Using design expert d-optimal for formula optimization of functional drink that enriched with moringa leaf extract (Moringa oleifera)

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Abstract. The nutritional content found in Moringa leaf can be used as a supporting substance, the utilization of Moringa leaf extract as for the enrichment of drink products that are ready for consumption such as instant drink products. The use of Moringa leaf extract as an instant drink is an innovation of a local food product to help girl adolescent that are already menstruating to prevention iron deficiency anemia. The purpose of this study was to determine the optimization of the instant drink formula enriched with Moringa leaf extract using the Expert D-Optimal Design. The research stages were conducted by: (1) preparation of the Moringa leaf extract, (2) determination of the fillers from cassava flour, modification cassava flour, and dextrins, (3) characterization of the instant drinks with selected fillers, (4) Moringa leaf enriched instant drink formula optimization using the Program of Design Expert-12 the Mixture Design method. The research results based on the prediction of the Program of Design Expert-12 show that the optimized formula from 38.01% moringa leaf extract and 29.94% dextrins with desirability value is 0.521. Verification result has a water soluble time of 17.54 seconds; water insoluble part 0.002%; yield 61.15%; bulk density 0.72 g/mL; 64.65 degrees of brightness; moisture content 1.32%; ash content 0.27%; pH 3.22; antioxidant activity 0.00027; tannin content 0.07%; iron content 3.47 μg/mL and organoleptic values include color 4.15; aroma 3.99; taste 3.94; and overall 4.02.

1. Introduction

The Moringa oleifera plant has several nicknames, including The Miracle Tree, Tree for Life, and Amazing Tree, because the parts of the moringa plant from roots, stems, leaves, skin, flowers, fruit, to seeds have health benefits. Moringa plants are able to live in various types of soil, are easy to breed, are resistant to dry seasons, and do not require intensive care [1].

Moringa leaves contain high antioxidants [2], which can be used as a source of protein and minerals [3]. The nutrient content in 100 grams of dried Moringa leaves is 7.5 g of water; 38.2 g carbohydrates; 27.1 g protein; 2.3 g fat; 19.2 g fiber, 2003 mg calcium; 368 mg magnesium; 204 mg phosphorus; 0.6 mg copper; 28.2 mg iron; 870 mg sulfur; 1324 potassium; and calories 205 kcal [4]. In the process of drying Moringa leaves, suggest using a cabinet dryer instead of sun drying or drying it in a room, based on the efficiency of drying time and the mineral content of dry, stable Moringa leaves [5]. Moringa leaves can be processed into flour, according to [6] in 100 grams of Moringa leaf flour contains 28.25% protein. Moringa leaves have the potential to be a functional drink because they
contain antioxidants, ascorbic acid, flavonoids, phenolics, and carotenoids [7]. The highest antioxidant content is found in the leaves, including: tannins, steroids, triterpenoids, flavonoids, saponins, interquinones, and alkaloids [8].

The high content of nutrients found in Moringa leaves can be used as a supporting material for the enrichment of functional drinks that are ready for consumption, one of which is instant drinks. Based on the Indonesian National Standard (SNI) Number 01-4320-1996.

Traditional beverage powders are beverage ingredients in the form of powder or granules made from a mixture of sugar and spices with or without the addition of other food ingredients and permitted food additives [9]. The most important process steps in making instant drinks enriched with Moringa leaf extract are the extraction and drying processes. Extraction is very important because it affects the color, aroma, taste, of the product. The purpose of extraction is to obtain Moringa leaf extract, while drying is to get instant drink with dry conditions and form of flour. This drink will be given to young women to prevent iron deficiency anemia, with claims to contain iron (Fe). Anemia is a nutritional problem caused by iron deficiency, around 27% of adolescent girls experience anemia in developing countries and 6% in developed countries [10].

Formula optimization is needed in the process of making instant drinks enriched with Moringa leaf extract. Determination of formula optimization can be done using the Design Expert application. Design Expert is a program used for product or process optimization in the main response caused by several variables, and the goal is to optimize the response [11]. The advantage of the Design Expert program with the Mixture Design method is that it has a numerical accuracy of up to 0.001 and can process data quickly and accurately as needed. The purpose of this study was to determine the optimization of the instant drink formula enriched with Moringa leaf extract using the Expert D-Optimal Design.

2. Material and Methods
2.1. Material
The ingredients used in the process of making instant drinks, moringa leaves with green petioles which obtained from the Gedebage area of Bandung city with a harvest age of three weeks, dextrins, cassava flour, mocaf flour, granulated sugar (refined sugar, added green food coloring, dried, carried out sieving 40 mesh), citric acid, food color, and gum arabic.

2.2. Methods
2.2.1 Preparation of the Moringa leaf extract
Fresh Moringa leaves were trimmed, washed, drained, blanched at a temperature of 70-80 °C for 5 minutes, then dried at 50 °C for 6 hours. The result of drying is in the form of dried moringa leaf simplicity, added warm water (1: 3) then crushed, then squeezed using a filter cloth to get the extract. The next step was to analyze the levels of tannin [12] and iron [13] leaves extract.

2.2.2 Determination of the fillers from cassava flour, modification cassava flour, and dextrins
Moringa leaf extract is mixed with gum arabic and 3 types of fillers (mocaf flour, cassava flour, and dextrin). Furthermore, homogenization and thickening were carried out using a steam jacket kettle at 72.5 °C for 4 minutes, then dried with a drum dryer at 120 °C with a distance between the drums being 0.4 mm and a drum speed of 5 rpm. After drying, refining it using a disc mill and sifting using a vibrator screen with a size of 40 mesh. The next step was dry mixing with citric acid and sugar granulation. The research design is the determination of the materials to be formulated in the D-Optimal Design Expert method as a changing variable. In Table 1, it can be seen that the instant drink formulation enriched with Moringa leaf extract by determining the filler.
Table 1. Instant drink formulation enriched with Moringa leaf extract

| Material                  | Dextrins (%) | Cassava Flour (%) | Mocaf Powder (%) |
|---------------------------|--------------|-------------------|------------------|
| Moringa leaf extract      | 37.9         | 37.95             | 37.95            |
| Filler                   | 30.00        | 30.00             | 30.00            |
| Citric Acid              | 0.50         | 0.50              | 0.50             |
| Arabic Gum               | 0.05         | 0.05              | 0.05             |
| Granulation Sugar        | 31.50        | 31.50             | 31.50            |

2.2.3 Characterization of the instant drinks with selected fillers

To determine the selected filler, organoleptic testing was carried out using the hedonic method [14]. There were 30 girl adolescent panelists who had experienced menstruation by assessing the attributes: color, aroma, taste, and overall.

2.2.4 Moringa leaf enriched instant drink formula optimization using the Program of Design Expert-12 the Mixture Design method

Determination of formula optimization by making a comparison between Moringa leaf extract and selected fillers using the D-Optimal Design Expert method with (1) physical response: solubility test time dissolved in water [15], part not water soluble [9], yield [16] density of kamba [17], degree of brightness [18], (2) chemical response: moisture content [9], ash content [9], pH [19], antioxidant activity [20], tannin content [12], and iron content [13] and (3) organoleptic response: using the hedonic test method with 30 girl adolescent panelists of 12 - 15 age who have experienced menstruation, by assessing the attributes of color, aroma, taste, and overall.

Table 2. Instant Drink Main Formulation Enriched With Moringa leaf extract

| Material                  | F1 (%) | F2 (%) | F3 (%) | F4 (%) | F5 (%) | F6 (%) | F7 (%) | F8 (%) |
|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| Moringa leaf extract      | 39.00  | 39.95  | 36.95  | 38.95  | 40.95  | 40.95  | 38.95  | 37.95  |
| Dextrin                   | 28.95  | 28.00  | 31.00  | 29.00  | 27.00  | 27.00  | 29.60  | 30     |
| Citric Acid              | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    |
| Arabic Gum               | 0.05   | 0.05   | 0.05   | 0.05   | 0.05   | 0.05   | 0.05   | 0.05   |
| Granulation Sugar        | 31.50  | 31.50  | 31.50  | 31.50  | 31.50  | 31.50  | 31.50  | 31.50  |

3. Results and Discussion

3.1 Moringa leaf extract

Moringa leaf extract was analyzed for tannin levels and iron levels. Because the iron content in the final product will be claimed, this instant drink can be given to girl adolescent as a functional drink to prevent of anemia. But the moringa leaves contain tannins, which can inhibit iron absorption in the body. Then both analyzes were carried out, to determine the maximum limit of tannin levels that may be in functional drink products. In Table 3, you can see the results of the analysis of tannin and iron levels from Moringa leaf extract.

Table 3. Results of the analysis of Moringa leaf extract

| Sample                  | Tannin Content (%) | Iron Content (μg/mL) |
|-------------------------|--------------------|----------------------|
| Moringa leaf extract    | 0.3827             | 4.60                 |

Tannin is a polyphenol compound that has a molecular weight of more than 1000 phenol groups which undergoes an oxidation process. Based on the Acceptable Daily Intake (ADI), the safe limit for tannins in foodstuffs is 560 mg / kg body weight / day [21].
Iron (Fe) is one of the minerals contained in Moringa leaves. The iron (Fe) content of Moringa leaf extract was 4.60 μg/mL, equivalent to 22.99 mg/100 grams. According to [4], dried Moringa leaves contain iron content of 28.2 mg / 100 grams. The results of the analysis of the iron content of Moringa leaves can be different due to differences in the mineral content of the soil where it is grown, the degree of soil acidity (pH), soil texture, and age of harvesting of Moringa leaves [22].

3.2. Determination of Selected Fillers

The determination of fillers used the hedonic method of organoleptic testing with 30 girl adolescent panelists of 12-15 age who had experienced menstruation, assessing the attributes: color, aroma, taste, and overall. In Table 4, the results of organoleptic testing are presented to determine the selected flour to be used in the manufacture of instant drink products. Cassava flour and modified cassava flour (mocaf) are intermediate products from cassava. The use of cassava to support food crop development programs and activities in West Java Province in 2015-2019 is Palawija Jagung Kedele, which is one of the locations for the development of plant cultivation in Subang District [23].

Table 4. Results data of organoleptic test to determine the selected flour

| Filler            | Colour | Aroma | Taste | Over All | Total |
|-------------------|--------|-------|-------|----------|-------|
| Dextrins*         | 4.93   | 3.93  | 4.47  | 5.00     | 18.33 |
| Cassava Flour     | 4.07   | 3.87  | 3.77  | 4.17     | 15.88 |
| Mocaf Flour       | 3.90   | 4.10  | 3.67  | 4.27     | 15.94 |

*Note: Selected formula

Table 4 shows that dextrin fillers are preferred overall by the panelists, compared to cassava flour and mocaf flour. Furthermore, dextrin fillers are used in the formulation of the Design Expert 12 program. Dextrin functions as an encapsulation material, because it is able to enter the capsule matrix and cover the pores of the capsule thus protecting the bioactive components of Moringa leaf extract [24]. In the process of making dry yogurt using a spray dryer at an inlet temperature of 120°C and an outlet of 80°C, adding corn starch and DFA III as prebiotic compounds that can protect probiotics by means of encapsulation, so as to maintain the viability of lactic acid bacteria dry yogurt products [25].

3.3. The physical response of Moringa leaf enriched instant drink formula optimization

In Table 5, you can see the results of the physical analysis of instant drinks enriched with Moringa leaf extract.

Table 5. Results of physical analysis of instant drinks enriched with Moringa leaf extract

| Formula | Solubility time in water (second) | Water insoluble part (%) | Yield (%) | Bulk Density (g/mL) | Degree of brightness L* |
|---------|----------------------------------|--------------------------|-----------|---------------------|------------------------|
| 1       | 19.04                            | 0.0076                   | 58.86     | 0.6325              | 67.471                 |
| 2       | 20.38                            | 0.0159                   | 57.36     | 0.6387              | 68.819                 |
| 3       | 18.11                            | 0.0040                   | 64.25     | 0.6312              | 66.453                 |
| 4       | 19.10                            | 0.0091                   | 59.77     | 0.6424              | 68.376                 |
| 5       | 16.43                            | 0.0013                   | 56.42     | 0.6177              | 63.389                 |
| 6       | 18.63                            | 0.0059                   | 56.32     | 0.6625              | 66.914                 |
| 7       | 18.62                            | 0.0053                   | 59.82     | 0.6424              | 68.902                 |
| 8       | 17.10                            | 0.0026                   | 61.19     | 0.7484              | 61.963                 |

Instant drink is closely related to the time it dissolves in water, because in the process of serving it must be dissolved first using water. The increase in moisture content in food ingredients will form bonds that cause clots to form and result in a longer time to break the bonds between particles [26]. Instant drink products enriched with 40.95% Moringa leaf extract and 27% dextrin, have the fastest water-soluble time of 16.43 seconds. The value of the product water-soluble time is influenced by the moisture content of the product (formula 5 has moisture content content 1.2585%). According to [27],
one of the factors that affect the dissolving time is the moisture content of the material, the higher the moisture content of the instant powder drink, the longer it takes to dissolve.

Instant drinks are also related to the insoluble part of water, the less the water insoluble part, the better the quality of the product. Instant drink enriched with Moringa leaf extract with the lowest water insoluble part value of 0.0013% from the 40.95% moringa leaf extract formulation and 27% dextrin. The value of the insoluble part of this water is influenced by the moisture content, where the greater the moisture content, the higher the value of the insoluble part of the water.

Instant drink products with the highest yield value of 64.25% from the formulation of 36.95% Moringa leaf extract and 31% dextrin. The high yield is closely related to the amount of filler added. This is in line with [28], that the greater the concentration of dextrin fillers, the more yields are produced. The density of kamba from instant drinks with the formulation of 40.95% Moringa leaf extract and 27% dextrin has the lowest value, namely 0.6177. The highest kamba density value was 0.7484 from the formulation of 37.95% moringa leaf extract and 30% dextrin.

The highest degree of brightness (L *) for the instant drink formula was 68.902 from the 38.95% moringa leaf extract and 29.60% dextrin. These results are consistent with the organoleptic test for color attributes, which most panelists like instant drinks with the same formulation.

3.4. The chemical response of Moringa leaf enriched instant drink formula optimization

In Table 6, you can see the results of the chemical analysis of instant drinks enriched with Moringa leaf extract.

| Formula | Moisture Content (%) | Ash Content (%) | pH | Antioxidant activity | Tannin Content (%) | Iron Content (μg/mL) |
|---------|----------------------|-----------------|----|----------------------|-------------------|----------------------|
| 1       | 1.4333               | 0.3190          | 3.30 | 0.00035              | 0.1163            | 2.28                 |
| 2       | 1.4743               | 0.3392          | 3.16 | 0.00036              | 0.1242            | 3.58                 |
| 3       | 1.2585               | 0.2569          | 2.89 | 0.00023              | 0.0680            | 1.64                 |
| 4       | 1.4076               | 0.2919          | 3.51 | 0.00031              | 0.0980            | 2.36                 |
| 5       | 1.5872               | 0.3491          | 3.25 | 0.00039              | 0.1277            | 5.41                 |
| 6       | 1.4829               | 0.4580          | 3.14 | 0.00037              | 0.1287            | 7.76                 |
| 7       | 1.3667               | 0.2734          | 3.42 | 0.00029              | 0.0882            | 2.29                 |
| 8       | 1.2945               | 0.2578          | 3.11 | 0.00024              | 0.0719            | 2.14                 |

Instant drink moisture content meets the requirements of SNI No. 01-4320-1996, which is a maximum of 3%. Instant drink products with the lowest moisture content of 1.2585% from the formulation of 40.95% Moringa leaf extract and 27% dextrin.

According to SNI No. 01-4320-1996, the maximum ash content in instant drinks is 1.5%. Instant drink products with the lowest ash content of 0.2569% from the formulation of 36.95% Moringa leaf extract and 31.00% dextrin. The ash content is influenced by the Moringa leaf extract, the more addition of Moringa leaf extract, the more the ash content of the product will increase, this is because the Moringa leaf extract contains the highest minerals [4].

Instant drink products from the moringa leaf extract formulation of 38.95% and 29% dextrin have the highest pH value of 3.51, while the lowest pH value is 2.89 from the formulation of 36.95% moringa leaf extract and 31% dextrin. The pH value was not influenced by the addition of Moringa leaf extract and dextrin, but was influenced by the addition of citric acid. The function of citric acid in instant drinks is to manage pH of instant drink [29].

Antioxidant Activity Index (AAI) from instant drinks with moringa leaf extract formulation of 40.95% and dextrin 27%, has the highest antioxidant activity level of 0.00039. Antioxidant activity is influenced by the addition of Moringa leaf extract, the more addition of Moringa leaf extract, the more its antioxidant activity increases. Because moringa leaf extract contains high antioxidants [30]. The
antioxidant activity of instant drinks is also influenced by temperature stability during the drying and blanching processes, because this process can reduce its antioxidant activity [30].

Instant drink products with the lowest tannin content of 0.0680% from the formulation of 36.85% Moringa leaf extract and 31% dextrin. This tannin level is influenced by the addition of Moringa leaf extract, the more addition of Moringa leaf extract, the tannin content will increase, because the Moringa leaf extract contains tannin content [31]. But it will decrease when it becomes an instant drink product. According to [31] the tannin content in food can be reduced by soaking, boiling, and fermentation. Tannins can inhibit iron absorption in leaf instant drink products by forming complex compounds. The reaction between metal ions and organic molecules that have a pair of electrons will bind metal ions [29].

Instant drink products with 40.95% moringa leaf extract formulation and 27% dextrin have the highest iron content of 7.76 μg / mL. This iron level is influenced by the addition of Moringa leaf extract, the more the addition of Moringa leaf extract will increase the iron content in the product. Because Moringa leaves contain 0.70 μg/mL iron and 4.60 μg/mL extract. Iron levels in Moringa leaf meal 28.2 mg / 100 g; 3.86–6.28 mg / 100 g [32]; Moringa leaves contain iron levels of 28.2 mg / 100 grams [4].

The function of iron in the body; (1) synthesizing hemoglobin in the blood so that the hemoglobin concentration is maintained, (2) a source of energy for muscles that affects physical endurance and ability to work, especially in adolescents. According to [33], iron deficiency is mostly found in adolescence due to growth acceleration, unbalanced iron intake and blood loss due to menstruation in young women.

3.5. Organoleptic response of Moringa leaf enriched instant drink formula optimization

In Figure 1, you can see the results of organoleptic testing from instant drinks enriched with Moringa leaf extract.

![Figure 1. Organoleptic test results from instant drinks enriched with Moringa leaf extract](image)

Moringa leaf instant drink products with the highest color response value of 4.37 were produced by products using moringa leaf extract at 38.35% and dextrin at 29.60%. This result is in accordance with the physical response analysis test of the degree of brightness where the optimum results were obtained with a combination of the proportion of moringa leaf extract 38.95% and dextrin 29.60%. The instant moringa leaf drink product with the highest aroma response value of 4.10 was produced by products using moringa leaf extract at 36.95% and dextrin by 31%. Moringa leaf instant drink products with the highest taste response value of 4.03 were produced by products using 38.35% Moringa leaf extract and 29.60% dextrin.
3.6. Determination of the Optimal Formula with the Design Expert Program 12

The formula optimization process is carried out to get the most optimal response, with a desirability value close to 1. Optimized components, target values, limits, and importance at the formula optimization stage using the Design Expert 12 program can be seen in Table 7.

Moringa leaf extract components with a range of 36.95-40.95% and dextrin with a range of 27-31% were optimized with target components in the range and importance level or 3 (+++). The optimization phase is carried out to provide the best formula solution from several suggested formulas with the optimum desirability value. Figure 2 shows the desirability value of each instant drink product formula enriched with Moringa leaf extract, it can be seen that the range of optimum desirability values is in the formulation with the use of 36.95% moringa leaf extract and 31% dextrin to the formulation using 40.95 moringa leaf extract. % and dextrin 27%. The Design Expert 12 program recommends 1 formula, data solutions recommended by the Design Expert 12 program at the formula optimization stage can be seen in Table 7.

| Name of Response | Response Goals | Lower Limit | Upper Limit | Importance |
|------------------|----------------|-------------|-------------|------------|
| Moringa leaf extract | In Range | 36.95 | 40.95 | 3 (+++) |
| Dextrin | In Range | 27 | 31 | 3 (+++) |
| Solubility time in water | Minimize | 16.43 | 20.38 | 1 (+) |
| Water insoluble | Minimize | 0.0013 | 0.0159 | 1 (+) |
| Kamba Density | Minimize | 0.6177 | 0.7484 | 1 (+) |
| Rendement | Maximize | 56.32 | 64.25 | 3 (++++) |
| Degree of Brightness | Maximize | 61.963 | 68.902 | 3 (++++) |
| pH | Maximize | 2.89 | 3.51 | 3 (++++) |
| Moisture Content | Minimize | 1.2585 | 1.5872 | 5 (+++++) |
| Tannin content | Minimize | 0.0680 | 0.1287 | 5 (+++++) |
| Ash content | Minimize | 0.2569 | 0.4580 | 5 (+++++) |
| Antioxdant activity | Maximize | 0.00023 | 0.00039 | 5 (+++++) |
| Iron content | Maximize | 1.64 | 7.76 | 5 (+++++) |
| Color | Maximize | 3.63 | 4.37 | 3 (+++)|
| Aroma | Maximize | 3.53 | 4.10 | 3 (+++)|
| Taste | Maximize | 3.23 | 4.03 | 3 (+++)|
| Over all | Maximize | 3.67 | 4.30 | 3 (+++)|

![Figure 2. Desirability graph of the entire product formula (two component mix)](image)
Table 8. Solution of formula after process optimization

| Moringa leaf extract (%) | Dextrins (%) | Desirability |
|-------------------------|-------------|--------------|
| 38.01                   | 29.94       | 0.521*       |

*Remarks: The optimum formula

The formula solution chosen was the optimum formula consisting of 38.01% Moringa leaf extract and 32.41% dextrin. This formula has a desirability value of 0.521, which means that this formula produces a product that has the characteristics according to the optimization target of 52.1%. This formula is predicted to have a water solubility time of 17.51 seconds; water insoluble part 0.0021%, the yield value 61.15%; kamba density 0.72 g / mL; 64.6525 degrees of brightness; moisture content 1.3238%; ash content 0.2726%; pH 3.22; antioxidant activity 0.00027; tannin content 0.0842%; iron content of 2.05 μg / mL and organoleptic values include color 4.15; aroma 3.99; taste 3.94; and overall (overall) 4.02.

3.7. Verification of the Optimal Formula

The optimum formula produced is then used in the manufacture of instant drinks for re-analysis using the same response. The purpose of testing is to find out the actual value of the optimum formula so that it can be compared with the predictions given by the Design Expert 12 program. In Table 9 we can see the results of the verification stage along with the predictions of each response.

Table 9. The results of the verification stage and the prediction of each response

| Response                  | Prediction | Actual | 95% CI Low | 95% CI High | 95% PI Low | 95% PI High |
|---------------------------|------------|--------|------------|-------------|------------|-------------|
| Solubility time in water  | 17.51      | 16.31  | 15.88      | 19.33       | 14.61      | 20.40       |
| Water insoluble           | 0.0021     | 0.0012 | -0.0021    | 0.0063      | -0.0053    | 0.0096      |
| Kamba Density             | 61.15      | 60.04  | 60.66      | 61.64       | 60.00      | 62.29       |
| Degree of Brightness      | 0.7207     | 0.6182 | 0.6369     | 0.8046      | 0.58893    | 0.8525      |
| Moisture content          | 64.6522    | 69.4070| 60.5510    | 68.7534     | 57.3589    | 71.9456     |
| Ash content               | 1.3238     | 1.5436 | 1.1997     | 1.4479      | 1.1031     | 1.5444      |
| pH                        | 0.2726     | 0.2544 | 0.2317     | 0.3135      | 0.1753     | 0.3699      |
| Antioxidant activity      | 3.22       | 3.24   | 3.05       | 3.39        | 2.83       | 3.61        |
| Tannin content            | 0.00027    | 0.00029| 0.00025    | 0.00030     | 0.00021    | 0.00033     |
| Iron content              | 0.0742     | 0.1052 | 0.0741     | 0.0946      | 0.0600     | 0.1087      |
| Color                     | 3.47       | 4.46   | 0.84       | 3.26        | -0.83      | 4.94        |
| Aroma                     | 4.15       | 3.77   | 3.86       | 4.45        | 3.47       | 4.84        |
| Taste                     | 3.99       | 3.60   | 3.61       | 4.37        | 3.40       | 4.59        |
| Over all                  | 3.94       | 4.33   | 3.65       | 4.23        | 3.42       | 4.45        |
|                           | 4.02       | 4.13   | 3.87       | 4.17        | 3.66       | 4.38        |

Based on the verification that has been done, it can be seen that the verification results of data are still in accordance with the predictions made by the Design Expert program 12, moisture content, ash content, pH value, antioxidant activity, tannin content, iron content, and organoleptic responses including color, aroma, taste, and overall meet the predicted 95% Confidence Interval (CI) and 95% Prediction Interval (PI) by the Design Expert program 12.

4. Conclusion

In conclusion the tannin content in the product is reduced compared to Moringa leaf extract. Optimization of product formulas using the Design Expert 12 program based on time dissolved in water, water insoluble portion, yield, density of cages, degree of brightness, moisture content, ash content, pH value, antioxidant activity, tannin content, iron content and organoleptic response from
color, aroma, taste, and overall (overall) optimum with a desirability value of 0.521. The desirability value of 0.521 means that this optimum formula will produce a product that has the characteristics according to the optimization target of 52.1%. This optimum formula consists of a combination of 38.01% moringa leaf extract and 29.94% dextrin. The verification results show that the selected formula has solubility time in water of 16.21 seconds; water insoluble part 0.0012%; yield 60.04; kamba density 0.6185 g / mL; degrees of brightness 69.407; moisture content 1.5436%; ash content 0.2544%; pH value 3.24; antioxidant activity 0.00029; tannin content 0.1052%; iron content 4.46 μg / mL; and the organoleptic value of the color 3.77; aroma 3.60; taste 4.33; and overall (overall) 4.13. Reduced levels of tannins in products, relatively high levels of iron, eating instant drinks enriched with Moringa leaf extract can be consumed by young women as functional drinks to prevent iron nutritional anemia. It is necessary to carry out further research on the shelf life of the product using an appropriate packaging and recommended storage temperature. It is necessary to test the product's effectiveness to prevent iron nutrition anemia in teenage girls.

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