Detection of metal elements within Inductively Couple Plasma Emission Jambi batik waste and views as Muslim education

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Abstract. Batik in Jambi is located along the Batanghari river, making it easier for craftsmen to throw waste into the river. Batik waste containing heavy metals used is organic and inorganic dyes that are difficult to degrade naturally in the environment. The use of this dye by the batik craftsman industry has a negative impact on aquatic life, this study aims to detect the content of heavy metals and the views of Muslim intellectual. Detection of heavy metals using ICP (Inductively Couple Plasma) and proven to contain inorganic compounds that contain heavy metals Cd, Co, Cr, Cu, Fe: 1,335; 1,287; 1,325; 0.877; 1,022 mg / L. As a Muslim intellectual this is a challenge that must be resolved because it is his duty and together look after and find solutions to what has happened, all the inhabitants of the earth are responsible for the care of the earth. Earth is a place where we can do good and worship in a clean, friendly place with the earth, then friendly with its contents, we associate the environment with science and religion (greendeen).

1. Introduction

Opposite the city of Jambi is the northern part of the city of Jambi which is separated by the Batanghari river is one of the locations that developed the batik industry, known as Jambi batik, Jambi batik itself has now penetrated the international arena [1,2]. However, this industry has a negative impact in the form of pollution of colored liquid waste and containing heavy metals which causes many problems for the surrounding environment, although many prohibitions and appeals have been promoted, they have not been heeded. The city of Jambi across adjacent to the Batanghari river lip which is the location of the batik is located that makes it easy to access waste disposal to the river. The process of making batik is identical to the process of coloring and making motifs. The dyes commonly used by batik craftsmen are synthetic dyes because they are easy to obtain and also produce better colors. In batik coloring, this compound is only used in the range of 6%, while the remaining 95% is discarded as waste [3].

Batik dye waste is a significant contributor to the Batanghari river pollution. This contamination is marked by changes in the color of the waters originating from the batik waste and other contents that damage the water composition [4], pollution conditions are very worrying because in addition to containing dyes, textile waste also contains several types of dangerous heavy metals [5]. The content of heavy metals contained in waste is caused by two things, that is, the heavy metal is first used as a catalyst
during the dyeing process or is present as a by-product (by product). Second, some dyes have metals in them as part of the dye molecules, metal content in dyes listed has been regulated by the ministry of environment [6].

The source of heavy metals in waste dyes does not always come from the dyes used, but can also come from the afterchrom process for wool fibers, impurities in fiber, salt, caustic soda also from oxidizing and reducing agents. Dyestuff containing heavy metals is quite stable in waters especially at high concentrations will be a source of poison for aquatic life. Toxic effects caused by one type of heavy metal on all biota are not the same, but poisoning from one group can cause a break in the life chain. At a higher level, these conditions can damage the order of aquatic ecosystems [7]. I will begin to waste that contains heavy metals in the body will cause poisoning, health problems until death. Around the Batanghari watershed is widely used as a residential area for agricultural activities, livestock, even for washing and bathing.

Considering that the function of the Batanghari river is also as an irrigation flow and a source of water for activities, then as a Muslim scholar it is necessary to research the level of heavy metal pollution in the waste of dyes. Therefore, researchers do measurements of metal content in the dye waste. Therefore batik researchers so that later what levels and metals contained therein [8]. In a book written “Earth is a mosque,” said the Prophet; besides meaning we may pray in any place that is clean and holy, there is an implied message to preserve nature. Be close to God, be friendly to the environment, and care for one another on our planet” (Greendeen). It seems clear the task of researchers as a Muslim who devotes himself at the Islamic University to care for the environment this study aims to examine the sources of heavy metals and Muslim intellectual views.

2. Materials and methods
The research was performed in Terpadu Laboratory in the UIN STS Jambi April - July 2019 while the sample taking was performed in Waste Batik Jambi in across Jambi city.

![Figure 1. Location of Batik Jambi Industry.](image1)

The batik industry is located along the Batanghari river with around 20 industries and is located close to the river's edge, making it easier for the work to drain its waste into the river, the existence of the industry can cause river water pollution.

![Figure 2. ICP (Inductively Couple Plasma).](image2)
Batik dye waste, measured by ICP, can detect 24 types of metals.

The ICP (Inductively Coupled Plasma) principle is an analytical technique used for the detection of trace metals in environmental samples in general and in determining the element as an atomizing element so that it emits certain wavelengths of light which can then be measured. ICP is used to analyze many elements simultaneously and at levels as low as 1-10 parts per billion or ppb. ICP operates using Argon plasma injected with an atomized liquid sample.

3. Results and discussion

3.1. Analysis of heavy metal content and types of batik dye waste based on experiments

According to RI Law No. 23 of 1997 concerning environmental management (RI Law No. 23 concerning Environmental Management 1997), Polluted environment is the entry or inclusion of living things, substances, energy or other components into the environment, by human activities so that the quality drops to a certain level that causes the environment cannot function according to its designation. Likewise, in the water environment, the research on the environment of polluted water waste aims to obtain data and information on the latest environmental conditions from the content of heavy metals in batik dyes wastewater. The content of heavy metals of waste dyes measured in mg / L as follows: Cd, Co, Cr, Cu, Fe, Mg, Mn, Ni, Pb: 1.335; 1.287; 1.325; 0.877; 1.022; 0.312; 0.888; 0.785; 0.556 mg / L.

Measured using an ICP (Inductively Coupled Plasma Emission) tool, the results can be seen in Figure 4.

From the figure 4 above, it can be concluded that batik dye waste besides containing organic waste also contains inorganic waste, heavy metal content in many dye wastes is outside the threshold. It is clear that this dye waste threatens the aquatic environment and damages it if it is thrown away into the Batanghari river, which will pollute the water body [5].
Table 1. The results of the analysis of metals contained in batik dye waste.

| Metals | Quality standards | Analysis Results |
|--------|-------------------|------------------|
| Ag     | 0.05              | 0.065            |
| Al     | 0.2               | 0.211            |
| As     | 0.05              | 0.031            |
| B      | 1.0               | 0.010            |
| Ba     | 1                 | 0.020            |
| Ca     | 0.1               | 0.145            |
| Cd     | 0.005             | 1.335            |
| Co     | 0.2               | 1.287            |
| Cr     | 0.05              | 1.325            |
| Cu     | 1.0               | 0.877            |
| Fe     | 0.3               | 1.022            |
| Hg     | 0.001             | 0.028            |
| Mg     | 0.3               | 0.312            |
| Mn     | 0.1               | 0.888            |
| Ni     | 0.5               | 0.785            |
| Pb     | 0.05              | 0.556            |
| Se     | 0.01              | 0.055            |
| Sn     | 2                 | 0.094            |
| Ti     | 0.002             | 0.002            |
| Zn     | 0.10              | 0.155            |

The heavy metal content of Cd, Co and Cr in the dye waste shows accumulation which tends to be more significant. The heavy metal is far outside the specified threshold.

Mercury (Hg), Mercury is a metal that evaporates at room temperature, is a systemic poison and can accumulate in the liver, kidneys, spleen, or bones. Hg poisoning will cause symptoms of central nervous system disorders such as personality disorders and tremors, convulsions, senility, insomnia, loss of self-confidence, irritation, depression and fear. It can be seen from the table that mercury exceeds the permissible level of the waste metal content of the dye.

Arsenic (As) is a silvery metal that is very toxic. In Nature arsenic is very limited and is present with Cu, often used as rat poison, arsenic poisoning in humans has been so many cases, intentional or not. The most severe poisoning causes vomiting of blood, coma, if left to cause death, based on the metal content table in the dye waste is far from the threshold, so it can be said that the dye waste is not too dangerous the arsenic content in other words Arsenic is on a small scale.

Cadmium (Cd) is a silvery-white metal shaped crystal. Cd in nature is present with Zn, Cu, Pb, in small amounts. Cd is obtained in the alloy industry. The human body does not need Cd in its function and growth, because Cd is very toxic to humans. Acute poisoning will cause symptoms of gastrointestinal, kidney disease. Cd based on the results of the analysis table has high levels, so it needs to be watched out and handled.

Chromium (Cr) is a hard gray metal, a very irritating and corrosive compound. Causes deep ulcers on the skin and mucous membranes. Can cause damage to bones and can cause cancer. Cr metal content far beyond the threshold can be seen from the metal content analysis table.

Silver (Ag) white metal, if it enters the body, Ag will accumulate in various organs and cause gray pigmentation, skin irritation, blacken the skin, if bound nitrate Ag will become very corrosive, based on research results, Ag is above the standard threshold of waste metallic dyes.

Copper (Cu) is needed for the development of the human body. But high levels can cause symptoms of GI, CNS, Kidney, liver, vomiting, dizziness, weak head, anemia, camp, convulsions, shock, coma, and can die. In low doses, it can cause roughness, color and corrosion on metal equipment. After analysis of Cu, it is below the threshold.
Lead (Pb) is a black metal. Often used in paints, added to gasoline to increase octane levels, Pb poisoning will experience a black line on the gums, metal taste in the mouth, vomiting, blindness, paralysis and in poisoning can cause acute coma, even death.

Selenium is a heavy metal that smells like garlic can be found naturally with Cu, Au, Ni and Ag. Cellium poisoning can cause loss of reflexes and even death.

Zinc (Zn) is a metal used in the alloys, ceramics, cosmetics, pigments and rubber industries. The body needs Zn in the process of metabolism in low levels, whereas in high levels can be toxic.

The heavy metals discussed above are dangerous heavy metals, where the metal content has a threshold in the level of dye waste. The average heavy metal contained in the dye waste above the threshold is allowed, then this can be categorized as batik dyes waste in a bad condition.

Quality standard data is based on the Republic of Indonesia's Minister of Health Regulation No. 32 of 2017 concerning environmental health quality standards and water health requirements and the Minister of Health's Regulation on water quality conditions and supervision [9].

If the dye waste is not processed properly it will have an impact on health and the environment, as follows:

- Health: Batik dyes contain harmful metals that can damage the nervous system of the brain, damage the kidneys, are harmful to the fetus and can move through breast milk, as well as congenital defects. Besides the heavy metals content of batik dye waste disrupts the circulatory system, and the development of a child's brain.
- Environment: dye waste can pollute the environment with toxic chemicals, for example polluting soil and groundwater. It also can cause air pollution (lead pollution) which is very dangerous. According to the Decree of the State Minister for the Environment Number Kep.51 / MenLH / 10/1995, Regarding: Quality Standards for Liquid Waste for Industrial Activities.

3.2. Cromium
After conducting research on chrome contained in batik dye 1,325 mg / L while the threshold of 0.05 mg / L is clearly visible if it is not good to just throw away the batik dye waste. Chrome is one of the heavy metals produced from the batik Jambi production process [10]. Chrome is a water pollutant that is hazardous when in water even in small quantities, especially in the form of chrome (IV) [11]. The chromium used in dyeing is usually as good as the dyes (CrCl3, K2Cr2O7) as well as mordan, mordan, which are binding agents for dye, Cr(NO3)3 and PbCrO4. Pb as a color mixer, namely the color of white lead [Pb (OH) 2.2PbCO3] and the red color of red lead (Pb3O4), can have a significant impact on surrounding life, causing pain, heart problems [11,12].

3.3. Cadmium
The results of the study obtained levels of 1,335 mg / L while the allowable threshold is 0,005 mg / L. Cd in excessive amounts in the waters can cause disease experienced by residents in the form of damage to the kidneys and fragility of the bones. This metal, if entered into the body will settle in the liver and kidney, in a short time will have an acute effect and in the long run will cause chronic effects that will endanger the health of the Batanghari river range population [12].

As a Muslim scholar we are caliphs, the task of a caliph is the guardian of the earth, how our earth is protected from pollution that can damage the earth. This is very interesting because in the range of batik artisans there are many Islamic schools, after a discussion with several religious leaders, they did not like this, but they could not do anything. How is implied in the letter al-baqarah 11-12.

نَحْنُ مُصْلِحُونَ (11) أَلَا إِنَّهُمْ هُمُ الْمُفْسِدُونَ وَلَكِنْ لا يَشْعُرُونَ (12)

And when it is said to them, "Do not make mischief on earth: They answered, "Surely we are the ones who made repairs." Remember, in fact they are the people who make damage but they are not aware of it.
4. Conclusion

Based on research results analysis of metal content in batik Jambi dyes there are 20 types of metals that are Ag, Al, As, B, Ba, Ca, Cd, Co, Cr, Cu, Fe, Hg, Mg, Mn, Ni, Pb, Se, Sn, Ti, Zn. and proven to contain inorganic compounds that contain heavy metals Cd, Co, Cr, Cu, Fe: 1,335; 1,287; 1,325; 0.877; 1,022 mg/L where the metal content far exceeds the threshold which can increase the level of Batanahari river pollution. The content of heavy metals in batik dye waste already exceeds the quality standards for wastewater dyes.

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