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## The effect of antimicrobial kecombrang (*Nicolaia speciosa*) powder on the chemical and microbiological properties of tempe nugget during storage time

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### ABSTRACT

#### BACKGROUND

Tempe nugget is rich in nutrients, especially proteins and fats, that can support the growth of microorganisms. The growth of microorganisms can damage the dietary product. One of possible efforts to prevent microbial growth is by adding natural preservative substances. Kecombrang contains antimicrobial substances. Its inner stem, flowers and also fruits have their own potentials to inhibit microorganisms which are different one and other.

#### OBJECTIVE

The aim of this study was to determine the best part of kecombrang plant to produce tempe nugget with good chemical and microbial characteristics.

#### METHODS

This study used an experimental method of Randomized Block Design. Factors Studied factors were parts of kecombrang plants consisted of inner stem of kecombrang plant, kecombrang's flower, and kecombrang's fruit; concentrations of kecombrang powder consisted of 1%, 2% and 3%; and storage times consisted of 0, 1 and 2 weeks.

#### RESULTS

The result showed that the combination experimental unit that produced tempe nugget with the best chemical and microbiological characteristics was tempe nugget with 3% kecombrang's inner stems for instead of in 6 days storage time.

#### CONCLUSION

This tempe nugget with 3% kecombrang's inner stems for instead of in 6 days storage time had water content of 50.477%(±0.05); total titrated acid content of 0.001469%db(±0.07); total bacteria of 2.0 x10<sup>4</sup>cfu/g; total mold of 3.3x10<sup>4</sup>cfu/g; and total microbe of 1.0x10<sup>4</sup>cfu/g.

**KEYWORDS:** tempe nugget, kecombrang, storage time

### I. INTRODUCTION

Nugget is processed meat based product that is formed, cooked and frozen with addition of some additive content that allowed (BSN, 2002). Generally, people will prefer practically and easily served food in a short time. Nugget can be made with variety kind of meat, such as meat from cow, chicken and fish. Indonesian Nasional Standard 01-6683 said that chicken nugget has nutrient content: maximum water content of 60%, minimum protein content of 12%, maximum fat content 20% and maximum carbohydrate content of 25% (BSN, 2002). Beside that, nugget can also be made from vegetable ingredients like tempe. Tempe has

high amount of protein, vitamin B12, antioxidant like isoflavon and other bioactive substance. During fermentation process, vitamin B12 content increased dramatically. Mineral content also increased up to 40.52% after fermentation. Most of mineral content in soybean are organic minerals that is linked with protein and another organic compound. Tempe is indicated has benefit for nutrition value and health (Astuti *et al.*, 2000). High nutrient content in nugget made this product easily damaged (perishable product) because of the microbe's higher activity and growth. Effendi and Supli (2009) said that food nutrient content can establish kind of microbes grows because kind and quantity of nutrient are needed for microbe's growth. One of possible efforts to prevent foods damage caused by microbial growth is by doing prevention.

One of prevention technique that generally used for food products is by adding additive compound like preservatives substance. Food preservatives substance is additive compound that can prevent or obstruct food damages caused by microbes (Naufalin and Herastuti, 2012). Syntetic preservative substance usage in food get special notice from government because it's include of food safety. Mass media publication about the dangerous of syntetic preservative substance usage like formalin and borax makes people prever to use natural preservatives substance because it's more safe to consume. Because of that, its necessary to find natural substances that have high potential effect of being natural preservatives substance. One of the natural substance that potential as preservative is kecombrang plant.

Naufalin and Herastuti (2013) said that chemical compound in kecombrang's fruits are alcaloids, falvonoids, glicosides, saponin, fenolic, and triterpenoid. There are may kind of kecombrang study that have done. Some of them shows that kecombrang's fruits formula has function as antimicrobes, such as it can prevent pathogenic microbes like *B. cereus*, *E. coli*, *Botytris* and *Saccharomyces sp* (Naufalin, 2013).

The aim of this study are to analyse natural preservatives compound from part of kecombrang plant with powder concentration variation that give the best chemical and microbial characteristics of nugget tempe during storage time.

## II. MATERIALS AND METHODS

### Research Design

This research used an experimental methode. Research design used in this study is Randomized Block Design (RBD) with 9 threatment combination and 3 repetation that give

27 experiment unit. Factors used in this study include variety part of kecombrang plant (stem, flower and fruit) and powder concentration (1%, 2%, and 3%).

Observation did on 0, 1<sup>st</sup> and 2<sup>nd</sup> week. Variabel observed in this study include microbial and chemical characteristics. Microbial characteristic includes total microbes, and chemical characteristics includes total titrated acid. Data achieved from this study then to be analysed using F test with 5% degree. If the analysis result shows diversity then continued with *Duncan's Multiple Range Test (DMRT)* with 5% degree.

#### ***Kecombrang flower powder processing (Naufalin, 2008).***

The kecombrang stem, flower and fruit were cut and spread on trays and dried with a blower dryer at temperature of 50°C until dry. Kecombrang stem, flower and fruit which have been dried crushed in a blender until a homogeneous powder and ready to be extracted.

#### **Tempe Nugget Making**

Kecombrang natural preservative substance powder added in tempe nugget making with concentration of 1%, 2%, and 3% from the total nugget's dough used.

#### **Tempe Nugget Storing**

Tempe nugget was stored in refrigeration temperature. Observation done on 0, 1<sup>st</sup>, and 2<sup>nd</sup> week include microbial and chemical analysis.

### **III. RESULTS AND DISCUSSION**

#### **Total Microbes**

Total microbes of tempe nugget observation result with kecombrang natural preservatives concentration treatment during storage time showed in Figure 1.

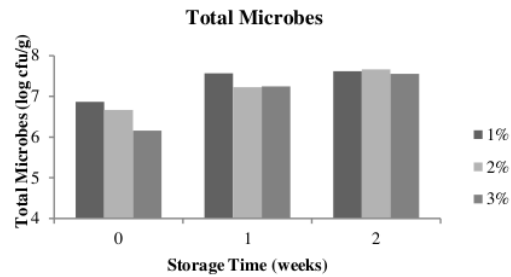


Figure 1. Effect of kecombrang powder concentration to total microbes on tempe nugget during storage time.

Figure 1 shows that total microbes in tempe nugget was increased during the storage time. Increasing the concentration of kecombrang natural preservatives powder can decrease the quantity of total microbes. This is caused by the higher preservatives substance's concentration the amount of the active compound of kecombrang on the preservatives substance is also goes higher. As the bigger the amount of active compound in preservatives substance, the effectiveness to prevent microbes activity is also increased. Active compound of kecombrang's fruits are alcaloids, saponin, tanin, fenolic, flavonoid, triterpenoid, steroid, and glycosides act actively as antioxidant (Naufalin and Herastuti, 2013).

Prevention of microbe's activity by the active compound of plants substance is caused by some factors, such as: 1) interference to the cell wall's comound substances, 2) increased of cell membran's permeability that caused lack of cell substances components, 3) inactivation of metabolic enzym, and 4) destruction genetic material fuction (Brannen and Davidson, 1993). Kanazawa *et al.* (1995) added that the process occured because of adhering the antimicrobial substance to microbes cell surface or that the substance wass difused into the cell.

Total microbes of tempe nugget observation result with part of kecombrang plant as natural preservatives treatment during storage time showed in Figure 2.

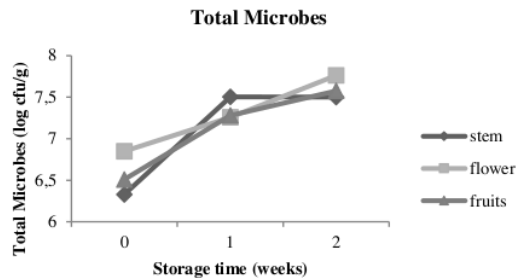


Figure 2. Effect of kecombrang plants part variation to total microbes on tempe nugget during storage time.

Addition of preservative kecombrang's flower powder decrease the total microbes more than the stem and fruits of kecombrang plant. Control (tempe nugget without kecombrang powder addition) showed that total microbes was increased highly during storage time (from  $2 \times 10^4$  to  $4 \times 10^5$  cfu/g). Microbes used nutrient components in tempe nugget for their growth. Tempe nugget contains a lot of nutrient especially protein. According to Buckle *et al.* (2007), microbes grow better in cooked foods than uncooked foods. This because the nutrients was better available and competition among the microbes were decreased. Microbes that can provide proteolythics enzym can break the protein molecules become amino acids.

The average value of total bacteria on tempe nugget during the storage time 0, 1<sup>st</sup>, and 2<sup>nd</sup> weeks are  $3.51 \times 10^6$ ;  $1.95 \times 10^7$ ; and  $1.65 \times 10^8$  cfu/g (Figure 3). Total bacteria on tempe nugget was increasing during the storage time. The average increasing value from 1<sup>st</sup> week to 2<sup>nd</sup> week is 0.927 log cfu/g. This was maybe caused by the growth and the amount of bacteria is increasing as long as the storage time. Bioactive substances will reacted with protein inside the microbes cell wall or in cytoplasm and caused protein denaturation. So that, cell membran can't regulated liquid exchange inside and outside the cell and caused lysis (Naufalin and Herastuti, 2013). As long as the storage time, antimicrobes activity is decreasing but the activity of microbes themselves are increasing. This is why the amount of microbes in tempe nugget is increasing.

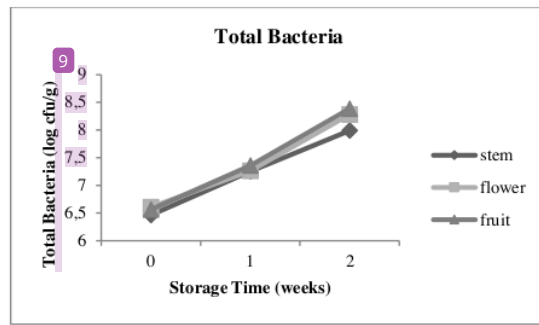


Figure 3. Effect of kecombrang plants part variation to total bacteria on tempe nugget during storage time.

The increasing of kecombrang powder concentration in tempe nugget effected on decreasing of total mold value (Figure 4). This is equal with kecombrang fruit's antimicrobial activity research on chicken nugget by Nandani (2013). This decreasing effect was perhaps caused by the higher concentration of kecombrang powder, the amount antimicrobial substances inside it is also goes higher. Zuhud et al. (2001) said that as high as the concentration of preservatives substance, so the amount of antimicrobial released is also going higher so that substance penetration into the cell is going easier. Naufalin et al. (2009) report that kecombrang contains bioactive substance such as flavonoid, triterpenoid, steroid and glycosides that have function as antimicrobia.

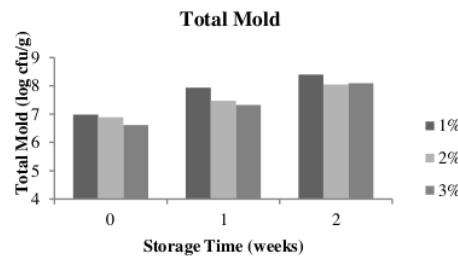


Figure 4. Effect of kecombrang powder concentration to total mold on tempe nugget during storage time

Total mold in tempe nugget was increased during the storage time (Figure 5). This is perhaps caused by growth activity of mold goes higher as long asg the storage time, so that the amount is also increasing. Fardiaz (1992) said that all of microbes live in food have heterothroph characteristic, that is need organic material to grow. Tempe is one kind of food with protein and fat high content so that tempe nugget easily contaminated.

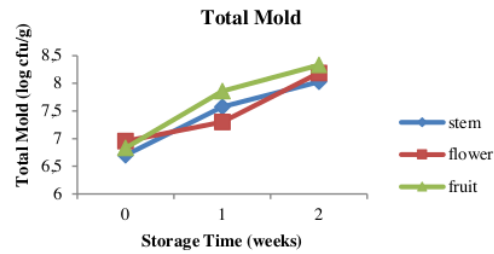


Figure 5. Effect of kecombrang plants part variation to total mold on tempe nugget during storage time.

### Total titrated acid

Total titrated acid value of tempe nugget with kecombrang natural preservatives substance powder in variety concentration during storage time is between 0.00135 %db to 0.00175 %db (figure 6 and 7).

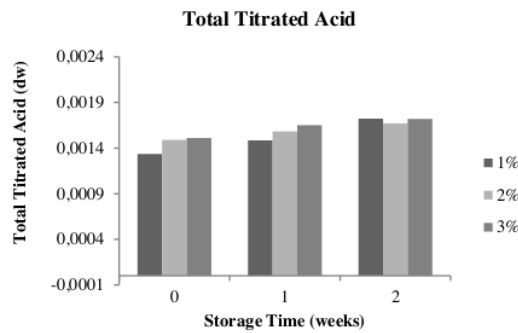


Figure 6. Effect of kecombrang powder concentration to total titrated acid on tempe nugget during storage time

Figure 6 shows that total titrated acid of tempe nugget decreased as long as the storage time and as high as the concentration of kecombrang powder added.



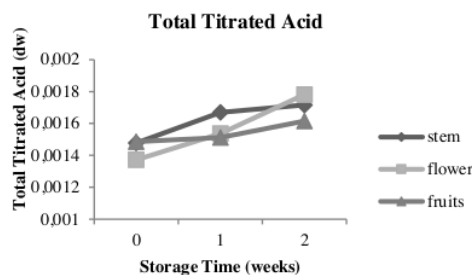


Figure 7. Effect of kecombrang plants part variation to total titrated acid on tempe nugget during storage time.

During the storage time, the value of nugget tempe is increased (Figure 7). This is because of the protein hidrolisis by the microbes that produce protheolythics enzyme to become organic substance that is sour. Buckle *et al.* (2010) said that foodstuffs that contain sugar provide energy for the microorganism metabolic process. Most of them contain those nutrients in enough amount to active growth of fermentatives organisms. Some of microbes produce lactic acids as their last metabolism product. This lactic acid will decrease pH value and cause sour flavor.

#### IV. CONCLUSIONS

Tempe nugget with addition of kecombrang plant's part and concentration as natural preservatives substances in tempe diversification shows a good chemical and microbial characteristics. Kecombrang powder with concentration of 3% decrease total microbes in tempe nugget more than concentration of 1% and 2% so that can longer the sotrage time of tempe nugget.

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