The organoleptic quality of noodles and functional grits with fortified lycopene coated by maltodextrin during storage

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Abstract. This study aims to determine the organoleptic quality which includes taste, aroma, the color of selected noodle and functional grits with lycopene fortifier coated by Maltodextrin during storage at room temperature. Achieving goals by applying the effect of the concentration of lycopene coated by maltodextrin in the batter noodles and functional instant grits consisting of five levels of concentration, for noodles applied 500 ppm, 1000 ppm, 1500 ppm, 2000 ppm and 2500 ppm, while the grits are applied for 250 ppm, 500 ppm, 750 ppm, 1000 ppm and 1250 ppm. The results showed lycopene damage during processing functional instant noodles were not affected by the concentration of lycopene in the noodle dough, with damage levels between 95 % and 98 %. While lycopene damage during processing functional instant grits influenced by the concentration of lycopene in the batter porridge, the level of damage increases with increased concentration of lycopene in the dough. The concentration of lycopene coated by maltodextrin in batter noodles and grits that produce a functional instant noodle and functional instant grits with the best organoleptic quality of each 2000 ppm and 250 ppm. The damage of lycopene in noodles and functional instant grits during storage at room temperature followed zero order reaction for a period respectively is 8.17 and 8.11 months.

1. Introduction
Lycopene is one of the processed tomato products of high economic value and has a fairly wide spectrum of usage. Lycopene is used as a natural dye in the food industry, which also serves to prevent food damage caused by oxidation [1].

Utilization of rejected tomatoes for lycopene production was done [2], while the production of lycopene from fresh tomatoes was done [3]. Both researchers found rough lycopene with a yield of less than 3% and the lycopene content of less than 10%. The lower degree of purity which has constraints in their applications. Therefore, efforts need to be done to increase the degree of product purity of lycopene from rejected tomatoes.

The rough lycopene (lycopene is the separation of tomatoes) in a encapsulation packaging are relatively stable in storage under and around room temperature [3]. Expiration of rough lycopene
(food supplement), a temperature 30°C was 83.46 days, while at a temperature of 20°C, the expiration was 154.46 days. The expiration date may still be rising if lycopene is coated by maltodextrin. The shelf life of rough lycopene of watermelon coated by maltodextrin at 30°C increased from 12 days to 416 days [4].

Lycopene coated by maltodextrin can be processed into functional foods such as functional noodles and instant porridge so that should be the determination of levels of lycopene damage during processing noodles and functional instant grits, at room temperature.

2. Materials and Methods

2.1. Materials
The basic ingredients used in this study were tomato, and lycopene standard (Lycopersicum), Maltodextrin DE 10-12, aquadest. The equipment used is UV-Vis Spectrophotometer, blender (Phillips), stainless steel pan, hock stove, hotplate Oven and other glass tools.

2.2. Methods
The ratio of maltodextrin lycopene used to make noodles and functional instant porridge is 1:1 (b/b) [5]. Treatment applied is the effect of lycopene concentration of maltodextrin in the batter coated on the level of damage and the organoleptic quality of noodles and functional instant grits.

The concentration of lycopene coated maltodextrin is applied to both products (noodles and functional instant grits) consists of five levels of concentration, to noodles applied 500 ppm, 1000 ppm, 1500 ppm, 2000 ppm and 2500 ppm, whereas the grits are applied to 250 ppm, 500 ppm, 750 ppm, 1000 ppm and 1250 ppm. Lycopene concentration coated by maltodextrin which produces noodles and functional instant grits with the best organoleptic quality is applied to determine the shelf life of noodles and functional instant grits products at room temperature (about 30 °C). The corn used in the processing of grits is young corn (grain maize), put in a blender, and add enough water and blended, then added flavoring and lycopene coated by maltodextrin according to treatment.

3. Result and Discussion

3.1 The extent of damage of maltodextrin coated lycopene in processing functional instant noodles
The results of the analysis of the damage level of lycopene found in table 1, shows that the level of lycopene damage for all concentrations tested relatively high, above 90 percent. The extent of damage is suspected not only caused by heating and drying but due to the use of bulk edible oil before the boiled noodles. Noodles did not experience separation without the use of bulk edible oil before the boiled noodles. Noodles did not experience separation without the use of bulk edible oils. It is assumed that bulk edible oil can dissolve lycopene.

| No | The concentration of lycopene in the noodle dough (ppm) | The concentration of lycopene in functional instant noodles (ppm) | The Extent of damage lycopene (%) |
|----|--------------------------------------------------------|-------------------------------------------------------------|----------------------------------|
| 1  | 125                                                    | 4.43                                                        | 96.46                            |
| 2  | 250                                                    | 6.76                                                        | 97.30                            |
| 3  | 375                                                    | 8.93                                                        | 97.62                            |
| 4  | 500                                                    | 13.61                                                       | 95.28                            |
| 5  | 625                                                    | 14.45                                                       | 97.69                            |
3.2 *Organoleptic quality functional instant noodles given lycopene coated by Maltodextrin At Various Concentrations*

Figure 1 shows there is no pattern of changes in the value of quality score on the concentration of microencapsulated lycopene (lycopene coated by maltodextrin) for all the organoleptic quality of good taste, color, aroma, and selection. Quality color tends to increase the value of the quality score, from the value of 3.72 to 5.16 value. Score color quality decreases in the use of 2000 ppm lycopene coated by maltodextrin, namely 4.48; whereas 1500 ppm namely 4.92. Thus lycopene coated by maltodextrin provides color rendition noodles are categorized by the panelists.

![Figure 1. Histogram score organoleptic quality in various concentrations of lycopene coated by maltodextrin used in instant noodle dough](image)

3.3 *The level of damage of maltodextrin coated lycopene in processing functional instant grits*

Table 2, shows the extent of damage of lycopene, which increases with the use of lycopene in the grits. It provides information of damage levels of lycopene in the dough grits increased in the region between 179 ppm and 716 ppm, while the area above the 716 ppm level of damage has not changed.

| No | The concentration of lycopene in the grits (ppm) | The concentration of lycopene in the functional instant grits(ppo) | The Extent of damage lycopene(%) |
|----|----------------------------------|-------------------------------------------------|-------------------------------|
| 1  | 179                              | 144.48                                           | 19.28                         |
| 2  | 358                              | 263.11                                           | 26.51                         |
| 3  | 537                              | 358.81                                           | 33.19                         |
| 4  | 716                              | 448.83                                           | 37.32                         |
| 5  | 895                              | 560.75                                           | 37.35                         |

Damaged lycopene in functional instant grits during processing is relatively small compared to the damage of lycopene in the functional instant noodle; while on the other hand, the heating time in the processing of functional instant pulp is relatively longer than the processing of functional instant noodles, as well as the drying time. If the damage of lycopene during processing is due to warming and drying, then the damage of lycopene in functional instant grits should be higher than in functional noodles.
3.4 Organoleptic quality of functional instant grits by maltodextrin coated lycopene at various concentrations

Figure 2 shows there is no pattern of changes in the value of the quality score to the concentration of lycopene coated by maltodextrin for all the organoleptic quality including taste, color, aroma, and selection. The use of microencapsulated lycopene concentration of 250 ppm, and the lowest quality score (3.3) was found in the use of 1000 ppm. Quality fondness for all concentrations of lycopene microcapsules a concentration of 250 ppm and 500 ppm. Thus the use of 250 ppm is a good concentration to be used instability testing functional instant grits at room temperature storage.

![Figure 2. Scores organoleptic quality in various concentrations of lycopene used maltodextrin coated in grits](image)

3.5 Reaction order and term expiration functional instant noodle products

The quality of lycopene in instant noodles during storage can be determined by analyzing every seven days during 49 days of storage at room temperature and followed by the determination of the retention of lycopene, lycopene levels at time t divided by the initial levels of lycopene \((t - 0)\) [6]. Table 3 shows the retention of lycopene decreased from day to day, but the decline in lycopene has not reached 50% up to 49 days of storage.

| Storage period (day) | Retention of lycopene (%) | In Retention of lycopene | 1/ Retention of lycopene |
|----------------------|---------------------------|--------------------------|-------------------------|
| 0                    | 100                       | 4.605                    | 0.010                   |
| 7                    | 91.06                     | 4.512                    | 0.011                   |
| 14                   | 87.71                     | 4.474                    | 0.011                   |
| 21                   | 86.86                     | 4.464                    | 0.012                   |
| 28                   | 84.87                     | 4.441                    | 0.012                   |
| 35                   | 81.96                     | 4.406                    | 0.012                   |
| 42                   | 76.51                     | 4.337                    | 0.013                   |
| 49                   | 73.33                     | 4.293                    | 0.014                   |

Determination of the reaction order of lycopene in functional instant noodles made through retention procedure of lycopene against time to save for zero reaction order obtained the highest \(R^2\) value is 0.974 with the equation \(Y = -0.273X + 96.89\), which X is the time saved and Y is the...
retention of lycopene [7]. If the assumed period of expired functional instant noodles when lycopene retention value reaches 30%, then the expiration date or the shelf life of functional instant noodles at room temperature was 241.02 days or 8.17 months. But if it is based on 50% or 50% retention of lycopene, the lycopene has suffered damage as time expired, therefore the time savings and functional instant noodles are only 171.76 days or 5.73 months.

3.6 Reaction order and expire date of functional instant grits products
Using the same way of point 3.4 above, the results of that analysis based on table 4, shows the value of $R^2$ is highest on the relationship between the retention of lycopene against time save by $R^2$ to zero-order is 0.972, while the value of $R^2$ to-order reactions one and two respectively 0.948 and 0.875. [8] Thus the destruction of lycopene in functional instant grits during storage at room temperature followed by the zero-order reaction equation $Y=-0.326X+109.3$; where $X$ is the time saved and $Y$ is the retention of lycopene.

Table 4. Retention, value retention and value ln 1/Retention lycopene in functional instant grits on a variety of storage time at room temperature storage temperature (around 30°C)

| Storage period (day) | Retention of lycopene (%) | ln Retention of lycopene | 1/ Retention of lycopene |
|----------------------|---------------------------|--------------------------|--------------------------|
| 0                    | 100                       | 4.605                    | 0.010                    |
| 7                    | 97.44                     | 4.579                    | 0.010                    |
| 14                   | 93.02                     | 4.533                    | 0.011                    |
| 21                   | 87.33                     | 4.470                    | 0.011                    |
| 28                   | 76.56                     | 4.338                    | 0.013                    |
| 35                   | 74.48                     | 4.311                    | 0.013                    |
| 42                   | 68.18                     | 4.222                    | 0.015                    |
| 49                   | 56.87                     | 4.041                    | 0.018                    |

If the assumed period of expired instant grits functional when lycopene retention value reaches 30%, then the expiration date or the shelf life of instant noodles at room temperature is 243.25 days or 8.11 months (obtained from the equation $30 = -0.326X+109.3$, where $X$ is the shelf life or expiration date). But if it is based on 50% or 50% retention of lycopene, the lycopene has suffered damage as time expired, therefore, the time savings and functional instant grits are only 181.9 days or 6.06 months [9].

4. Conclusion
Based on the results of the study, it can be summarized as follows: The damage of lycopene during the processing of functional instant noodles is not affected by the concentration of lycopene in the noodle dough, with damage levels between 95 and 98 percent. The damage of lycopene during the processing of functional instant grits influenced by the concentration of lycopene in the grits, with the level of damage increases with increased concentration of lycopene in the dough. The concentration of lycopene coated by maltodextrin in batter noodles and grits that produce functional instant noodles and functional instant grits with the best organoleptic quality of each 2000 ppm and 250 ppm. The damage of lycopene in noodles and instant grits functional during storage at room temperature followed zero order reaction. The time saved or expiration of instant noodles and porridge functional stored at room temperature respectively is 8.17 and 8.11 months.

References
[1] Wenli Y, Yaping Z, Zhen X, Hui J and Dapu W 2001 J Amer Oil Chem Soc. 78 697-701
[2] Mappiratu, Nurhaeni and Israwaty I 2010 Media Litbang Sulawesi Tengah 3, 1 : 64-69
[3] Ibrahim N 2011 *Kajian Waktu Simpan Likopen dari Tomat (Lycopersicum pyriforme) dalam Kemasan Kapsul* Tesis Program Pascasarjana Universitas Tadulako, Palu.

[4] Sukriadi, Mappiratu and Nurhaeni 2013 *J. Natural Science* **2** 3545.

[5] Sumarni N K, Mappiratu, Nurlina, Diharnaeni and Khaerunisa 2016 *Online Jurnal of Natural Science* **5** 69-75.

[6] Geovannucci E 1999 *Journal of the National Cancer Institute* **19** 317 – 331.

[7] Mappiratu, Mirzan and Sari M A 2011 *Prosiding Seminar Nasional Kimia*: Pemberdayaan Potensi Daerah Melalui Pengembangan Pendidikan, Sains, dan Teknologi Palu 23 Juli 2011.

[8] Rao V A and Agarwal S 2000 *Journal of the American College of Nutrition* **19** 563–569.

[9] Di Mascio P D, Kaiser S and Sies H 1989 *Arch Biochem Biophys*. **274** 532 – 538.