

Effect of Cylinder Rotation Speed on Corn Drying Characteristics in a Rotary Dryer

Journal of Mechanical Engineering,
Science, and Innovation
e-ISSN: 2776-3536
2026, Vol. 6, No. 1
DOI: 10.31284/j.jmesi.2026.v6i1.8620
ejournal.itats.ac.id/jmesi

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Abstract

Corn has a high post-harvest moisture content (20-40%), making drying very important to maintain quality and extend shelf life. This study investigated the effect of drum rotation speed in a rotary dryer on the drying characteristics of corn and compared it with solar drying. The drying method was carried out using an LPG-fueled rotary dryer with an inlet air temperature of 70°C and an air flow velocity of 7.9 m/s. The drum rotation speed was varied at 6 rpm, 9 rpm, and 12 rpm with an initial corn mass of 5 kg. Drying was carried out for 6 hours. And data collection was carried out every 30 minutes during the drying process. As a result, a higher drum rotation speed significantly increased the drying rate. A speed of 12 rpm showed the best performance with a maximum drying rate of 0.46 kg/hour and an average of 0.24 kg/hour. However, the highest energy efficiency was obtained at a speed of 6 rpm, indicating that lower speeds require less energy despite longer drying times. Overall, the rotary dryer performed better than solar drying in reducing corn moisture content more quickly, stably, and controlled in a shorter time.

Keywords: Corn, Cylinder rotation rate, Drying Efficiency, Drying rate, Rotary dryer, Water content.

Received: January 14, 2026; Received in revised: January 31, 2026; Accepted: February 2, 2026

Handling Editor: Naili Saidatin

INTRODUCTION

Corn (*Zea mays* L.) is a major global food crop from the Poaceae family, serving as an important source of carbohydrates for humans and livestock. This crop is used as a raw material for animal feed, vegetable oil, starch (cornstarch), and other industries. National corn demand increases every year, with more than 50% of the demand used for the animal feed industry. National corn demand increases every year, with more than 50% of the demand used for the animal feed industry [1]. One of the main problems in post-harvest handling of corn is the high water content after harvest, which ranges from 20-40% [2].



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High water content can reduce the quality and shelf life of corn by increasing the risk of damage from fungi and microorganisms. The Indonesian National Standard (SNI 01-4483-1998) stipulates a maximum water content of 14% for corn used as feed, to ensure safe storage and distribution [3]. Moisture content is the amount of water in a food ingredient expressed as a percentage of its weight. This parameter is important because it affects the quality, texture, and flavor of the food. High moisture content accelerates the growth of microorganisms and spoilage, while low moisture content inhibits the growth of microorganisms and extends shelf life [4]. Corn drying methods are generally divided into two categories: traditional and modern. Traditional methods use sunlight as a heat source and have drawbacks, including long drying times, uneven drying, unhygienic drying, and the potential for reduced corn quality. In contrast, modern methods such as bed drying (flat bed dryers) and continuous drying (rotary dryers) use mechanical power for more efficient and controlled drying. Continuous drying allows for a continuous process with simultaneous flow of material and hot air [5]. The heat sources used can vary, such as firewood, oil, gas, charcoal, or solar energy. Drying can also be achieved by breaking the water bonds in the material's structure. When the bonds between water molecules (which are composed of oxygen and hydrogen) are broken, the water is released from the material, reducing its moisture content [6].

A rotary dryer is a drying tool consisting of a rotating cylinder in an inclined or horizontal position, allowing wet granular/granular materials to move along the drying tool due to rotation, gravity and inclination, with this inclination the solid material comes out the other end [7]. Rotary dryers use a rotating drum driven by an electric motor and heated by an automatic LPG burner for energy efficiency. The drum rotation speed can be adjusted, and the system includes safety features for both the electric motor and the burner flame [8]. Additional factors that influence the drying process include cylinder rotation speed, hot air flow rate, initial moisture content of the material, and operating temperature, all of which need to be optimally controlled. Increasing the cylinder rotation rate generally results in more uniform heat distribution, accelerating the water evaporation process. Furthermore, the hot air flow rate also plays a significant role. The higher the flow, the faster the drying rate. This occurs because the incoming hot air, together with the effect of the cylinder rotation, is able to provide more even heating to the material being dried. The use of a rotary dryer as a drying machine effectively overcomes drying problems. The working mechanism of a rotary dryer relies on the heat transfer process, either directly or indirectly, between the material being dried and the heating medium in the form of high temperature hot air. During operation, the drum or cylinder rotates at low speed, causing the material inside is constantly moving and obtains consistent contact with the hot air flow. This movement and exposure to heat causes the water content in the material to gradually decrease until it reaches the specified level of dryness, while increasing the efficiency of the process and the quality of the dried product [9].

Research shows that varying cylinder rotation speed affects drying results. Optimal rotation speed is needed to prevent grain cracking and achieve uniform drying [10]. Research by Akbar et al. [2] reported that a drum rotation speed of 20 rpm at a temperature of 65 °C produced the best corn moisture content, at 12.7% in 30 minutes. Similar results were also shown by Rapindo et al. [11] where drying at 3 rpm for 120 minutes was able to reduce the water content by up to 13.07% and reach the SNI standard (14%). Thus, variations in the cylinder rotation rate in a rotary dryer affect the drying rate, drying efficiency, and moisture content. Therefore, this study analyzes the effect of cylinder rotation rate on the corn drying process using a rotary dryer to optimize results.

METHODS AND ANALYSIS

This rotary type dryer model is driven by an electric motor and heated using LPG

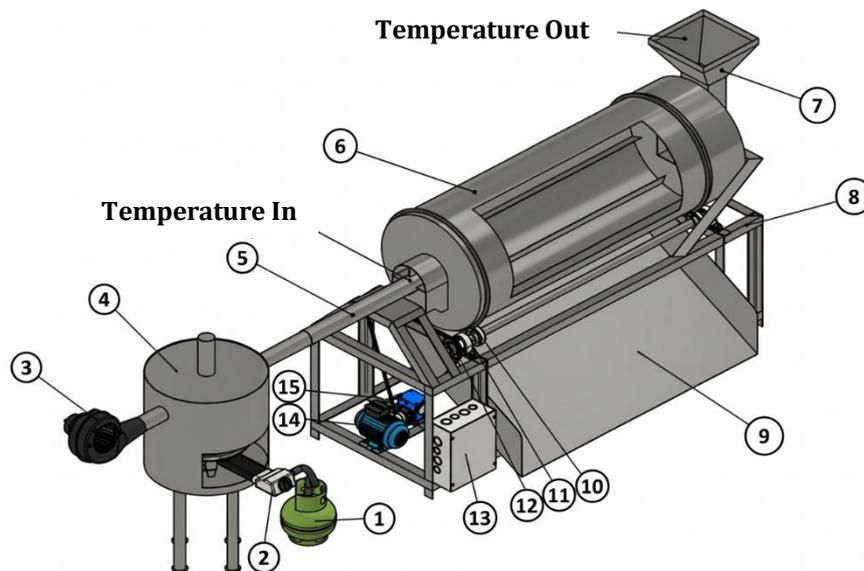


Figure 1. Schematic of rotary dryer system, 1). LPG gas cylinder, 2). Stove, 3). Blower, 4). Heat exchange, 5). Pipe in, 6). Rotary drum, 7). Material inlet, 8). Frame, 9). Material outlet, 10). Pulley rotary drum, 11). Pillow block bearing, 12). Gear, 13). Panel box, 14). DC motor, and 15). Gearbox

gas fuel [8]. This study focuses on the effect of cylinder rotation rate on the drying characteristics of corn in a rotary dryer. The materials and tools used were corn, LPG gas, a rotary dryer, digital scales KT-5004 IDEALIFE with accuracy (0,1 grams), an anemometer Uni-Trend UT363 with accuracy (0,1 m/s), a water meter, a thermocouple Hti HT - 9815 with accuracy (0,1°C), and a digital hanging scale J049 with accuracy (0,5 gram). The corn used was corn that had been separated from the cob to form corn kernels. In this study, the rotation speed of the cylinder on the rotary dryer was varied. The drying process was carried out with three variations in cylinder rotation speed, namely at 6 rpm, 9 rpm, and 12 rpm. and each rotation was carried out with 3x repetitions. The hot air flow rate used was constant at 7.9 m/s with a tolerance limit of $\pm 0,05$ m/s and the temperature was constant at 70 °C with a tolerance limit of $\pm 2^\circ\text{C}$. The weight of the corn used was 5000 grams. The drying process was carried out for 6 hours with a weighing process every 30 minutes during the drying period. The objects weighed were the mass of corn and the mass of LPG gas. The rotary dryer used has several component structures and will be shown in Figure 1.

As shown in Figure 1, the rotary dryer consists of 15 main components, each with a specific function. During the drying process, the parameters measured include the initial and final mass of the material, the initial and final mass of LPG, as well as the inlet air temperature, the drying chamber temperature, and the outlet air temperature. Therefore, to determine the moisture content of the material after the drying process, the calculation is carried out using the following equation (1-3).

$$K_a = \frac{m_i - m_k}{m_i} \times 100\% \quad (1)$$

K_a is the water content (%) which influences the drying process, m_i is the initial mass of the material (kg) and m_k is the dry mass of the material (kg) which is obtained by heating the material in an oven at a temperature of 105 – 110 °C until there is no weight loss [12]. The drying rate, \dot{m}_p (kg/s) is the ratio between the mass of water evaporated, m_{ah} (kg) and the drying time, t (seconds) [12]. The mass of evaporated water, m_{ah} , is the mass of

water lost due to the drying process in the drying machine [12]. m_f is the mass of the material after drying (kg).

$$\dot{m}_p = \frac{m_{ah}}{t} \quad (2)$$

$$m_{ah} = m_i - m_f \quad (3)$$

The energy used is as follows as Eq. (4-7). Q_{use} is the amount of heat used for drying (kJ), Q_1 is the sensible heat of the material (kJ) [12]. Q_2 is the latent heat of water (kJ). T_r is room temperature ($^{\circ}C$), T_{link} is ambient temperature ($^{\circ}C$), and C_{pb} is the specific heat of corn (kJ/kg. $^{\circ}C$) [13]. h_{fg} is the latent heat of vaporization of water (kJ/kg) [14].

$$Q_{use} = Q_1 + Q_2 \quad (4)$$

$$Q_1 = m_i \cdot C_{pb} \cdot (T_r - T_{link}) \quad (5)$$

$$C_{pb} = 1,1444 + 0,032 \cdot k_a + 0,0051 \cdot T_r \quad (6)$$

$$Q_2 = m_{ah} \cdot h_{fg} \quad (7)$$

The energy entering the drying chamber, Q_{suplay} is the amount of energy used to run the machine (kJ) as shown in the following formula (8-11). Where $Q_{suplay1}$ is the energy produced by LPG (kJ), $Q_{suplay2}$ is the energy produced by the blower (kJ), $Q_{suplay3}$ is the energy produced by the drive motor (kJ) [15]. \dot{m} is the mass flow rate of LPG (kg/hour), and NKBB is the calorific value of the fuel, NKBB for LPG gas has been determined to be 47089 kJ/kg [15]. Where P_a is the power produced by the blower (kJ), and P_b is the power produced by the drive motor (kJ).

$$Q_{suplay} = Q_{suplay1} + Q_{suplay2} + Q_{suplay3} \quad (8)$$

$$Q_{suplay1} = \dot{m} \cdot NKBB \quad (9)$$

$$Q_{suplay2} = P_a \cdot t \quad (10)$$

$$Q_{suplay3} = P_b \cdot t \quad (11)$$

Drying efficiency, η_{th} is the ratio between the amount of heat used to dry Q_{use} (kJ) to the amount of energy used to run the machine, Q_{suplay} (kJ) as shown in the following equation (12) [16].

$$\eta_{th} = \frac{Q_{use}}{Q_{suplay}} \times 100\% \quad (12)$$

RESULTS AND DISCUSSIONS

Drying using a rotary dryer machine

The effect of cylinder rotation rate on the characteristics of corn drying in a rotary dryer has been carried out. Figure 2 shows the relationship between corn mass and drying time at three rotational speeds: 6 rpm, 9 rpm, and 12 rpm. The graph shows a gradual decrease in mass as the drying time increases. It also shows water evaporation as the primary drying mechanism. Variation in rotation rate affects the rate of mass reduction. At higher speeds a lower final mass is produced because the increased agitation inside the drying tube increases the contact between the material and the hot air. Resulting in accelerated heat and mass transfer. The relatively uniform pattern of decline at each time

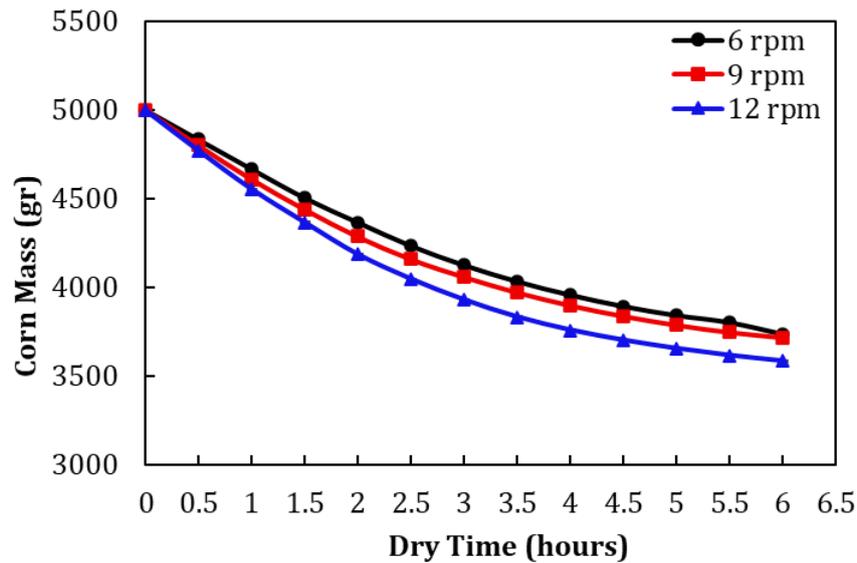


Figure 2. The effect of variations in cylinder rotation on the reduction in corn mass over 6 hours.

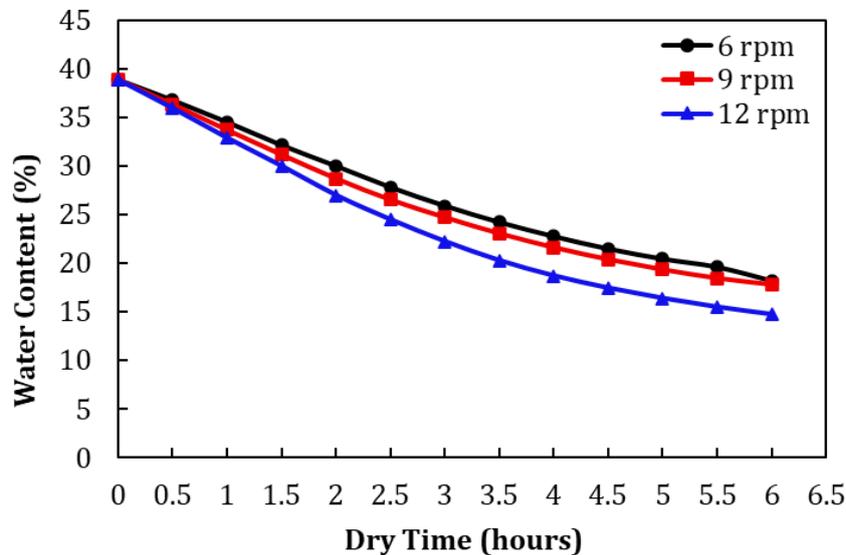


Figure 3. The effect of cylinder rotation rate on the decrease in corn moisture content during drying time

interval also indicates that the process is in the falling-rate phase, namely the stage where the evaporation rate is increasingly dependent on the internal moisture diffusion of the material [17].

The variation in rotation rate that had the greatest reduction in material mass was at a rotation rate of 12 rpm with a final mass of 3585 grams with an average reduction in material mass of 101,08 grams. then followed by a rotation speed of 9 rpm to obtain a final mass of 3719 grams with an average reduction in material mass of 92,16 grams. and finally at a rotation speed of 6 rpm with a final mass value of 3736 grams with an average reduction in material mass of 91,83 grams. This shows that the higher the cylinder rotation rate, the higher the drying rate of the material mass. Of course, the results of this study are in line with the results of research conducted by Rapindo et al. [11] which showed that the highest mass reduction was at 3 rpm with a final mass value of 8100 grams. Figure 3 The graph of the relationship between water content and time shows that the water content decreases gradually as the drying time increases for all variations in cylinder rotation speed. The decrease in the water content of corn seeds occurs relatively quickly in the initial stages of drying, then slows down as the drying time increases until

it approaches the specified final water content, which is around 14 % [18]. This consistent decrease in water content indicates that there is an effective heat and mass transfer process between the hot air and the material, so that the water in the corn evaporates. At a higher rotational speed of 12 rpm, the water content was 14.74%. The rate of water reduction appeared faster than at 9 rpm and 6 rpm. This indicates that increasing the rotation speed can improve the mixing and surface contact between the corn and the hot air. This condition accelerates the release of water vapor from the material. Meanwhile, at lower rotation speeds, the reduction in water content is slower because the intensity of stirring and heat distribution is relatively less than optimal.

The results of this study are in line with research conducted by Nabhan et al. [19] which states that the rotation rate can affect the water content of the material. Figure 4 shows a graph of the relationship between the rate of corn drying and drying time. The graph shows that the drying rate of corn decreases progressively with increasing drying time at all rotation speed variations (6 rpm, 9 rpm, and 12 rpm). The highest drying rate was obtained at a rotation speed of 12 rpm with a value of 0.46 kg/hour with an average drying rate of 0.24 kg/hour for 6 hours. Meanwhile, at 9 and 6 rpm, the average drying rate was 0.21 kg/hour and 0.20 kg/hour. This is because the higher cylinder rotation rate

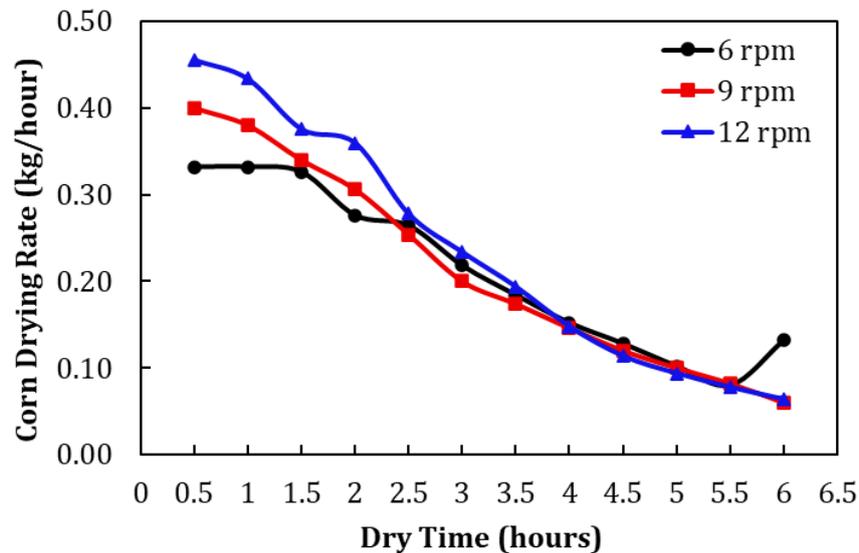


Figure 4. The effect of the cylinder rotation rate on the drying rate of corn during the drying process

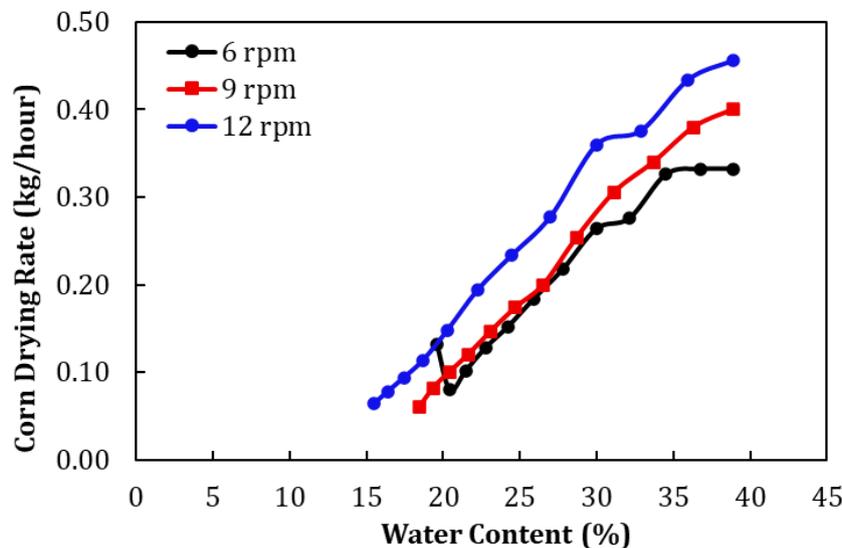


Figure 5. Relationship between corn drying rate and water content at each variation of cylinder rotation rate

increases the turbulence of the air flow inside the drum. This turbulence increases the rate of convective heat transfer and mass transfer. This allows heat from the air to be transferred more quickly to the material, and water vapor to be released more easily from the corn surface into the drying air. These changes follow the general pattern of the drying process [20]. The initial drying rate pattern is high. Then it decreases as the water content of the material decreases. This pattern occurs because the initial water content is high, resulting in faster water vapor mass transfer from the material to the air. Meanwhile, in the final phase, the water content approaches equilibrium, resulting in a decreased drying rate. This pattern occurs because the initial water content is high, resulting in faster water vapor mass transfer from the material to the air. Meanwhile, in the final phase, the water content approaches equilibrium, resulting in a decreased drying rate. This decrease in drying rate is consistent with the commonly reported phenomenon of drying kinetics, where the drying rate is initially fast and then slows down as free water at the surface decreases [21].

Figure 5 shows that the corn drying rate tends to increase with increasing corn moisture content across all variations in cylinder rotation speed. This condition indicates that at high moisture content. Variation of cylinder rotation rate shows that increasing cylinder rotation rate results in higher drying rate at the same moisture content which is caused by increasing mixing intensity and contact frequency between corn granules and drying air. The water release process takes place more quickly due to forced heating resulting from the turbulence flow rate caused by the fast cylinder rotation rate. The water in corn evaporates more easily when it interacts with the hot air in a rotary dryer, resulting in a relatively high drying rate. As stated by Kusuma et al. [22], the highest drying rate occurs at high water content due to the dominance of water in the material meeting high forced heating. This increases the effective surface area for heat and mass transfer, resulting in faster water evaporation. Especially at medium to high moisture content. As the moisture content of the material decreases, the drying rate decreases significantly. This condition indicates a shift in the drying mechanism from evaporation of free water to diffusion of bound water from the inside of the material to the surface, which occurs more slowly due to internal resistance. At this stage increasing the rotation speed no longer provides a significant increase in the drying rate.

The efficiency of a rotary dryer is the ratio between the amount of heat used in the drying process and the amount of heat produced from the combustion process in the rotary dryer. Drying efficiency is influenced by the amount of heat utilized. The more input heat utilized, the greater the efficiency of the rotary dryer, as shown in Figure 6. For all rotation rate variations, drying efficiency was highest at the beginning of the drying process. This is caused by the high water content in corn. This result is in line with research by Alit, et, al. [23], which states that the initial efficiency of the drying process is very high because the drying energy absorbed by the product is still high. However, during the drying process, the water content decreases, which causes the energy absorbed by the product to also decrease. The lowest rotation speed of 6 rpm has the highest efficiency value compared to rotation speeds of 9 and 12 rpm. This is due to the high water content in the material. The higher the water content, the higher the efficiency obtained. At 30 minutes, the drying efficiency was obtained successively from the smallest rotation rate of 10.78%, 10.57%, and 9.6%. at 360 minutes, 3.77%, 3.70% and 3.22% were obtained. The greater the mass of the material, the higher the drying efficiency. This indicates that although high rotational speeds can increase the drying rate, this increase is not always accompanied by an increase in energy efficiency. Higher rotational speeds have the potential to increase energy losses due to excess turbulence, mechanical friction, and increased energy required to drive the cylinder. Thus, reducing the overall drying efficiency. This is in line with research by Raisa, et, al. [10], that although higher drum speeds accelerate the drying rate, thermal efficiency actually decreases at higher opera-

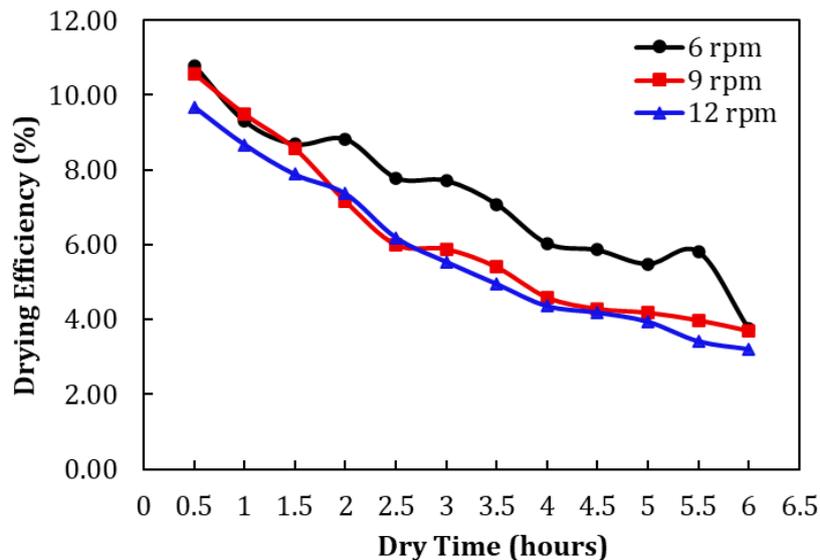


Figure 6. Comparison of Drying Efficiency at 6 rpm, 9 rpm, and 12 rpm

ting conditions. This is supported by the system's energy balance. Increasing the drum rotational speed reduces the material's residence time in the rotary dryer, reducing the amount of heat absorbed for water evaporation. Consequently, the fraction of energy lost with the exhaust air increases, while the energy used for drying decreases. This leads to higher drying efficiency at lower drum rotational speeds[24] .

Drying using the sun method

Solar drying depends directly on weather conditions such as radiation intensity, ambient temperature, and relative humidity. This makes solar drying generally slower than rotary drying, which uses an artificial heat source, airflow control, and cylinder rotation control. This is consistent with actual findings in research showing that mechanical drying devices such as rotary dryers increase the air temperature around the material thereby accelerating the drying rate compared to solar drying which relies on ambient heat [25].

Figure 7 shows that the reduction in water content of corn occurs much faster in the drying process using a rotary dryer compared to drying using direct sunlight (sun dryer). At all rotation speed variations (6 rpm, 9 rpm, and 12 rpm), the rate of water content reduction was higher within a relatively short drying time span. This shows that the rotary dryer system is more effective in accelerating the evaporation of water from corn grains when compared to the sun drying method which requires a much longer time span of up to more than 30 hours to achieve equivalent water content. This is in line with research by Sekyere, et, al [26] who studied that drying requires a longer duration because it depends on the intensity of solar radiation thus takes longer than mechanical drying. In the initial stage of drying corn with a rotary dryer, it shows a rapid decrease in water content due to controlled hot air circulation and intensive convection, thus heat and mass transfer is more efficient. The drum rotation speed increases contact between the corn and the hot air, accelerating water evaporation. While solar drying depends on solar radiation, wind speed and environmental temperature. Consequently, the process becomes slower and requires a longer drying time. The decrease in water content is influenced by the drying rate. Figure 8 shows the drying rate versus time using the two methods.

Based on the graph shown, the comparison of drying rates between rotary dryers and natural drying (sun drying) shows a very different pattern in terms of drying time. In the initial phase of drying time, 0-4 hours, the rotary dryer shows a higher drying rate compared to sun drying. Data points for the rotary dryer at 6, 9, and 12 rpm show a fairly

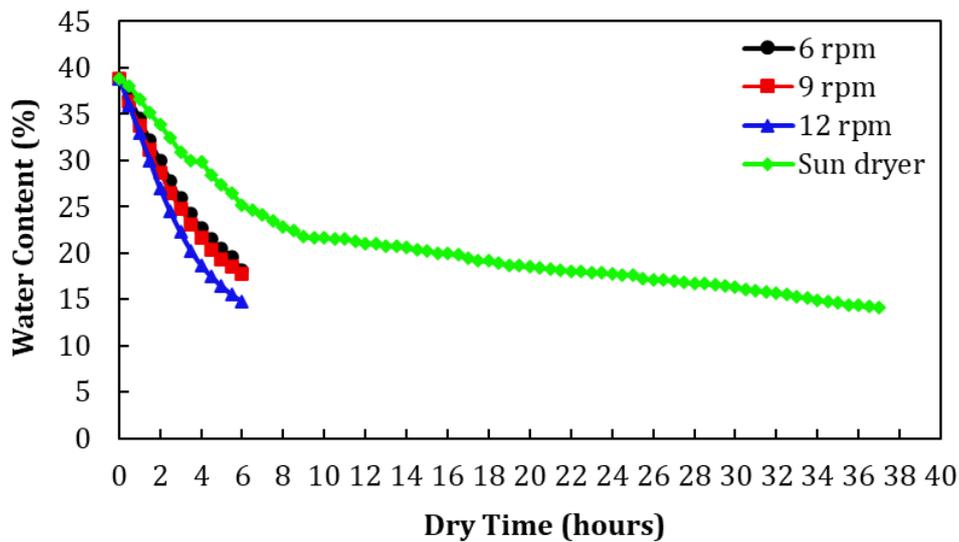


Figure 7. relationship and comparison between water content and drying time in rotary drying and sun drying

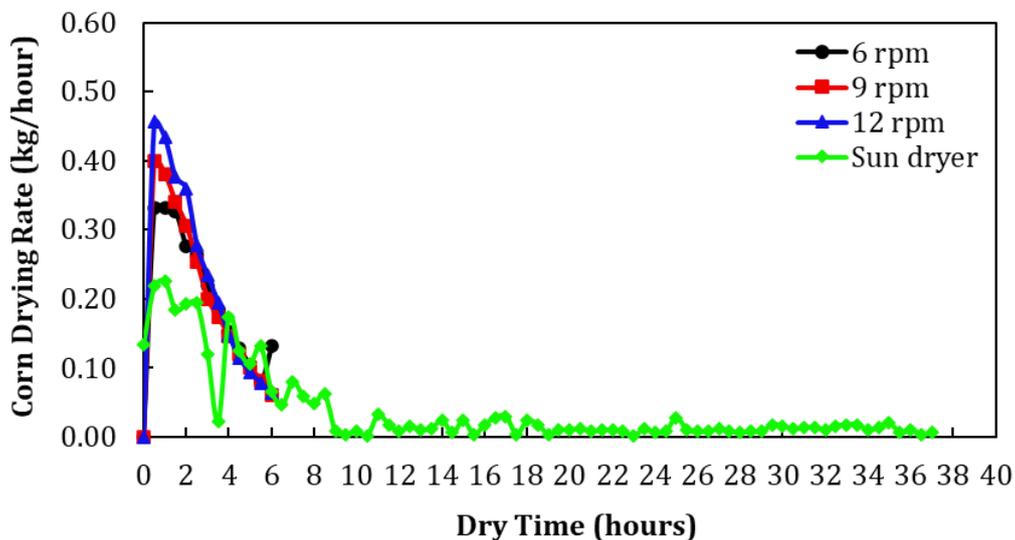


Figure 8. relationship between drying rate and drying time using the rotary drying and sun drying methods.

drastic reduction in water mass in a short time, reaching around 0.30-0.45 kg/hour at the start of the process. Meanwhile, in solar drying, the drying rate is relatively lower and gradual with an initial value of around 0.10-0.25 kg/hour and then decreases gradually to approach zero after several hours of drying. In both methods, the drying rate appeared to decrease with time. In rotary dryers, the drying rate declines relatively rapidly after an initial high period, indicating that once most of the water bubbles are removed, the drying rate follows a falling rate phase where drying is slower because evaporation becomes limited by the diffusion of water from the interior of the material. This pattern is consistent with the general drying kinetics described in the drying literature (periods of steady rate and decreasing rate) [27].

CONCLUSIONS

The conclusion obtained is that drying corn using a rotary dryer shows superior and more consistent performance compared to the sun drying method. Variation in cylinder rotation rate has been shown to play an important role in determining drying characteristics. Increasing the cylinder rotation rate strengthens the stirring of the material and the turbulence of the air flow inside the drum, thereby expanding the contact

area between the corn and the hot air. This condition encourages increased heat and mass transfer which is reflected in a faster decrease in mass and water content, especially at the highest rotation speed at 12 rpm, it shows a drying rate of 0.46 kg/hour with a final water content of 14.74%. However, the pattern of changes in mass, water content, and drying rate at all variations in cylinder rotation rate shows that the drying process is dominated by a decreasing rate phase. Where the mechanism of moisture diffusion from the interior of the material to the surface is the primary controlling factor, the drying rate gradually decreases as the water content decreases. The relationship between water content and drying rate indicates that the highest rate occurs at high water content and decreases significantly as it approaches equilibrium conditions. Increased rotation rate is effective at medium to high water content. But the impact is limited to low water content due to the dominance of internal resistance of the material. In terms of energy, low rotation speed 6 rpm has better drying efficiency, namely 10.78% compared to rotation speeds of 9 rpm and 12 rpm which have efficiencies of 10.57% and 9.67%. This is caused by the utilization of heat energy for water evaporation taking place more optimally. While high speeds have the potential to increase energy losses due to excessive turbulence and the need for additional mechanical energy. On the other hand, solar drying is slower, fluctuating, and highly dependent on environmental conditions, making it less effective than rotary dryers. Thus, the rotary dryer is considered more effective and controlled with the need to determine the optimal cylinder rotation rate to balance drying speed and energy efficiency in a sustainable manner.

ACKNOWLEDGEMENTS

DECLARATION OF CONFLICTING INTERESTS

The authors declare that they have no potential conflicts of interest regarding the research, authorship, and/or publication of this article.

FUNDING

REFERENCES

- [1] S. R. Rahmi, Ainun Sulaeman Malik, "Strategi Pengembangan Jagung Hibrida Kelompok," *J. Agrotekbis*, vol. 12, no. 2, pp. 332–340, 2024.
- [2] T. F. Akbar, N. A. Ariyanto, and M. K. Usman, "Analisis pengaruh variasi kecepatan putaran and temperatur pada proses pengeringan biji jagung menggunakan mesin rotary dryer dengan pemanas gas lpg," *Tugas Akhir*, 2021.
- [3] S. Effendy, A. Syarif, Zulkarnain, et al., "Study Of Rotary Dryer Prototype Based On The Revolutions Of The Dryer And Air Flow Rate Towards The Thermal," *J. Kinet.*, vol. 9, no. 02, pp. 43–49, 2018.
- [4] E. Ndumuye, T. M. Langi, and M. I. Taroreh, "Chemical Characteristics Of Muate Flour (Pteridophyta Filicinae) As Traditional Food For The Community Of Kimaam Island," *J. Agroteknologi Terap.*, vol. 3, pp. 261–268, 2022.
- [5] A. H. Salahuddin, A. Rahman, and O. Ghani, "Drying characteristics of grain corn subjected to different drying techniques," *J. Food Res.*, vol. 7, no. 2, pp. 160–166, 2023.
- [6] S. Syahrul, R. Romdhani, and M. Mirmanto, "Pengaruh variasi kecepatan udara and massa bahan terhadap waktu pengeringan jagung pada alat fluidized bed," *Din. Tek. Mesin*, vol. 6, no. 2, pp. 119–126, 2016.
- [7] G. F. Marintika, L. Cundari, and F. H. Kurniawan, "Proses pengeringan NPK

- berdasarkan evaluasi rotary dryer and kadar air NPK di PT. Petrokimia," *J. Rekayasa Mesin*, vol. 14, no. 1, pp. 273–289, 2023.
- [8] I. K. Suherman, S. Sudirman, A. Wibolo, et al., "Performance Evaluation of Rotary Dryer for Drying of Ginger," *Sci. Technol. Publ.*, pp. 1062–1066, 2023.
- [9] I. P. Afisna, I. D. Denara, E. Pujiyulianto, et al., "Design and Simulation of Rotary Dryer Frame Strenght using Finite Element Analysis," *Motivecton*, vol. 4, no. 3, pp. 245–252, 2022.
- [10] T. A. Raisa, I. Mayasari, N. Kholidah, et al., "Analisis Variasi Temperatur And Kecepatan Silinder Pada Pengeringan Biji Kopi Dengan Rotary Dryer Berpemanas LPG," *J. Kinet.*, vol. 9, pp. 196–204, 2024.
- [11] G. Rapindo, M. Izzuddin, A. Manggala, et al., "Analisis Pengaruh Variasi Kecepatan Putar and Waktu Pengeringan Jagung Terhadap Effisiensi Thermal Alat Rotary Dryer," *Innov. J. Soc. Sci. Res.*, vol. 5, pp. 325–333, 2025.
- [12] I. B. Alit and I. G. B. Susana, "Pengaruh Kecepatan Udara Pada Alat Pengering Jagung Dengan Mekanisme Penukaran Kalor," *Rekayasa Mesin*, vol. 11, no. 1, pp. 77–84, 2020.
- [13] R. Ince, E. Guzel, and A. Ince, "Thermal Properties of Some Oily Seeds," *J. Agric. Mach. Sci.*, vol. 4, no. 4, pp. 399–405, 2008.
- [14] L. Sultan, G. Tanjung, and R. Sutanto, "The Effect of Hot Air Flow Velocity on The Drying Characteristics of Turmeric in A Rotary Dryer," *J. Rekayasa Mesin*, vol. 20, no. 2, pp. 229–236, 2025.
- [15] Z. Djafar, W. H. Piarah, and R. Riadi, "Analisis Prestasi Pengering Kopi Berbasis Bahan Bakar Gas (LPG)," *Pros. Semin. Ilm. Nas. sains and Teknol. Ke - 4 tahun 2018*, vol. 4, pp. 399–408, 2018.
- [16] M. F. Suhelmi, R. dewi anjani, and N. Fauji, "Perhitungan Efisiensi Pengeringan pada Mesin Pengering Gabah Tipe Flat Bed Dryer," *J. Rekayasa Mesin*, vol. 17, no. 1, pp. 15–20, 2022.
- [17] S. Talebzadeh, Fatemi. H, Azizi. M, et al., "Interaction of Different Drying Methods and Storage on Appearance, Surface Structure, Energy, and Quality of Berberis vulgaris var. asperma," *J. food Res.*, vol. 11, no. 3003, pp. 1–17, 2022.
- [18] R. Sutanto and H. S. Tira, "Analysis of Corn Drying Rack Position on Tray Type Dryer on Drying Rate," *J. Pijar MIPA*, vol. 19, no. 5, pp. 888–892, 2024.
- [19] I. E. Nabhan, and A. febriana, "Uji Kinerja Rotary Dryer Pada Pengeringan Jagung Pipil," *J. Multidisiplin Saintek*, vol. 8, no. 10, 2025.
- [20] H. Sari, A.R. Rahman, R.A. Shukri, et al., "Effects of hot air drying on the kinetics and characteristics of pregelatinized," *FOOD Res.*, vol. 9, no. 4, pp. 286–293, 2025.
- [21] R. V. Rubi, M. A. Jajurie, K. A Javier, et al., "A Comprehensive Review on Drying Kinetics of Common Corn (Zea mays) Crops in the Philippines †," *Eng. Proc.*, vol. 87, no. 84, pp. 1–11, 2025.
- [22] H. S. Kusuma, Y. Mahendra, D. Engeliem, et al., "Evaluation of drying kinetics , electric and emission study of Musa paradisiaca L . leaves using microwave-assisted drying method," *Appl. Food Res.*, vol. 3, no. 2, 2023.
- [23] I. B. Alit and I. G. B. Susana, "Thermal Performance of LPG Stove as Heat Source of Rotary Dryer for Drying Corn for Small Farmers," *J. Tek. Pertan. lampung*, vol. 14, no. 2, pp. 537–546, 2025.
- [24] A. R. Vargas, L. P. Garcia, C. S. Guillen, et al., "Performance evaluation of a flighted rotary dryer for lateritic ore in concurrent configuration," *Heliyon*, vol. 9, no. 21345, 2023.
- [25] I. G. B. Susana, I. B. Alit, and I. D. K. Okariawan, "Rice husk energy rotary dryer experiment for improved solar drying thermal performance on cherry coffee," *Elsevier*, vol. 41, pp. 102616, 2023.
- [26] E. Owusu-sekyere, G. Obeng-akrofi, J. O. Akowuah, et al., "Performance Analysis and

Drying Kinetics of Maize in an AflaSTOP Dryer Performance Analysis and Drying Kinetics of Maize in an AflaSTOP Dryer," *Agricultural Biosyst. Eng. Publ.*, vol. 11, pp. 327–342, 2021.

- [27] I. N. Sari, "Uji Kinerja Alat Pengering Hybrid Tipe Rak Pada Pengeringan Chip Pisang Kepok [Performance Test Of Hybrid Dryer Shelves Type For Drying Banana Chips]," *J. Tek. Pertan. Lampung*, vol. 3, no. 1, pp. 59–68, 2014.