Eco-friendly batik painting wax made from tamarind seed powder (*Tamarindus indica* L)

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**Abstract.** Various attempts were made to continue preserving batik as one of the nation’s identities of Indonesia. One of the attempts is to simplify the process of producing hand-drawn batik using natural cold wax made from tamarind seed powder (*Tamarindus indica* L). The polysaccharide content in tamarind seed powder has good coagulant properties so it can be used as a barrier in the process of coloring batik. The use of the natural ingredient makes cold wax environmentally friendly, not harmful to health, and safe to use by anyone, including children. This research is a qualitative research with an exploratory method, through literature studies and direct experiments on the use of gutta tamarind as a medium for batik painting. The purpose of this study is to further inform the role of tamarind paste or gutta as an environmentally friendly material that functions as wax in the process of batik making, and compare it with traditional hot batik wax.

1. **Introduction**

Batik is one of Indonesia's cultural heritages with existence has become an identity and is inherent in the daily lives of Indonesian people, even the world. UNESCO has also established batik as an Indonesian cultural heritage, an intangible cultural heritage recognized by the world. In its development, batik is no longer just a cloth worn in certain traditional events, but its use has widely spread for various purposes. According to the 5th edition of the Big Indonesian Dictionary (KBBI), batik is interpreted as a pictorial fabric made specifically by writing or applying wax on the fabric, then undergo a certain process. On March 12, 1996, at the National Seminar on Batik in Jakarta, a national standard was applied on the understanding of batik. Batik is interpreted as a fabric that uses wax as a media to cover the surface during the dyeing the process [1]. Based on this understanding, then if a patterned fabric is processed using wax in the making, it is considered batik. While a piece of cloth, although having pattern of batik, cannot be called batik if it does not use wax in the coloring process, instead it will only be called as batik-pattern fabric. Based on this, it can be concluded that the core of the understanding of batik lies in the use of wax.

One of the batik-painting techniques that continue to develop is painting on textiles using cold wax. The cold wax functions as a color barrier on textiles/fabric, therefore it resembles the traditional technique in a simpler process. Unlike the traditional process, making batik with cold wax does not use heated wax and canting, but inscribing a paste from the mixture of several ingredients replacing the...
heated wax. That is why this process is called the process of making batik with cold wax. The basic ingredients developed as the main material in making cold wax are a mixture of seaweed, CMC (carboxymethyl cellulose) and glutinous rice flour, also a mixture of tamarind seed powder with vegetable fat (margarine) and water called gutta or gutha tamarind. The use of tamarind seed powder as the material for cold wax has been shown to hinder color on the surface of the fabric, as well as using hot wax. However, based on the results of the study, the use of hot wax on batik as a waste product (non-product output) can cause environmental pollution, even the smoke from heated batik wax can cause health problems. The World Batik Summit 2011 held in Jakarta has produced a joint declaration, in point number 5 which states; the Indonesian Batik industry must be based on the protection of nature and the environment, as well as research on the supply of traditional natural dyes in large quantities is important to be encouraged. Another advantage of using gutta tamarind is the environmentally friendly ingredients. The coloring process is also more varied, which can use disperse dyes or natural dyes depending on the fabric type. The results of this process are batik paintings that tend to be more expressive and not bound by certain rules, a contemporary batik. This study aims to further inform the role of tamarind paste or gutta (gutha) as an environmentally friendly material in its function as wax in the batik painting process compared to traditional batik wax.

2. Research methodology
This is a qualitative research with exploratory method. Explorative methods are studies by tracing, especially in consolidating concepts that will be used in a wider scope of research with greater conceptual reach [2]. Explorative methods are used to formulate and define problems, construct hypotheses based on existing data or theories [3]. Explorative methods can be done in two ways, namely literature review and experience survey. The purpose of the application of this exploratory research is to make the topic of the use of cold wax made of environmentally friendly gutta tamarind to become more well known to a wider community, by providing a basic description of the characteristics and its implementation in batik painting, and comparing with other batik wax so that it can be known the advantages and disadvantages of this material. In addition to literature studies, this study also conducts direct experiment regarding the use of gutta tamarind as batik painting media. The results are then analyzed and delivered descriptively to produce a conclusion. Explorative research is important because it will produce a strong foundation for further research.

3. Results and discussion
3.1. Characteristics of Tamarindus indica L
Tamarind (Tamarindus indica L), also known as Javanese Tamarind, has physical characteristics in the form of fruit pods, almost cylindrical, bent or straight, up to 10 seeds, often with a narrowing between two seeds, hard skin in brown color or gray with scales, with veins that are hardened and are threadlike. The color of the flesh is greenish when unripe, and then turns brownish red to blackish when ripened, with sweet and sour taste, also sticky. The shape of the seeds is rather square, blackish brown, shiny, and hard [4]. Tamarind trees are often found in India and are known as a multipurpose tree. The tree is a large evergreen tree with a beautiful crown, planted throughout the country, except the Himalayan Mountains. Almost all parts of the tree are useful, for example as food, chemicals related to the pharmaceutical and textile industries, as well as wood and fuel [5]. Tamarind seeds have a 30% share of the whole fruit. The seed contains a large polysaccharide content, around 50% -60%. Polysaccharides are very important for medicines and other benefits. One of them, polysaccharides can also be used in the textile industry as an adhesive or reinforcing fabric fibers [6].

3.2. The process of making tamarind flour
Currently tamarind seeds that have been mashed into flour or tamarind seed powder are very instrumental in the Indonesian textile industry, namely as textile printing thickener. The process of
making tamarind seed flour begins with sorting and selecting the seeds to collect good quality seeds with same size, not deformed. Then the seeds will be soaked for 2-3 days to identify the young seeds. After soaking, the seeds are drained to reduce the moisture content, followed with peeling the skin. The next step is roasting at 110°C for 3 hours, then grinding. The filtration process can be done to acquire cleaner flour [7]. Unfortunately, the needs for tamarind flour is still imported from India, even though Indonesia is a potential producer of Javanese tamarind fruit, especially in the regions of Madura, Mojokerto, West Nusa Tenggara and East Nusa Tenggara, and throughout Central Java including in Pekalongan Regency.

3.3. Gutta tamarind

The polysaccharide content in tamarind seed as a good coagulant (simplifying or accelerating the thickening process) later inspired Niken Apriani, a junior high school teacher at that time, to use it as a cold wax ingredient. In the beginning, Niken, who was already engaged in batik painting, was familiar with cold wax made from urea fertilizer. However, due to limited raw ingredients, she then tried to make a cold wax in the form of pasta (gutta) with a mixture of tamarind flour, margarine, and water. The mix came to be known as gutta tamarind. The term gutta or gutha comes from Hindi (India), meaning sap.

Gutta tamarind then became one of the batik painting media that are widely used as a substitute for other types of wax because it is more practical and easier to make, even many have been sold in ready-to-use form. Aside from being the raw ingredient for cold wax, tamarind flour is also used as a thickener to produce fabric stiffness and color strengthener, as it works better compared to other commercial products on the market. One of the communities that actively introduce batik-painting techniques with gutta tamarind to the society is the Komunitas 22 Ibu, where Niken Apriani is one of the activists. Through workshops and exhibitions in the country and abroad, the community invites people, including children, and introduces batik techniques using cold wax with an aim to preserve the tradition of batik.

3.4. Cold wax gutta tamarind vs traditional hot wax and its impact on the environment

The process of painting batik using gutta tamarind is almost the same as the process of making batik in general. The difference lies in the wax used. In the traditional batik process, batik wax used is in the form of solid chunks, which later melted with a heater (small stove) and then inscribed on fabric using a canting. The first thing to prepare in making batik painting is the dough to make gutta tamarind, consisting of a mixture of tamarind flour, vegetable fat (margarine) and hot water, with the largest composition of tamarind flour. After the mixture is evenly mixed, add more plain water until a certain thickness is obtained. To maximize the dough adhesion, it should be stored for one night before using. The thickness of the tamarind paste that fits is one of the key success factors for the cold wax to function as a color barrier. The next process is to put gutta tamarind into a piping bag (plastic triangle) and inscribe it onto the fabric that has been sketched. This process requires high concentration and perseverance because the thickness of the gutta tamarind must be maintained to produce a consistent and unbroken line. After leaving it for a while until the wax dries and adheres completely, the next process is to color the empty part that has been lined by gutta tamarind.
In the traditional batik process (using hot wax), batik wax functions as a resistance (reject) to the color given to the fabric for the next process. Sticking the wax on the fabric to make the desired batik motif is done by incising the wax using a canting or by using a canting stamp. In order to be incised on batik, the batik wax needs to be heated first at a temperature of ± 60°-70°C. The heating process of the batik wax turns out to cause pollutants contained in the smoke namely NO\textsubscript{2}, SO\textsubscript{2}, CO, CO\textsubscript{2}, HC, H2S gases, and [8] particles, and are harmful to workers and the environment. A study conducted on 327 workers exposed to batik wax and gas fumes released by heaters caused pulmonary disturbance by 20.7% with details of obstruction 11.8%, restrictions on 7.8% and 1.1% combinations. Pollutants if inhaled by labor will cause acute and chronic damage to the lung tissue, depending on the concentration of pollutants, duration of exposure, and body vulnerability. If this process lasts long, it can cause occupational diseases. Pollutant gases are irritants to the respiratory tract, especially SO\textsubscript{2} and NO\textsubscript{x} gases. The concentration of pollutants is influenced by the levels of these ingredients. If inhaled, it can cause abnormalities in the respiratory tract in the form of decreased levels of VO\textsubscript{2max} and respiratory complaints [8,9].

The traditional batik coloring process generally uses synthetic dyes because it is easy to obtain also produces bright colors. As example are indigosol, naphtol, and indanthrene that used by the batik Trusmi industry. The use of synthetic dyes and other processes in the manufacture of batik such as wax removal, washing, soaking, and rinsing will produce waste or liquid waste containing dyes and oils [10]. These chemical dyes are not environmentally friendly. Besides being harmful to humans, naptol and indigosol dyes can cause organisms in the water to die. In addition, batik dye chemical waste can make river water dirty and polluted. If the waste is not treated properly, then it can exacerbate environmental pollution. From the health side of workers in the batik industry, at the coloring process health complaints that arise are itching on the surface of the hands and feet skin, thinning of the epidermal layer caused by the use of staining without the use of adequate personal protective equipment, such as; gloves and boots, so that chemicals are directly exposed to the workers' skin. The use of chlorine as a cleaning agent after exposure to dyes causes thinning of hands and feet skin of the batik workers [11].

**Figure 1.** (a). Tamarind seeds before processing, (b) after becoming flour, (c) and after becoming gutta.
The coloring process in batik painting with *gutta* tamarind is the same as painting on canvas using a brush. Dyes used are not limited to certain types of fabric. Fabrics made from natural fibers can use natural dyes such as *suji* leaves (*Dracaena angustifolia*), turmeric (*Curcuma domestica*), mangosteen peel (*Garcinia mangostana*), secang (*Caesalpinia sappan*), and so on, while for synthetic fiber types textiles can use disperse dyes. Disperse dyes are organic dyes made synthetically, which are not soluble in water but are easily dispersed or suspended in water. The dyeing process must use high temperature with thermosol process [12]. Painted batik is batik that has a free pattern that does not have a certain bond like traditional batik. The coloring of painted batik is free, diverse and not tied to the color of *wedel* blue (blackish blue) and *soga* brown. Creating color according to new styles will produce a beautiful and dynamic arrangement that requires artistic power [13]. To make the wax and dye adhere more perfectly, the finished painted batik is flip over and ironed at a moderate temperature. But for certain types of dyes, this process is replaced by steaming for approximately one hour. The final stage of the batik painting process is removing the wax by washing (without rubbing) under running water. The process of painting batik with *gutta* tamarind does not require several times of dyeing as does the process of batik in general, which usually will produce waste that if not managed properly can potentially cause environmental pollution.

In the traditional batik process, there are stages of removing batik wax which is the work of partial removal of certain places by crushing (whining) or removing entirely by means of "melorod" (also called: *nglorod, ngebyok, mbabar*). At the end of this process, there is still a lot of waste from the process (non-product output) that can actually be reused but still wasted into the environment thereby increasing the potential for pollution. At the wax removing process (*pelorodan*), health complaints were found in the form of shortness of breath, and heavy chest, watery eyes, and obtained a sample of batik workers at this stage experiencing anatomical defects in the form of lordosis and kyphosis. Complaints of shortness of breath and heavy chest also occur due to wax melting steam and biomass produced from the wood burning process used for melting wax [14]. In batik painting that uses cold wax, the use of tamarind flour as the main raw ingredient for cold wax is quite safe for the environment because during the washing process, the *gutta* tamarind that has been released from the fabric will dissolve into water without producing waste.

### 3.5. Batik painting *gutta* tamarind

Batik painting techniques with *gutta* tamarind continue to be explored until later applied in the development of contemporary batik art. There are several things that still need to be improved in this technique, including the use of detailed and small shapes that have not been able to produce maximum shape, if the *gutta* mixture is too thick or thin then the color can still be mixed or passed through the
pattern, and its application is still limited to the product which is displayed or used but with special treatment.

Paintings produced with this technique do not always follow the standards in the rules of making classical batik art but rather are more expressive and have messages and meanings that are easier to understand. Through this technique, which became known as *gutta* tamarind, the wider community and even children can learn the process of making batik in a simpler way and can express their imagination more freely. The end result of this painting technique with *gutta* tamarind can be a painting that can be enjoyed through its art expression. In *Komunitas 22 Ibu*, the batik that was produced was not just a painting, but carries a visual message about folklore, the animal world (fables), and local wisdom. Through several exhibitions held by this community, the batik paintings displayed always convey messages about the richness of the archipelago's treasures and of course about the use of *gutta* tamarind in these paintings. It aims to be an educational media for the community to love their culture and at the same time build awareness to protect the environment by using environmentally friendly media.

4. Conclusion
The use of *gutta* tamarind as a cold wax in the process of painting batik is an exploration and experiment in the effort to preserve batik. By using gutta tamarind, batik-painting technique becomes simpler and provides freedom of expression. The technique needs to be developed continuously in order to create a simpler basic technique without diminishing the essence of batik, which was previously made in a more difficult process. Another foundational factor to continue the development of this technique is the use of natural material in gutta that is safe to use by all ages, and the coloring and washing process that do not interfere with health and pollute the environment.

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