Isolation and Determination of Enzymatic Activity of Selected Fungi on Sugarcane Bagasse as Feed for Ruminant

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ABSTRACT

It was found that ester and covalent bond between lignin, polysaccharides, and protein could reduce the digestibility of cellulose and hemicelluloses of sugarcane bagasse. Objectives of this experiment were to identify and to isolate the fungi that capable of degrading the lignocellulosic materials in sugarcane bagasse and to determine the decomposition ability of enzymatic selected fungi. The method used to culture the fungi was enrichment and platting method, while the method used for selection of fungi was the enzymatic selection method. Isolated fungi in this experiment were: *Aspergillus* sp, *Penicillium citrinum*, *Penicillium* sp(2), *Penicillium* sp(3), *Penicillium* sp(4), *Penicillium* sp(5), *Penicillium* sp(6), *Memnoniella* sp(1), *Memnoniella* sp(2), dan *Helminthosporium* sp. Further test showed that these isolated fungi have cellulolytic activity.

Key words: fungi, cellulase, and sugarcane bagasse

INTRODUCTION

As a center of agro-based industry in Indonesia, Lampung Province has a very high fibrous agricultural residues and agro-industrial byproducts, including sugarcane bagasse. This resource could be used as a main feed for ruminants (goats, sheep, and cows) in the future. These animals have the ability to digest the cellulosic materials using microorganisms in the rumen to help in breaking down the feed and nutrients, so that the host animals can get the nutrients from it. However, lignocellulosic materials, such as sugarcane bagasse, have long been demonstrated to have high degree of resistance to ruminal degradation. Therefore, this abundant renewable biomass in fact still has a minimum benefit as a feed for ruminants.

Kirby (2006) explained that lignin has a highly complex and relatively random structure that provides this organic material with a high degree of resistance to degradation. Their wide varieties of chemical bonds make specific cleavage by the active site of an enzyme difficult, and would require many enzymes, each with a specific active site, for degradation. Moreover, Taherzadeh and Karimi (2008) stated that lignin is a complex molecule constructed of phenyl propane units linked in a three-dimensional structure, which is particularly difficult to biodegradation.

Numerous attempts have been made to improve the utilization of cellulosic materials as a feed for ruminant, include pretreatment of cellulosic materials and optimizing the bioprocess in the rumen. The whole digestion process in the digestive tract of the ruminants, especially in the rumen, could be accelerated by application of feed treatment (pretreatment), including chemical and biological treatments. Mosier *et al*., (2005) stated that pretreatment is an important tool for improving cellulose conversion or degradation processes. Pretreatment is required to alter the structure of lignocellulosic biomass to make cellulose more accessible to the enzymes that convert the carbohydrate polymers into fermentable sugars. The ultimate goal of pretreatment is to break the lignin seal and disrupt the crystalline structure of cellulose.

A number of preliminary studies have investigated the benefit effects of fungal cultures on improving the lignocelluloses decomposition. Culture of *Trichoderma viride* in sugarcane bagasse could improve the availability of structural carbohydrate (Prayuwidayati, 2006) and improve the crude protein content of fermentation product (Prayuwidayati and Muhtarudin, 2006). However, the exact mechanism or process of the effects is still not yet explored. Moreover, early enzymatic exploration of several fungal that could be