

Comparative Study of The Conventional Curing Machine with The Electric at Aluna Masaran Batik Manufacturer Industry

Suharno^{1a♦}, Joemintono^{1b}, Aji Widi Kuncoro^{1c}, Dewa Akbar Rasta Pradana^{1d}, Muhammad Glozali^{1e},
Muhammad Ridwan K.^{1f}, dan Muhammad Sholeh^{1g}

Abstract. *The batik industry is constantly increasing its production. During production, a curing machine is used to dry the batik after the printing/screening process. The main problem with conventional machines is their inability to produce maximum heat. Currently, they are used in most industries and generate uneven heat, with LPG gas as the main fuel. Therefore, this study aims to develop an electric curing machine as an alternative to overcome the challenges of the conventional type. It was carried out using a sample of the experimental test site selected through a purposive sampling method, namely the Aluna Batik industry in Masaran, Sragen. The data were collected by observing the outcomes of mechanical engineering and analyzed using descriptive methods. The results showed that conventional curing provides an advantage in the speed of heat supply, while electric curing stabilizes heat requirements. This showed that the electric machine is more profitable for large and fast quantities production, while the conventional is ideal for daily production..*

Keywords: batik industry, curing machine, machine efficiency

I. INTRODUCTION

Indonesia has different cultures and natural beauty such as Batik, which are being adored by foreign countries. Batik is a pictorial cloth whose manufacture is carried out specifically by writing or gluing liquid wax with a tool in form of a canting or stamp (Hidayat, 2019).

The batik industry in Indonesia is generally a small and medium industry (SME) as the livelihood of some people (Nurainun, 2008). The current industry continues to grow rapidly and produces a high level of productivity (Zainul Arifin, 2019). The smoothness of the production

process is used as a benchmark that the industry is successful to create good product quality, gain trust, and loyalty from consumers (Yani, 2019). The success of quality products can be proven by measuring productivity on production machines (Raihudaya, 2017). This showed that good machine effectiveness is needed in the production process (Suharno, et.al., 2022). Therefore, for efficient production, there is a need to carry out structured maintenance and involve every workforce in the company to achieve optimal machine effectiveness (Biegel, 1998).

This case study involves the use of a curing machine in the Aluna Batik industry located in Masaran, Sragen. During production, a curing machine is used to dry the batik liquid after screen printing. The existing machines in the industry are still the conventional type that generate uneven heat, with LPG gas as the main fuel. Meanwhile, the heat in the machines will cause uneven drying of the screen printing on the batik, which affects the final product. The process is simply by pushing or pulling the machine, which requires more energy from the workers in the batik production.

The creation of an electric curing machine is assumed to give a breakthrough to the Aluna Batik industry. This is because the work will be more effective, efficient, and generate evenly distributed heat, with maximum drying results.

¹ Mechanical Engineering Education Faculty of Teacher Training and Education Universitas Sebelas Maret. Jl. Ir. Sutami No. 36 A Surakarta

² Faculty of Technical and Vocational Education, Parit Raja, Universiti Tun Hussein on Malaysia, Johor, Malaysia

^a email: suharno_ptm@fkip.uns.ac.id

^b email: masmentosragen@gmail.com

^c email: ajiwidi13@gmail.com

^d email: pradanadewa20@gmail.com

^e email: muhammadglozali@gmail.com

^f email: mridwankusuma@gmail.com

^g email: msholeh679@gmail.com

♦ corresponding author

Therefore, this study aims to determine the effectiveness, efficiency, temperature differences of the two curing machines.

II. RESEARCH METHOD

Based on the problem of this study, a descriptive qualitative method was used. According to Anggraini and Oliver, (2019), an exploratory descriptive method aims to describe the state or status of a phenomenon. Generally, this is a non-hypothetical study and the steps do not need to formulate a hypothesis. Primary and secondary data used were collected through observations (Creswell, 2012). Meanwhile, a qualitative descriptive method was used to describe the existing phenomena, showing the present condition (Sukmadinata, 2013).

Primary data were obtained directly when the curing machine is operating, while secondary data were obtained from daily journals and literature studies. The data were arranged in tabular form and depicted in graphic form. The increase in temperature of the machine is depicted in form of a graph according to the conditions shown. The study activities were carried out by preparing material tools, conducting tests, data collection, and analysis. The increase in temperature was taken every minute until it reached the maximum from conventional or electric curing machines.

Materials and Tools: The material used in this study includes LPG gas with a capacity of 3 kg and electricity with a power of 5,000 Watt. Meanwhile, the tool is thermogenic, which is used to measure the temperature of the heat generated by the curing machine with a timer to mark the temperature rise every minute.

Work Procedures: The steps for study activities in the Aluna Batik industry, Masaran, Sragen are as follows:



Figure 1. Study Design

Data collection techniques used in this study are as follows:

Observation: Observations are divided into two, namely direct and indirect. Direct observations were carried out on an event, activity, or phenomenon (Pahlevi, 2018), which is related to the recordings of the place where the event occurs. Meanwhile, indirect observations are made not at the time an event was investigated (Lumintang, 2013). Therefore, this study used direct observation by visiting the Aluna Batik industry in Masaran, Sragen. This includes observing the work process and taking curing machine temperature data.

Interview: An interview is a data collection technique in a study by holding a dialogue with respondents (Sadli, 2019). This study used an unstructured interview technique that is flexible. Therefore, the order of the questions and the wording in each question can be changed during the interview, according to the needs and conditions of the interview (Sukirno, 2020).

Documentation: Documentation is a record of events that have passed in form of writing, pictures, or someone's monumental work by collecting work notes and collecting data on things in form of transcripts, books, and others (Efriyanti, 2018). It is also a supporting activity in completing the data obtained as a support to strengthen the discoveries during interviews and observations (Anggraini, 2019).

It can be interpreted that documentation is an activity or action taken by perpetuating a picture of a situation related to a place, object, action, activity, event (Sodik, 2019). Documentation was selected to obtain data directly from the site. This technique is used to obtain the photos of the curing machine, therefore it can be designed through the Solidworks application to further emphasize the study data.

The data analysis techniques used are data reduction, data presentation, and conclusion drawing (Megawati, 2016). Reducing data means summarizing (Putra, 2013), selecting the main things, focusing on the important factors, and searching for themes and main points. Therefore,

the reduced data provide a clearer description and ease data collection (Hidayat, 2016).

After the data has been reduced, the next step is to display the data. In a qualitative study, the presentation of data can be carried out in form of a brief description, a chart of relationships between categories, and others. By displaying the data, it is easier to understand what happened and plan further work based on previous knowledge. Furthermore, this study displays data using narrative text. The third step in qualitative data analysis is drawing conclusions and verification. The initial conclusions are still tentative and change when no strong evidence supported the next stage of data collection. Subsequently, the conclusions that were put forward at an early stage are supported by valid and consistent evidence, which were collected in the field (Purnamasari, 2016).

III. RESULT AND DISCUSSION

The quality, coloring, and flexural strength of the batik are largely determined by the production process (Debrina Puspita Andriani, 2019). One of the vital manufacturing processes is the determination of tools or machines to support production (Masiswo. et al, 2017). Batik craftsmen are usually very disturbed when many orders do not support the production process (Muhammad Faisal, 2020). The erratic production process also results in decreased consumer confidence (L. Mott, Robert, 2009). This includes the post-dyeing batik process, where most craftsmen usually rely on conventional machines. Moreover, a curing machine is a tool or batik dryer after dyeing that binds the chemical elements in the dye to dry and blend. This study developed an electric curing machine and compared its advantages and disadvantages. Based on the results, it was discovered that the machine selection decisions depend on industry needs.

The data also indicated the use of conventional machines has several drawbacks. This includes the unevenly distributed heat throughout all gas pipes, delaying the processing time. Subsequently, cloudy or rainy weather also

affects the condition of the production room, which does not support the production process (Suranto & Djunaidi, 2021). The amount of gas required is also 2 times the production process during hot weather. The daily consumption of gas that is not reducing makes expenses quite high. This has caused a delay in the work process because it still uses human power.

Meanwhile, the use of an electric machine has drawbacks because it requires high voltage for the production process. It is also advisable to use a single cable or solid copper to avoid the strength of the cable with high voltage. This machine needs to be provided with additional tools as a driving force to optimize the performance of existing human resources. The advantages and disadvantages of conventional and electric curing machines are shown below.

Conventional Curing Machine: Data from the test results on conventional curing machines showed that there are technical and economic advantages and disadvantages. Technically, the advantages are very good drying effectiveness, easy operation, and simple construction. Economically, they are inexpensive tools due to their simple construction.

The disadvantages include low efficiency of heat, high production costs, uneven heat generated, and a stifling workplace due to wasted heat. Furthermore, they require LPG gas to turn on the stove fire up to 4 tubes when the weather is sunny or hot, while in the rainy season, it requires 10 LPG gas.



Figure 2. Conventional Curing Machine

The conventional curing machines produced an unevenly distributed flame on the stove fire, thereby, the drying results are uneven. They also

cause screen printing to be scorched or overcooked due to a large flame and produced a maximum temperature of 338oC. The graph of the temperature increase in a conventional curing machine for 4 minutes is shown below

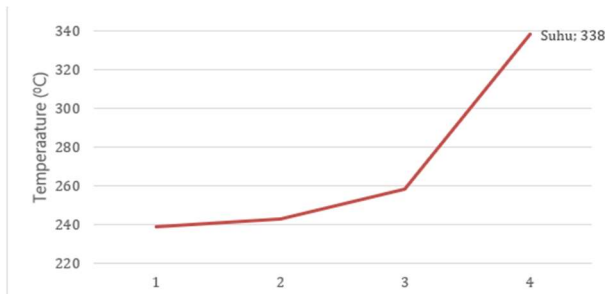


Figure 3. Graph of the Conventional Curing Machine Temperature Increase

Electric Curing Machine: The test results of the electric curing machine showed a very good performance. The heat generated by the machine is also stable and controllable, which allows the craftsman to adjust the level of heat demand. For the use of thick fabrics and varied patterned batik, an electric curing machine is highly recommended. There is a need to further investigate the relationship between variations in batik motifs with heat requirements, however, the symptoms that indicate a relationship is very strong. This is in line with previous research, which showed that the thicker and more varied the motifs, the more heat settings are needed.

In the electric curing machine, the craftsman is not affected by the weather, even though the machine can be operated at night or when the weather is rainy. This is different from conventional curing machines that are highly affected by weather conditions. Another advantage is lower production costs because when the engine is in a stable condition, the heat input is smaller. However, high power requirements are only needed at the starting time.

The disadvantages of electric curing machines are high power supply and more complicated machine construction. Based on observation, it was discovered that the shortcomings of the electric curing machine are

the requirement of high electrical power of above 4000 watts and use high voltage cables.

The maximum temperature produced by an electric curing machine is not as fast as a conventional machine. Based on the experiment, it was shown that for 4 minutes, the electric machine produces a temperature of 258oC, while the conventional produces a 338oC. Figure 4 showed a graph of the temperature rise of the electric machine per minute.

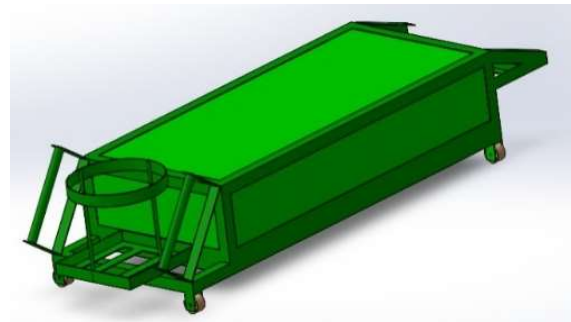


Figure 4. Electric Curing Machine

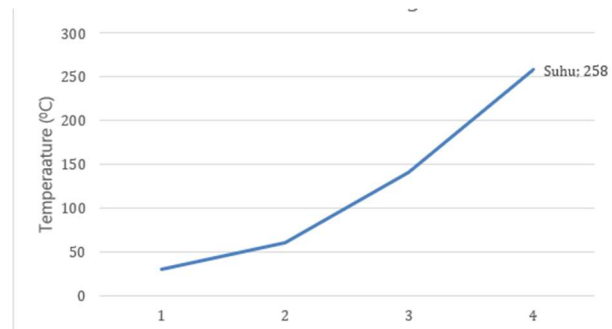


Figure 5. Graph of Electric Curing Machine Temperature Increase

IV. CONCLUSION

The results showed that an electric curing machine is more profitable for large and fast quantities of production, while the conventional is ideal for daily production. This is due to the description and discussion of the engineering results of an electric machine and its comparison with a conventional type. These results indicated that the selection of the machines depends on industry needs

ACKNOWLEDGMENT

The authors are grateful to:

1. Ministry of Research, Technology and Higher Education which has provided grants in the 2021 Kedaireka scheme.
2. Faculty of Teacher Training and Education, Sebelas Maret University, Surakarta, has technically facilitated the implementation of this study.
3. Director of Aluna Batik Masaran who facilitated the implementation of this study.

REFERENCES

- Agung P.B. & Wahyu Dwi D.K., (2017). Efisiensi Proses Produksi Batik Melalui Penerapan Mesin Pengereng Batik Dan Kompor Pemanas Lilin Batik Semi Otomatis. *Otopro: Volume 13 No. 1*, 30-34.
- Anggraini, W & Putri, A.D. (2019). Penerapan Metode Bermain Peran (Role Playing) dalam Mengembangkan Kognitif Anak Usia 5-6 Tahun. *Journal of early childhood education and development*. Vol 1 No 2
- Ardianto, T., Nurgiyatna, & Prasetyo, T. (2013). Aplikasi Pengenalan Batik Indonesia Berbasis Mobile Android. (Doctoral Dissertation, Universitas Muhammadiyah Surakarta).
- Biegel, J.E. (1998). Pengendalian Produksi, Suatu Pendekatan Kuantitatif. Terjemahan. Tarsito Bandung.
- Creswell. (2012). "Mixed Methods Research in Sports Marketing." *International Journal of Multiple Research Approaches*. Vol 09. September.
- Debrina Puspita Andriani. (2019). Optimasi Parameter Ketahanan Luntur Batik Terhadap Keringat Dengan Desain Eksperimen Taguchi. *DKB: Dinamika Kerajinan dan Batik*. VOL. 36 NO. 1, JUNI 2019, HAL 81- 94.
- Efriyanti, M., Garaika., Irviani, R. (2018). Analisis Implementasi Electronic Commerce Untuk Meningkatkan Omset Penjualan Butik Mery Berbasis Web Mobile. *Jurnal Signaling STMIK Pringsewu*. Vol 7 No 2 ISSN : 2085-2304
- Hidayat, M. (2016). Model Komunikasi Kyai Dengan Santri Di Pesantren. *Jurnal Komunikasi ASPIKOM*. Vol 2 No 6. <https://doi.org/10.24329/aspiko.m.v2i6.89>.
- Hisayat, T & Hamijoyo, K. (2019). Alat Pewarna Batik Rol Ganda (Peder). *Jurnal Litbang Sukowati*. Vol 2 No 2. Hal 113-121
- Lumintang, F.M. (2013). Analisis Pendapatan Petani Padi Di Desa Teep Kecamatan Langowan Timur. *Jurnal EMBA*. Vol 1 No 3 Hal 991-998. ISSN 2303-1174.
- L. Mott, Robert. 2009. Elemen-Elemen Mesin dalam Perancangan Mekanis. Yogyakarta: ANDI.
- Masiswo. Dkk., (2017). Karakteristik Fisik Produk Batik Dan Tiruan Batik. *DKB: Dinamika Kerajinan dan Batik*. Vol. 34, No. 2, Desember, 103-112.
- Megawati, F. (2016). Kesulitan Mahasiswa Dalam Mencapai Pembelajaran Bahasa Inggris Secara Efektif. *Jurnal Pedagogia*. Vol 5 No 2. <https://doi.org/10.1007/s00381-016-3174-3>.
- Muhammad Faisal, et.al. 2020. Reducing Environmental Impact on SME Metals Production Process Using Life Cycle Assessment and Analytical Hierarchy Process Method. *Jurnal Ilmiah Teknik Industri*. 19(1). 84-94.
- Nurainun, Heriyana, & Rasyimah. (2008). Analisis Industri Batik Di Indonesia. *Jurnal Fokus Ekonomi*. Vol 7 No 3. Hal 124-135. ISSN: 1412-3851
- Pahlevi, Omar., Mulyani, A., & Khoir, M. (2018). Sistem Informasi Inventori Barang Menggunakan Metode Object Oriented Di PT. Livaza Teknologi Indonesia Jakarta. *Jurnal Prosisko*. Vol 5 No 1. e-ISSN: 2597-9922
- Purnamasari, et al. (2016). Efektivitas Pengelolaan Badan Usaha Milik Desa (Bum Desa) Berbasis Ekonomi Kerakyatan Di Desa Warungbambu Kecamatan Karawang. *Jurnal Politikom Indonesiana*. Vol 1, No 2
- Putra, S., Purwanto, & Kismartini. (2013). Perencanaan Pertanian Berkelanjutan Di Kecamatan Selo. *Prosiding Seminar NAsional Pengelolaan Sumberdaya Alam Dan Lingkungan 2013*, No. 1
- Raihudaya, A. (2013). Pengukuran Efektivitas Mesin Curing Menggunakan Metode Overall Equipment Effectiveness (OEE) (Studi Kasus: PT. Pentasari Pranakarya). Thesis. Fakultas Teknologi Industri. Universitas Islam Sultan Agung
- Sadli, M. (2019). Analisis Pengembangan Budaya Literasi Dalam Meningkatkan Minat Membaca Siswa Di Sekolah Dasar. *Jurnal Pendidikan dan Pembelajaran Dasar*. Vol 6 No 2. e-ISSN 2580-8915
- Sodik, M., Sahal, Y.F.D., & Herlina, N.H. (2019). Pengaruh Kinerja Guru dalam Pelaksanaan Pembelajaran terhadap Prestasi Belajar Siswa pada Mata Pelajaran. *Jurnal Penelitian Pendidikan Islam*. Vol 7 No 1
- Sudaryono. (2017). Metodologi Penelitian (Ed. 1.-Ce). Jakarta: Kharisma Putra Utama Offset.
- Suharno, et.al. 2022. Calendering Machine Performance Analysis to Improve the Smoothness of Batik. *Jurnal Ilmiah Teknik Industri*. 21(2). 223-229.
- Sukirno, A & Rohayanti. (2020). Konseling Kelompok

Dalam Upaya Meningkatkan Semangat Belajar Mahasiswa Aktifis Pramuka. Jurnal al-Shifa. Vol 1 No 2

Sukmadinata, N. S. (2013). Metode Penelitian Pendidikan. Bandung: Rosda Karya

Suranto & M. Djunaidi. 2021. Marketing Development Model of Goyor Woven Fabric Increases Consumer Buying Interest in Pandemic Covid-19 Era: Study at Sragen Goyor Industry Center. Jurnal Ilmiah Teknik Industri. 20(1). 61-70.

Taufiqoh, B. R., Nurdevi, I., & Khotimah, K. (2018). Batik Sebagai Warisan Budaya Indonesia. Seminar Nasional Bahasa Dan Sastra, 58–65. <http://research-report.umm.ac.id/index.php/SENASBASA/article/view/2220>

Yani, A.S & Asya, A. (2019). Pengaruh Keakuratan Timbangan Dan Pengendalian Kualitas Terhadap Kelancaran Proses Produksi Pada Pt Smart Tbk. Jurnal Administrasi Dan Perkantoran Modern. Vol 8 No 3. ISSN: 2301 – 7813

Zainul Arifin. (2019). The Effect of RTV Silicone Rubber Mold Runner, Speed, and Direction of Spin Casting Machine on The Success and Quality of Pewter Craft Product. DKB: Dinamika Kerajinan dan Batik. Vol. 36 No. 2, December 2019, pp. 113-124.