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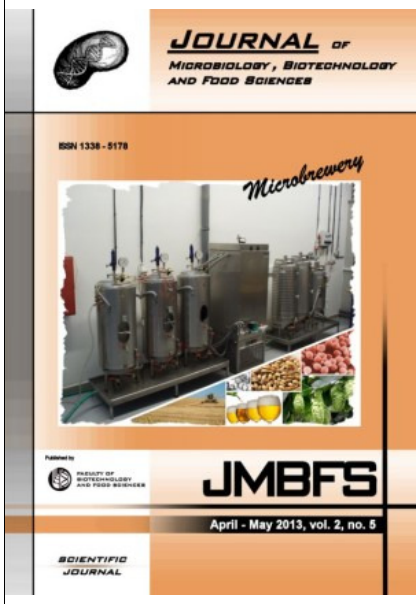

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E-MAIL	lukas.hleba@gmail.com
PHONE NUMBER	+ 421 904 189 191
JMBFS CONTACT	www.jmbfs.org jmbfs@jmbfs.org info@jmbfs.org
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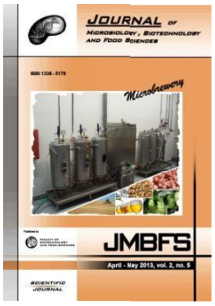

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PARTIAL HYDROLYSIS OF PURPLE SWEET POTATO FLOUR BY AMYLASE FROM *Saccharomycopsis fibuligera* AND ITS APPLICATION FOR COMPOSITE BREADMAKING

*Agus Safari, Dian S. Kamara, Fransiska Silalahi, Muhammad Fadhlillah, Idar Kardi, Safri Ishmayana**

Address(es): Safri Ishmayana
Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Padjadjaran, Jln. Raya Bandung-Sumedang km. 21 Jatinangor, Sumedang, West Java 45363 Indonesia. Phone number: +62-22-7794391.

*Corresponding author: ishmayana@unpad.ac.id

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ABSTRACT

Purple sweet potato is one of underutilized carbohydrate sources in Indonesia, whilst known as good source of carbohydrate and can act as functional food due to its anthocyanine and dietary fiber contents. Therefore in the present study, we try to modify the sweet potato flour by partial hydrolysis using amylase produced by *Saccharomycospsis fibuligera* R64 and apply the partially hydrolyzed flour for composite breadmaking. The amylase was produced using batch method and partially purified by the addition of ammonium sulfate followed by gel filtration chromatography on Sephadex G25 using fast performance liquid chromatography system. The enzyme was then used to hydrolyze the purple sweet potato flour. Characterizations of the partially hydrolyzed flour comprise reduction in amylose-iodine complex, SEM and XRD. Partially hydrolyzed flour was then used as composite flour for bread, with ratio of wheat to partially hydrolyzed purple sweet potato flour was 70 : 30. The produced bread was then analyzed for its texture, organoleptic test and visualization of the bread crumb using TEM. The results of the present study indicate that the enzyme partially hydrolyzed the sweet potato flour. Even though the quality of the composite bread is not as good as wheat bread, partial hydrolysis seems to improve the texture and appearance of the composite bread, as indicated by better swelling volume and firmness of the composite bread using partially hydrolyzed purple sweet potato flour.

Keywords: Purple sweet potato, amylase, partial hydrolysis, composite bread

INTRODUCTION

Purple sweet potato is one of carbohydrate source which can be considered as functional food due to its natural content of dietary fiber **(Huang *et al.*, 1999)** and anthocyanin that can act as antioxidant, anticarcinogenic, antihypertensive and antimutagenic **(Terahara *et al.*, 1999; Oki *et al.*, 2002; Kano *et al.*, 2005)**. However, its application in various food products is still limited. Therefore there are many efforts has been conducted to develop various sweet potato based food product **(Collado *et al.*, 2001; Singh *et al.*, 2004; Ahmed & Ramaswamy, 2006)**.

Bread is usually made from wheat flour because the presence of two specific proteins, gliadin and glutenin, that form protein network known as gluten which can seize carbon dioxide produced during fermentation of bread dough, which consequently make the bread swell **(Goesaert *et al.*, 2005)**. Unlike wheat, sweet potato does not have network forming protein. Instead, it has different type of protein, sporamin, that has been confirmed to have trypsin inhibitory activity **(Shewry, 2003)**.

Enzyme application in breadmaking has been widely known to improve the quality of bread **(Gerrard *et al.*, 1998; León *et al.*, 2002; Caballero *et al.*, 2007)**. Amylases are one of the enzymes that are used to improve physicochemical properties of bread **(Goesaert *et al.*, 2009; Fadhlillah, 2011)**. However, as far as we aware, none of the published work used enzyme pretreated flour for making composite bread. Our lab has been working with amylase from locally isolated food-borne yeast (*Saccharomycopsis fibuligera* R64), which known to produce both α-amylase and glucoamylase and it was also found that the α-amylase belongs to mesophilic enzyme **(Soemitro, 1996)**. The α-amylase produced by this yeast was found to have raw starch degrading activity without adsorption mechanism, while the glucoamylase was found to adsorb onto starch granule **(Hasan *et al.*, 2008)**.

The objective of the present study was to investigate the effect of partial hydrolysis using partially purified amylase produced by *S. fibuligera* R64 and apply the partially hydrolyzed flour for composite bread making.

MATERIAL AND METHODS

Production and partial purification of amylase

S. fibuligera cells were maintained on agar slant containing sucrose (6% w/v) and bacto agar (1.5% w/v) in bean sprout broth (10% w/v). Starter culture was developed by aseptically inoculated one yeast colony to 50 mL media containing sago starch (1% w/v) and yeast extract (1% w/v) for 48 hours at room temperature with 180 rpm shake speed. The starter culture was then transferred into a 500 mL fermentation media which has the same composition as starter culture media. The fermentation conducted for 72 hours at room temperature with 180 rpm shake speed. After 72 hours, the media was centrifuged at 4000×*g* to separate it from the cells. The supernatant contains enzyme which then partially purified by addition of ammonium sulfate (60-100% saturation), followed by gel filtration chromatography on Sephadex G-25 matrix (2 × 20 cm) using ÄKTAprime plus fast performance liquid chromatography system with 1 mL/min flow rate. The presence of protein and salt was detected using UV detector at 280 nm and conductivity meter attached to the system, respectively. Fractions with high absorbance at 280 nm were pooled and used for partial flour hydrolysis. Activity of the enzyme was monitored as described elsewhere **(Hasan *et al.*, 2008)**.

Partial hydrolysis of sweet potato flour

Purple sweet potato used in this study was *Ipomoea batatas* var. Ayamurasaki. The potato was peeled, washed and thin cut followed by sun dried. The dried chip was then grinded to obtain the sweet potato flour. Native purple sweet potato flour was refereed as NF. Hydrolysis was conducted in 20% w/v suspension of sweet potato flour in 50 mM phosphate-citrate buffer pH 5.8. Partially purified enzyme was added to achieve 50 unit/g flour. The hydrolysis was performed at two different temperatures, i.e. the optimum temperature of enzyme activity (50°C) and room temperature for 12 hours. The flour was then separated by centrifugation at 4000×*g* and the reducing sugar content of the supernatant was determined using alkaline ferricyanide assay **(Walker & Harmon, 1996)**. The resulting flour was referred as HTr and HTo for partially