ISSN 2349-0292
Impact Factor 3.802

GLOBAL JOURNAL OF ADVANCED ENGINEERING TECHNOLOGIES AND SCIENCES

CONTROL EFFECT OF PORI STRUCTURE ON TRITERPENOID MODIFICATION IN MOCAF

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DOI: 10.5281/zenodo.1238612

ABSTRACT

A new discovery of substitute of low protein but rich in nutrients wheat flour. Mocaf, low protein cassava flour, got structural changing caused by fermentation process. It occurated because lactic acid bacteria activity produced protease enzyme and cut peptide bond on protein chain in that it created dispersible lactic acid into water. In result, protein concentration was decreasing and it changed the cassava structure being porous. This porous structure enabled mocaf to be modified to triterpenoid compound to increase its nutrient content. The purposes of this study was to investigate about the influence of operating condition of fermentation to the cassava pore structure changing. Amount of triterpenoid that modified by mocaf was also studied in detail. The finding of the study showed that the fermentation time that produced expected pore structure was 12 hours and pH 4 with BIMO-CF as a bioactivator. Mocaf modified by triterpenoid was 0.457 µg/g.

KEYWORDS: mocaf, triterpenoid, fermentation

INTRODUCTION

Mocaf, cassava flour which modification, becomes an alternative substitution of wheat flour with low protein content. Mocaf synthesis with the addition of pegagan extract has been done and has been applied to 6 (six) students of autistic respondents Extraordinary Junior High School Kedungkandang Malang. Quality of service is positive. (Astuti et al, 2016; 2017). Extract of Centella asiatica which is coated on mocaf surface give revitalizer effect of blood distribution system to the brain.

Continues development of mocaf to expand use of cassava flour, this study modified process of starch granule structure in cassava by fermentation using Bacteria Acid Lactic Microorganisms (BAL). BAL activity results in a more hollow cassava structure. This property is used to increase the amount of triterpenoids that can be modified into mocaf. In addition to changes in the structure of starch granules, BAL also provides a better effect of color, flavor and aroma than ordinary cassava flour (Koch & Jane, 2000; Zulaida, 2011).

Microorganism used is BIMO-CF (Biological Modified Cassava Flour) is a starter of lactic acid bacteria that has ability to remodel the crude fiber cellulose in food by breaking bond through the osmosis process. As a result the porosity of the material will be formed.

Structural changes caused by the activity of lactic acid bacteria in the fermentation process are studied in detail. The physicochemical mocaf characterization and its effect on triterpenoid modification in mocaf were investigated to obtain supplement products for autistic persons.

METHODS

The study was conducted by experiment. The main raw material in the form of cassava and gotu kola as triterpenoid source obtained from Precet, Sekar Dau, Batu - Malang. As solvent is used water deminerilasi, and bioactivator BIMO CF. To obtain mocaf characterization of ready to modified triterpenoids, experiments were performed by adjusting BIMO CF concentrations varied from 1 to 5 g/L and fermentation time in the range of 10-18 hours.

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The process of making cassava flour using methods that have been developed previously (Astuti et al, 2013). In detail can be explained as follows: cassava that has been washed, thinly sliced with a thickness of 1 mm and fermented at room temperature with the fermentation time as set (10-18 hours) with BIMO CF at various concentrations. After fermentation. The cassava chips are washed with demineralized water. Furthermore, salt water added by 10 - 15% and washed again until the salt taste is reduced. Drying is done at temperature 50^{o}C until moisture content ≤ 15%. Next a number of triterpenoids are coated on the chip. The siege up to 100 mesh is done when the tritepenoid coating process is complete and the surface of the chip becomes slightly dry.
Characterization of product physicochemical using macro photo (Model Type MCB-1, Convensional 35 mm Camera; Magnification range : 50 – 1000X for visual observation 20 – 160X for 35 mm photography, Camera Nikon SMZ – 800, Japan), SEM (Scanning Electron Microscopy), FTIR (Fourier Transform Infra Red spectrophotometer (FTIR 8400s, Shimadzu).

RESULTS AND DISCUSSION

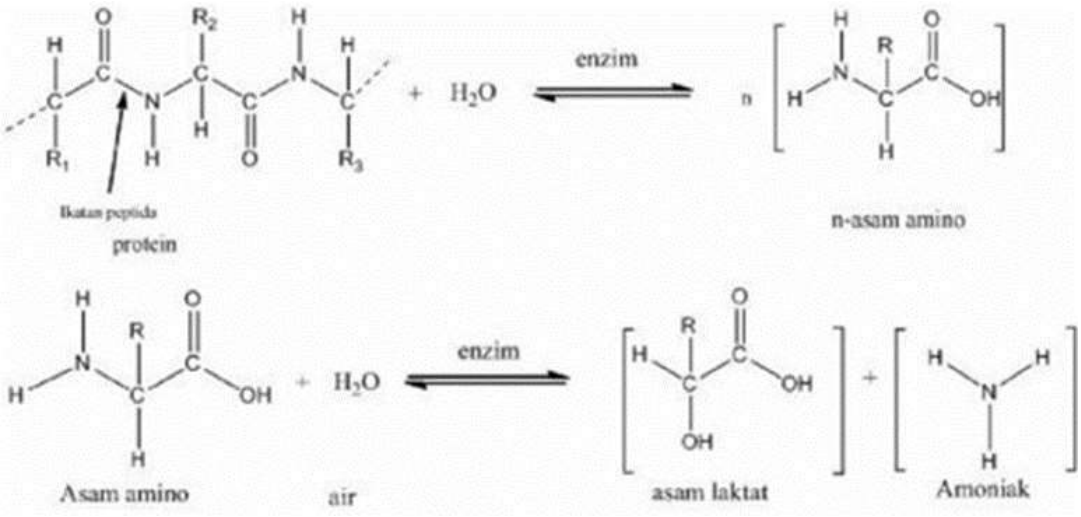
Effect of BIMO-CF Bioactivator Concentration
BIMO-CF is a starter in the form of powder, consisting of lactic acid bacteria that is safe for food. BIMO CF is manufactured as a stabilizer in starch fermentation process. The activity of lactic acid bacteria in the fermentation process produces lactic acid, other organic acids, enzymes, volatile compounds dispersed in water. Osmolysis caused by the activity of lactic acid bacteria can alter the structure of the starch granules found in the cassava becomes more porous. In addition, a more fragrant aroma and whiter colors are characterized as effect of using BIMO CF on cassava fermentation process.

The lactic acid formed is the effect of protein breakdown by the BIMO CF activity. The reaction of protein breakdown into lactic acid can be seen in Figure 1. (Ngili, 2009).

With reaction of carbohydrate and protein reshuffle by lactic acid bacteria, the content of both compounds in the material will be reduced. Lactic acid bacteria are proteolytic that produce protease enzymes. In this case, the protease enzyme will meutus peptide word on protein chain to form lactic acid.

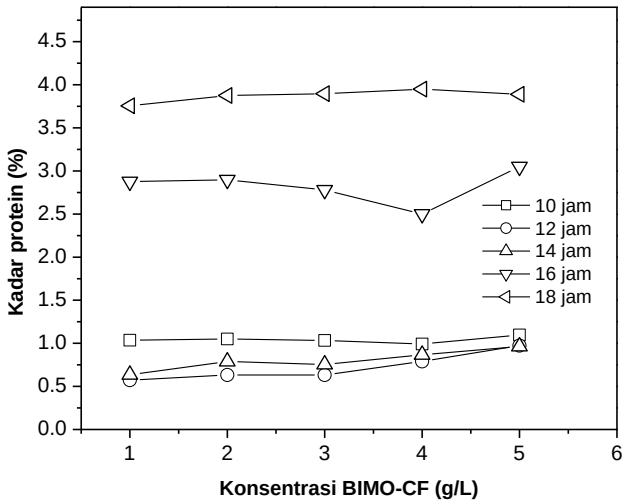
BIMO CF activity in the fermentation process has no significant effect on amount of protein produced. The variation on the BIMO CF concentration performed gives amount of protein that is not big difference. As can be seen in Figure. 2, it can be shown from Figure. 2 that the higher the BIMO CF concentration the higher the protein content produced. It can be explained that, at high concentrations there is a competition struggle between lactic acid bacteria that break down proteins. The condition in which number of lactic acid bacteria is high and protein to be decomposed remains, this has resulted in a lot of dead lactic acid and bacteria acid. The correlation of the amount of lactic acid formed is also small.

Figure 1:



The mechanism of lactic acid formation by breaking the peptide bond at protein

Figure 2:



Correlation between bioactivator concentration and fermentation time to levels protein mocaf

Effect of Fermentation Time

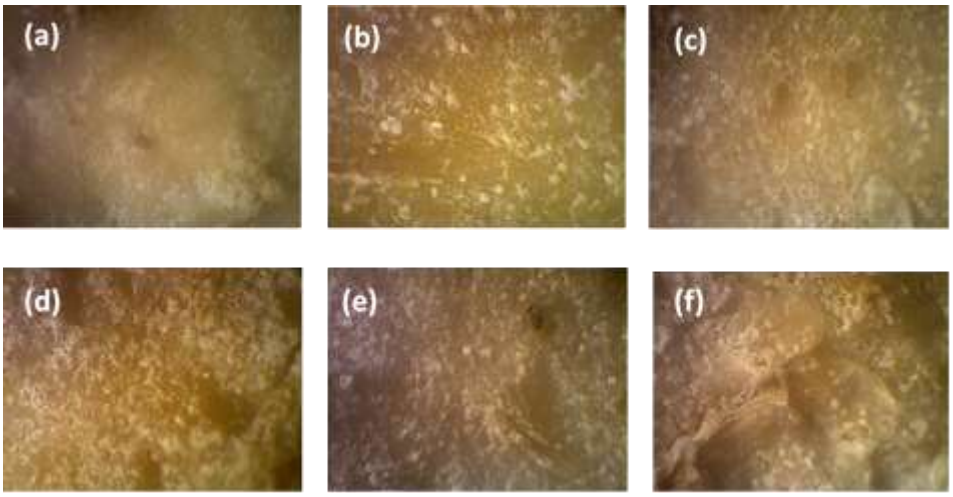
BIMO-CF performance on process fermentation is greatly influenced by time fermentation. The more time fermentation then BIMO CF opportunity to disconnect peptide bond on the protein becomes acidic lactate is getting bigger, as seen in Figure 2. It appears that at the time fermentation 12 hours, mocaf produced provides the most protein content low. While at the time of fermentation longest, protein levels in mocaf shows the largest number. This matter also explained that at the time fermentation of older, acidic bacteria lactate inefficiently reforms the protein become lactic acid.

Phocochemical Characterization of Mocaf Modified Triterpenoid

The fermentation process is done as a biological modification to cassava flour delivers a deep change its structure. Before fermented, cassava which contains starch granules having tight structure. Once done fermentation process, BIMO CF activity causing osmolysis on the surface garanula starch so when done drying process, water coming out leaving pores on its structure.

Changes in mocaf structures were investigated macro using macro photos, as shown in Figure 3. It appears that the porous changes the structure It appears at the time of fermentation 10 to clearly 16 hours, while on time fermentation longer porosity structure reduced pore closure by dead lactic bacteria acid.

Figure 3:

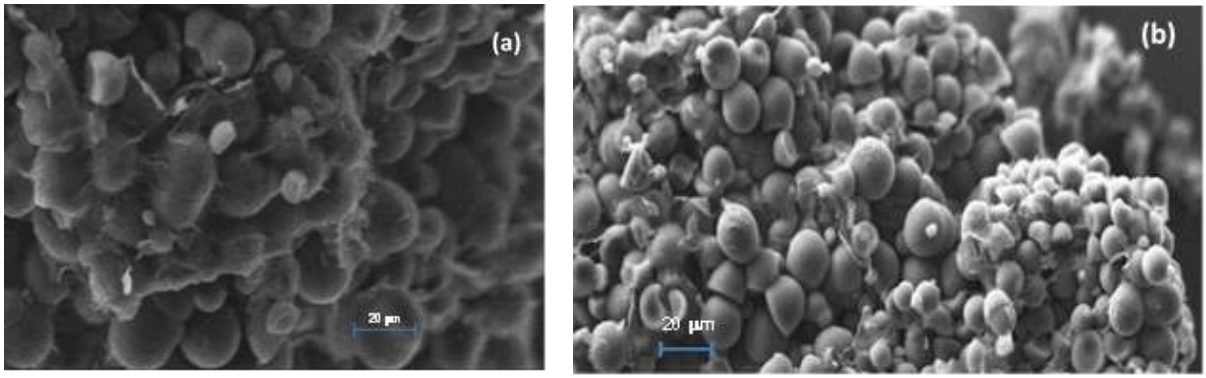


Analysis of cassa flour structure: (a) before modification and after modification with fermentation time:

(b) 10 hours; (c) 12 hours; (d) 14 hours; (e) 16 hours; (f) 18 hours

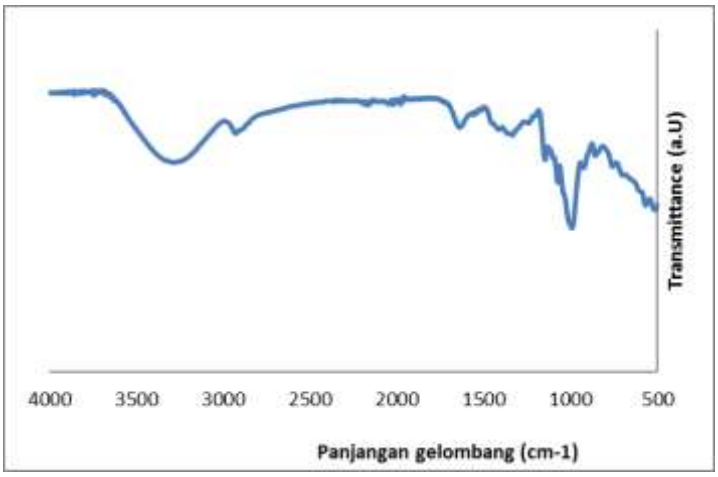
Analytical results with SEM as well clarify that porosity of the structure cassava occurs due to fermentation. Figure 4, shows the SEM image of the sample before mocaf overlaid with triterpenoid and after coated with triterpenoids. From Figure 4 (a) can be explained that process fermentation provides empty spaces on mocaf, where this condition allowing it to be filled with triterpenoid. In Figure 4 (b) is visible that mocaf plating with triterpenoids causing the empty spaces filled with triterpenoids. Coating triterpenoids occur on the surface and part mocaf. This explains it modification with fermentation process can be enlarge the number of triterpenoids on mocaf.

Figure 4:



SEM image mocaf: (a) before modification; (b) after modification with triterpenoids

Figure 5:



FTIR spectrum mocaf modified triterpenoid

ACKNOWLEDGEMENTS

This research was funded by the Ministry of Research,Technology and Higher Education. Directorate General Research and Development Directorate of Research and Community Service. Through Grant Research of Competitive, Fiscal Year 2015-2016.

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