International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Flavor Characteristics of Crab Boiled Water Powder with the Addition of Magnesium Oxide (MgO) as an Anti-Caking Agent

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DOI: https://doi.org/10.55248/gengpi.5.0624.1426

A B S T R A C T

Crab cooked water is a waste of fishery products that contains glutamic acid that can be utilized as a powder flavor. Crab cooked water powder flavor has the characteristics of easy clumping so it is necessary to add magnesium oxide (MgO) as an anti-clay material to prevent clumping. The purpose of this study was to determine the effect of different concentrations of magnesium oxide (MgO) on the characteristics of crab cooked water powder flavor. The research method used was a completely randomized design (CRD) consisting of 4 treatments of magnesium oxide (MgO) concentration, namely 0%, 0.2%, 0.4% and 0.6% with 3 replications. The test parameters used were water content, glutamic acid, protein content, solubility, dwell angle, flow time, hygroscopicity, color and hedonic test. The data were analyzed using ANOVA and conducted the Honest Real Difference (BNJ) test. The results showed that the concentration of magnesium oxide (MgO) had a significant effect ($P<0.05$) on the parameters of water content, glutamic acid, protein content, angle of repose, flow time, hygroscopicity and hedonic level but had no significant effect ($P>0.05$) on the solubility parameter. The addition of magnesium oxide (MgO) 0.6% gave the best results based on hedonic test with a confidence interval value of $7.64<\mu<7.97$, glutamic acid 14.10%, moisture content 7.82%, dry weight protein content 9.23% and wet weight protein content 8.52%, solubility 90.26%, angle of repose 29.17°, flow time 6.27 seconds, L* value of 81.99, a* of 0.73, b* of 22.60 and hygroscopicity value of 16.31%. The use of magnesium oxide (MgO) at a concentration of 0.6% produces flavor products with physical characteristics that do not clot and are easy to pour and have good hedonic values.

Keywords: *anti-caking, crab boiled water and flavor powder*

1. Introduction

Crab cooking water is one of the fishery waste products that is not well utilized. Crab cooking water waste increases along with the increase in exports of canned crab meat products with a value of 16.4% or 28,00 tons (Silaban, 2022). Crab cooking water contains 17 amino acids with glutamic acid reaching 0.04% (b/v). The content in this crab cooking water can be utilized as a flavoring ingredient (Mumtazah, 2021).

The flavor produced from crab cooking water has the characteristics of powder form. The characteristics of the powder can make the product easy to experience clumping so that food additives are needed that can prevent clumping. Anti-caking agent is one of the food additives that play a role in preventing clumping in powder products. Anti-caking also plays a role in maintaining the resulting powder that can be poured over storage time (Aprialdi, 2023).

There are several types of anti-clay that can be used in food, one of which is magnesium oxide (MgO). Magnesium oxide (MgO) is a food additive used in the food industry. Magnesium oxide (MgO) acts as an anti-caking agent and an additive used to make it easier for products to flow freely. Magnesium oxide (MgO) is commonly used in the manufacture of milk powder, cream powder and chocolate powder (JSC Kausar, 2018). Magnesium oxide (MgO) functions as a flow enhancer and anti-caking agent in a dry breakfast cereal food, salt and powder concentrates such as in soft drink powder drink mixes (Mirhosseini and Afzali, 2016). Magnesium oxide in the food field has a role that acts as an anti-caking agent and keeps food in powder form free flowing. As an anti-caking agent, magnesium oxide plays a role in preventing interactions between particles through moisture absorption (Martin, 2022).

The use of magnesium oxide (MgO) is often used in food products from vegetable sources such as soft drink powders, milk and cereals with a concentration limit in accordance with the provisions of BPOM Number 10 of 2013 which is 0.625% mg / kg. However, the use of magnesium oxide (MgO) has not been used in food products from animal sources. Therefore, based on the problems described, the addition of magnesium oxide (MgO) to crab boiled water flavor powder is carried out to determine the effect of the addition of magnesium oxide (MgO) with different concentrations on physical, chemical and hedonic characteristics and get the best addition formulation based on the results of physical, chemical and hedonic tests on crab boiled water flavor powder products.

2. Materials and Methods

2.1 Material and tools

Materials used for the manufacture of flavor include crab cooking water obtained from the crab boiling process, maltodextrin 7.5%, egg white 1.5%, garlic 0.2%, shallots 0.3%, salt 0.5% and magnesium oxide (MgO). Materials used for chemical analysis included distilled water, concentrated sulfuric acid, 30% NaOH, 2% boric acid, 0.1 N HCL, H2SO4, NaOH, H3BO3 and methyl red.

The tools used for making flavors include measuring cups, beakers, analytical scales, mixers, stirrers, ovens, grinders, baking sheets, sieves, pans, basins, plastic seals and 100 mesh filters. Tools used for chemical analysis include analytical scales, spectrophotometer, burete, erlenmeyer, cup, tongs, kjedhal flask, deconstruction flask, measuring cup, beaker glass, 3000 rpm centrifuge funnel, stopwatch, CR-400 chromameter and score sheet.

2.2 Preparation of Flavoring Powder of Crab Boiled Water with Magnesium Oxide (MgO) Addition

The method used in the research on the manufacture of crab boiled water powder flavor with the addition of magnesium oxide (MgO) anti-cramping refers to the research of Fajri et al. (2021) which was modified. The manufacturing procedure begins with preparing the material used, namely crab cooking water. The material is then mixed with filler material, namely maltodextrin with a concentration of 7.5%, then egg white with a concentration of 1.5% is added as a foaming agent. Foam was made using a mixer at 3000 rpm for 10 minutes. After that, the foam was put into a baking sheet covered with plastic with a thickness of 3 mm. The baking sheet was then put into an oven to dry for 18 hours at 60º C. After that, the dried sheet was crushed using a blender for 2 minutes. Next, the crab cooking water flavored powder was sieved with a 100 mesh sieve to produce a flavored powder with a certain size, then put in a ziplock plastic and added magnesium carbonate (MgO) anti-crust added to the flavored powder with concentrations of 0%, 0.2%, 0.4%, and 0.6%.

2.3 Moisture Content (BSN, 2006)

Testing the moisture content of the flavor powder begins with an empty cup prepared and dried for 1 hour in the oven then cooled for 30 minutes in a desiccator before weighing. One gram of sample was taken, placed on the cup and heated for 24 hours in an oven with a temperature of 105°C. Then cooled into a desiccator for 30 minutes and weighed again. To determine the percentage of water content (wet weight) of the data, it can be calculated using the following formula:

$$\text{Moisture content (\%)} = \frac{sample\ weight\ (g) - weight\ of\ saucer\ and\ sample\ (g)}{sample\ weight\ (g) - weight\ of\ saucer\ (g)} \text{ x } 100\%$$

2.4 Glutamat Acid (Khokhani et al., 2013)

Glutamic acid testing was carried out using the spectophotometric method with five concentrations of standard solution, namely 100, 200, 300, 400, and 500 ppm using pure glutamate samples. 1 gram of pure glutamate sample was weighed, diluted with 100 milliliters of distilled water, added 1 milliliter of nihidrin then heated in hot water for twenty minutes until the color turned purple and added. Standard and sample curves were measured with a spectophotometer with a wavelength of 570 nm. The curve result data was obtained to determine the level of glutamic acid in the sample.

2.5 Protein Content (BSN, 2006)

Protein content testing refers to BSN (2006) using the Kjeldahl method. Testing protein content begins with the deconstruction process as much as 2 grams of samples that have previously been homogenized then the sample is placed in a paper that has been folded and then put into the deconstruction flask. The next step is to prepare 2 catalyst tablets 15 mL of concentrated H2SO4 (95-97%) and 3 mL of H2SO2 then let stand for 10 minutes in the acid room. The deconstruction process is carried out at 410 ° C for 2 hours or until the solution becomes clear and then allowed to stand at room temperature. A total of 50-75 mL of distilled water and 25 mL of 4% H3BO3 were added to the flask. The flask containing the deconstruction results was added with 50-75 mL of sodium hydroxide-thiosufat solution before the distillate flask was attached to the steam distillation device and the distillation process was carried out. The results of the distillation process will form a yellow solution color then the solution is collected in an Erlenmeyer until it reaches 150 mL. The titration process is carried out with 0.2 N HCl until the color of the solution changes from green to gray. The titrant volume is then read and recorded. The blank solution is analyzed as an example. Protein content can be calculated using the following formula:

$$\%N = \frac{(\text{ml HCL sample} - \text{ml HCL blank}) \text{ x N HCL x } 14{,}007 \text{ x } 100}{\text{mg sample}}$$

2.6 Solubility (Susanti and Putri, 2014)

Solubility testing of flavor powder begins with the stage of first determining the moisture content of the sample as much as 5 grams of powder mixed with 100 ml of water and then filtered using Whatman paper. The filter paper used was dried in an oven at 105°C for 30 minutes and then weighed. After filtering, the filter paper and residue were dried in an oven at 105°C for 3 hours then cooled in a desiccator and weighed.

2.7 Standstill Angle (Voight, 1994)

Quiescent angle testing is determined by measuring the pile of powder by pouring the powder into the measuring device to measure the cone height and radius of the powder and then calculating. The angle of repose is measured using the following formula:

$$\text{Tg } \alpha = \frac{height\ of\ the\ cone}{radius}$$

2.8 Flowing Time (Voight, 1994)

The time taken for a certain amount of granule to flow through a device is referred to as flow time. The presence of a lubricating agent can improve the flow properties of a granule of 100 grams. The flow rate is determined in units of grams/second, and the granule flows in less than 10 seconds. This flow property can be used to assess the effectiveness of the slippery agent.

2.9 Color (Manera et al., 2012)

Color tests were analyzed using a Konica Minolta CR-400 Chromameter based on the CIE L* a* b* system (CIE LAB) with parameters of lightness (L*), redness (a*), yellowness (b*). L* has a range of 0 for black to 100 for white. a* determines the quality of red if it is positive, gray if it is 0 and green if it is negative. b* determines the quality of yellow if it is positive, gray if it is 0 and blue if it is negative.

2.10 Hygroscopicity ((Ng and Sulaiman, 2017)

The study was conducted with 1 gram of powdered sample put into a weighing bottle and then put into an applicator containing saturated sodium chloride solution (75% RH). The samples were stored for 1 week in a controlled room at 28-32°C. This time was sufficient to measure the hygroscopicity of the samples. Samples that had been stored for 1 week were then weighed in grams of absorbed water content per 100 grams of dry solids. The calculation of hygroscopicity is expressed in the following formula:

$$\text{higrosopicity} = \frac{\text{weight of sample after 1 week} - \text{weight of initial sample}}{weight\ of\ initial\ sample} \text{ x } 100\%$$

2.11 Hedonic (BSN, 2006)

Based on BSN (2006) on organoleptic or sensory testing instructions on fishery products, hedonic testing is carried out. Hedonic test is a test method used to measure the level of liking for a product using a scoring sheet, usually with specifications such as appearance, aroma, taste, texture, and other specifications. The evaluation of the test is based on the level of favorability of the panelists. The level of liking depends on the selected quality range. The hedonic test is conducted using a hedonic value scale, which is set from 1 to 9 and indicates a value of 1 = very strongly dislike, 2 = very strongly dislike, 3 = dislike, 4 = somewhat dislike, 5 = neutral, 6 = somewhat like, 7 = like, 8 = very much like, and a value of 9 = very strongly like. To draw conclusions, the ratings can be converted into a mean number at the 95% confidence interval which is then used to statistically analyze the data. Rating sheet data was calculated and quality scores were determined.

2.12 Data Analysis

Data analysis of this study was carried out using statistical tests with the SPSS 16 application, including tests of normality, homogeneity, and ANOVA (Analysis of Variance). Completely Randomized Design was used for homogeneous treatment. The data obtained showed a normal and homogeneous distribution of data so that it was possible to further analyze using ANOVA.

3. Result and Discussions

3.1 Moisture Content

Analysis of mosture value aims to determine the water content of crab stew water flavor with the addition of magnesium oxide (MgO) concentration with different concentrations. The results of the water content value of crab stew water flavor with the addition of magnesium oxide (MgO) are presented in (Table 1).

Table 1. Mouisture Content Result

Concentrations (MgO)	Moisture Content (%)
0%	$9,80 \pm 0,14^{c}$
0,2%	$8,39 \pm 0,00^{b}$

0,4%	$8,25 \pm 0,07^{b}$
0,6%	$7,82 \pm 0,18^{a}$
Crab cooked water	$91,39 \pm 0,01$

Data with different superscript indicates significant difference (P<0.05)

From (table 1) shows that the treatment of the addition of magnesium oxide (MgO) 0.6% showed the lowest result of 7.82% while the highest result resulted from the treatment of the addition of magnesium oxide (MgO) 0% at 9.80%. The treatment of the addition of magnesium oxide (MgO) 0.6% get the highest results because it has a high effectiveness in water absorption. According to Bashir *et al.* (2023), anti-caking is an agent that can provide protection against moisture between powder particles in the product. Anti-caking agents have the potential to absorb moisture faster up to 2.5 times their weight. The addition of anti-caking prevents the entry of water vapor and breaks the continuity of liquid formed between particles.

The treatment of adding magnesium oxide (MgO) 0% showed the highest water content of all treatments. The high water content in the treatment was due to the absence of the amount of magnesium oxide (MgO) added to the material. The addition of magnesium oxide (MgO) as an anti-clay material functions as a material that can slow down the absorption process of water content in the material. According to Sunyoto *et al.* (2017), the high value of water content is because the material without anti-clay will absorb more water than the material added with anti-clay. This is because anti-caking plays a role in slowing down the process of water absorption in the product so that water vapor can be absorbed by anti-caking before it is absorbed by the material.

2.2 Glutamic Acid

Analysis of glutamic acid value was carried out with the aim of knowing the value of glutamic acid in crab cooking water flavor with the addition of magnesium oxide (MgO) concentration with different concentrations and the value of glutamic acid in crab cooking water. The results of the water content of the crab cooking water flavor are presented in (Table 2).

Table 2. Glutamic Acid Result

Concentrations (MgO)	Glutamic Acid (%) (Wet Weight)	Glutamic Acid (%) (Dry Weight)
0%	$0,12 \pm 0,00^{a}$	$0,13 \pm 0,00^{a}$
0,2%	$0,13 \pm 0,00^{b}$	$0,14 \pm 0,00^{b}$
0,4%	$0,13 \pm 0,00^{cd}$	$0,14 \pm 0,00^{cd}$
0,6%	$0,14 \pm 0,00^{d}$	$0,15 \pm 0,00^{d}$
Crab cooked water	0,02	0,23

Data with different superscript indicates significant difference (P<0.05)

The results showed that the average value of dry weight of glutamic acid flavor of crab stew water was highest obtained from the treatment of the addition of magnesium oxide 0.6%, which was 0.15%, while the lowest average value was obtained from the treatment of the addition of magnesium oxide 0%, which was 0.13%. The existence of real differences is due to the content of water content due to the addition of different concentrations of magnesium oxide (MgO). The more concentration of magnesium oxide (MgO) added to the material makes the water content of the flavor decrease, followed by an increase in the value of glutamic acid proportionally in the formulation. According to Yonata *et al.* (2021), the value of glutamic acid is one of the amino acids that make up the protein which is related to the value of water content and solubility value. Crab shell flavor has a high glutamic acid value followed by a decrease in the water content of the product.

The results of the glutamic acid value of crab cooking water flavor with the addition of magnesium oxide (MgO) in each treatment showed a lower glutamic acid value compared to the glutamic acid value contained in crab cooking water. Crab cooking water has a dry weight value of 0.23%. The decrease in glutamic acid value in crab cooking water flavor is because during the drying process the flavor uses high temperature so that the value of glutamic acid which has unstable properties at high temperatures decreases. According to Lestari *et al.* (2018), free glutamic acid derived from food ingredients has a tendency to be unstable, especially at high temperatures during the cooking process. Some glutamic acid will break down and become pyroglutamate. This reaction begins with the release of the OH- group on the side chain of the carboxyl group of glutamic acid. The OH- group then combines with the proton of the amine group to form H2O, which leaves the amide group on the pyroglutamate.

2.3 Protein Content

Analysis of protein content value aims to determine the protein content of crab stew water flavor with the addition of magnesium oxide (MgO) concentration with different concentrations and water content of crab stew. The results of water content of crab stew water flavor with the addition of magnesium oxide (MgO) are presented in (Table 3).

Table 3. Protein Content Result

Concentrations (MgO)	Protein Content (%) (Wet Weight)	Protein Content (%) (Dry Weight)
0%	7,34 ± 0,27[a]	8,13 ± 0,32[a]
0,2%	7,58 ± 0,15[b]	8,27 ± 0,17[b]
0,4%	7,88 ± 0,11[ab]	8,58 ±0,12[ab]
0,6%	8,52 ± 0,47[b]	9,23 ± 0,52[b]
Crab cooked water	0,80	9,30

Data with different superscript indicates significant difference ($P<0.05$)

(Table 3) shows that the average value of flavor protein content in each treatment increases with the high concentration of magnesium oxide (MgO) added. The highest protein content results of this study were obtained from the treatment of the addition of magnesium oxide (MgO) 0.6% which amounted to 9.23% while the lowest average value was obtained from the treatment of the addition of magnesium oxide (MgO) 0% which amounted to 8.13%. These results indicate that the addition of magnesium oxide (MgO) as an anti-kempal material has a significant effect on the flavor of crab stew water. High protein levels in the addition of magnesium oxide (MgO) 0.6% due to the low water content contained therein. The more magnesium oxide (MgO) added to the flavor of crab stew water, the lower the water content produced so that it affects the protein content. According to Bahalwan (2011), water content is an important component in a product and will have a real influence on other content. Decreasing the value of water content in food ingredients will result in increasing compounds such as protein, carbohydrates, fats and minerals. However, the content of vitamins and dyes will generally decrease as the value of water content decreases**.**

The results of the protein content value of crab stew water flavor with the addition of magnesium oxide (MgO) concentration in each treatment showed a lower value compared to the protein content value of crab stew water. Crab cooking water has a wet protein content value of 0.80% and a dry weight value of 9.30%. The decrease in protein content value is due to the drying process using high temperatures in the flavor making process so that the protein content is denatured. High drying temperatures cause protein components to dissolve and form other compounds. According to Fauzy *et al.* (2016), the decrease in protein value is due to the use of high temperatures during the processing process, causing protein denaturation. The heating causes the protein to dissolve and form other compounds and reduce the protein content when viewed in terms of nutrition.

2.4 Solubility

Solubility value analysis aims to determine the solubility value of crab cooking water flavor with the addition of magnesium oxide (MgO) concentration with different concentrations. The results of flavor solubility are presented in (Table 4)**.**

Table 4. Solubility Result

Concentrations (MgO)	Solubility (%)
0%	84,87 ± 0,98[a]
0,2%	84,71 ± 0,99[a]
0,4%	86,45 ± 1,56[a]
0,6%	88,63 ± 1,64[a]

Data with the same superscript indicate no significant difference ($P>0.05$)

(Table 4) shows that the results of solubility values do not show significant differences between treatments statistically. This is because the magnesium oxide (MgO) added is not significant. The solubility value of the research results showed a higher value compared to the research. According to Novitasi et al. (2021), which showed the average value of solubility value in crab lemi flavor with combined treatment of maltodextrin and carrageenan fillers, which ranged from 71.37-82.68%. The difference can be caused by the composition of the raw materials used which is related to the different concentrations of fillers and binders used in the product manufacturing process so that it can affect the amount of solubility content. According to Hakim (2013), solubility in powdered flavor products is influenced by the fillers and binders used during the drying process. Maltodextrin added as a filler is known to have more ability to increase the solubility value compared to the use of carrageenan.

2.5 Standstill Angle

Analysis of the angle of silence aims to determine the value of the angle of silence of the crab cooking water flavor with the addition of magnesium oxide (MgO) concentration with different concentrations. The results of the stationary angle test of crab cooking water flavor with the addition of magnesium oxide (MgO) are presented in (Table 5).

Table 5. Standstill Angle Result

Concentrations (MgO)	Standstill (°)
0%	84,87 ± 0,98[a]
0,2%	84,71 ± 0,99[a]
0,4%	86,45 ± 1,56[a]
0,6%	88,63 ± 1,64[a]

Data with different superscript indicates significant difference (P<0.05)

(Table 5) shows that the best average value of angle of repose is obtained from the treatment of the addition of magnesium oxide (MgO) 0.6% while the lowest average value of angle of repose is obtained from the treatment without the addition of magnesium oxide (MgO) 0%. The value of the angle of repose in the treatment of the addition of magnesium oxide (MgO) 0.2%, 0.4% and 0.6% indicates that the flavor of crab boiled water has good flowability because it has a value of angle of repose of 25 ° < α < 40 °. According to Voight (1994), the determination of the flow properties of granules is determined based on the value of the stationary angle of a product. The stationary angle test is said to be qualified if it has a value of 25° < α < 40°. The flow properties of the powder can be seen from the flatter the cone produced, the smaller the angle of repose.

The addition of magnesium oxide (MgO) as an anti-caking agent has a significant effect on the flowability of crab cooking water flavor during storage. Magnesium oxide (MgO) acts as an ingredient that is able to provide control on the flavor of crab stew water not to clot quickly. According to Lipasek *et al*. (2012), powder sample formulations treated with anti-caking treatment during storage have varying angle of repose. The powder that was not added anti-caking treatment during storage had a much lower avalanche strength than the powder without anti-caking treatment. The powder added with anti-caking treatment will increase the flowability of the powder so that it has good flowing properties.

2.6 Flowing Time

Flow time analysis aims to determine the flow time of crab cooking water flavor with the addition of magnesium oxide (MgO) concentration with different concentrations. The results of the flow time analysis of crab cooking water flavor are presented in (Table 6).

Table 6. Flowing Time Results

Concentrations (MgO)	Flowing Time (second)
0%	11,39 ± 0,06[d]
0,2%	9,29 ± 0,14[c]
0,4%	8,44 ± 0,08[b]
0,6%	6,27 ± 0,04[a]

Data with different superscript indicates significant difference (P<0.05)

The results showed that the treatment of the addition of magnesium oxide (MgO) 0.6% had the lowest flow time value of 6.27 seconds while the treatment of the addition of magnesium oxide (MgO) 0% had the highest flow time value of 11.39 seconds. The quality of the flow time is determined by the fast or slow flowability of a material. The material is said to have good flowability if it has a flow time of <10 seconds. The flow time of a material is influenced by several factors, namely particle shape, particle size and cohesiveness between particles. A good powder is a powder that has the ability to flow freely. Based on the results obtained that the treatment of the addition of magnesium oxide (MgO) 0.2%, 0.4% and 0.6% shows the powder has a good flow time ability because it has a flow time <10 seconds. These results are different from the results obtained from the treatment of the addition of magnesium oxide (MgO) 0% which shows that the powder has a poor flow time ability because it has a flow time >10 seconds. This is due to the effect of the addition of magnesium oxide (MgO) concentration. The smaller the concentration of anti-caking material added, the smaller the size, viscosity and density will be so that the cohesion force between powder particles will increase which causes the powder to be difficult to flow freely. According to Fu *et al.* (2023), anti-caking is a substance added to powders to prevent clumping and improve the flowability of the powder. A powder with a high percentage of anti-caking agent added will have better flowability compared to a powder with little anti-caking agent added.

2.7 Color

The color test analysis aims to determine the color of crab cooking water flavor with the addition of magnesium oxide (MgO) with different concentrations. The results of the color test value of crab stew water flavor with the addition of magnesium oxide (MgO) are presented in (Table 7).

Tabel 7. Color Results

Concentrations (MgO)	Values		
	*L**	*a**	*b**
0%	73,85 ± 0,86[a]	2,54 ± 0,03[d]	23,77 ± 0,15[b]
0,2%	75,75 ± 0,85[b]	2,09 ± 0,10[c]	23,13 ± 0,34[ab]
0,4%	81,90 ± 0,47[c]	0,88 ± 0,03[b]	23,16± 0,02[ab]
0,6%	81,99 ± 0,36[c]	0,73 ±0,02[a]	22,60 ± 0,39[a]

Data with the same superscript indicate significant difference (P<0.05)

a. ***L****

Based on the results obtained, the average value of the color test for the *L** parameter in the crab stew water flavor ranges from 73.85 - 81.99 and tends to approach a light color, which means that the resulting flavor has a bright color because it is close to the value of 100. These results show that the higher the concentration of magnesium oxide (MgO) added, the brighter the color of the flavor while the lower the concentration of magnesium oxide (MgO) added, the color of the resulting flavor becomes darker. The appearance of the dark color is due to the maillard reaction formed due to the presence of free ammonia compounds formed from the degradation process of amino acids which triggers the formation of brown color thus reducing the *L** value. The decrease in *L** value is also due to the effect of changes in the water content contained in it. Flavor added with magnesium oxide (MgO) at a lower concentration will produce a high water content value. The high value of water content in the flavor will reduce the *L** value. According to Kurniawan (2020), the reflected wavelength of a food material changes due to rehydration or changes in water content. During rehydration water will enter the air space between tissues and change the wavelength reflected from the surface resulting in a change in the *L** color value.

b. ***a****

The results of the average value of the color test for the *a** parameter show that the higher the concentration of magnesium oxide (MgO) added to the material, the resulting *a** value will decrease and vice versa. The decrease in *a** value is due to the influence of the water content contained in the material. Low water content will be followed by a low *a** value so that the treatment of adding magnesium oxide (MgO) with a high concentration produces a low *a** value because it has a low water content. According to Horvath (2016), color in powder products is influenced by several factors, namely particle size and water content. The lower the water content, the lower the *a** value. This causes the resulting powder product to tend to be reddish.

c. ***b****

The results of the *b** parameter color test show results that are in line with the *a** parameter. The *b** value shows decreasing results along with the increasing concentration of magnesium oxide (MgO) added due to the influence of water content. The higher the concentration of magnesium oxide (MgO) produces a low water content which results in a decreased *b** value while the lower the concentration of magnesium oxide (MgO) added produces a high content thus increasing the *b** value. According to Waskale and Bhong (2017), the moisture content contained in the material has a significant influence on the *b** value of the product. The lower the moisture content value, the lower the *b** value and vice versa.

2.8 Higroscopisity

Hygroscopicity analysis aims to determine the level of hygroscopicity of flavor with the addition of magnesium oxide (MgO) with different concentrations. The hygroscopicity test results are presented in (Table 8).

Table 8. Hygroscopisity Result

Concentrations (MgO)	**Hygroscopisity (%)**
0%	23,26 ± 0,17[c]
0,2%	17,37 ± 0,38[b]
0,4%	16,77 ± 0,06[ab]
0,6%	16,31 ± 0,23[a]

Data with the same superscript indicate significant difference (P<0.05)

Based on the results above, it shows that the lowest hygroscopicity value is obtained from the flavor of crab stew water added with 0.6% magnesium oxide (MgO) treatment, which is 16.31%, while the highest hygroscopicity value is obtained from the flavor of crab stew water added with 0% magnesium oxide (MgO) treatment, which is 23.26%. A high hygroscopicity value is characterized by a high water content because a high hygroscopicity value will have a high ability to trigger the absorption of water vapor. Hygroscopic parameters do not determine the good or bad characteristics of a product quality but the hygroscopic level is one of the parameters that are closely related to the shelf life of the product. The deterioration of food quality will increase as the hygroscopic level of the product increases. According to Yonata *et al. (*2021), hygroscopicity is closely related to the quality of flavoring. Products that have a high level of hygroscopicity will tend to absorb water more strongly. This will cause the product to clump more easily and will shorten the shelf life.

There are several categories of hygroscopicity levels, namely non-hygroscopic, slightly hygroscopic, hygroscopic, very hygroscopic, extremely hygroscopic and extremely hygroscopic. Flavor of crab cooking water with the addition of magnesium oxide (MgO) 0.6%, 0.4% and 0.2% sequentially showed hygroscopicity values of 16.31%, 16.77% and 17.37% and belonged to the category of hygroscopic materials because it has a range of values of 15.1% - 20% while the flavor of crab cooking water with 0% magnesium oxide (MgO) addition treatment had a hygroscopic value of 23.26% so it was included in the category of very hygroscopic materials because it had a range of values of 21.1%-25%. Flavor products with hygroscopicity values that fall into the very hygroscopic product category will have an easier ability to absorb water. According to Enriquez *et al.* (2017), highly hygroscopic powders can absorb water more easily when exposed to an atmosphere with an RH of 50% or lower and will increase their water content by more than 60% when exposed to 90% RH. Moderately hygroscopic and slightly hygroscopic powders will absorb water only when exposed to RH conditions of 60% and 80% and will increase their water content by less than 60% and 40%, respectively.

2.9 Hedonic

Hedonic analysis aims to determine the water content of crab stew water flavor with the addition of magnesium oxide (MgO) with different concentrations. The results of the hedonic test of crab stew water flavor with the addition of magnesium oxide (MgO) consist of several parameters, namely appearance, taste, aroma and color presented in (Table 9).

Table 9. Hedonic Result

Parameters	Concentrations (MgO)			
	0%	0,2%	0,4%	0,6%
Color	$7{,}03 \pm 0{,}18^{a}$	$7{,}56 \pm 0{,}66^{bc}$	$7{,}80 \pm 0{,}54^{c}$	$8{,}16 \pm 0{,}73^{d}$
Taste	$7{,}16 \pm 0{,}46^{a}$	$7{,}63 \pm 0{,}67^{bc}$	$7{,}66 \pm 0{,}61^{cd}$	$7{,}50 \pm 0{,}64^{c}$
Odor	$7{,}16 \pm 0{,}37^{a}$	$7{,}20 \pm 0{,}88^{a}$	$7{,}46 \pm 0{,}86^{a}$	$7{,}53 \pm 0{,}68^{a}$
Texture	$6{,}93 \pm 0{,}36^{a}$	$7{,}40 \pm 0{,}67^{b}$	$7{,}80 \pm 0{,}55^{cd}$	$8{,}06 \pm 0{,}63^{d}$
Confidence Interval	$7{,}00<\mu<7{,}14$	$7{,}35<\mu<7{,}54$	$7{,}54 <\mu<7{,}81$	$7{,}64<\mu<7{,}97$

Data with the same superscript indicate significant difference ($P<0.05$)

a. Color

The results of hedonic testing on the parameters of the appearance of crab stew water flavor with the addition of different concentrations of magnesium oxide (MgO) showed that the treatment of the addition of magnesium oxide (MgO) 0.6% got the highest average value of 8.16 with a bright yellow appearance. While the lowest results were obtained from the treatment of the addition of magnesium oxide (MgO) 0% which got an average value of 7.03. These results indicate that the appearance parameter for the treatment of 0.6% magnesium oxide (MgO) addition is most preferred by panelists. These results are in line with the results of color testing which show that the $L*$ value parameter in the flavor added to the concentration of magnesium oxide (MgO) with a concentration of 0.6% produces a bright color so that panelists tend to like the flavor in the treatment of the addition of magnesium oxide (MgO) 0.6% compared to the flavor added to the concentration of magnesium oxide (MgO) with a concentration of 0% produces a dark color. Color parameters a* and b* values also showed similar results, namely yellowish and reddish colors that were high in the treatment of the addition of magnesium oxide (MgO) 0.6%. These results indicate that the addition of magnesium oxide (MgO) concentration as an anti-crust material has a significant effect on the appearance parameters of the hedonic test where the higher the concentration of anti-crust material added to the flavor of crab cooking water produces a high level of liking for panelists. This is related to the presence of anti-clay ingredients that play a role in changing the brightness of the product. According to Saputri and Rohmawati (2021), magnesium oxide (MgO) is a solid mineral that has a white color. Magnesium oxide is nano-sized which has broad potential in the industrial field. Magnesium oxide (MgO) is a food additive that has a color effect on ingredients.

b. Taste

The treatment of adding 0.4% magnesium oxide (MgO) is the treatment that many panelists like because it has more savory taste characteristics. The savory taste that arises is due to the influence of glutamic acid content. The results of the glutamic acid value presented in Table 4.2 show that the higher the magnesium oxide (MgO) added, the value of glutamic acid will increase, this causes the flavor to increase along with the addition of magnesium oxide (MgO). The results of the hedonic test analysis of the taste parameters show that the higher the treatment of adding magnesium oxide (MgO) concentration, it will affect the level of panelist preference. Magnesium oxide (MgO) is a food additive which when added with a higher concentration will give a more dominating taste sensation when entering the mouth. According to Purwanto *et al. (*2013), flavor can be influenced by the composition or constituent ingredients. The more concentration of additives given, the more the resulting flavor will be felt on the tongue. So that the high and low additives added will affect the taste.

c. Odor

Based on the odor parameter, the highest average value is (7.53) obtained by the flavor treatment with the addition of magnesium oxide (MgO) 0.6% with the aroma characteristics of the crab stew water specifications while the lowest average value is (7.16) obtained by the flavor treatment with the addition of magnesium oxide (MgO) 0% with the aroma characteristics of the crab stew water specifications. The results of the aroma parameter test showed that the addition of magnesium oxide (MgO) did not have a significant effect. This is because magnesium oxide (MgO) is an odorless material so it does not have a significant effect when added to the flavor. The highest average was obtained from the treatment of adding magnesium oxide (MgO) 0.6%, which means that panelists have a level of preference for this treatment because the addition of magnesium oxide (MgO) can slightly cover the aroma of boiled water specifications which are quite strong in the 0% treatment so that panelists have a higher level of preference for the 0.6% treatment. According to K.B *et al.* (2021), the aroma that appears is an odor produced by chemical stimuli that are smelled by different olfactory nerves in the nasal cavity when food enters the mouth. Aroma is an attribute that can affect the perception of good taste in a product. The aroma parameter is a parameter that can quickly determine the panelists' interest in a product**.**

d. Texture

The results of hedonic testing of texture parameters show that the treatment of adding 0.6% magnesium oxide (MgO) concentration produces the highest value of (8.06) with flavor characteristics that are in accordance with flavor specifications, smooth and not lumpy while the lowest result is (6.93) obtained from the treatment of adding 0% magnesium oxide (MgO) with fairly lumpy flavor characteristics. Based on these results, it shows that the addition of different concentrations of magnesium oxide (MgO) has a significant effect. ased on the research results presented in (Table 5) and (Table 6), it shows that the higher the concentration of magnesium oxide (MgO) added in the material shows a smoother texture of flavor and does not clot so it is easier to pour. The results presented in Table 4.1 also show that the treatment of adding 0.6% magnesium oxide (MgO) concentration has a low water content value compared to other treatments so as to produce flavors that are not clumpy and have good flow properties. According to Anggriani *et al.* (2019), the texture of the material can be influenced by the water content in it. Ingredients that have low water content will produce a dry and non-clumpy texture. Low water content in the material will also produce uniform particles.

3. Conclusion

The treatment of the addition of magnesium oxide (MgO) concentrations of 0%, 0.2%, 0.4% and 0.6% had a significant effect ($P < 0.05$) on glutamic acid, water content, protein content, dwell angle, flow time, color and hedonics in the flavor of crab stew water but had no significant effect ($P>0.05$) on solubility. The best addition of magnesium oxide (MgO) to the flavor of crab stew water is obtained from the treatment of adding magnesium oxide (MgO) 0.6% based on the hedonic test with a confidence interval value of $7.64 <\mu<7.97$ which indicates that the flavor is preferred by panelists, the value of glutamic acid 0.14%, moisture content value of 7.82%, dry weight protein content value of 9.23% and wet weight protein content value of 8.52%, solubility value of 88.63%, dwell angle value of 29.17°, flow time value of 6.27 seconds, color test value for L^* parmeter of 81.99, a^* of 0.73, b^* of 22.60 and hygroscopicity value of 16.31%.

Acknowledgements

This research was conducted using personal funds

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