THE EFFECT COMPARISON MALTODEXTRIN AGAINST RESULTS CHARACTERISTICS OF MICROENCAPSULATION OF TURMERIC (CURCUMA DOMESTICA VAL)

Tri Yuni Hendrawati¹, Muhammad Ardian Mubarok¹ and Anwar Ilmar Ramadhan²
¹Department of Chemical Engineering, Faculty of Engineering, Universitas Muhammadiyah Jakarta, Indonesia
²Department of Mechanical Engineering, Faculty of Engineering, Universitas Muhammadiyah Jakarta, Indonesia
E-Mail: yuni.hendrawati@ftumj.ac.id

ABSTRACT
Saffron has been established and used by the widely in both urban and in rural areas especially in a household for various kinds of its usefulness of them as an antiseptic, drug diarrhea, a nonsteroidal anti-inflammatory natural, prevent metastasis (spreading cancer), and made digestion make appetite children increase. The purpose of this research was to study the influence of concentration maltodextrin to rendemen, the water level, and time the solubility of flour turmeric by using dryer spray (spray blow dryer). Variation composition maltodextrin used consisting of 6 %, 8 %, 10 %, 12 %, 14 % at the temperature inlet spray blow dryer 120°C. A method of making flour saffron done by means of the pollen from saffron in grated, then sari saffron obtained added maltodextrin with a variety composition and in stirring use homogenizer that homogeneous. We do drying in spray blow dryer at the temperature inlet 120°C. Testing the physical properties of flour saffron produced covering the water level, and rendemen solubility of time. As his application flour saffron then used as the adder power appetite on children is feasible. The research results show that rendemen largest namely 3.40 % there are in samples of 14 % and are the condition of the best with the regression equation is \( y = 0.017x^2 - 0.535x + 7.9 \) \( R^2 = 0.952 \). The solubility of the fastest time where the sample concentration maltodextrin 6 % during 416 second by the regression equation is \( y = 8.267x^2 - 72.73x + 601.4 \), with \( R^2 = 0.917 \). In testing kurkumin content done testing in hplc where prove kurkumin levels in flour saffron of 3.01 %.

Keywords: flour saffron, spray blow dryer, curcumin.

INTRODUCTION
Turmeric (Curcuma domestica Val.) is a type-finding meeting containing kurkuminoid, consisting of curcumin compounds and derivatives that include desmetoksikurkumin and bidesmetoksikurkumin (Ernita and Rosyidah, 2000). Kurkuminoid the active ingredient in turmeric that has a broad spectrum of biological activity, one of which antihematotoksis (Sujatno, 1997). Turmeric has been known and widely used by people both in urban and in rural areas, especially in the household for a variety of uses. Part of turmeric which is mainly used is the rhizome that is widely used for the purposes of traditional medicine, dye textiles, food seasonings, spices, and cosmetics ingredients. Benefits of Turmeric as a traditional medicine among others for drug itching, tingling, swollen gums, sores, shortness of breath, abdominal pain, ulcers, scurvy, gout, jaundice, improves digestion, antidiarrheal, antidote, appetite enhancer and so forth (Rukmana, 1999).

Microencapsulation is a technology coating solids, liquids and gases by the capsule in the form of a small capsule which can release contents under specific conditions. Microencapsulation aims to protect components sensitive ingredients, reduce the loss of nutrients, and add a food component liquid form to a solid form that is more easily handled (Dzieczak, 1988). Product microcapsules can be used as raw material for the food industry, cosmetics, and pharmaceuticals, using bioactive compounds. (Sutrisno Koswara, 2005).

Based on research that has been done, turmeric contains many chemical compounds that are beneficial for the body. Some chemical constituents of turmeric that has been known that as much as 6% essential oil composed of monoterpenes and sesquiterpenes class of compounds (including zingiberen, alpha and beta-turmerone), yellow dye called kurkuminoid as much as 5% (including curcumin 50-60%, monodesmetoksikurkumin and bidesmetoksikurkumin), protein, phosphorus, potassium, iron and vitamin C. Of the three compounds kurkuminoid, curcumin is the largest component is one of the uses is to increase appetite in children.

RESEARCH METHOD
The methodology used is Microencapsulation techniques. In this study, using a spray drying microencapsulated most widely used in the food industry because the cost is relatively lower. The process is flexible, can be used for a variety of materials in microencapsulated equipment was easily applied in processing a variety of materials and produce particles are of good quality with a consistent particle size distribution.

Raw foods are packaged in this manner include fats, oils, and flavor. Upholstery can be a carbohydrate, such as dextrin, sugar, starch, and gum, or proteins, such as gelatin and soy protein. Microencapsulation process includes forming an emulsion or suspension of active ingredients and coatings, and fogging the emulsion into the hot dry air circulation inside the drying chamber using...
an atomizer or nozzle. The water content in the emulsion droplet is vaporized by contact with hot air.

The remaining solids of the coating material to trap the core material. Spray drying is useful for foodstuffs that are sensitive to heat for the drying process takes place very quickly. However there is still a loss of active ingredients that have a low boiling point. The physical properties of the microcapsules depends on the temperature of hot air (approximately 150 - 200°C), the degree and uniformity in emulsion fogging, density levels of emulsion (30-70%), and the temperature of the emulsion. Advantages include spray drying diversity and availability of machines, the quality of the microcapsules are still good, wide range of particle sizes that can be produced, and the ability of a good dispersibility in aqueous media. Some losses gained among loss of active ingredients with a low boiling point, the process of oxidation in the flavoring compounds, and the limitations on the choice of wall material, wherein the wall material must be soluble in water with a decent amount.

![Diagram](image)

**Figure-1.** Flour making process flow diagram turmeric.

### RESULTS AND DISCUSSIONS

#### Data Testing Results

This study was conducted to determine the concentration of maltodextrin best variable. Turmeric extract volume by 300 ml maltodextrin is added as thickeners to vary the concentration of as much as 6%, 8%, 10%, 12% and 14% later performed the homogenization of materials using homogenizer until evenly mixed in 500 ml glass beaker volume.

Then the sample homogenization that has been incorporated magnetic stirrer. This rotating magnetic stirrer when the stirrer to the spray dryer is turned on so that the samples remain homogeneous during suctioning. The next stages of drying material on the tool type spray dryer SPRAY DRYER SD-BASIC LabPlant. The inlet temperature is set for this study is 120°C, 80-100°C outlet temperature, P (blower) = 4m$^3$/min.
Table-1. The results of the study variables Maltodextrin concentration of turmeric powder to the yield on the Spary Dryer inlet temperature of 120oC.

<table>
<thead>
<tr>
<th>No.</th>
<th>Sample</th>
<th>Concentration of Maltodextrin (m/v %)</th>
<th>Flour yield of Turmeric (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I</td>
<td>6</td>
<td>2.02 %</td>
</tr>
<tr>
<td>2</td>
<td>II</td>
<td>8</td>
<td>2.23 %</td>
</tr>
<tr>
<td>3</td>
<td>III</td>
<td>10</td>
<td>3.20 %</td>
</tr>
<tr>
<td>4</td>
<td>IV</td>
<td>12</td>
<td>3.04 %</td>
</tr>
<tr>
<td>5</td>
<td>V</td>
<td>14</td>
<td>3.40 %</td>
</tr>
</tbody>
</table>

Then to test turmeric powder obtained from the spray drying process is done in the form of test results of water content and solubility of turmeric powder which can be seen in Table-2.

Table-2. Maltodextrin concentration variable research results on water content and solubility of turmeric powder on the inlet temperature of 120oC.

<table>
<thead>
<tr>
<th>No.</th>
<th>Sample</th>
<th>Concentration of Maltodextrin (m/v %)</th>
<th>Percentage of Water (%)</th>
<th>Solubility (Second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I</td>
<td>6</td>
<td>6.0%</td>
<td>416</td>
</tr>
<tr>
<td>2</td>
<td>II</td>
<td>8</td>
<td>5.5%</td>
<td>503</td>
</tr>
<tr>
<td>3</td>
<td>III</td>
<td>10</td>
<td>4.5%</td>
<td>588</td>
</tr>
<tr>
<td>4</td>
<td>IV</td>
<td>12</td>
<td>4.5%</td>
<td>608</td>
</tr>
<tr>
<td>5</td>
<td>V</td>
<td>14</td>
<td>4.0%</td>
<td>959</td>
</tr>
</tbody>
</table>

Turmeric powder that has been generated is applied to the field of pharmaceutical formulated for power adder child's appetite.

The effect comparison concentration maltodextrin against turmeric wheat yield

Value yield in the drying process depends on the amount of product produced. In this study, the yield obtained ranges from 2.02% - 3.40% yield obtained showed quite small based on the dry products obtained by starting from a liquid feed entered. In the drying process, the free water which is on the surface can be easily evaporated materials so that the yield obtained is small enough (M Kumalla, et al. 2013).

Based on the concentration of maltodextrin with a yield variable, the results of which can be seen in Table 1 at the time of the higher concentration of maltodextrin obtained the higher yield compared with the concentration of maltodextrin is lower. The yield can be seen also obtained when the concentration of maltodextrin 14%, so that the effect of the concentration on the yield of turmeric powder maltodextrin can be seen in Figure-2.

![Figure-2. Influence of maltodextrin concentration on the yield of turmeric powder.](image-url)

The curve shows that with increasing concentration of maltodextrin shows increased yield as maltodextrin to bind water. However, a decline in the yield on a 12% sample of concentrate maltodextrin caused when mixing is not homogeneous, so a lot of turmeric powder that coagulates in the pipe leading to the cyclone and are not counted as yield.

Based on the chart the effect of the concentration of maltodextrin to the yield of turmeric powder obtained simple regression equation, namely $y = -0.0148x^2 + 0.4749x - 0.3706$. From the increase in concentration proved to have a positive influence on the yield, meaning that the higher the concentration of maltodextrin, the higher the yield of turmeric powder was obtained.

Determasi known coefficient at the picture of $R^2 = 0.8775$, the results obtained $R = 0.9365$. Rooting results
are the result of the correlation, because the correlation coefficient on the interaction between maltodextrin concentration and yield of turmeric extract turmeric powder products amounted to 0.9365 which means the relationship between the two variables are closely and have relevance. Then determinasi coefficient of 87.7% of the yield is influenced by the concentration of maltodextrin.

The effect comparison concentration maltodextrin against flour water content turmeric

The relationship between the concentration variables maltodextrin turmeric powder with water levels on the implementation of the research results that the greatest water content contained in the sample with a concentration of 6% maltodextrin with a water content of 6.0%. While most low water content contained in the sample with a concentration of 14% maltodextrin with a water content of 4.0%. The addition of the coating material could increase the total solids materials and the higher total solids are dried to a certain extent, the rate of evaporation will be higher so that the moisture content of materials to be low (Masters, 1979).

This shows that the higher the concentration of maltodextrin is added, the smaller the water content contained in turmeric powder. The water content in turmeric powder effect on storability, appearance and contained in turmeric powder. The water content test results can be seen in Figure-3.

Determine known coefficient at the picture of R squared = 0.952, the results obtained R = 0.9757. The results of rooting is a correlation, because the correlation coefficient on the interaction between the concentration of maltodextrin turmeric extract and water content in turmeric powder products amounted to 0.9757 which means the relationship between the two variables are closely and have relevance. Then determinasi coefficient of 95.2% of the water content is influenced by the concentration of maltodextrin.

The effect comparison of the solubility wheat maltodextrin concentration turmeric

Solubility is an important test for powder products. According to Lewis (1987) the solubility of the powder is affected by the composition, the process conditions during drying, solvent temperature, moisture content and method of mixing. Time solubility of turmeric powder is affected by moisture, where the greater water content of turmeric powder, the faster time of turmeric powder solubility in water. This is consistent with the statement Srijari (2010) that the higher the water content in turmeric powder then has a tendency to beraglomerasi where it helps accelerate time to resolve the powder is completely underwater.

This is because more and more water content in turmeric powder, the higher the ability of the particles to absorb water on its surface, so that more time is needed turmeric powder wetted by water. The relationship between the concentration of maltodextrin with a variable solubility turmeric powder on the implementation of the research results that the samples had concentrations of 6% has a solubility of time faster than most other samples that for 416 seconds. Likewise with the sample at a concentration of 14% has solubility longest time is 959 seconds.

Barbossa-Canovas et al. (2005) explains that the solubility of milk powder spray drying process usually results greater than 1000 seconds. The solubility of turmeric powder to the concentration of maltodextrin and spray drying Tinlet tool in this study faster, because is obtained less than 1000 seconds although it is said that there are still further process.

Based on Table-2 obtained equations and graphs that connects between the concentrations of maltodextrin with solubility, shows a tendency the higher the concentration of maltodextrin time’s greater solubility will follow the graph such as Figure-4:

The curve shows the higher concentration of maltodextrin, the tendency of the water content further down for more total solids. Based on the chart the influence of maltodextrin concentration on water content turmeric powder obtained simple regression equation, namely y = 0.0179x² - 0.6071x + 9.0429. Of the increase in concentration proved to have a positive influence on water content, meaning that the higher the concentration of maltodextrin, the lower the water content of turmeric powder were obtained.
Figure-4. Maltodextrin concentration versus time influence the solubility of turmeric powder.

The curve shows that turmeric powder will dissolve faster in water samples had levels greater because of the tendency algomerasi. Based on the chart the influence of maltodextrin concentration on the yield of turmeric powder obtained simple regression equation, namely \( y = 8.267x^2 - 72.73x + 601.4 \). From the increase in concentration proved to have a positive influence on the solubility of the time, meaning that the lower the concentration of maltodextrin, the faster the time the solubility of turmeric powder.

Determinasi known coefficient at the picture of \( R^2 = 0.917 \), the results obtained \( R = 0.9576 \). The results of rooting is a correlation, because the correlation coefficient of interaction between the concentration of maltodextrin in saffron sari and a solubility in turmeric powder products amounted to 0.9576 which means the relationship between the two variables are closely and have relevance. Then determinasi coefficient of 91.7% of the time the solubility is influenced by the concentration of maltodextrin.

In the test results turmeric powder processing, to produce content of curcumin done with HPLC testing. The test results prove the content of curcumin in turmeric powder amounted to 3.01%, see Figure-5.

<table>
<thead>
<tr>
<th>Code of sample</th>
<th>Content Bisdemetoksi curcumin (%)</th>
<th>Content Demetoksi curcumin (%)</th>
<th>Content curcumin (%)</th>
<th>Total Content kurkuminoid (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 4</td>
<td>0.09</td>
<td>0.70</td>
<td>2.22</td>
<td>3.01</td>
</tr>
</tbody>
</table>

Figure-5. Chromatography HPLC results on the test results of microencapsulated turmeric.

CONCLUSIONS

Based on the research manufacture of turmeric powder made with maltodextrin concentration ratio results have been obtained with the following conclusion:

a) From the results of drying at 120oC Tinlet found that in various concentration levels of 6% maltodextrin with a yield of turmeric powder had a low of 2.02%, while the largest yield is at a concentration of 14% maltodextrin with levels that have a yield of turmeric powder is 3.40% with the equation \( y = -0.014x^2 + 0.0474x - 0.370 \) and \( R^2 = 0.877 \). This research shows that
greater the number concentration of maltodextrin is added, the greater the yield of turmeric powder were obtained.

b) From the research results drying at 120°C Tinlet found that the variations in the concentration of maltodextrin with levels 14% had the lowest moisture content that is 4% while the highest water content is at a concentration of 6% maltodextrin with high levels of as much as 6%. This shows that more and more of maltodextrin is added, the water content is obtained on the wane, can be seen in the following equation $y = 0.017x^2 - 0.535x + 7.9$ and $R^2 = 0.952$.

c) Time solubility is strongly influenced by the concentration of maltodextrin and water content of turmeric powder. With the high concentration of maltodextrin is added then the dissolution time will be longer, which can be seen in the following equation $y = 8.267x^2 - 72.73x + 601.4$ and $R^2 = 0.917$. At the time of the test obtained solubility turmeric powder with a fastest time of 416 seconds at a concentration of 6% maltodextrin and solubility with the longest time 959 with concentrations of 14% maltodextrin.

d) HPLC testing to prove the levels of curcumin in turmeric powder amounted to 3.01%.

ACKNOWLEDGEMENT

Thanks to the Laboratory of Chemical Engineering Universitas Muhammadiyah Jakarta and Laboratory TIAP, BPPT, Puspiptek Serpong.

REFERENCES


