Chapter 2

Cellulolytic Microorganisms: A Review

Amritha Govindrao Kulkarni
Karnatak University, India

Ankala Bassappa Vedamurthy
Karnatak University, India

ABSTRACT

Cellulose is the most abundant polymer in plants and the microbial conversion of cellulose is a subject of active research. Currently, cellulase is commonly used in many industrial applications, especially in animal feed, textile, waste water, brewing and wine making. A challenging strategy for the efficient utilization of this renewable resource is to use it as a base material for the production of desired metabolites. This chapter therefore focuses on exploring the cellulase producing bacteria and optimizing the parameters for the enzyme cellulase under varied conditions. Cellulolytic bacteria can be exploited for cellulase production which serves wide applications in industries, pharmaceuticals and further, use of these CDB as bio-inoculants can be incorporated to enhance organic matter decomposition in soil to increase soil fertility and to minimize the fertilizer application. It finds wide applications in reducing the environmental pollution and promote sustainable agriculture.

INTRODUCTION

Anselme Payen (1795-1871) coined the term cellulose and introduced it to scientific literature in 1839 after isolating a fibrous substance mostly found in wood, cotton and other plants (Payen, 1838). Cellulose, the leading bio-residue from agricultural sector is the predominant renewable biopolymer in the world which comprises of celluloses, hemicelluloses and lignin. A promising strategy for the efficient utilization of this renewable resource is to use it as a base material for the production of desired metabolites (Kulkarni and vedamurthy 2016). Cellulose is probably the most abundant Biomass/biological compound on earth specially, on terrestrial and aquatic ecosystem and is the main component of plant biomass. Cellulose is probably one of the most ubiquitous and abundant polymers on the planet, given its widespread industrial use in the present age, but also in the past for ropes, sails, paper, timber for

housing and many other applications. By far the most commercially exploited natural resource containing cellulose is wood (Nishida et al., 2007).

It occurs in almost pure form in cotton fiber and in combination with other materials, such as lignin and hemicelluloses, in wood, plant leave stalks, etc. It has already been used in processing of coffee, in textile industry and in laundry detergents. Cellulases cause hydrolysis of the individual cellulose fibres to break it into smaller sugars units & finally producing glucose molecules (Shaheen et al., 2010).

Cellulose is probably one of the most ubiquitous and abundant polymers on the planet, given its widespread industrial use in the present age, but also in the past for ropes, sails, paper, timber for housing and many other applications. By far the most commercially exploited natural resource containing cellulose is wood (Echhiron et al., 2009). It occurs in almost pure form in cotton fiber and in combination with other materials, such as lignin and hemicelluloses, in wood, plant leave stalks, etc. It has already been used in processing of coffee, in textile industry and in laundry detergents. Cellulases cause hydrolysis of the individual cellulose fibres to break it into smaller sugars units & finally producing glucose molecules (Muhammed, 2012).

It is the dominant waste material from agricultural industry in the form of stalks, stems and husk, there has been great interest in utilizing cellulose as an energy resource and feed (Karmakar & Ray, 2011). The cellulose is composed of D-glucose units linked together to form linear chain via β-1, 4-glycosidic linkages (Abdelnasser & Ahmed, 2007). It is the primary product of photosynthesis in terrestrial environments and the most abundant renewal bio-resource produced in the bio-sphere. Cellulose in natural substrates is persistent in the environment and remains as an environmental pollutant (Singh, 2007). Cellulosic materials can, however, be a valuable and vast resource replenished by photosynthesis. Apart from the production of value-added products, its bioconversion offers an effective solution for the abatement of pollution due to solid-waste and their utilization, which would act at low sustainable process and products. It is well known that plants are the most common source of renewable carbon and energy on the earth. Lignocellulosic crop residues, such as cereal straw, provide the principal input of cellulose to arable soils (Lynch et al., 2008).

**Structure and Classification of Cellulose**

The cellulose molecule is an unbranched linear polymer of glucose. This is shown by its empirical formula \((C_6H_{10}O_5)_n\), and its structural formula shown in Figure 1.

*Figure 1. Structure of Cellulose*
Related Content

Environmental Object Recognition in a Natural Image: An Experimental Approach Using Geographic Object-Based Image Analysis (GEOBIA)
[www.igi-global.com/article/environmental-object-recognition-in-a-natural-image/111214?camid=4v1a](www.igi-global.com/article/environmental-object-recognition-in-a-natural-image/111214?camid=4v1a)

Endophytes and Their Role in Phytoremediation and Biotransformation Process
[www.igi-global.com/chapter/endophytes-and-their-role-in-phytoremediation-and-biotransformation-process/196805?camid=4v1a](www.igi-global.com/chapter/endophytes-and-their-role-in-phytoremediation-and-biotransformation-process/196805?camid=4v1a)

Use of Remote Sensing Data for Landslide Change Detection: Montescaglioso Large Landslide (Basilicata, Southern Italy)
[www.igi-global.com/article/use-remote-sensing-data-landslide/62063?camid=4v1a](www.igi-global.com/article/use-remote-sensing-data-landslide/62063?camid=4v1a)

Spain
[www.igi-global.com/chapter/spain/45089?camid=4v1a](www.igi-global.com/chapter/spain/45089?camid=4v1a)