

Production, Purification and Characterization of β -Galactosidase Enzyme from *Penicillium* sp. and *Curvularia* sp.

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β -Galactosidase producing various eight microbial isolates were isolated and evaluated their potential for production. Among these isolates best producers *Penicillium* sp. and *Curvularia* sp. were selected. Both the mould isolates were grown in to chemically defined medium and deproteinized cheese whey medium for the enzyme production. Enzyme purification was also carried out by procedures including ammonium sulphate precipitation and ethanol precipitation. These steps resulted a purification of 0.570 and 9.52 fold by ammonium sulphate and ethanol precipitation, respectively and a 71.2 U mg⁻¹ and 1184 U mg⁻¹ protein, respectively using *Penicillium* sp. Whereas, in *Curvularia* sp. 5.35 and 17.44 fold purification was achieved by ammonium sulphate and ethanol precipitation method, respectively. Some enzyme characteristics were determined using *o*-nitrophenol- β -D-galactopyranoside as a substrate. The pH and temperature optimum of the β -galactosidase activity produced from *Penicillium* sp. were about 5.8 and 80°C, respectively when production was carried out in chemically defined medium and purified by ethanol precipitation method. The Km and Vmax values were 5.2 mM and 8000 U mg⁻¹. β -galactosidase of *Curvularia* sp. is thermotolerant and shows the activity at 80°C under acidic pH 5.2 with Km 9.1 mM and Vmax 1000 U mg⁻¹ values when it was produced in chemically defined medium and purified by ethanol precipitation method.

Biomethanation of *Ipomoea carnea* Leaves Along with Buffalo Dung

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A laboratory scale experiment was conducted at Biogas Research and Extension Centre, Gujarat Vidyapeeth, Sadra, Dist. Gandhinagar during 7th July, 2009 to 13th February, 2010. The experiment was conducted on daily feeding basis in 5L capacity glass digesters with working volume of 4.8L. Six bottles were used. Buffalo dung was mixed with water (to obtain 6% total solids) and fed in all the digesters. Since the hydraulic retention time for Gujarat region is of 40 days so to fill the digesters upto 4.8L working volume, 120mL mixture of buffalo dung and water was fed daily from the very first day of feeding to 40 days. Active microbial inoculum, in the form of digested slurry from the running biogas plant of the centre, was also added in all the digester @ 10% (v/v). After 40 days till 101 days, above feeding remained continue in all the digesters to obtain stabilized biogas production. From 102nd day onward this feeding remained continue in control digesters whereas in Test-1 digesters a portion of buffalo dung was substituted by powdered *Ipomoea carnea* leaves waste but the contents of solids was kept constant i.e. 6% and in Test-2 digesters *Ipomoea carnea* leaves waste alone was added at 6% total solids content. Biogas production in all the digesters was recorded daily at 6:00pm and 9:00am from 102nd day onwards along with corresponding environmental temperature. Feeding and effluent slurries of all the digesters were analyzed for various chemical and enzymic parameters at weekly interval. Comparison of biogas produced in various treatments show that compared to control Test-1 and Test-2 digesters produces 122.01 and 212.39% higher biogas, respectively whereas between test digesters Test-2 digester produces 40.71% higher biogas than test-1. The effect was found significant. Methane content was also higher in biogas produced in Test-2 digesters compared to rests. Further, content and per cent increase in effluent slurry over feeding slurry for electrical conductivity, organic carbon, available potassium, calcium and magnesium were found higher in Test-II than Test-I. Here also the effect



was significant statistically. It can be concluded that *Ipomoea carnea* leaves can be digested successfully alone and with buffalo dung and at 6% total solids content it produces significantly higher biogas compared to buffalo dung alone. The nutritive value of digested slurry produced from *Ipomoea carnea* leaves digesters was also found significantly higher compared to that of buffalo dung.

Vermicomposting of Plant Leaves

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An experiment in pits of 45x32x21 cm (LxBxH) was conducted during July 2009 and January, 2010 at Biogas Research and Extension Centre, Gujarat Vidyapeeth, Sadra, to find out the efficiency of *Eisenia foetida* for degradation of leaves of *Cassia fistula*, *Croton tiglium*, *Ipomea carnea*, and *Calotropis gigantean* along with buffalo dung. A total of 20 pits were prepared and the experiment was laid down in Randomized Block Design with five treatments and four replications. Green fresh leaves of experimental plants were chopped into small pieces of 1 cm length and laid down in a layer in pits above the layer of buffalo dung. Plant leaves and buffalo dung were used in 1:8 proportion, respectively. 8 kg buffalo dung and 1 kg plant leaves were added in a single pit. First layer in the pit was of 4 kg buffalo dung followed by one layer of 1 kg green plant leaves covered by second layer of 4 kg buffalo dung. The floor of pits was made cemented before starting the experiment to stop leach down of nutrients. The moisture in each pit was kept 70% by regular sprinkling of water. Earthworms (*Eisenia foetida*) were added 15 days after addition of buffalo dung and plant leaves. Pits were covered with moist gunny bags and observed daily for moisture content. Sufficient protective measures were applied against the attack of ants and rats on earthworms. Weekly turnings were given to the material in pits. After maturation of compost it was analysed for its various physico-chemical, microbial and enzymatic parameters. Vermicompost is prepared in 40-55 days. Analysis of vermicomposts for above parameters revealed that the vermicompost prepared from *Cassia fistula* leaves contains higher plant nutrients, higher numbers of nitrogen fixing bacteria and higher activity of enzymes such as urease, acidic and alkaline phosphatase, acidic and alkaline protease, dehydrogenase and α -glucosidase. The contents were found statistically significant.