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# STABILITY THE CONTENT OF NUTRITION AND SHELF LIFE PREDICTION FLAKES FLOUR MADE FROM CASSAVA (*Manihot esculenta* Crantz) FLOUR FORTIFICATION RED BEANS (*Phaseolus vulgaris* L.).

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**ABSTRACT-**Flakes is one practical food products that have been developed in various circles. Flakes are generally made from cereals or corn. However, to meet the nutritional needs flakes flakes then developed products that are not only rich in carbohydrates, but also rich in protein that flakes made from cassava flour (Manihot esculenta Crantz) flour fortified with red bean (Phaseolus vulgaris L.). Estimation of shelf life is one of the things that are important in the production of food. This study aims to determine the shelf life of the product flakes made from cassava flour fortified with red bean flour and determine whether there is a reduction in the levels of the nutrients in the product during storage. This study uses the proximate analysis to determine the nutrient content changes flakes during storage, where the levels of ash and moisture content using the gravimetric technique, test methods Kjehdahl protein levels, test methods sokhletasi fat content, carbohydrate content test method by difference. As well as methods Labuza with the method for determining the critical water content estimation flakes shelf life, starting with the initial determination of water content, and then proceed with the determination of the critical water content that is based on the humidity, the manufacture of sorption isotherm curve, and continued with the calculation of the shelf life of flakes. Based on the methodLabuza(1982) approachto estimate thecriticalwater content ofthe shelf lifeof a product, resultingvalue ofthe productshelf lifeflakesup to307days.

**Keywords:** flakes, nutrition, shelf life, andstability.

## INTRODUCTION

Flakes is a food that is usually eaten at breakfast with milk mixed. Flakes are generally made from cereals or corn now have another alternative that flakes made from cassava flour. To add protein and fiber in flakes, made of flour fortification with the addition of red beans. Food processing generally aim to extend shelf life, increase the economic value and improve or maintain the quality (Andarwulan and Hariyadi, 2004).

Before the food products reach the consumer, it will be through the storage process in advance that can cause loss of quality. Therefore we need specific treatments to the food product to extend the shelf life, one factor that is packaging (Farid et al., 2009). Foodstuffs have yan properties vary in their susceptibility to uptake or release of gas (air and water vapor). Dry material should be protected from moisture absorption and oxygen by using packaging material that has low permeability to gas (Purnomo, 1995)

Shelf life estimation method can be done by the method of Self Accelerated Life Testing (ASLT) ie by storing food products in the environment that causes rapid deterioration, either in temperature or humidity conditions higher storage space. Acceleration method can be performed with a shorter time with good accuracy. ASLT method often used is Arhennius models and models of critical water content (Gordon, 2010).

## MATERIALS AND METHODS

### Equipment and Materials

The tools used are furnaces, ovens, pumpkin fat, pumpkin Kjehdahl, cup porcelain, a petri dish, buret and clamps, mortar and pestle, desiccator, beaker (50 mL, 200 mL, 250 mL, 500 mL), analytical balance and tools Other glasses are required in the study. Flakes, selenium, concentrated H2SO4, distilled water, NaOH, H3BO3, indicators (ciran methyl red and bromine creosol green), HCl 0.1 N, solvent hexane, NaCl (RH 76), K2Cr2O7 (RH 98), KI (RH 69), KCl (RH 84), NaOH (RH 7).

**Nutrient Content Test During Storage Periode**

Nutrient content analyzed periodically at room temperature for a week 0, week 2, week 4, week 6, week 8, and week 10.

*Ash Content Test*

Using the gravimetric method with ashing samples in an electric furnace for 4-6 hours at a temperature of 400° C-600 ° C. Cooled in a desiccator and weighed to constant weight (AOAC, 1995).

ash content= (ash mass) / (mass of sample) × 100%

*Assay Test Water*

Oven emptied petri dish, then cooled and weighed empty weight. A number of flakes weighed (3-5 grams) put in a petri dish. Then put in a preheated oven at 105 ° C. The sample is weighed on a regular basis to obtain a fixed weight (AOAC, 1995).

water content = ((a-b)) / (c) × 100%
description :
a = weight of the cup and the initial sample
b = weight of the cup and the final sample
c = weight of the initial sample

*Protein Assays*

Phase destruction: flakes weighed as much as 0.5 - 1 gram and then inserted into the flask Kjehdahl. 0:25 grams of selenium and 25 ml of H2SO4 was added to the flask. Flask is then inserted into a heater. Silakukan destruction process until the solution is clear green color. Phase distillation: destructed samples were poured into a distillation flask and then added 50 ml of distilled water. Rinse water is also put into the distillation apparatus and 40% NaOH is added to 20 mL. The fluid in the tip of the condenser tube accommodated in the Erlenmeyer flask containing a solution of H3BO3 and 2 drops of indicator (methyl red and green creosol bromine). Performed to obtain a bluish-green distillate. Phase titration: Titration done using 0.1 N HCl solution until the color changes to pink. Titrant volume is read and recorded (AOAC, 1995).

% N = ((ml HCl-ml HCl blank) × 14 007 × 0.1 N HCl) / (mg sample) × 100%
Nitrogen levels of protein = % Nx 6:25

*Assay Fat*

Flask used dried and roasted at 105 ° C, then cooled in a desiccator. Once cool, weighed empty weight. Flakes weighed as much as 3 grams, wrapped in filter paper and put into the extraction tool (sokhlet) which already contains the solvent hexane. Soxhletation process is carried out until a clear solution and a solvent that is in the fat pumpkin distilled. Furthermore, fat pumpkin contains the results of extraction is heated in a preheated oven at 105 ° C until its weight is constant, cooled in a desiccator and weighed (AOAC, 1995).

Fat content= (fat weight) / (weight of sample) × 100%

*Determination ofLevels ofCarbohydrates(AOAC, 1995).*

Using the methodbydifference, carbohydrate levelscan be determinedformula
%Carbohydrates=100-(P +KA+A+L)
description :
P = Protein content
KA= Water content
A =Ash content
L= Fat content

**Food Shelf Life Estimation with Critical Water ASLT Method**

*Determination of Initial Moisture Content (Mo)*

Initial moisture content was analyzed by the oven method (AOAC, 1995). Initial moisture content expressed in dry weight (% bk). Results of the analysis of the initial moisture content will be used as a correction factor in determining the weight of solids (Ws) of samples required in the calculation of the equation Labuza shelf life.

*Determination of Critical Water Content*

Determination of the critical water content is done by storing products in containers that have high humidity (Labuza et al., 1985) and organoleptic testing periodically. Products are stored in a container or chamber with a saturated salt solution is NaCl which has a value of RH 76.Observations were conducted periodically every 24 hours. After the rejection of the products specified limit, then carried out a critical analysis of water content. Analysis of the critical water content is done using the oven method (AOAC, 1995) and expressed in dry weight (% bk).

*Determination of sorption isotherm curve*

Sample preparation is done saturated salt solution. Then weighed amount of salt and put in a container or chamber. The salt is then stirred and added some water to maintain saturation of the solution so that the resulting relative humidity remains and does not interfere with the process of sorption. Chambers then covered and left for 24 hours in a constant temperature.

**Table 1**. Number Salt and Water Preparation Salt Saturated Solution

| Type Salt | RH (%) | Quantity | |
|---|---|---|---|
| | | Salt(g) | Water(mL) |
| NaOH | 7 | 150 | 85 |
| KI | 69 | 200 | 50 |
| KCl | 84 | 200 | 80 |
| $K_2Cr_2O_7$ | 98 | 100 | 100 |

Sumber : Agus (2004)

Flakestaken5gramsthen put intoaglassmeasureorsmall. Then inserted into thechamberswhichalready containssomesaturated salt solution. The sample is weighedperiodicallyto obtaina fixedweight. Thencalculatethe moisture content

*Determination ofShelf Life*

Shelf lifecalculationequationdeterminedLabuzamodifiedas follows(Labuza, 1982)

$$\theta = \frac{\ln\frac{(Me-Mo)}{(Me-Mc)}}{\left(\frac{k}{x}\right)\left(\frac{A}{Ws}\right)(Po/b)}$$

Description :

θ = time to reach the critical moisture content or shelf life (days)

Mo = moisture content of the product at the beginning of storage (% bk)

Mc = critical moisture content at a specific temperature (% bk)

Me = equilibrium moisture content (% db)

k / x = permeability of packaging (g / m2.day mmhHg)

A = area of the packaging which is calculated based on the dimensions of packaging used (m2)

Ws = weight of initial product solids (g)

Po = saturated vapor pressure (mmHg)

b = slope of the curve isotherm

## RESULTS AND DISCUSSION

**Nutrient Content Stability**

In the stability test, namely the test nutrient content of fat, carbohydrates, moisture content, ash content, and protein assay results obtained as well as table stability for 10 weeks (Table 2). Water activity turned out to affect the stability and durability of food. The increase in water levels caused by different environmental conditions, such as storage and temperature (Kusnandar, 2010). The water content during the storage period indicated increasingly rising every week. This water activity causes a decrease in other elements. The levels of protein, fat and carbohydrate levels keminggunya week decreases with increases in water content.

**The Flakes Shelf Life**

The shelf life is determined by using accelerated method to approach the critical moisture content. The shelf life is calculated by an equation Labuza (1982) is a storage shelf life at 76% RH. Based on this equation obtained several factors and parameters of initial moisture content (Mo), the water content of critical (Mc), the water content equilibrium (Me), constant water vapor permeability of packaging (k / x), the ratio of the packaging with the dry weight of the product (A / Ws), saturated water vapor pressure at storage conditions (Po), and the slope of the curve of sorption isotherms (b).

Initial moisture content obtained is 0.0330 g H2O / g solids. Critical water content obtained by the 0.1040 g H2O. / G solids. The equilibrium moisture content is 0.2163 g H2O / g solids. This is obtained by the sorption isotherm curve.

Based on the chart below, the value of the slope on the curve sorption isotherm flakes product is 0.136. Estimation of shelf life trials flakes based methods ASLT according Labuza approach to critical water content, obtained several supporting factors and parameters as listed in Table 4. Source: Primary Data Research (2015) and Labuza (1982)

The value obtained is then put into the equation Labuza (1982).

$$\theta = \frac{\ln \frac{(Me-Mi)}{(Me-Mc)}}{\frac{k}{x}\left(\frac{A}{Ws}\right)\frac{Po}{b}}$$

$$\theta = \frac{\ln \frac{(0.21636-0.0330)}{(0.21636-0,1040)}}{0.0136\left(\frac{0.02535}{50}\right)\frac{31.824}{0.136}}$$

$$\theta = \frac{\ln \frac{(0.18336)}{(0.11236)}}{0.0136\,(0.0005)\,(234)}$$

$$\theta = \frac{\ln\ 1.6312}{0.0015912}$$

θ = 307.5 hari

**Table 2.** Nutrient Content Data storage for 10 weeks

| Test | week (content %) | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 2 | 4 | 6 | 8 | 10 |
| water | 3.31 | 5.3 | 7.2 | 7.6 | 7.7 | 7.94 |
| ash | 3.23 | 3.15 | 3.12 | 3.12 | 3.1 | 3.1 |
| Fat | 4.85 | 4.8 | 4.75 | 4.73 | 4.71 | 4.7 |
| protein | 9.94 | 9.93 | 9.87 | 9.84 | 9.8 | 9.75 |
| karbohidrat | 78.9 | 77 | 75.1 | 74.7 | 74.54 | 74.34 |

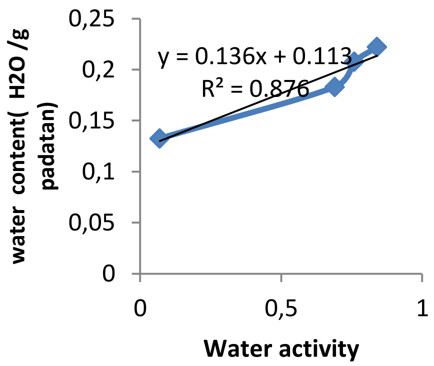
**Table 4.**ParameterValue of CalculationShelf LifeFlakes

| Parameter | Value |
|---|---|
| RH(%) | 76 |
| Aw | 0.76 |
| KA initial (Mi) (g H2O / g solids) | 0.0330 |
| Critical KA (Mc) (g H2O / gsolids) | 0.1040 |
| Sorption isotherm curve slope (b) | 0.136 |
| A Equilibrium (Me) (g H2O / g solids) | 0.21636 |
| Packaging permeability (k / x) (g / m2.day.mmHg) | 0.0136 |
| Size Packaging (A) (m2) | 0.02535 |
| Solids weight per package (Ws)(g) | 50 |
| Saturated vapor pressure temperature of 30 ° C (Po)(mmHg) | 31,824 |

**Table 3.** Water Content Equilibrium Flakes and Time Achievement In some RH Storage.
Salt RH (%) Aw (RH / 100) KA Equ

| Salt | RH | Aw (RH/100) | KA Equilibrium (g $H_2O$/g solid | Time (day) |
|---|---|---|---|---|
| NaOH | 7 | 0.07 | 0.1325 | 18 |
| KI | 69 | 0.69 | 0.1830 | 25 |
| KCl | 84 | 0.84 | 0.2220 | 14 |
| $K_2Cr_2O_7$ | 98 | 0.98 | 0.2704 | 4 |

Sorptionsigmoidcurveshaperesembles the letterS, though not perfect.




## CONCLUSION

Based on theresults offurther researchflakesproductsmade fromcassavaflourfortificationred bean flourcan be concluded that:

1. Nutrientflakesduring storagechanges.These changes arecaused bythe increase inmoisture contentduring storage. The high water contentcauses changes inthe content ofdiminishinganddurabilityarereduced.
2. Based on the methodLabuza(1982) approachto estimate thecriticalwater content ofthe shelf lifeof a product, resultingvalue ofthe productshelf lifeflakesup to307days.

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