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Design a Pepper Seed Drying Oven with a Capacity of 8-10 (kg/hour)

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Abstract

The drying process of pepper seeds is still done by relying on sunlight, whereas rainy weather conditions will greatly slow down drying. Drying using an oven is done to make the pepper cleaner from dirt and efficient against the time of drying the pepper, For this reason, an oven is needed to dry pepper seeds so as not to be too dependent on weather conditions. This oven heating system uses LPG gas, a hygrometer used to estimate temperature and humidity, and a thermostat to regulate the room temperature in the oven, also equipped with an automatic lighter to make it easier to start the fire in the oven. The dried peppers that have been tested ranging from 50°C, 60°C, 70°C, 80°C, and 90°C are all dry with the longest duration of 99 minutes and the fastest time of 15 minutes.
Keywords: *Oven, Dryer, Lighters, Pepper*

Abstrak

Pengeringan menggunakan oven dilakukan untuk supaya lada lebih bersih dari kotoran serta efisien terhadap waktu terhadap pengeringan lada, Proses pengeringan dari biji lada ini masih dilakukan dengan mengandalkan sinar matahari, dimana jika kondisi cuaca hujan akan sangat memperlambat pengeringan. Untuk itu dibutuhkan oven sebagai alat untuk pengering biji lada, agar tidak terlalu bergantung dengan kondisi cuaca. Sistem pemanas oven ini menggunakan gas LPG, hygrometer yang digunakan untuk mengukur suhu serta kelembaban dan thermostat untuk mengatur suhu ruangan didalam oven, juga di lengkapi dengan pemantik api otomatis supaya mempermudah dalam menghidupkan api didalam oven. Pengeringan lada yang telah diuji mulai dari 50°C, 60°C, 70°C, 80°C dan 90°C semua kering dengan waktu terlama 99 menit dan waktu tercepat 15 menit.
***Kata-kata kunci**: Oven, Pengering, Pemantik, Lada*

1. Introduction

Drying is an easy process of adjusting the moisture content of a product at a certain level, to prevent spoilage in the product, and can be stored for a long time [1]. The moisture content of the product should be adjusted so that it contains only between 5/10% of the original amount to inactivate any microorganisms that may be present. In general, drying can be done by various techniques, with the most popular being drying machine technology that utilizes kinetic energy [2].

Pepper is a plant that requires a drying process after harvesting, after the seed soaking process [3]. The drying process takes 3-10 days if you use sunlight, so the water content contained in pepper seeds is still quite high, which ranges from 15-18%. The water content still allows the fungus to grow and develop so that it can damage the quality of the pepper [4]. This condition can occur because the drying process still relies on the weather.

Where if the weather is sunny the drying process can be done optimally, but if it is cloudy the drying process cannot be done optimally, so it can make the quality of pepper not optimal. If you use the oven at the best temperature and time, which is 85°C for 20 minutes, the remaining moisture content is 10.65% [5].

Referring to the above phenomenon, the author is interested in making a Pepper Drying Oven Design tool. With an oven that can be adjusted the temperature using a thermostat, and can also turn on the oven fire automatically using an automatic lighter if the temperature has been reached the fire will turn off and will turn on again when the temperature setting has been set using a solenoid valve.

It is hoped that later on the results of this tool can dry agricultural seeds quickly and provide clean and hygienic results, can determine their size, can regulate heat in the drying room, drying no longer depends on the weather, and also this drying no longer requires a large space.

2. Method

This research utilizes the design of a pepper seed dryer which can be seen in **Figure 1**.

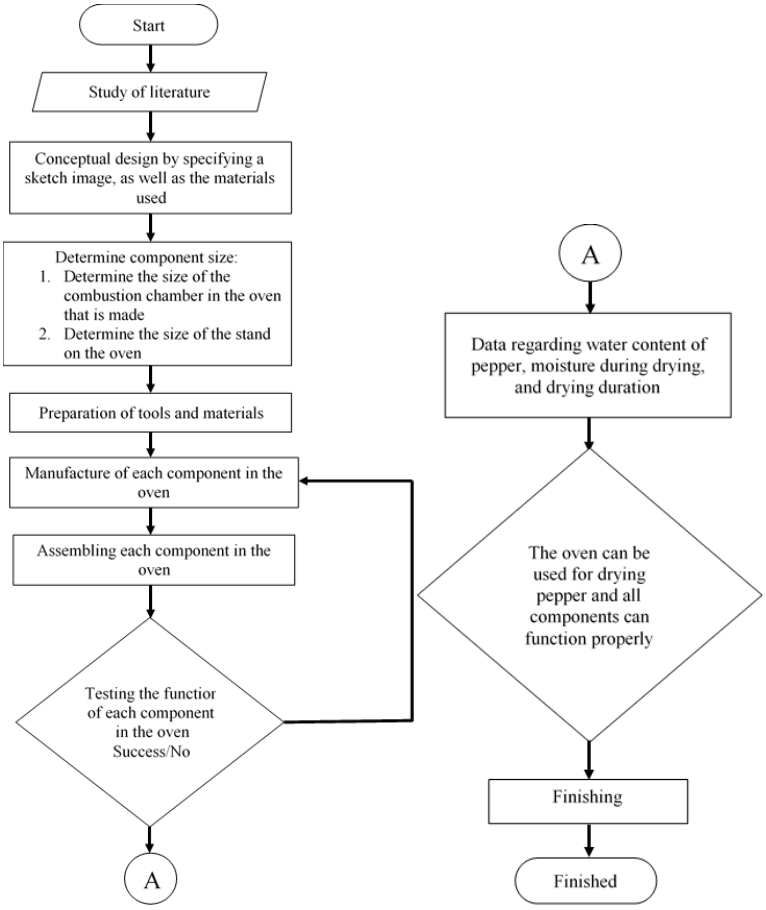

Figure 1. Research Methods

The flowchart starts from the study of literature, conceptual design is carried out by determining sketch drawings and then determining the materials and components used, then determining the dimensions of size, preparation of tools and materials, making each component in the oven then assembling each component, testing each component in the oven. Automatic lighter circuit is presented on **Figure 2**.

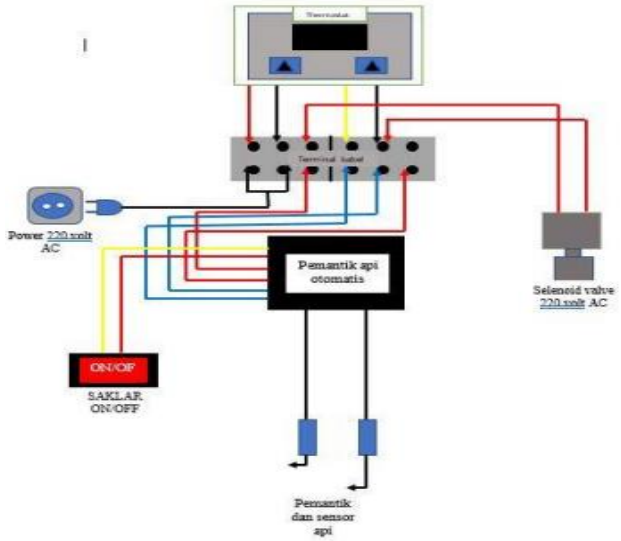

Figure 2. Automatic Lighter Circuit

This series of lighters is automatic, making it easier for users to turn on the oven. Dryer design is presented in **Figure 3.**

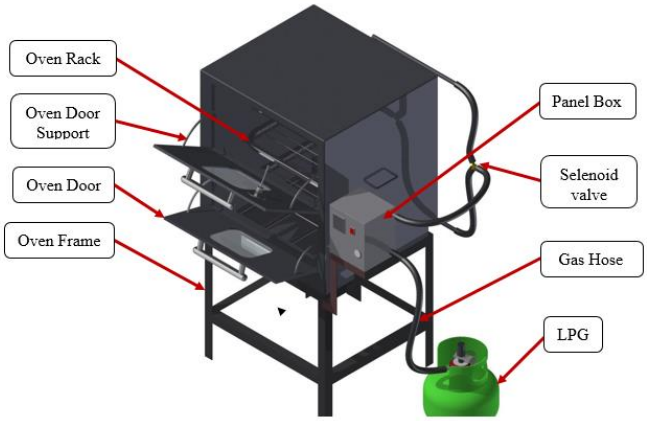

Figure 3. Dryer Design

Components of the oven:

1. Rak door
2. Door support
3. Oven door
4. Oven frame
5. Selenoid valve
6. Panel box
7. Gas hose
8. LPG

After the design and preparation of tools and materials are completed, the next stage is the manufacture of component tools, the initial stage of making a pepper drying oven frame using hollow iron then the oven body using aluminum plates that are assembled using rivets and then making doors, bodies, and frames with the same process Then add glass after it is attached to the oven body. The last stage is to make a series of lighters in the oven in the panel box.

Testing of the tool is carried out on several parameters contained in the pepper dryer, including:

a. The amount of water that shrinks after the drying process is carried out using a pepper drying oven.
b. Humidity and temperature outside the oven before drying and during the drying process.
c. The duration of each drying process using a pepper drying oven.
d. Test the working of the no-load pepper dryer with temperatures of 50°C, 60°C, 70°C, 80°C, and 90°C to see how long it takes to arrive at the maximum temperature that has been set.

3. Results and Discussion

This yield was tested on five samples. Yield is the percentage of dry weight compared to weight before drying.

3.1 Presenting research results

The calculation of yield on pepper seeds is carried out using the following equation [6]:

$$Rendemen = \frac{weight\ after\ drayer}{weight\ before\ drayer} \times 100\%$$

In testing, a reinstatement of the highest is obtained.

1. Sample yield (one)

   $= \frac{176\ gr}{222\ gr}$ x 100% = 79,27 – 100% = 20,73 %

2. Sample yield (two)

   $= \frac{177 gr}{222\ gr}$x100% = 79,72% - 100% = 20,28 %

3. Sample yield (three)

   $= \frac{178\ gr}{222\ gr}$x100% = 80,81% - 100% = 19,82 %

4. Sample yield (four)

   $= \frac{179\ gr}{222\ gr}$x100% = 80,63% - 100% = 19,37 %

5. Sample yield (five)

   $= \frac{180\ gr}{222\ gr}$x100% = 81,08% - 100% = 18,92 %

So the yield of pepper produced in this test ranges from 19.37%-20.73%, thus the yield is to the standard results determined by this researcher [7].

3.2 Create a discussion

Tests were carried out at five levels of temperature. After testing, data is obtained so that analysis can be carried out. Tes results is presented in Table 1 and Figure 4.

Table 1. Test Results

No	Sample	Initial sample weight	Final sample weight	Test Temperature	Time/Duration of Testing	Difference
1	First	222 gr	176 gr	50-55°C	99 menit	46 gr
2	Second	222 gr	177 gr	60-65°C	48,47 menit	45 gr
3	Third	222 gr	178 gr	70-75°C	39,37 menit	44 gr
4	Fourth	222 gr	179 gr	80-85°C	30 menit	43 gr
5	Fifth	222 gr	180 gr	90-95°C	15 menit	42 gr

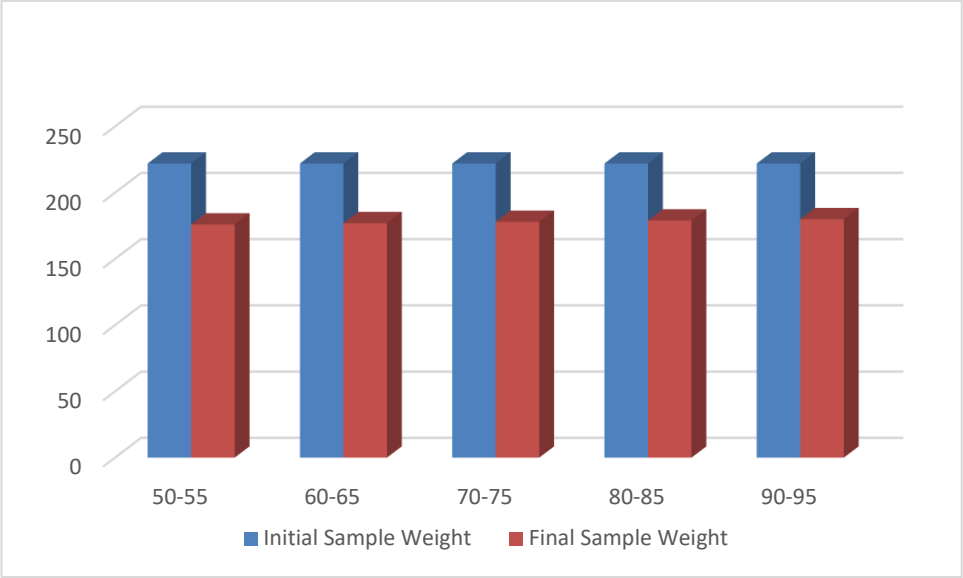

Figure 4. Test Result Graph

In sample one with a temperature of 50-55 °C, the duration is 99 minutes, and the yield obtained is 20.73%. This sample has a relatively good refinement by the standards set and also by the selection of specified temperatures [8] by these temperature standards the compounds contained in pepper are still maintained while microbes and fungi at this temperature will die, it's just that the duration of the drying process is long enough and using a stable temperature will make the pepper more durable and the quality of the pepper produced is higher according to the study [9].

In simple two with a temperature of 60-65C °, the duration is 48.47 minutes, and the yield obtained is 20.28%. This sample has a relatively good refinement because it is still by the standards set in the selection of temperature this sample is good because the higher the temperature used in the drying process [10], the higher the energy sent and the faster the drying time, at this temperature microbes and fungi will die and the compounds of the chemical and physical structure of pepper will be more awake.

In simple three with a temperature of 70-75C °, the duration is 39.37 minutes, and the yield obtained is 19.82%. This sample has a yield according to predetermined standards [11], the selection of temperature in this sample is good because it is still by the standards we use, only the drying process time is also standard.

In simple four with a temperature of 80-85 °, the duration is 30 minutes, and the yield obtained is 19.37%. This sample has a yield by the standards that have been determined in this sample, the temperature used is relatively high due to the high temperature and air circulation rate [12], the more drying speed takes place, the process can damage the material to become drier, therefore it is not

comparable to the rate of water mobility of the material to the surface [13]. This causes microbes and fungi to grow on the pepper, causing the quality of the pepper in this test sample to be damaged cannot be used.

In simple lima with a temperature of 90-95 °C, the duration is 15 minutes, and the yield obtained is 18.92%. This sample has a low yield and is not according to standards because the drying air temperature above 75 ° C makes the structure damaged due to changes in pepper cells [14], causing the quality of pepper to decrease.

The results of the five samples above can be concluded that samples 1, 2, 3, and 4 are by predetermined standards while sample 5 is not by standards due to drying with high temperatures and fast drying duration causing the surface structure of the material to dry quickly [15], then the water in the material does not overflow because it is closed

causes pepper to become moist and causes mold and microbes to grow so that the product is not durable and the product quality is low. Rendemen is presented in **Table 2** and **Figure 5**.

Table 2. Rendemen

Sample	Test Temperature	Timer/Duration of Testing	Rendemen
First	50-55	99	20,73%
Second	60-65	48,47	20,28%
Third	70-75	39,37	19,82%
Fourth	80-85	30	19,37%
Fifth	90-95	15	18,92%

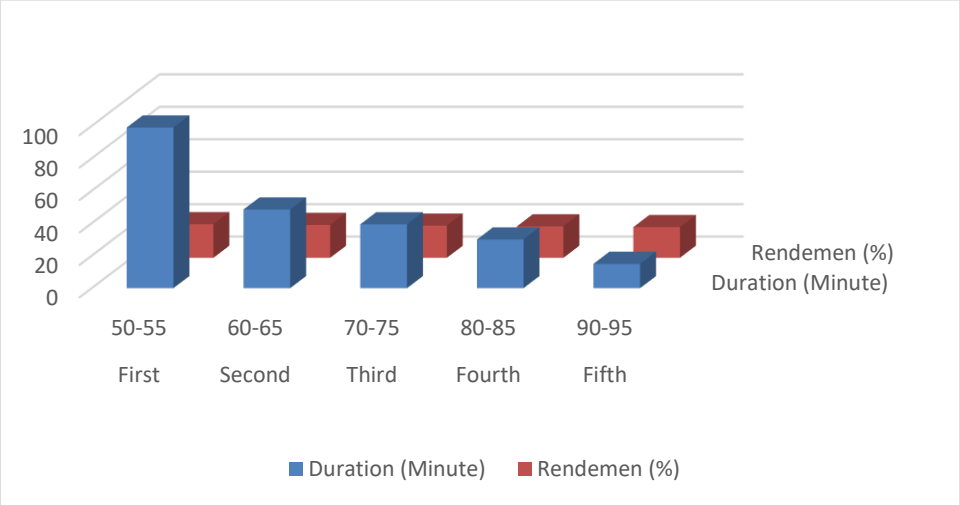

Figure 5. Rendemen Results

4. Conclusion

From the results of making tools and test results as well as the analysis that has been carried out, conclusions can be drawn, namely:

a. When testing the no-load function the data obtained strongly shows that the manufacture of the oven can be said to be successful, where when the oven is adjusted to the temperature in the thermostat, the temperature to be reached is carried out properly, and when the desired temperature has been reached the fire will die and the solenoid valve will also close and turn on again when the temperature drops that have been determined.

b. From the data obtained in the results of drying research using an oven that has been made, the temperature suitable for drying is obtained at a temperature of 60-65 ° C with humidity at the time of testing about 40% humidity outside the oven, because the temperature is very suitable because the water content in the pepper and microbes and fungi will die and the chemical compounds contained in the pepper will be better.

c. After taking data with an initial sample of 222 grams, the difference after drying was around 46 grams using a temperature of 50-55 °C, a duration of 99 minutes, and the yield obtained was 20.73%. This sample has a high yield, it's just that the drying process time is very long. Meanwhile, with a sample of 222 grams, the difference after drying is around 42 grams using a temperature of 90-95 ° C with a duration of 15 minutes and the yield of drying pepper is obtained at 18.92%. This sample has a low yield, it's just that the drying process time is fast.

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