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Production Optimization of β-Cyclodextrin: Orphan Molecule for Renal Diseases Treatment

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Objectives: Beta cyclodextrin (β-CD) has acquired trendamouly industrial importance with application in medicines (Hydroxypropyl beta cyclodextrin HPβCD) as a cholesterol removal. They form a water-soluble complex with cholesterol in the kidney cortex which is then execrated. Due to this unique property, β-CD and its derivatives treat kidney diseases, atherosclerosis, hypercholesterolemia, and Niemann-Pick Type C diseases. The objective of this research is to optimize microbial production of β-cyclodextrin and its characterization.

Methods: β- CD is produced by the action of CGTase on starch. For this purpose *Bacillus* sp. NCIM 5799 was inoculated in a production medium kept in the gyratory shaker (121 RPM at 30°C). After incubation, the appropriately diluted enzyme was used for the production of β-CD. Effects of different starches, incubation temperature, buffers, and incubation time were studied. β-CD was precipitated from the reaction mixture and characterized using FTIR.

Results: The crude CGTase from *Bacillus* sp. NCIM 5799 was employed for the bioconversion of starch to β-cyclodextrin. The maximum activity of CGTase 161 U/ml was observed at 96h of fermentation. Soluble starch was found to be the best substrate for β-CD production with 183 µg/ml. The best activity was observed at pH 7 in phosphate buffer, with an incubation temperature of 60°C. The β-CD yield was found to increase with the increase in the incubation period at pH 7. The FTIR spectrum of standard and isolated β-CD was similar, which confirms the identity of the isolated β-CD.

Conclusions: *Bacillus* sp. NCIM 5799 could be utilized for industrial-scale production of β-CD. The β-CD thus produced in its native form or as derivatized form (HPβCD) has been indicated to be used as a cholesterol sequestering agent for renal diseases.