Chapter 4
Recent Molecular Approaches for Development of Value-Added Products From Lignocellulosic Food Waste

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ABSTRACT

The escalating global population has led to an ever-increasing demand for food processing industries, and as a result, the generation of huge amounts of food waste. The severity of this problem is augmented due to dawdling development of effective waste treatment and disposal strategies. In a quest of potential alternative bioenergy resources, lignocellulose is proven to be a good, abundantly available raw material on the land as a leftover of agricultural and industrial byproduct made up cellulose, hemicelluloses, and lignin. It is mostly utilized for biofuels, bio-ethanol production, and other value-added products. The development of the conversion of lignocellulosic biomass to fine chemicals still remains a big challenge. The deciphering molecular mechanism and effective cellulase and hemicellulases producing microorganisms might successfully be accomplished with transcriptome, proteome, and recombinant DNA technology; these are discussed in this chapter.

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INTRODUCTION

Lignocellulose is a common term used to explain biomass of plant. Most of the food and food processing industry waste are lignocellulosic in nature with a global estimate of up to 1.3billion tons/year (Ravindran and Jaiswal, 2015). The many value added products are routinely generated fromreducing sugars obtained hydrolysis of Lignocellulose viz bioethanol, biogas, organic acids, enzymes and biosorbents. It is highly inexpensive renewable carbon resource having 75% of polysaccharide (Sun & Cheng, 2002).

In general it is composed of cellulose (40 to 50%) and hemicelluloses (25 to 30%) and lignin (10 to 20%) (Wyman et al., 1999). Lignin is a non carbohydrate polyphenolic compound. Cellulose hydrolysates comprise glucose and various levels of cellobiose and other glucose oligomers. On the other hand, hemicellulose hydrolysates are more complex mixtures as they include several hexoses (glucose, galactose, and mannose) and pentoses (xylose and arabinose) (Wiselogel et al., 1996). The food processing industry in the all over world is progressing at a very fast speed. Such an increasing industralisation can give rise to more waste that is ultimately left untreated due to lack of treatment options. The land filling could be the cheapest option for waste management by many industries. Incineration could be the one approach but it requires a lot of expenditure of energy recourses. However second one is composting of food waste are time consuming and sluggish. However improper disposal treatment of these waste leads to their putrefaction giving rise to toxic gases such as methane and leaching of other toxic liquids proving hazardous to the environment. Being the plenty and easy availability of food waste, exploitation of value added products from them is meagerly studies. Most of the waste generated from the food industry is lignocellulosic in nature, and thus can be used as potential substrates for the production of high value products.

One such problem that needs to be addressed immediately is the carbohydrate source used for enzyme production. Theoretically, it is possible to recycle cheap carbohydrate sources from industries and use it as a sugar source for enzyme production. However, the heterogeneous nature of biomass carbohydrate sources hinders them to be efficient nutrients leading to incompetent growth of the enzyme producing microorganisms. This is due to the fact that 5-C and 6-C sugars are absorbed by the microbe at different rates during fermentation (Abdel- Rahman et al., 2015). Furthermore these carbohydrate sources comprises of other substances that may act as inhibitors for microbial growth, and leads to poor fermentation yields and subsequently raising the production costs for the desired products.