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Effect of amino acids in the stability study of hydrolase enzymes produced via solid-state fermentation using empty fruit bunch and palm oil mill sludge

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ABSTRACT

Solid-state fermentation (SSF) is an alternative treatment for valorizing agro-waste, as well as broadening their potential uses in the production of industrial enzymes. This study aims to investigate an addition of amino acids affecting the stability of hydrolases enzymes produced from SSF. The SSF was carried out for nine days with and without the addition of amino acids as a booster. About 16–57 % increased yield in the hydrolytic enzymes were obtained in the SSF with amino acids when compared to the SSF without. The yields of the enzymes remained high in the SSF with amino acids over the wide range of temperature and pH. Hence, the addition of amino acids enhanced the stability and enzymes yield.

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1. Introduction

The agricultural sector plays an important role and contributes significantly to global economic growth, especially in Malaysia. As a result of this activity, considerable agricultural biomass waste is produced. It was reported that there was only 27 % of the total quantity of waste generated is employed as fuel for drying timber, brick making, curing tobacco leaves, drying rubber sheets and manufacturing products such as particleboard and fiberboard [1]. The rest is considered agricultural waste that is being disposed of or discarded by burning, dumping or unplanned landfilling. The most widely used edible oil in the world is palm oil, which is utilized in a variety of consumer goods. The production of palm oil in Malaysia ranks second in the world, after Indonesia. Malaysia's palm oil mills in Malaysia produced 2.4 million tons of empty fruit bunch (EFB) every year, with just a small portion of it utilized as fuel for electricity and steam generation and most of them discarded [2]. EFB and palm oil mills sludge also become the breeding ground for pests and diseases that cause organisms in the environment [3]. By using EFB and palm oil mill sludge (POMS) as substrates in solid-state fermentation (SSF), the negative environmental impacts caused by their disposal can be reduced.

The idea of turning agro-waste into useful enzymes is commercially attractive and involves further research. The particular reason is enzymes are biological catalysts produced by living cells and are useful in synthesis and degradative processes. Solid residues from agricultural industries such as EFB and POMS are a potential source of important substances and can be used in the chemical, food, pharmaceutical and textile industries. Currently, the potential of utilizing agro-waste for industrial enzymes production, especially hydrolase enzymes such as amylase, protease and cellulase has become a major focus for researchers [4]. Recently, amylase enzyme has received widespread attention due to its economic and technological significance [5]. Amylase is an enzyme that breaks down starch molecules into glucose-based smaller polymers. It is very vital in the field of biotechnology, especially in the food industry, textile and paper industry, pharmaceutical industry and alcoholic compounds production. Amylases from microorganisms are more stable than those from animals and plants because they have a wider range of industrial applications. The main advantages of using microbes to make amylases are their inexpensive cost of total production and their simplicity in manipulation to manufacture enzymes with the required features.

Proteases are an industrial group that accounts for over 60 % of global enzyme output [6]. Proteases aid, mature, or destroy distinct protein sets in response to developmental signals or environmental changes. Most proteases use alkaline proteases as detergent addi-

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