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Modification of Tankring Oven as a Dryer and Sample Storage for Research Activities of Fish Products in Microbiology and Biotechnology Laboratory

Modifikasi Oven Tangkring Sebagai Alat Pengering dan Penyimpan Sampel untuk Kegiatan Penelitian Produk Hasil Perikanan di Laboratorium Mikrobiologi dan Bioteknologi

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Abstract

Ovens or artificial/mechanical drying devices are tools used in educational and research activities in laboratories that function for sterilization, drying, and storing samples or processed products. This research modifies the tangkring oven with an innovative use of electricity. The background of the study is because there is no drying device and small sample storage with a small number of samples. The modification aims to make a replacement device as a dryer and sample storage in the laboratory. This study used an experimental method, and the data were analyzed descriptively. The oven that has been modified using a tangkring oven has an inner dimension of length =36 cm; width=36 cm; height =32 cm, heat source from 150-watt halogen lamps totaling two pieces, and a 12 cm diameter fan, the outer part of the tool has a length = 42.5 cm; width = 38 cm; height = 38 cm, equipped with legs and four wheels with a height = 85 cm. Temperature testing was carried out on each shelf with a thermometer as a temperature measuring instrument, with a temperature range of 30-60ºC. The time required to reach a constant temperature is 0.5 to 20 minutes, and the temperature difference between the regulated temperature and the temperature achieved on the tool ±2ºC shows the results obtained are still within tolerance, the error value is still within tolerance ±5% indicates the results of the tool system performance is not disturbed. From the observations made, it is concluded that the modified tangkring oven can be used as a drying device and sample storage with a faster time and using limited samples for laboratory activities.

Keywords: Tangkring Oven, Dryer, Modification, Halogen Lamp

Abstrak

Oven atau alat pengeringan buatan/mekanik merupakan alat yang digunakan pada kegiatan pendidikan dan penelitian di laboratorium yang berfungsi untuk sterilisasi, pengering dan penyimpan sampel atau produk olahan. Penelitian ini memodifikasi oven tangkring dengan inovasi penggunaannya dengan listrik. Latar belakang penelitian karena belum adanya alat pengering dan penyimpan sampel ukuran kecil dengan jumlah sampel yang sedikit. Modifikasi bertujuan untuk membuat alat pengganti sebagai alat pengering dan penyimpan sampel di laboratorium. Penelitian ini menggunakan metode eksperimen dan data dianalisis

secara deskriptif. Oven yang telah dimodifikasi menggunakan oven tangkring mempunyai dimensi bagian dalam panjang = 36 cm; lebar = 36 cm; tinggi = 32 cm, sumber panas dari lampu halogen 150 watt berjumlah 2 buah serta memasang kipas diameter 12 cm, bagian luar alat mempunyai panjang = 42,5 cm; lebar = 38 cm; tinggi = 38 cm, dilengkapi kaki dan 4 roda dengan tinggi = 85 cm. Uji coba suhu dilakukan pada tiap rak dengan termometer sebagai alat ukur suhu, dengan rentang suhu 30- 60ºC. Waktu yang dibutuhkan untuk mencapai suhu konstan adalah 0,5 sampai 20 menit dan selisih suhu yang diatur dengan suhu yang dicapai pada alat ±2ºC menunjukkan hasil yang diperoleh masih di dalam toleransi, nilai error yang masih dalam toleransi ±5 % menunjukkan hasil kinerja sistem alat tidak begitu terganggu. Dari pengamatan yang dilakukan diambil kesimpulan bahwa oven tangkring hasil modifikasi dapat digunakan sebagai alat pengering dan penyimpan sampel dengan waktu lebih cepat dan menggunakan sampel terbatas untuk kegiatan di laboratorium.

Kata kunci: Oven Tangkring, Alat Pengering, Modifikasi, Lampu Halogen

1. Introduction

The dryer is a rack-shaped equipment that dries and stores various types of food and non-food raw materials using hot air from a heating source distributed throughout the drying room using a blower (Ida et al., 2020). Artificial/mechanical drying device used in educational and research activities in laboratories, which functions for sterilization, drying, and storing materials/samples or processed products. The advantage of mechanical tools as drying tools is that the drying process can run smoothly because the devices can be controlled regardless of the weather (Fronthea et al., 2020).

Recognizing electric ovens in laboratories currently available, we face a mix of technology and effectiveness in its use. The model design applies modern microprocessor controller technology. The advantage of an electric oven is that it is easier to regulate its temperature. All these innovations are to produce effective and efficient drying methods and equipment (Saputra, 2020).

Several studies using ovens as a means of drying samples of fishery products using a dryer have been carried out either traditionally or automatically. Among other things, a simple drying tool using an incandescent lamp as a heat source with a similar function was made by Sumarto, a lecturer in a microbiology and biotechnology laboratory, with a large/large capacity (Indrawati et al., 2018), but this tool is less effective for samples with small amounts of processed results. So, a drying device is needed that accommodates these needs to avoid damage to processed fishery products that are dried and stored at a specific temperature and time and use limited or small quantities of samples in research activities in microbiology and biotechnology laboratories.

One of the simple artificial/mechanical drying devices with a working principle using a rack is a tangkring oven, as shown in (Figure 1). It is called that because it is used by placing or perching it on the stove. Ovens, often referred to as stove ovens or stoves, use heat from the stove fire, which heats the sides of the oven.

Figure 1. Oven Tangkring

Modifying the Tangkring oven, which initially used a non-electric heat source (stove), switches to using electricity as a heat source with halogen lamps as a heat source. This halogen lamp has the advantage of being easy to install; its physical shape and size are small, so it is suitable for installation in narrow spaces. A significant advantage of halogen lamps is that the material evaporates more water than incandescent lamps (Wahyudi et al., 2012). Reducing the water content will make the product last longer and avoid spoilage, and the dried product will be more stable and have a longer shelf life (Nurul et al., 2021).

This research aims to support activities in microbiology and biotechnology laboratories by using ovens as drying tools and storing small samples by switching the stove's heat source to electricity

2. Material and Method

2.1. Time and Location

This research was carried out in the fishery product microbiology and biotechnology laboratory, fishery product technology department, Universitas Riau. The time for conducting the research is May to October 2022.

2.2. Method

The experimental method is part of the quantitative method carried out in the laboratory (Fatabura, 2012). This research refers to research conducted by (Nofriati, 2018). The action research consists of designing equipment, changing how to operate the talking oven, testing the temperature and time to reach a constant temperature, collecting data, and drawing conclusions. This research is applied research with the primary objective of improving tool performance using experimental methods by modifying and testing tool performance. The research flow diagram can be seen in Figure 2.

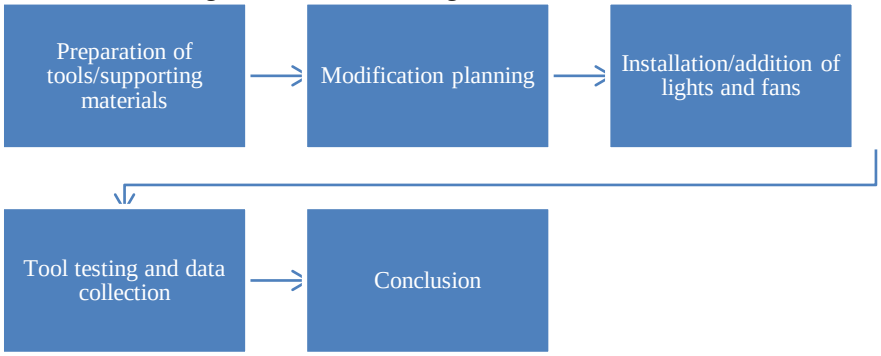


Figure 2. Research flow diagram

3. Result and Discussion

3.1. Tool Modification

Waer The research consists of several stages, including data collection (references, tool selection, and purchase), modification, installation, and testing of tool performance, as in Figure 3.

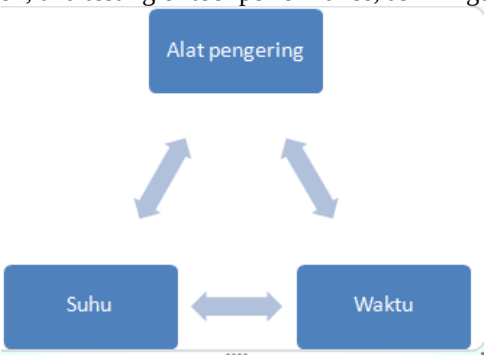


Figure 3. Data collection method

The oven design was modified by adding electrical components to control the operation of the oven, which is displayed digitally so that it can control the heating process according to the required temperature. The heat source uses 150-watt halogen lamps, 1 set each, placed on the left and right sides of the oven, equipped with a small fan on the back side of the inside. On the outer right side, a digital thermostat type w3230/v220 is installed with a temperature range of -50–120ºC and a digital temperature indicator with two colors, red and blue. The red light is for temperature readings in the oven, and the blue is for temperature readings adjusted as needed. The appearance before and after installing the thermostat looks like in Figure 4.

Installing a thermostat makes operation easier and provides information for the tool's work instructions so users can operate it quickly and safely (Saputra, 2020). The inside view of the oven is shown in Figure 5.

The oven's interior is equipped with a 150-watt halogen lamp installed on the left and right sides, a source of heat and light in the oven's interior. Halogen was chosen because of its small size, so it is suitable for installation in narrow spaces and evaporates more heat than incandescent lamps (Wahyudi et al., 2012). The complete view of this modified oven is shown in Figure 6. The oven has legs with a height of 85 cm and 4-sided wheels for ergonomic suitability and placement in the laboratory room (Septiadi et al., 2021).

With the new appearance of this modified oven, the operation control uses an electric button. It can be placed in a room in the laboratory and can be moved according to site conditions

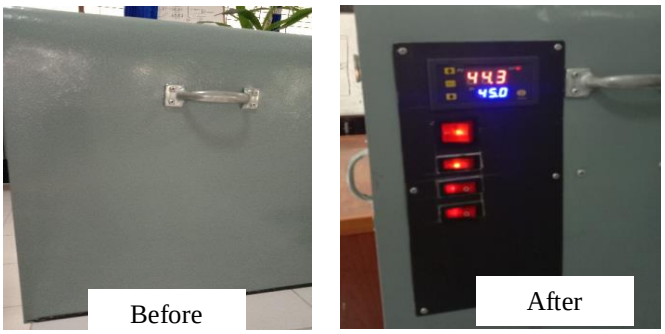


Figure 4. Outer right-side view of the oven before and after adding the thermostat

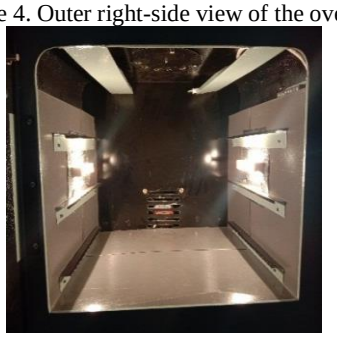


Figure 5. Inside view

Figure 6. Full view

3.2. Modified Oven Temperature Testing

Testing for oven temperature is carried out by operating using work instructions that have been prepared with trials at processed drying and storage temperatures, namely 30 to 60ºC, recording observations of temperature changes on the thermostat sensor displayed on the right side of the oven, observations and temperature readings are also carried out with a thermometer rod placed on each shelf. The temperature aligns with the drying temperature for processed fishery products (Sobri et al., 2017). The time achieved varies from 0.5 to 20 minutes. Temperature and time observations are constant, as shown in Table 1.

Table 1. Temperature observations and time to constant

Temperature settings/ requirements (ºC)	Temperature on Thermostat (ºC)		Temperature on the shelf (ºC)			Time (minutes)	RH (%)
	Beginning	Achievements	Lower	Middle	On		
30	28.5	30.7	31	32	32	± 0.5	77
35	28.8	35 .0	37	38	35	± 1-2	69
40	28.1	40 .0	41	43	42	± 4-5	66
45	28.8	45 .0	44	45	44	± 6	63
50	27.2	50 .0	53	52	51	± 10	57
55	29 .0	54.9	55	56	53	± 12	52
60	28.9	60 .0	59	62	58	± 20	50

Based on Table 1, it shows that the increase in each temperature has been determined. The temperature increase is based on stabilizing the equipment and oven space. The higher the temperature on the thermostat, the more significant the difference. Then, the growth is followed by a more extended period (0.5-20 minutes), which is more effective. A thermostat is a device that can disconnect and connect electric current when it detects changes in temperature in the surrounding environment according to the specified temperature settings (Akhyar, 2022). Then, the higher the temperature in the dryer, the RH also decreases. This decrease occurs due to the expansion of the air every hour. Research by Wahyudi et al. (2012) stated that an environmental perspective will influence the reduction of RH in the drying room and can enter the dryer input, and steam expansion occurs in the morning, afternoon, and evening.

Furthermore, this research also analyzed the temperature in each space on the oven rack. In line with the thermostat temperature being correlated with the shelf temperature, each temperature increase takes the same time. But temperature The stable and highest temperature on the oven shelf is the middle shelf with a more constant temperature. In this way, a thermostat can stabilize the temperature of an object and act as a means of detecting temperature changes. In line with the statement (Kho, 2019), a thermostat is a device that can disconnect and connect electric current when detecting temperature changes in the environment according to the specified temperature setting. The increase in temperature can be seen in Fig 7 and Fig 8

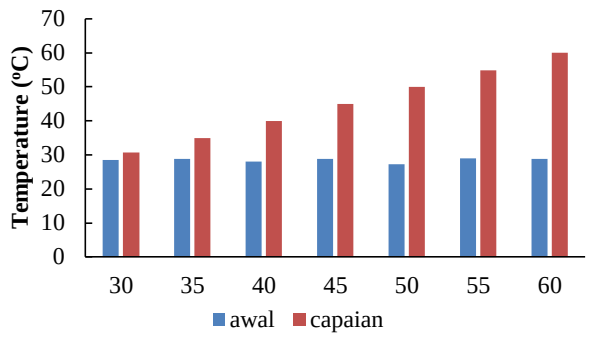


Figure 7. Increase in thermostat temperature

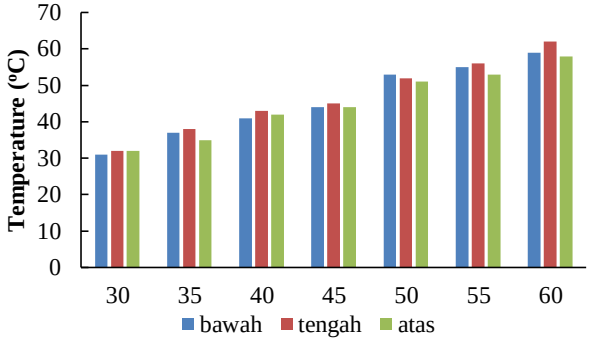
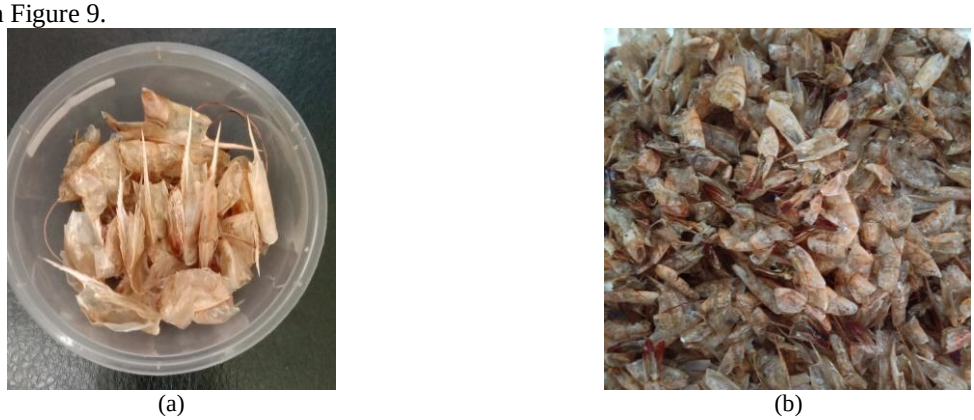


Figure 8. Increased temperature on the shelf

3.3. Sample Testing

In this study, vannamei shrimp carapace was used at a temperature of 50ºC for 6-8 hours to test the oven temperature using samples. The temperature used is in line with the opinion of Rao et al. (2013), which states that shrimp waste dried in an oven can be heated from 50ºC to 60 ºC for 8-10 hours. This experiment can shorten the drying time, which initially took approximately 2 to 3 days using sunlight (Handoko, 2018). The color of the shrimp shell looks bright and reddish, which is then used as a further processed material. Vannamei shrimp carapace has a group of natural pigments from colorless to yellow and dark red (Karomah et al., 2021), as shown in Figure 9.



(a) (b)

Figure 9. Appearance of the shrimp carapace after heating
Note: a. mini oven; b. big oven

4. Conclusions

Based on this research, it was concluded that the modification of the tangkring oven using a heat source from a halogen lamp equipped with a fan was successfully carried out at a temperature range that suited the needs for drying and storing processed fish samples, namely a temperature range of 30-60°C. The test results on vanammei shrimp shellfish showed that the drying results using this modified oven had a brighter color than the large-capacity oven available in the laboratory. The display obtained shows that the modified oven design can be used as a dryer and for storing samples that will be used for further fishery processing.

5. Suggestion

This research still needs improvement. For further investigation, it is recommended to look for alternatives to reduce the reflection of halogen lamp light, which causes glare when the oven cover is opened.

6. Acknowledgment

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