

Bacterial cellulases

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Cellulolytic bacteria play an important role in the biosphere by recycling cellulose. The cellulase systems they produce usually comprise a number of distinct enzymes, which can have specific activities comparable to those of cellulolytic fungi. The cellulase systems of certain bacteria may be found as discrete multi-enzyme aggregates. Many cellulolytic bacteria utilize a multi-enzyme complex that binds to and synergistically hydrolyzes cellulose substrates. This review is an attempt to summarize the available literature concerning applications and cellulolytic enzymatic systems of the bacterial genera *Bacillus*, *Clostridium* and *Cellulomonas* sp. The composition of complex cellulases produced by these organisms were examined at the enzyme level.

Cellulose is the major carbohydrate synthesized by

level of commercialization due to many factors complexity of cellulose structure, production of cellulases in low amounts by cellulolytic organisms due to carbon gene repression, high cost of cellulase production and poor yields of glucose (Gregg and Saddler, 1996; Ruijter and Visser, 1997).

Cellulase enzymes are derived from cellulolytic microorganisms. Bacterial cellulases have demonstrated variable activities and modes of action on cellulose hydrolysis. The use of cellulases with higher specific activities and those which are not feedback inhibited by the products of hydrolysis will also aid in reducing the overall costs of cellulose bioconversion.

The cellulolytic enzyme system of bacteria seems to be quite complex. Two extracellular and one cell-bound endoglucanase components were identified in bacterium,

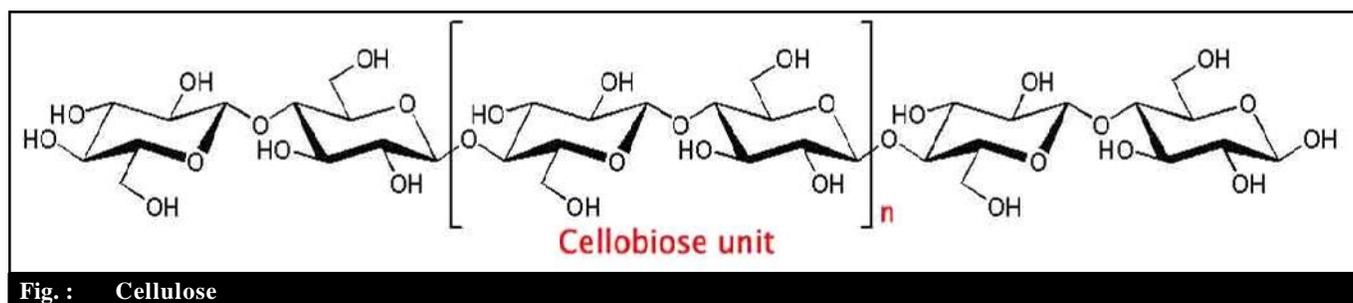


Fig. : Cellulose

plants. It serves as a vast reservoir of glucose units linked by β -1, 4 glucosidic bonds. Release of the bound glucose units from cellulosic wastes by cleavage of β -glucosidic bonds, known as saccharification facilitates the utilization of glucose depot in cellulosic wastes for production of food, fuel, single cell protein, feed stock synthesis of chemicals and value - added products. Development of processes for conversion of low-value product in wastes/effluents to high value product has become necessary and the saccharification process of cellulose waste relies on participation of cellulolytic organisms and their cellulase enzymes (Singh and Hayashi, 1994; Beguin and Aubert, 1994). This process has not yet reached to the

Pseudomonas fluorescens va. Cellulose (Yamanae *et al.*, 1970). Two tightly substrate-bound (designated as CB1 and CB 2) components were observed with another bacterium, *Cellulomonas fimi* (Beguin *et al.*, 1992). CB 1 and 2 were identified as an endoglucanase and exoglucanase. The enzymology of cellulose degradation is documented in several recent reviews (Robson and Chambliss, 1984; Wood, 1992; Kudanga and Mwenje, 2005; Coughlan, 1992b; Felix and Ljungdahl, 1993; Gilbert and Hazelwood, 1993; Singh and Hayashi, 1994; Beguin and Aubert, 1994; Bayer *et al.*, 1994; Leschine, 1995).

Endoglucanases or Carboxy Methyl Cellulases (CMCases) (Endo- β -1,4-glucanase, EC 3.2.1.4) randomly