



Awareness Analysis of Batik Craftsmen Regarding the Toxic and Hazardous Waste of the Batik Industry in Kampung Batik Laweyan (Case Study: Afina Batik)

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Abstract - The Batik industry is one of the industrial sectors that has an important role in improving the economy. As time goes by, the demand for batik is increasing. Not only favored by adults and the upper class, but batik is also increasingly favored by the youngsters. Therefore, batik industry craftsmen continue to follow technological developments in order to be able to meet the demand for batik, as in the batik industrial area of Kampung Batik Laweyan. Some of the equipment used is still relatively simple, but the use of chemicals has been carried out for quite a long time because the price of batik materials continues to increase. In fact, if the industrial waste is not handled properly, it can pollute the river. This shows that some batik industry perpetrators do not yet have a full level of awareness and responsibility for the output of batik making. Therefore, comprehensive research is needed on toxic and hazardous waste management in order to determine the perception of craftsmen towards toxic and hazardous waste and increase the awareness of craftsmen towards toxic and hazardous waste. Based on research conducted at Afina Batik using a combination of quantitative and qualitative approaches, information was obtained that some craftsmen did not know the types and dangers of chemical waste produced. In fact, there are chemicals used in the coloring process, such as naphthol and chrome soda, which pose a risk of danger.

Keywords – Batik Industry, Chemicals, Dyes, Toxic and Hazardous Waste, Waste Management

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1. Introduction

Batik industry is one of the industry sectors that holds an important role in raising Indonesia's economy. The batik industry growth has rapidly increased each year. The sole cause of the rapid growth in this sector is that youngsters and adults both loved to use batik. In order to fulfill a lot of demands on the industry, the perpetrator of batik needs to keep up with technological developments. However, the industry needs to maintain the balance between producing goods and how they are affecting the nearby environment.

Generally speaking, the process of making batik goes through several steps starting from preparing materials needed to coloring. The process includes removing starch from mori fabric, applying starch flimsy, flattening the starched fabric, embedding wax on the fabric, coloring, and removing the remaining wax. Besides producing useful goods, those processes are responsible for the waste produced that may be harmful to the surroundings. Waste

such as heavy metal, BOD, COD, and other parameters that do not meet quality standards.

Some of the industry perpetrators were found not having a full level of awareness and responsibility of the waste produced from the making of batik. Those people only think about the efforts to keep the business running and gain maximum profit, without any effort of increasing knowledge and awareness of the potential dangers caused.

Kampung Batik Laweyan is the oldest batik area located in Surakarta, Central Java. Until now, the area continues to grow rapidly into a center for the development of handicrafts and the batik industry. Kampung Batik Laweyan is also known as an industrial area that can support the lives of the people of Surakarta and its surroundings.

Most of the industrial perpetrators in Kampung Batik Laweyan still use relatively simple equipment and materials, where the use of simple equipment and materials results in a problem both in terms of quality and quantity of

the production process. In addition, other problems were also found in the form of excessive use of chemicals. Cumulatively these chemicals can certainly cause environmental pollution in the area around the batik industry area. Industrial perpetrators argue that the price of raw materials continues to increase and they also need to pay attention to the welfare of the workforce which must be met. The absence of a good waste management system is also an inseparable problem in the batik industry, so that industrial waste that is disposed of by the environment does not meet the standards which in turn pollutes rivers.

Comprehensive research on toxic and hazardous waste management in the batik industry needs to be carried out. It's because of the large impact of toxic and hazardous waste that may be generated. The results obtained are expected to show the craftsmen's perception of toxic and hazardous waste. Not only that, the results of this study are expected to increase the awareness of batik craftsmen towards toxic and hazardous waste.

2. Literature Study

According to Government Regulation No. 101/2014, what is meant by toxic and hazardous waste is the residue of a business and/or activity containing hazardous and/or toxic materials which due to their nature and/or concentration and/or amount, either directly or indirectly, can pollute and/or damage the environment and/or endanger the environment, health, survival of humans and other living creatures. Material which due to concentration and/or nature and/or amount contains toxic and hazardous waste and is harmful to humans, living things, and the environment, regardless of the type of residual material.

Toxic and hazardous waste contains pollutants that are toxic to the human body which can cause death if it enters the body. To detect the pollutants, we can use a poison indicator called TCLP (Toxicity Characteristics Leaching Procedure) as stated in Government Regulation No. 101/2014 article 5. In Government Regulation No. 101/2014 article 5, there are 6 characteristics of toxic and hazardous waste, namely:

- a. Easy to explode
- b. Flammable
- c. Reactive
- d. Infectious
- e. Corrosive
- f. Toxic

The existence of the batik industry has both positive and negative impacts. The positive impact that can be felt because of the existence of the batik industry is contributing to Original Local Government Revenue, providing welfare, and providing employment for the community. In addition, it is also a form of cultural preservation (Indrayani, 2019). One of the negative impacts caused by the batik industry is waste in batik processing which can cause water pollution. More serious environmental problems can be caused by toxic and hazardous waste during the batik dyeing process. In the

batik production process, acids and bases are used as materials, namely in the coloring process and also as auxiliary materials, namely the initial mordanting process and the color strengthening process (fixation).

The batik industry produces liquid waste that is toxic and harmful to living things and the environment. The waste produced by the batik industry has a large organic content, thick color, pungent smell, and has a high temperature. The values of acidity (pH), biochemical oxygen demand (BOD), chemical oxygen demand (COD), and total suspended solids are also high. COD value is the amount of oxygen in mg/L required to chemically decompose organic matter. The higher the COD level, the worse the water quality. Dissolved oxygen (DO) is a measure of the amount of oxygen dissolved in water (Indrayani and Rahmah, 2018). This dissolved oxygen is the most important thing for fish. The optimum DO content for fish is 5-6 mg/L, while the minimum DO content is 3 mg/L. The pH value is an indicator to show the degree of acidity in the waters. Fish can live in a pH range of 5-9. Fish will die if the pH of the water is less than 4 or more than 11. Waste that is directly released into the environment is certainly very dangerous for the survival of life in the vicinity. In the management of toxic and hazardous waste, the batik industry requires awareness from craftsmen and the role of the government.

The waste management can be done through the Wastewater Treatment Plant, but in reality, many batik industries do not apply this method. For example, many batik craftsmen in Pekalongan City dispose of waste directly into the river through water pipes (Sugiharto and Diani, 2018). A high formal educational background does not necessarily indicate that the craftsmen has the ability to process batik waste properly. The educational background that plays an important role here is non-formal education, which is through training by experts in the field of batik. So that the more batik craftsmen take part in the training, the wider their knowledge and experience in managing batik waste (Miftaurridlo, 2020).

Law Number 23/2014 concerning Regional Government becomes a guideline in the implementation of regional autonomy in Indonesia or can be referred to as the legal basis for regional autonomy in Indonesia, including being able to regulate batik industry centers. However, almost all regional regulations which are the centers of the batik industry do not stipulate special regional regulations for waste handling or special quality standards for batik waste, except for the Yogyakarta Special Region Regulation Number 7/2016 concerning Wastewater Quality Standards for Batik Industry Activities. Considering that Yogyakarta has been designated by the World Craft Council as the world's batik city, the DIY Province is the only province that specifically regulates the quality standards of the batik industry's wastewater.

3. Materials and Methods

3.1 Research Methods

The method used in this research is a combination method by combining quantitative and qualitative approaches from the aspects of technique, method, perspective, concept, and language. This combination is based on the emphasis on how to collect data from the perspective of the craftsmen through questionnaires that have defined the boundaries of questions from researchers and also open interviews with industry owners regarding in-depth field findings as a source of hypotheses and assisting the construction of a predetermined scale. Then the data obtained is integrated into a comprehensive form of linkage.

3.2 Research Time and Location

This research was conducted in the home batik industry at the Laweyan Batik Industry Center Solo. The home industry studied in this study is Afina Batik which is located on Nitik Street, Laweyan, Laweyan District, Surakarta City. Afina Batik was chosen as the research location because it is located in the center of the Laweyan batik village and has met the required criteria regarding data collection. Field data collection was carried out on November 8, 2021.

3.3 Tools and Materials

The tools used in this study were a sound recorder and statistical data processing application IBM SPSS Version 25. The materials needed in this study were in the form of a questionnaire sheet.

3.4 Data Collection

Data collection methods were carried out in two ways, namely by distributing questionnaires and in-depth interviews. Questionnaires were addressed and distributed to craftsmen who are directly involved with batik production activities in the Afina Batik industry. Respondents in this study amounted to 7 people. The statement submitted to the respondent amounted to 34 items and then validation was carried out to measure the validity of the statement given. Meanwhile, other data collection was carried out by in-depth interviews with the owner of Afina Batik.

3.5 Data Analysis

Analysis of the level of awareness of craftsmen who work in the Afina Batik Industry at Kampung Batik Laweyan Surakarta can be measured by quantitative methods using a Likert Scale. Then to translate the Likert Scale results obtained from the survey, interval analysis was carried out to calculate the weighted value of the respondents' answers. In addition, the data that has been obtained is also equipped with a qualitative descriptive analysis approach to see the perception of batik craftsmen on toxic and hazardous waste.

The data obtained from the questionnaire was then processed using the SPSS application to test its validity and reliability. Validity test requires a total of 7 respondents, then the required R table is 0.754 (significance 5%). Of the 34 statement items presented, there are 15 valid statements with the R count > R table.

Table 1. Test the Validity of the Questionnaire Statement

Number	Statement	R Count
1	I know the types of batik production waste	,793*
2	I know that batik production uses chemicals	,880**
3	I know that the chemicals used in batik production	,914**
4	I'm worried about batik production waste that can interfere with my health	,880**
5	I know that if batik production waste is not processed, it can pollute the environment such as polluting rivers, causing unpleasant odors and so on	,772*
6	I use enough chemicals for batik production	,937**
7	I remind other friends/colleagues when using excessive chemicals	,893**
8	Waste management is not necessary	,891**
9	Hazardous wastes such as residual dyes and hazardous chemical solvents need to be separated from waste	,877**
10	Batik waste pollutes the river	,891**
11	Batik waste can interfere with comfort and aesthetics	,951**
12	Batik waste is harmful to human health	,933**
13	Batik waste is a source of disease vectors	,951**
14	Factories need to provide training related to waste management	,933**
15	The local government needs to carry out inspections on batik waste management	,893**

After knowing the validity of each statement item, then a reliability test is carried out. Reliability test is a tool used to measure the consistency of the questionnaire which is an indicator of the variables. Reliability tests are used to give the same results if the instrument is applied at different times (Sürücü et al. 2020).

Table 2. Reliability Test of Questionnaire Statements

Reliability Statistics	
Cronbach's Alpha	N of Items
0,945	15

Cronbach's Alpha value indicates the level of reliability of the statement obtained. Cronbach's Alpha value is in the range 0-1 where the greater the value, the more reliable the statement grains. In this questionnaire, a total of 15 questions were distributed with a Cronbach's Alpha value of 0.945. The value obtained indicates that the questionnaire given is very reliable.

4. Results and Discussion

4.1 How Much Craftsmen's Knowledge in Research Sites and Analysis of References Aligned with Research

Table 3. Basic Knowledge of Craftsmen to Hazardous Waste

No	Statement	Score				
		SD	D	M	A	SA
1	I know the types of batik production waste	1 (14%)	4 (57%)	0	1 (14%)	1 (14%)
2	I know that batik production uses chemicals	1 (14%)	1 (14%)	0	3 (43%)	2 (29%)
3	I know the dangers of chemicals used in batik production	0	3 (43%)	1 (14%)	1 (14%)	2 (29%)
4	I'm worried about batik production waste that can interfere with my health	1 (14%)	1 (14%)	2 (29%)	0	3 (43%)
5	I know that if batik production waste is not processed, it can pollute the environment such as polluting rivers, causing unpleasant odors and so on	0	3 (43%)	0	2 (29%)	2 (29%)
6	I use enough chemicals for batik production	2 (29%)	0	1 (14%)	2 (29%)	2 (29%)
7	I remind other friends/colleagues when using excessive chemicals	0	2 (29%)	1 (14%)	4 (57%)	0

Note. SD = Strongly Disagree; D = Disagree; M = Moderate; A = Agree; SA = Strongly Agree.

Knowledge of batik industry wastewater in the Kampung Batik Laweyan area is an effort that can be made to determine the understanding of the community and batik industry owners towards the waste that is issued, especially with waste that has potential hazards and is toxic to humans and the environment. This statement was prepared and addressed to batik craftsmen in Afina Batik, Laweyan, Surakarta. The choice of craftsmen as respondents is because the craftsmen have greater exposure to chemicals.

From the results of table 3, it is stated that 4 (57%) of the 7 respondents, craftsmen in Afina Batik do not know the type of waste in the batik production process. Whereas knowledge about this type of waste makes batik craftsmen have an important influence on waste problems. This background knowledge has an important role in

maintaining a stable environmental condition (Miftahurridlo and Rahma, 2020).

Afina Batik craftsmen actually agree and know that this batik production uses chemicals. However, they do not agree with the dangers of the chemicals used in the production process. Whereas chemicals that may be toxic and dangerous, even at low doses, will cause changes. The use of hazardous chemicals has often resulted in cases of accidents, poisoning or health and environmental problems, both at mild, severe, and even fatal levels (Rintayati, 2011). This will be even more fatal if personal protective equipment (PPE) is not used such as masks, aprons, boots, and others.

Statement number 4 in Table 3 shows that 3 (43%) of the 7 responses are very worried that the batik industry wastewater can interfere with the health of the craftsmen. The liquid waste of the batik industry contains hazardous chemicals such as chromium, which are harmful to health and the environment (Astuti et al. 2020). With the intensity of using chemicals every day, the risk of exposure to chemical residues increases. Research by Latif et al. (2016) showed that there was a health effect on the batik-making process with impaired lung capacity, visual function and skin disorders.

The existence of a batik industry center in Laweyan District, Surakarta makes this area vulnerable to environmental pollution. The waste produced in the form of liquid and solid waste is a trigger for environmental degradation in Laweyan District. As many as 4 (57%) respondents agree or strongly agree with the existence of the batik industry polluting the environment. However, there are 3 (43%) respondents who do not agree with this statement. This is influenced by the craftsman's ignorance of the waste produced. Batik waste in Kampung Batik Laweyan has liquid and solid waste that harm the environment. The concentration of several parameters such as BOD, COD and TSS in the Jenes River, Laweyan District has exceeded the quality standard and needs to be reduced (Muslimah et al. 2020).

The batik industry in Afina Batik uses textile dyes to dye fabrics. This batik coloring process is called soga. This coloring process uses chemicals such as naphthol and chrome soga. These chemicals come from hydrocarbons that pose a risk of danger to craftsmen. The impact of this hazard is implemented by workers in using chemicals sparingly with a percentage agree and strongly agree to a value of 58%. However, the use of dyes also affects the results of batik production itself.

The participation of fellow craftsmen is needed to reduce the use of excessive chemicals. Based on the questionnaires distributed, as many as 4 (57%) respondents agreed to remind fellow craftsmen to reduce excessive use of chemicals. With joint awareness efforts can at least reduce the use of dyes that pollute the environment.

4.2 Craftsmen Perception of Hazardous Waste

Table 4. Craftsmen Perception of Hazardous Waste

No	Statement	Score				
		SD	D	M	A	SA
1	Waste management is not necessary	1 (14%)	2 (29%)	1 (14%)	2 (29%)	1 (14%)
2	Hazardous wastes such as residual dyes and hazardous chemical solvents need to be separated from waste	0	3 (43%)	1 (14%)	2 (29%)	1 (14%)
3	Batik waste pollutes the river	1 (14%)	2 (29%)	1 (14%)	2 (29%)	1 (14%)
4	Batik waste can interfere with comfort and aesthetics	1 (14%)	3 (43%)	0	3 (43%)	0
5	Batik waste is harmful to human health	0	4 (57%)	0	3 (43%)	0
6	Batik waste is a source of disease vectors	1 (14%)	3 (43%)	0	3 (43%)	0
7	Factories need to provide training related to waste management	0	4 (57%)	0	3 (43%)	0
8	The local government needs to carry out inspections on batik waste management	0	2 (29%)	1 (14%)	4 (57%)	0

Note. SD = Strongly Disagree; D = Disagree; M = Moderate; A = Agree; SA = Strongly Agree.

Craftsmen who work at Afina Batik have various perceptions regarding the toxic and hazardous waste generated by batik production activities. Opinions about waste management need not be met with very varied and evenly distributed responses across assessments. There are two dominant assessments containing the answers of the craftsmen agreeing and disagreeing with the statement that waste management does not need to be carried out, each of which is 29%. The craftsmen's understanding of the aspects of waste management can change along with the support by providing information on waste management according to standards.

Regarding the waste from dyes in the batik-making process, as many as 43% of craftsmen do not agree with the need to separate dyes and chemical solvents from waste. This can be caused by a lack of knowledge about the dangers of water pollution by batik industry waste. It can also be caused by the mindset and the assumption that disposing of waste without separation of certain chemicals is dangerous.

Batik waste polluting rivers is a subject that is often discussed. This aspect also received various responses from Afina Batik craftsmen, each of whom had opinions ranging from strongly agree with the statement to strongly

disagree. The personal answers of the craftsmen show the wealth of perceptions believed to have on the effect of waste on the river environment.

The majority of craftsmen do not have a problem with batik waste in terms of comfort and aesthetics. They are not bothered by the presence of batik waste that is often seen in the open environment. However, it does not deny that some craftsmen feel disturbed by the presence of waste, especially related to the aesthetics of the work environment. In fact, waste often causes unpleasant odors, which of course affects the comfort of workers. Nevertheless, all craftsmen still choose to stay to work in the industry for various reasons, one of which is to make ends meet.

Most of the craftsmen think that batik waste is not too dangerous for human health, as evidenced by the response that shows 4 out of 7 craftsmen answered disagree with the aspect of batik waste being harmful to human health. However, as many as 3 artisans feel that the batik waste generated from their production is harmful to health. The difference in response is caused by various reasons that underlie the opinions of each craftsmen.

There is a lack of evenness in the perception of craftsmen about the dangers of batik waste as a vector of disease. As many as 43% disagree and 43% agree. This shows the lack of socialization and knowledge of craftsmen about the dangers of waste on public health and craftsmen.

From the data in the field, the majority of craftsmen, namely 57%, do not agree if the factory provides training related to waste management. Such a response can be generated from various factors, one of which is a work culture that has been formed for a long time related to the handling of batik waste from the production carried out. In addition to the work culture that has become the habit of the craftsmen, personal knowledge related to batik waste is also a trigger factor that can encourage the urgency of waste management training.

As many as 57% of craftsmen agree on holding a surprise inspection by the government on batik waste management. This can be a trigger for batik waste management to keep trying to work well, so that the waste produced is in accordance with environmental quality standards.

5. Conclusion

Based on the results of the study, some of Afina Batik's batik craftsmen did not know about the types and dangers of chemical waste produced. However, they are also worried that the waste can harm their health. As for the chemicals used in coloring, such as naphthol and chrome soga, which pose a risk of danger. Increased awareness of craftsmen towards toxic and hazardous waste can be pursued through socialization or provision of management information that is adjusted to the standards. As well as the need for government support for inspections so that waste management is in accordance with environmental quality standards.

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