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Review

Bioconversion of sago residue into value added products

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Bioconversion of the agro-residue offers the possibility of creating marketable value-added products. In this regard, sago residue which contains solid and liquid materials produced abundantly as a by-product from the sago starch processing industry. Due to its organic nature and low ash content, attempts have been made to produce several products such as fermentable sugar, enzyme, compost for mushroom, animal feed and adsorbent. Utilization of sago residue not only reduce the polluting effects from the sago processing industries, but will also provide an economic solution for waste management system at sago processing mills. This review focuses on the developments in processes and products for the value addition of sago residues through biotechnological means.

Key words: Sago palm, sago starch, sago residue, sago 'hampas', sago wastewater.

INTRODUCTION

In Sarawak, East Malaysia, agro-residues from sago starch processing industries are abundant and readily available. As stated by Bujang et al. (1996), it has been estimated approximately 7 tons (t) of sago pith waste was produced daily from a single sago starch processing mill. Currently, these residues were washed off into nearby streams together with wastewater and deposited in the factory's compound, which can lead to serious environmental problems. The problems of pollution from sago starch processing are more social and economic in nature than technological. It has been shown that sago wastewater represents high organic material ('hampas'), chemical oxygen demand (COD) and biological oxygen demand (BOD), which contravened the standard limit discharge enacted in the Environmental Quality Act, 1974 (sewage and industrial effluents regulation, 1979). According to starch processors, the installation of pollution control devices can be 20 - 50% of the total investment cost of a large-scale factory. Thus, through the exploittation of these residues from sago starch processing industry, a promising materials resources such as sago bark (peelings from initial processing), sago 'hampas' (fibrous by products from crushing and sieving) and sago wastewater can be used for global environmental conservation and sustainable development. Sago 'hampas' which contained mostly starch and lignocellulosic materials is such a good choice to be used as a substrate for solid substrate fermentation either by fungal bioconversion or by enzyme or acid hydrolysis. Sago bark which contains mostly lignin is a rigid structure, traditionally used as a base around the sago processing mill. The present review addresses the progress that has been made in each of these resources with emphasis on the bioconversion into value added products.

SAGO PALM AND ITS PROCESSING INDUSTRY

The importance of starch production by sago palm is mainly focused in the Asia-Pacific region and South East Asia (Wang et al., 1996). Sago palms are those species of the genus *Metroxylon* belonging to the Palmae family. It is a species from which useful quantities of starch-rich flour can be extracted from stem tissue by shredding and

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