/mL, obtained on the 5th day with yeast extract (0.50 g). The enzyme activity was measured using amylase assay. There is a good potential of producing amylase by *A. niger* under solid state fermentation using ground nut shell as the substrate after digesting with *S. cerevisiae* and *Penicillium* sp.

Keywords: *Aspergillus niger*, *Saccharomyces cerevisae* Amylase, Ground nut shells, Solid state fermentation