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RICE SAMPLE VAPORIATION METHOD ON METER TESTING RESISTIVE WATER CONTENT BASED ON ULTRASONIC MIST

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ABSTRACT

Percentage moisture content is an important factor in assessing the quality and quantity of agricultural commodities, such as rice. The measurement of moisture content is very important to evaluate the moisture content of rice, which directly affects its quality. However, the measurement of moisture content takes a long time, so it is necessary to have an evaporation method to shorten the time so that the moisture content of the sample is as required. In this study, the method chosen was the evaporation method with ultrasonic mist. The results showed that this ultrasonic fog controller evaporation system successfully increased the moisture content of rice samples according to the criteria needed to be used in resistive-type moisture meter testing. The ultrasonic mist controller evaporation system can increase the water content of rice samples according to the criteria needed for use in resistive-type moisture meter testing, with an average increase of 0.9% within 15 minutes, 3.4% within 30 minutes, and 4.1% within 1 hour.

Keywords: moisture content, ultrasonic mist, evaporation

INTRODUCTION

Rice is a highly consumed in the world [1] especially in Indonesia. As a widely consumed food, the quality of rice needs to be considered. One of the determinants of rice quality is the water content. The water content in rice can affect the quality and selling price in the market [2]. Because the water content in rice affects its quality, a measuring instrument is needed [3] to determine the water content contained therein. Moisture content is the percentage of water content in a material that can be expressed based on wet weight [4] (wet basis) or dry weight (dry ground). The wet-weight moisture content has a theoretical maximum limit of 100 percent, while the moisture content based on dry weight can be more than 100 percent [5]. Water content is essential in deciding agricultural commodities' quality and quantity [6]. Due to the crucial function of the tool, the water content meter needs to be tested. There are four test methods carried out to test the water content meter, namely the reference method (oven), master meter, sample master, and also one-point testing. In testing the reference method (oven), the water content can be determined by comparing the results of the sample readings on the test water content meter [7] with the results of determining the moisture content of the samples evaporated by the oven. This method requires a different level of the water content of a sample for testing. Therefore a particular treatment is needed to increase the water content contained in the sample. Apart from that, testing a water content meter using a master meter also requires a sample with a different moisture content level (Decree of the Director General No. 122 of 2020 concerning Technical Requirements for Moisture Meters). The current treatment process to increase the sample's water content to be used in the testing process for the water content meter has time constraints [8]. So it requires a tool that can increase the sample's water content quickly and in accordance with the specified requirements, as well as speed up the process of testing the water content meter in accordance with the technical specifications that have been set.

Therefore, in this study, we will make a tool that can increase the moisture content of the sample quickly, measure the room's temperature and humidity, and temporarily measure the water content of the sample by controlling the water vapor produced. This tool will be used for sample preparation for moisture meter testing using the reference method (oven), which requires several levels of sample moisture content for testing moisture content meters. It is also used for conditioning water content meter testing samples using the master meter method. This tool will carry out its functions based on the program that has been made. This tool uses temperature and humidity sensors and a capacitive soil moisture meter as a monitoring system while controlling ultrasonic mist uses a timer.Here will be explained how to bring up a pop-up window to select a style.

METHOD

The system of vaporiation for rice

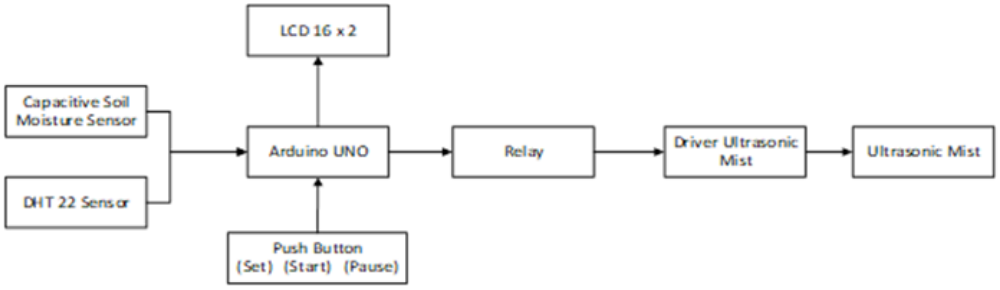

FIGURE 1. Diagram Block Vaporiation Method

Based on the block diagram above, this ultrasonic mist evaporation system has three input signals that enter the Arduino UNO to be processed based on the program created in the Arduino IDE application. Then the processed signal is issued as an output signal to control the relay connected to the ultrasonic mist and ultrasonic mist drivers. So that the ultrasonic mist can produce water vapor that is small in size because the ultrasonic mist transducer vibrates at a high frequency. In addition, the output signal from the measurement results of all sensors and the timer time are displayed on the 16 x 2 LCD. The study utilized the DHT 22 sensor to determine the measurement results obtained from the ultrasonic mist evaporation system, further supporting the effectiveness of the method in increasing the moisture content of rice samples.

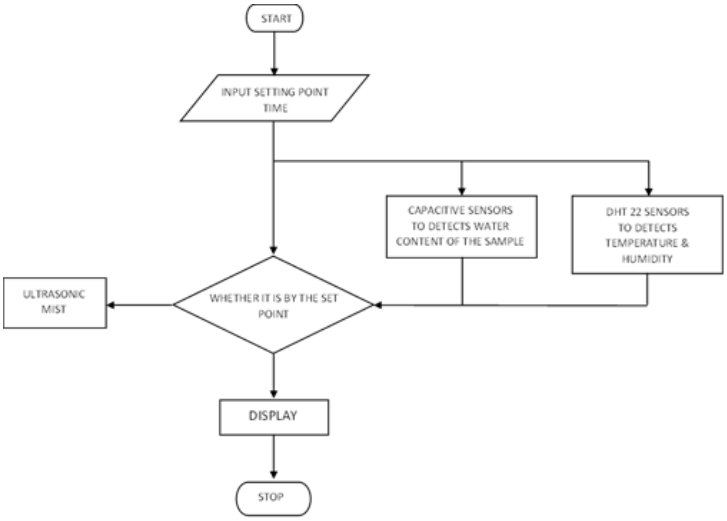

FIGURE 2. Ultrasonic Mist Evaporation System Flowchart

The flowchart above, this ultrasonic mist evaporation system has a simple working principle. This ultrasonic mist evaporation system begins by entering a set point value in the form of a timer to control the length of time the ultrasonic mist works. The desired length of time can be set by pressing Push Button Set, Push Button Start (up), and Push Button Pause/Reset

(down). After the timer is set and Push Button Start is pressed, the timer will count down to 0 seconds. While the timer is counting down, the ultrasonic mist will turn water into tiny droplets of water vapor so that the rice sample can absorb water easily.

RESULT AND DISCUSSION

The ultrasonic mist controller evaporation system successfully increased the water content of rice samples according to the criteria needed for use in resistive-type moisture meter testing. This design is used to increase the sample's water content by evaporation. The evaporation comes from the water, rapidly vibrating by the ultrasonic mist. This evaporation will increase the water content of the rice sample. To determine the evaporation ability of the ultrasonic mist, a test was carried out by comparing the readings of the rice sample's water content before and after being evaporated using a resistive type moisture meter.

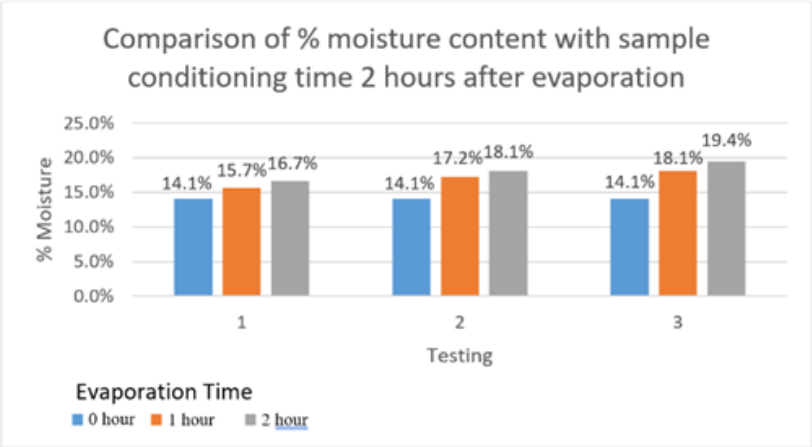

FIGURE 3. Graph of evaporation test results

FIGURE 3 shows that the evaporation resulted in an increase in % water content before evaporation for up to 60 minutes and conditioning of the samples after 2 hours of evaporation. The results indicated an average increase of 0.9% within 15 minutes, 3.4% within 30 minutes, and 4.1% within 1 hour, demonstrating the rapid increase in moisture content facilitated by the ultrasonic mist evaporation method [10]. Rice absorption of water vapor causes a dynamic and uniform increase in rice moisture content. It can be seen from the graph that the three lines have the same line pattern, which means that this tool is consistent in increasing the water content.

DHT 22 Testing Results

The DHT 22 sensor test aims to determine the measurement results obtained on this ultrasonic mist evaporation system. Testing the DHT 22 sensor was carried out by comparing the effects of readings on thermohygro.

TABLE 1. DHT 22 sensor test results.

Calculation	Temperature	Humidity
Standard Average	23.2	61.7
Test Averages	23.1	82.9
Correction	0.2	-21.2
Standard Deviation	0.537351	10.42619291
3a	1.612054	31.27857873
3a + bias	1.8	52.5
Bias	0.2	21.2
accuracy (%)	92.31	14.91
precision (%)	93.01	62.25
Error (%)	7.69	85.09

Based on the table above, the DHT 22 sensor used has a temperature reading accuracy of 92.31% and a humidity reading accuracy of 14.91%. Meanwhile, the precision of the temperature reading is 93.01%, and the humidity reading is 62.25%. This DHT 22 sensor monitors the temperature and humidity in the ultrasonic mist evaporation system box during evaporation.

Capacitive Soil Moisture Sensor Test Results

The capacitive soil moisture sensor test results showed differences in the measurement results between the capacitive soil moisture sensor and the water content meter used. The measurements' conditions influence the difference in these appointments. In measuring the water content of the rice sample using capacitive soil moisture, air voids affect the calculated capacitance value . Whereas in measuring the water content of the rice sample using a resistive type water content meter [11], there are no air voids, and the measurement is carried out by grinding the sample first.

Ultrasonic mist evaporation system Timer Testing Results

Timer testing is carried out to determine the timeliness possessed by the ultrasonic mist evaporation system with standard time. Testing is done by comparing the time indicated on the ultrasonic mist evaporation system with a stopwatch. This test is carried out on a 1-minute timer and multiples of 5 to 60 minutes. This test resulted in the difference in time obtained. The difference in the ultrasonic mist evaporation system timer time is shown in TABLE 2.

TABLE 2. Ultrasonic mist evaporation system Timer Test Results

Timer Ultrasonic mist evaporation system (minute)	Stopwatch (second)
1	1
5	5
10	9
15	14
20	17
25	22
30	25
35	30
40	34
45	38
50	42
55	46
60	50

Based on the results presented in TABLE 2, the ultrasonic mist evaporation system demonstrated its ability to accurately control the length of time the ultrasonic mist operates. For instance, at 5 minutes, the difference in time obtained was 1 minute, and at 10 minutes, the difference was 9 seconds. This trend continued with differences of 14, 17, 22, 25, 30, 34, 38, 42, 46, and 50 seconds for the respective time intervals of 15, 20, 25, 30, 35, 40, 45, 50, 55, and 60 minutes. The consistent and predictable differences in time obtained between the system timer and the stopwatch for each time interval tested underscore the system's capability to maintain precise timing, ensuring the controlled evaporation process is carried out for the intended duration. This level of precision is essential for achieving the desired increase in moisture content of the rice samples within specific timeframes, as observed in the study.

CONCLUSION

Based on the results of the testing that has been done, it can be concluded that:

1. The study successfully developed a method using an ultrasonic mist evaporation system to rapidly increase the moisture content of rice samples for resistive-type moisture meter testing.
2. The ultrasonic mist controller evaporation system can increase the water content of rice samples according to the criteria needed for use in resistive-type moisture meter testing, with an average increase of 0.9% within 15 minutes, 3.4% within 30 minutes, and 4.1% within 1 hour.
3. The ultrasonic mist controller ultrasonic mist evaporation system is equipped with a DHT 22 sensor with an accuracy of 92.31% temperature and 14.91% humidity and a capacitive soil moisture sensor to detect temporary sample moisture content.
4. The ultrasonic mist controller evaporation system can be controlled by the required performance time by adjusting the length of the set point using the push button

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