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A Review on Sustainable Development and Heritage Preservation and its Conceal Detrimental in Batik Dyeing

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Abstract. Sustainable generally refers to maintain, preserve and balance the ecological by avoiding depletion of natural resources. Sustainable puts the construct plan involved in economic growth, social progress and environmental protection which also imply in heritage preservation. However, the imbalance pillar towards the demand of the batik deteriorate the ecology despite of increase in demanding this prominent artefact. The methodology of this study used content reviewing by referring the previous study, texts and discussions. This paper aim is to bring up the issues on the use of synthetic dyes in batik dyeing that can harm the people and environment, but it initiatively can be overcome by using sustainable strategies – cradle-to-cradle. Therefore, the introduction to the use of natural dyes for batik dyeing initiatives may lead to the awareness and knowledge about eco-friendly dyeing and exposure to local wisdom dyeing process.

1. Introduction

Sustainable development briefly contributes to the balance systems of human demanding towards the economy profits, social status and probably environmental neglecting [1]. Meanwhile, heritage preservation is an alternatives taken to remain the cultural resources including tangible and intangible materials from folk-life community [2]. Both approaches have the same aim – remain the value things continuously for the long term usefulness and memorial local knowledge practices. Therefore, Malaysia inevitably also active being part in the international sustainable activities by participating 13th session of the commission on sustainability in New York [B. Bakhtiar & R. Ibrahim in [3]] and also incorporated of Sustainable Development Goals (SDGs) in economic planning process [4]. In addition, the implementation of policies through the National Heritage Act 2005, Creative Industry Policy 2008 and Malaysia Vision 2020 are some of the government concern towards enriching both sustainable development and heritage preservation. However, the execution might be covered several profitable heritage materials like monument sites, cultural landscape, community products – batik, songket, embroidery – instead of the traditional practiced and processed that also can contribute to detriment generation for the time being in future.

Literally, arts consist of values that can be exemplified and guarded significantly for cultural identity, then it indicates the potential for the economic development. In glance, batik is traditional textile vigorously practices and produces in East Coast of Peninsular Malaysia which is in Kelantan and Terengganu. Batik as well has been recognized as Malaysian heritage products by the government.
However, in our praise and appreciate heritage into the local and global market place – as steps in revitalizing the material culture among the generations. The problem emphasized in this paper, there is imbalance implementation in batik processes which is the use of materials and surplus of its productions which deteriorate the ecology systems. To what extend this material culture and art ‘preserve’ the environment in the fulfillment of social needs through economic pressures. Therefore, this paper discussed the effects obtained from less - controlled process of batik productions and thus, directs the use of alternative materials of natural colourant in batik dyeing.

The issue towards preserving environment and heritage has been discovered through the batik dyeing process. In this paper context, heritage and material culture emphasizing and referring to the batik dyeing process practiced in Malaysia. It consists the debated thought between relying the heritage for economical advantage or preserving the environment with limiting the production demand of heritage products. This paper prompt to review the techniques and material used in every stage of batik dyeing process and it extensively identified the caused due to the uncontrollable practices in batik dyeing. Moreover, it briefly shows the detriment effect of being exposed and excessively used the chemical substances to the vicinity and batik dyeing practitioners. Therefore, it is very significant to review the idea of heritage preservation towards sustainable development in batik dyeing process through possible risk to create the awareness for implying the natural dyes as alternative and enhance the eco – friendly procedures in batik dyeing process.

2. Literature Review

Generally, it is a glance of concern and aware relate to the responsibilities towards the questions of cultural heritage roles and how it copes with the sustainable development concept. Therefore, defining the sustainable development in the perspective of preserving traditional batik dyeing will introduce the imbalance of maintaining culture without considering the element of socio-economic and ecological consequences.

The term of sustainable development has numerous definitions that has been argued, used and applied according to the area of study. It was identified as the complex and multi domain issues that emerging the competency, values and intergenerational equity in balancing the social, economy and environment [5]. Inevitably the definition of sustainable development from the Bruntland Report in 1987, as ‘the need of the present without compromising the ability of future generation to meet their needs’ has been used to initiate the platform of discussions [6]. Whilst, it also understood as a holistic meaning which ‘… an attempt to combine growing concern about a range of environmental issues with socio – economic issues’ [7] literately leads to satisfying the three pillars of sustainability for more sustainable future and bring them towards the idea of equilibrium concern, even though it cannot imprecisely help all to agree the goals [8,9]. Moreover, the acceptance of sustainable development also depends on the involvement and positions they take and not just influences by ages [10]. Therefore, the sustainable development can be derived as the way of monitoring the activities to ensure the limitation of the preserving not only purposely towards the only one element but conducted with fairer.

Meanwhile, heritage can be defined as broad as ‘something inherited’ [11]. United Nations Educational, Scientific and Cultural Organisation (UNESCO) and World Heritage Convention [WHC] describe heritage as the tangible and intangible for the past relics that is still practiced and become part of the societies’ cultural life [12,13]. In Malaysia, the policy towards the heritage comes with National Heritage Act 2005 (NHA) written by the Badan Warisan Malaysia (The Heritage of Malaysia Trust) to protect and preserve the heritage. Meanwhile, it is an official documents of heritage protection that inclusively considered the local community, its background, environment, legends, myths, infrastructures and socio-economics [14]. The term of heritage can be interpreted as the inherit treasure [15] with recognition as representatives and highly valued [16]. Heritage may memorialize as tangible or intangible communities ‘things’ with full of local knowledge, experiences and skillfulness [17]. Besides, the way of preserving heritage determined the quality of life with the value and pride expressiveness [18]. Therefore, heritage consist the peoples’ culture relates to the people life which have
been developed thousand years before and there is no hesitance in inheriting the ideas, actions and artefacts directly or indirectly.

2.1 Issues Towards the Sustainable Development and Cultural Heritage
Sustainable development and cultural heritage may have mutual equity on the preservation issues. It tends to have same intention in preserving something for the next generations with the better living system and undeniable precious heritage entwined. Cultural heritage is part of communities’ life that has been created and constructed for its identity and memorial to get sustain in this current globalization [19]. Therefore, communities tend to suit their culture by the concern of time and changes [20]. However, unparallel practices have been manipulated the sustainable development principles to get the hidden trade-off opportunity intrinsically using the cultural heritage for economic values [1]. Then, it emanated the mass production industrial to fulfil the market demands but play the role on behalf of reviving the cultural heritage.

Nowadays, it is irrefutable towards the growth of cultural heritage revitalization and preservation awareness, meanwhile it also has highly potential in contributing to the socio-economic development. Cultural heritage encapsulates the significant ideas of local knowledges through centuries then continuously being referred until today’s generation and usually practically used as need. The need defines as the basic necessary consist of clothes, food and accommodation. Clothes which functional as the need for covering and protecting human skin [21], but the influences of globalization in economic and society has commonly intimate ties with the process and products using chemical substances [22]. While in Malaysia, one of the prominent traditional textiles that has been used over decade is Batik and there are various efforts from diverse organizations to encourage new generations in utilizing the function of Batik. Cultural heritage has been studied to retain its material culture effectively by having the religion activities and economic involvement [23,24]. However, the situation of 1) preserving heritage and 2) environmental degradation consequences from the process of heritage artefacts have been manipulated for economic and creates imbalance circulation of the living systems.

2.2 Batik
In Malaysia, one of the local textiles that must be practiced using knowledge and skill is Batik. Batik is one of the techniques in decorating textile surfaces. The main material used in this technique is wax. It functions as a resist or ‘wall’ or ‘tembok’ to avoid the designed area being coloured. Design with wax can be drawn using tools like ‘tjanting’, brushes and stamp block [25]. The production with the concept 1] resist technique and 2] design using the batik technique will be recognized as batik and otherwise will considered as batik inspirational [26]. The definition of batik derive from the word ‘ambah’ means carpentry works and ‘titik’ as dots drawing [27–29]. The dots perceived in very fine and closed lines follows the sketch on the fabrics and shows like a line drawing. However, usually batik pattern drawn in lines and imitating or developing designs with flora and fauna motifs.

Batik craftwork is one of the skills that has been practiced for approximately 2000 years in various countries like Malaysia, Indonesia, Thailand, Japan, India, Africa and Nigeria [30]. The resist technique not only known as ‘batik’ but different name taken by because of the language and materials used. They uses starch or flour as the resist media to decorate their textiles – In Nigeria known as adiri eleko and in Japan known as Tsutsugumi and Katazome [25]. Batik applied in textiles show two dimensional productions as appropriate functions with the people. Batik commonly applied on textiles and being used as kain sarong, kain Panjang, batik kain ela and also for the interiors like cushion cover, soft furnishing, blankets and various decorations [31]. In Malay clothes, royalties and noble people will wearing batik coloured with yellow background and black full meaning motifs [32]. Meanwhile, for the citizen batik become the clothes for fishermen and farmer. They tend to use this multifunctional batik sarong or batik panjang to cover their bodies and wiping sweat from the daylight [33,34].
3. Methodology
In order to see the review of consequences contributes along the batik process, it has been discussed according to previous studies and has been listed the materials used and its detriment effect towards several stakeholders as mention in analysis and result.

4. Analysis and Result
Analysis and Results involve discussion towards the batik process and its detriment caused by the material used along the process.

4.1 Batik Manufacturing Process
Batik requires three [3] basic ingredients which are fabrics, wax and dyestuff [30]. However, these materials will give different impact and appealing with various types of fabrics, sketching or designing pattern on fabrics, applying wax, colouring, fixing and wax removal with boiling solutions water, rinse and dry the fabrics [35]. Other than the whole process of making batik, one process which determine the vital and vibrant reflects on fabrics is colouring or dyeing process. After 1920, the year of synthetics dyes was introduced among the batik practitioners, the dyeing process may come in two choices which are 1] natural dyeing and 2] reactive dyeing for fulfilling the consumers demands and embark the local products into mass productions [31]. Therefore, the inference towards the consumer demand can vary with the contamination processes is possibly positive. The conventional batik in the early making used materials from surrounding and consumers demand based only for the need. However, the highly demand increased the production without considering the environment consequences but emphasizing on the good value for money.

Table 1 shows the materials used in the production lines of making textiles with batik. The process initially starts with fabrics treatment. Selected fabrics will be washed with chemical solutions like sodium carbonate or detergents with hot water implied for removing stains from fabrics. Meanwhile, batik can be manipulating into several techniques to make various designs. Techniques of batik consists stamp batik, hand drawn batik, screening batik, marbling, tie and dyes and discharged (show in Figure 1). Materials used along the batik preparation usually involves with the physical and chemical substances like paraffin and resin, photo emulsion, sensitizers, sodium silicates and hydrochloric acid.

| Process            | Techniques       | Materials Used                                      |
|--------------------|------------------|----------------------------------------------------|
| Fabrics Treatment  | x                | : Fabrics                                          |
|                    |                  | : Sodium Carbonate (Soda Ash)                       |
|                    |                  | : Detergent                                        |
| x Batik Tjap       | (Stamp Batik)    | : Wax (Paraffin and resin)                         |
|                    |                  | : Oil                                              |
| x Batik Tjanting   | (Hand Drawn Batik)| : Wax (Paraffin and resin)                         |
|                    |                  | : Oil                                              |
| x Screening Batik  |                  | : Photo Emulsion                                   |
|                    |                  | : Sensitizer                                       |
|                    |                  | : Cold Wax                                         |
| x Marbling         |                  | : Synthetics Colour Solutions                       |
|                    |                  | : Sodium Silicate                                  |
| x Tie & Dye        |                  | : Synthetics Colour Solutions                       |
|                    |                  | : Sodium Silicate                                  |
| x Discharged       |                  | : Hydrochloric acid                                |
| Colouring/Dyeing   | x                | : Naphtol (Caustic Soda, Hydrochloric Acid)         |
|                    |                  | : Remazol                                           |
### Process Techniques Materials Used

| Fixing | x | Sodium Silicate
|        |   | Mordant

| Boiling | x | Sodium Carbonate (Soda Ash)

**Figure 1.** Batik design with several techniques practiced in Batik industries in Malaysia. Photo shows [a] batik stamping, [b] hand drawn batik, [c] batik screen, [d] marbling batik, [e] tie and dye technique and [f] discharge technique in batik.

Dyeing and colouring textile surfaces always occupied a unique place in textile processes. The application of the dyestuff has been considered as a craft or an art in decorating and vitalize the colour of the textile’s surfaces. In Malaysia, batik dyeing practices into 1) natural dyeing and 2) reactive dyeing. Natural colourant need to use stabilize agent namely mordants as a fixatives to bind the extracted colours with the textiles surfaces and giving the different colour swatches according to the mordant used. The process of natural dyeing for textile colouration should be practiced in eco-friendly and eco-effectiveness which avoiding any harm towards humans and environment. However, unfortunately, because of the poor light stability and colour fastness, mordanting process has been replaced and manipulating with chemical substances like Iron (II) Sulphate, Potassium Dichromate, Aluminium Potassium Sulphate, Copper (II) Sulphate and Iron (III) Sulphate.

Meanwhile, the turbulence changes in technologies give highly opportunities in creating innovation and it is undeniable for batik dyestuff. The aim is to get the vital and vibrant colours with fast reaction and low cost in production. The products come in crystalline powder like naphthol, anthrosol, Remazol, Primazin, Hoecht, Sumitomo, I.C.I. and Benh Mayer. In order to use naphtol dyes – this dye is in azoic class, it is not ‘readymade’ dyes but have to be formed from two components. The composition used in preparing naphtol dyes are dekol oil, coastic soda, acid and base or ‘salt’. Naphtol dyes has limited colour range and its applications are complex. However, the combination of salt give the results of deep orange, red, scarlet and Bordeaux shades with excellent wash and colour fastness. Remazol® is a brand for reactive dyes and also known as vinyl sulfone dyes. It has multiple fascinating colours of Remazol Turquoise Blue G133, Remazol Red 194, Remazol Yellow 14 and many more. Dye bath with Remazol colouration undergo the process of fixative with sodium silicate for 4 to 8 hours to remain the colour on the fabrics. In the nutshell, generally
batik productions involve chemical solutions to form an attractive colour on textiles and mostly meet the demand of the consumers.

4.2 Detrimental Effects

Globally, textile industries reported to be one of the contributors towards wastewater pollution and water consumption [45]. Textile business like batik industry not one excluded from the water and environment issues. Batik industry consumes great amount of discharged effluent throughout colouring and finishing operations. The impurity of factories and entrepreneurs discharges the wastewater contain vast amount of untreated synthetics dye [39] like azo dyes, heavy metal solutions, strong colours and dissolved solid poses a threat towards vicinity, people, and environmental safety with continuous and exceed exposures [39,46–49]. Today, ‘protection of the environment’ become a challenge in chemical industry [50]. The traditional textiles like batik most practically and practices with synthetic dyes in their fabric’s treatment, dyeing and finishing processes. Then it becomes one of the most chemically intensive industry that contribute to number one polluter of clean water [51]. And surprisingly, the report in Eco-Textile [52] in Business Week article assume that ‘the population that is allergic to chemicals will grow to 60 percent by the year 2020’ [53].

The process of batik making was distinguished and summarized in the view of its detriment and causes [show in Table 2]. The long-term, excessive exposure towards the chemical substances without correct handling will lead to damage and harm for both practitioners and environment. In sight of the expert gives severe effect that can cause sudden and long-term injuries to human and environment pollutions. Table 2 shows the several chemical substances used along in the batik processes and its risk towards the negligent action. Therefore, this paper highlighted the risk that may contributed from our heritage products, whereas it can also create awareness into the safety and health environmental in pursuing batik dyeing process [54].

Table 2. Summarized process of batik making

| Materials          | Application in Batik Industry | Risks                                                                 | References |
|--------------------|-------------------------------|----------------------------------------------------------------------|------------|
| Caustic Soda [NaOH]| : Naphtol dyeing.             | : Dermal Exposure - cause nasal irritation, pneumonitis, edema, dermatitis, burn and chronic eczema. | [55]       |
|                    | : Fixation for reactive dyes. | : Contact with eyes - can cause in ulceration, perforation, opacification and blindness. |            |
|                    | : To control the pH value.    | : Inhalation or ingestion – can damage the respiratory, coughing, breathing difficulty and might esophageal cancer. |            |
|                    | : Bleaching process with Hydrogen peroxide. |                                                                       |            |
| Hydrochloric Acid [HCl]| : Apply in discharge technique. | : Exposure to high levels – can cause blindness, rapid breathing, swelling and some may develop asthma. | [55]       |
|                    | : Naphtol dyeing.             | : Long-term exposure – respiratory problems, skin and eyes irritation. |            |
|                    |                                | : Contact with HCl tend to lead a serious burning of the skin.          |            |
### Materials Application in Batik Industry | Risks | References
--- | --- | ---
Sodium Carbonate (\(\text{Na}_2\text{CO}_3\)) / Soda Ash | : Bleaching process in removing fabrics stains. | : Inhalation – causes irritation to the respiratory tract. | [55]
 | : To remove wax. | : Large doses may include severe abdomen pain, vomiting and diarrhea. | |
 | : Improves the substantivity of the dyestuff during the dyeing process. | : Excessive to skin contact may cause irritation with redness and acute. | |
 | | : Contact to eyes may be corrosive to eyes and corneal destruction. | |
Sodium Silicate (\(\text{Na}_2\text{SiO}_3\)) | : Involve in marbling technique. | : Excessive contact to skin can lead to chronic recurrent ulcerative lesions. | [55]
 | : Fixing agent for reactive dyes. | : Contact to eyes directly can cause severe irritation, pain and burns. | |
 | | : Can cause fibrogenesis in lungs. | : Can cause immediate pain and severe burns of esophagus. | |
Batik dyestuffs | : Apply in colouring textile surfaces as reactive dyes. | : Inhaling, skin contact, and long-term exposure can lead to fatalities. | [55]
| Naphtol, Remazol | | : Can cause skin irritation and eczema, eye itching, sore throat. | |
Wax (combination of paraffin and resin) | : Applied on textile surfaces as resistance agent to dyestuff and form designs. | : This is suspended solids. | [49]
 | | : Can cause sludge and anaerobic condition to environment. | |
 | | : Hot wax may cause odour problem and burn to direct skin. | |

### Discussion

#### 5.1 Sustainable Strategies for Malaysian Textile Industries

Sustainable strategy bring objectives of integrating social, economic and environment by firmly concern towards their implication for different socio-economy groups and continuously for future generations [56]. The strategies will implement the way to reduce, reuse, conserve and preserve as an alternative to let the cultural and environmental need being sustain and survivable [57]. The effective sustainable strategies always be encompassed with the practices taken by the practitioners and organizations [58]. Practices consist the processes of ‘making’ from cultural material or modern products, yet to meet the customers need. In consequences, today’s process focusing on chasing economic growth, satisfied social wants and neglecting the deteriorate environment. Therefore, sustainable strategies in this paper goes to the awareness using the alternative materials in re-practicing batik dyeing by production dyeing from nature.

Inevitably, the issues of practicing batik dyeing in industries widely discussed about low environmental awareness among batik entrepreneurs [59]. Moreover, it tends to get low level implementation among them towards the ‘green batik’ [60]. Instead of insufficient knowledge towards awareness and implementation about handling eco-effective batik dyeing, the vicinity community also having shallow awareness about the impact of manufacturing using synthetic dyes and uncontrollable batik disposal [61]. Therefore, the introduction to the alternative materials for dyeing process need to be referred as one of the precious local knowledge materials and biodegrade for biological system and
technical nutrient tend to continually circulate and giving valuable nutrient to vicinity communities and environment [62].

5.2 Achieving Sustainable Strategy through Natural Dyeing Procedures

Batik usually referred and recognized by the process of applying wax as design on the textile surfaces. The process of batik dying consist several materials namely wax, paraffin, fixation agents and moderants [63]; some techniques like batik stamps, screening batik, drawn batik, overlapping design and colours, marble [40]; and procedures as the way to decorate the splendid traditional textiles. However, the introduction towards the innovation and technology has owed the long process, not uniform coloured which leads to deterioration of traditional textile dyeing knowledges [63]. Several studies has been discussed towards the sustainable textile dyeing by using eco-friendly auxiliary chemicals [63,64], strategies including the sustainable prospects using natural colourant [65,66] and modelling green batik industry procedures [60,67]. Therefore, the approach of using natural materials in dyeing textile for batik is the kick off towards sustainable strategy.

Instead of sustainable concerned, this is an appropriate approach to remain, revitalize and disseminate traditional knowledge of natural dyeing on textiles. Figure 2 shows the general ideas of batik making procedures with natural dyeing implementations as it emerging traditional batik process [29,40] and sustainable batik process model [60,68,69].

![Figure 2. Batik making procedures with the natural dyes’s implementation process.](image)

Batik and dyeing process start with the fabric treatment (a). Fabrics was scoured and bleach to remove all the stains, impurities and starch using non-ionic detergent or soaking in the hot water for 20 to 30 minutes [70–72]. The main material to produce batik is wax. Heated wax inserted into tools name ‘tjanting’ or ‘canting’ – a small copper cup with handle – functioning like a pen to draw designs on the textile surfaces (b) [30]. There are no materials limitations to develop the designs using natural colourant. Instead of designing with wax, it can be experimentation on techniques using tie and dye and plain dyeing.

Dyeing process (c) consist variant techniques and materials to embark the best colourant on the textile surfaces. Therefore, non-soluble dyes or chemical colour take over the textile colourant because of mass production effectiveness and attractive admire colours to consumers [73,74]. Natural dyeing process involve the materials from plants, animals, minerals and insect (c1) [75]. Usually plants from surrounding are used to be extracted as dyes using conventional method of boiling, fermented or blended (c2) [76]. The dyeing process (c3) comes after the materials extractions and bind with the aqueous solutions called mordant. Mordant is the fabrics treatment agent used to fix the dyes with the textile fibres [77,78]. The emergence extract solutions and mordant derived the colours with the trial and error experimentation [25]. Occasionally, the use of mordant mistreated because of the dull colour and low colour fastness in natural colourant [79]. Some practitioner used chemical mordant like copper sulphate and iron to prolong and giving vibrant colour to natural dyes [78].
Besides, nowadays the awareness towards the eco-friendly mordant ascending and being used without worries. There are citrus from lemon [80], alum and wood ash [81], myrablan fruits, eucalyptus bark [82], averrhoa bilimbi [83] and many more. Positively, the husk and the waste water from the natural colourant production possibly are biodegradable and provides biological nutrient towards the environment (c5) (c6).

Animals and plants got benefits from the waste materials and its more valuable when there are less irritating effects on human and environment vicinity [65,84,85]. Then the wax on the textile were boiled in hot water until all the wax removed from the textile surfaces (d). The treated wax can be re-used and rotary the process of batik making [86]. Therefore, the process of using natural materials as natural colourant giving the idea of approaching green vision and mission that supporting and balancing the pillar of sustainable development.

6. Conclusion
As a conclusion, sustaining the inherit batik textiles through the traditional process gives positives efforts towards the economic growth. Besides, the detrimental effects towards human and environment can be reduced efficiently. The use of synthetic dyes nowadays in complying with the demand and fast technologies giving intense challenges for natural colourant especially in coping with the durations process. It is not deniable to take synthetic dyeing into marketplace for economic gain, but, the consideration towards the sustainable development may bring the equilibrium in environment. The various techniques must be trained and practiced to possible parties involved in the batik industry even though it might be high in cost. Meanwhile, program and experimentation may aware and lead the use and take better precautions in handling every step-in batik production. Hence, the sustainable of heritage just gives a platform for social and economic growth to build the development needed and take a good care of the environmental wisely.

References
[1] Wai-Yin C, Shu-Yun M 2004 Heritage preservation and sustainability of China’s development. Sustain Dev.
[2] Shaari N. 2015 Indigenous Knowledge Creativity in Batik Cultural Product based on Kansei. In: International Conference on Social Sciences and Humanities (ICSSH’15). Bali, Indonesia; 2015. pp 56–60.
[3] Saadatian O, Haw L C, Mat S, Sopian K, Dalman M, Salleh E 2011 Chem Biol Environ Cult. 2011 138–143.
[4] Economic Planning Unit 2017 Sustainable Development Goals Voluntary National Review 2017 High-level Political Forum. Putrajaya
[5] Ciegihs R, Ramanauskiene J, Martinus B 2009 Econ Cond Enterp Funct 62(2):28–37.
[6] Emas R 2015 The concept of sustainable development: definition and defining principles Brief for GSDFR
[7] Hopwood B, Mellor M, O’Brien G 2005 Sustainable Development : Mapping Different Approaches. Sustain Dev. 13(1) 38–52.
[8] Abas M A 2018 J Waste Manage Xenobio 1(2) 000107.
[9] Adams W M 2006 The Future of Sustainability: Re-thinking Environment and Development in the Twenty-first Century. The World Conservation Union.
[10] Joseph C. 2014 Soc Resposibility J. 9(3) 441–53.
[11] Dewan Bahasa and Pustaka 2010 Kamus Dewan Bahasa dan Pustaka. 4th ed. Baharom N, editor. Selangor: Perpustakaan Negara Malaysia; 2010. pp. 1801.
[12] UNESCO World Heritage Centre 1997 Operational Guidelines for the Implementation of the World Heritage Convention Paris
[13] UNESCO 2006 Understanding Creative Industries. Cultural statistics for public policy-making. Int Stud.
[14] Yusoff Y M, Dollah H, Kechot A S, Din M A O 2010 Pembangunan Warisan di Malaysia:
Tinjauan Umum Tentang Dasar. *J Melayu* 5 277–83.

[15] Jabatan Warisan Negara 2012 *Garis Panduan Pemuliharaan Bangunan Warisan* (Kuala Lumpur: National Heritage Departement)

[16] Marmion M M 2012 *Understanding heritage: multiple meanings and values* (Doctoral dissertation, Bournemouth University, School of Tourism)

[17] Ramli Z 2015 Kelestarian Warisan Semula Jadi di Malaysia: Peranan Jabatan Warisan Negara dan Jabatan Perancangan Bandar dan Desa Memelihara Warisan Semulajadi. In: Razman MR, Emrizal, Ramli Z, editors. *Kelestarian Alam Sekitar di Malaysia dan Indonesia: Pendekatan Pengurusan dan Undang-Undang*. 1st ed. Tanjong Malim: Universiti Pendidikan Sultan Idris.

[18] Rouhi J. 2017 *Asian J Sci Technol* 8(12) 7109.

[19] Nocca F 2017 *Sustainability* 9(10) 1882.

[20] Keitumetse S O 2009 *Sustain Dev.* 19(1) 49–59.

[21] Horn M J, Gurel L M. 1968 *The Second Skin*. 3rd ed. (USA: Houghton Mifflin).

[22] Ranke J, Stolte S, Sto R, Arning J, Jastorff B 2007 Design of Sustainable Chemical Products s The Example of Ionic Liquids

[23] Liao Z. 2010 The Revival of Traditional Handicrafts: A Model from a Local Community in Taiwan. *Coll Res.* 23:9–20.

[24] Sakakibara S, Wasista I P U 2017 Exploration of Indigo Natural Dye in Grinsing Cloth. In: 6th International Seminar on Nusantara Heritage. Bali: Institut Seni Indonesia pp. 587.

[25] Belfer N 1992 *Batik and Tie Dye Techniques*. 3rd ed. (New York: Dover Publications).

[26] Samah A J A 1990 Batik: Sejarah dan Keistimewaan Tekniknya. *Akademiaka* 37 73–90.

[27] Mohamaed A B 1990 Batik Kita: Falsafah Motif -Motif dan Sejarahnya. In: Salleh NNMN, editor. *Warisan Kelantan IX*. 1st ed. (Kota Bharu: Perbadanan Muzium Negeri Kelantan Istana Jajar) pp. 13–43.

[28] Haron N, Ramli Z, Rahman N H S N A 2015 Evolusi Perkembangan Blok Batik di Negeri Kelantan. In: Ramli Z, Samsudin M, Hadrawi M, Duli A, editors. *Prosiding Seminar Antarabangsa Ke-4 Arkeologi, Sejarah dan Budaya di Alam Melayu*. Bangi: Institut Alam dan Tamadun Melayu (ATMA), Malaysia.

[29] Akhir N H M, Ismail N W, Said R, Kaliappan S R 2016 Creative Craft: The Uniqueness and Potential of the Malaysian Batik Industry. *Int J Interact Digit Media* 4(1) 10–3.

[30] Toles G E 1971 The Ancient Art of Batik Making *Design* 72(6) 8–10.

[31] Ismail S Z 2018 *Reka Bentuk Kraf Tangan Melayu Tradisi*. 2nd ed. (Kuala Lumpur: Dewan Bahasa dan Pustaka).

[32] Mohammed A 1990 Batik Kita: Falsafah Motif - Motif dan Sejarahnya. In: Salleh NNMN, editor. *Warisan Kelantan IX*. 1st ed. (Kota Bharu: Perbadanan Muzium Negeri Kelantan Istana Jajar).

[33] Aziz A 2018 *Rupa & Gaya: Busana Melayu*. 1st ed. (Bangi: Universiti Kebangsaan Malaysia).

[34] Abdullah M Y 2018 Sarung dalam Masyarakat Melayu. In: *Seminar Kearifan Tempatan: Tekstil. Terengganu*: Muzium Negeri Terengganu, Malaysia

[35] Masrom N A 2012 Projek Integrasi Pengeluaran Bersih Pembuatan Batik. Putrajaya.

[36] Salehan F, Mohamed F, Hassan S, Kassim Z, Nor R M, Samsudin S M 2009 *Seni Kraf Batik: Pewarnaan Asli*. (Selangor: Institut Kraf Negara).

[37] Belemkar S and Ramachandran M 2015 *Int J Text Eng Process* 1(3) 33–41.

[38] Taylor G W 2008 *Rev Prog Color Relat Top.* 16(1) 53–61.

[39] Samanta A K, Agarwal P 2009 *Indian J Fibre Text Res* 34 382-399.

[40] Azmi J, Umor Z, Ismail M S, Abdullah K, Ali N, Kamaruzaman N 2009 *Seni Kraf Batik: Motif & Teknik*. (Selangor: Institut Kraf Negara).

[41] Lipol L S 2015 *Int J Sci Researcb Publ* 5(8) 1–4.

[42] Kiron M I 2011 Introduction of Naphtol Dyes : Dyeing Procedure of Naphtol Dyes : Role of Different Chemicals in Naphtol Dyeing. *Textile Learner.*
[43] Hauser P J and Tabba A H 2002 Dyeing Cationic Cotton with Fiber Reactive Dyes: Effect of Reactive Chemistries. *AATCC review* 2(5) 36-39.

[44] Rashidi H R, Sulaiman N M N and Hashim N A 2012 Batik Industry Synthetics Wastewater Treatment using Nanofiltration Membrane. In: *Procedia Engineering. Elsevier Ltd* p. 2010.

[45] Grau P 1991 Textile Industry Wastewaters Treatment. *Water Sci Technol* 24(1) 97–103.

[46] Arslan I, Balcioğlu I A 1999 Degradation of Commercial Reactive Dyestuffs by Heterogenous and Homogenous Advanced Oxidation Processes: A Comparative Study. *Dye Pigment* 43(2) 95–108.

[47] Gumus D, Akbal F 2011 *Water Air Soil Pollut.* 216 117–24.

[48] Rashidi H R, Sulaiman N M N, Hashim N A, Che Hassan C R 2013 *Adv Mater Res.* 627 394–8.

[49] Ilyas M, Ahmad W, Khan H, Yousaf S, Yasir M, Khan A 2019 *Rev Environ Health* 34(2) 171-186.

[50] Ali S I 1993 Revival of Natural Dyes in Asia. *J Soc Dye Colour* 109(1) 13–4.

[51] Kant R 2012 Textile Dyeing Industry an Environmental Hazard. *Nat Sci.* 4(1) 22–6.

[52] Khan S, Malik A 2014 Environmental and health effects of textile industry wastewater. In *Environmental deterioration and human health* (Dordrecht: Springer) pp. 55-71

[53] Malik N, Maan A A, Pasha T S, Akhtar S, and Ali T 2010 *Pak J Agri Sci.,* 47(1) 72-76.;

[54] Akintayo W L 2013 *Kuwait Chapter of Arabian Journal of Business and Management Review,* 33(856) 1-11.

[55] Handayani W, Kristijanto A I and Hunga A I R 2018 Behind the eco-friendliness of “batik warna alam”: Discovering the motives behind the production of batik in Jarum village, Klaten. *Wacana,* 19(1) 235-256.

[56] Harangozó G and Zilahy G 2015 *Journal of Cleaner Production* 89 18-31.

[57] Yaacob M R, Zain N F M, Zakaria M N, and Ismail M 2016 Environmental management practices in small batik industry in Kelantan, Malaysia *International Foundation for Research and Development (IFRD)* 117.

[58] Orsato R 2009 *Sustainability Strategies: When Does It Pay to be Green* (New York: Palgrave Macmillan)

[59] Yaacob M R, Zakaria M N, Zainol F A and Zain N F M 2015 *Int J Acad Res Bus Soc Sci.* 5(4) 338–47.

[60] Yaacob M R, Zain N F M, Zakaria M N and Ismail M 2016 *J Econ Sustain Dev.* 7(13) 36–43.

[61] Ramakreshnan L., Rajandra A, Aghamohammadi N, Fong C S and Nalatambi S 2019 A preliminary insight into the environmental awareness of community in the vicinity of batik manufacturing units in Kelantan, Malaysia. *GeoJournal* 1-9.

[62] McDonough W and Braungart M 2002 *Cradle to Cradle: Remaking the Way We Make Things.* 1st ed. (New York: Douglas & McIntyre).

[63] Varadarajan G and Venkatachalam P 2016 *Environmental chemistry letters* 14(1) 113-122.

[64] Kateshkaran J 2015 *J Basic Appl Eng Res.* 2(4) 248–51.

[65] Ado A, Yahaya H, Kwalli A A and Abdulkadir R S 2014 *International Journal of Environmental Monitoring and Protection,* 1(5) 76-81.

[66] Yusuf M, Shabbir M and Mohammad F 2017 Natural colorants: Historical, processing and sustainable prospects *Natural products and bioprospecting* 7(1) 123-145.

[67] Hidayat J, Fatmawaty 2014 The Art and Sustainable Aspect of Natural Dyeing in KANAWIDA Hand Drawn Batik (Green Batik). *J Proceeding Ser IPTEK.* 1 136–43.

[68] Amalia R and Akhtamimi I 2016 Studi Pengaruh Jenis dan Konsentrasi Zat Fiksasi terhadap Kualitas Warna Kain Batik dengan Pewarna Alam Limbah Buah Rambutan (Nephelium lappaceum). *Dinamika Kerajinan dan Batik.* 33(2) 85–92.

[69] Atika V and Salma I R 2017 Kualitas Pewarnaan Ekstrak Kayu Tegeran (Cudrania javanensis) pada Batik. *Dinamika Kerajinan dan Batik* 34(1) 11–8.

[70] Swami C, Saini S and Gupta V B 2012 *Journal of Textile and Apparel, Technology and Management* 7(4) 1-13.
[71] Kanchana R, Fernandes A, Bhat B, Budkule S, Dessai S and Mohan R 2013 Dyeing Of Textiles With Natural Dyes - An Eco-Friendly Approach. 5(5) 2102–9.
[72] Khattak S P, Rafique S, Hussain T, Inayat F and Ahmad B 2015 Journal of the Chemical Society of Pakistan 37(5) 903-909.
[73] Dalby G 1993 Greener mordants for natural coloration. Journal of the Society of Dyers and Colourists 109(1) 8-9.
[74] Pujilestari T 2015 Review : sumber dan pemanfaatan zat warna alam untuk keperluan industri. Dinamika Kerajinan dan Batik. 32(02) 93–106.
[75] Verma S and Gupta G 2017 Natural Dyes and Its Application: A Brief Review. Int J Res Anal Rev. 4(4) 57–60.
[76] Mansour R 2018 Natural Dyes and Pigments: Extraction and Applications. In: Yusof M, editor. Handbook of Renewable Materials for Coloration and Finishing. (Scivener Publishing LLC) pp 75–102.
[77] Rungruangkitkrai N and Mongkholrattanasit R 2012 Eco-Friendly of Textiles Dyeing and Printing with Natural Dyes. In: RMUTP International Conference: Textile & Fashion. Bangkok, Thailand pp 1–17.
[78] Choudhury A K R 2018 Advanced Materials and Technologies for Environmental 2 145-76.
[79] Jihad R 2014 Dyeing of silk using natural dyes extracted from local plants. Head of the Textile Engineering Department at Kombolcha, Institute of Technology, Wollo University, Ethiopia.
[80] Taif B, Hermida S, Som M, Zinnirah U and Yusof M 2017 Extraction of Natural Dyes from Clitoria Ternatea Flower. Int J Sci Technol. 3(1) 81–90.
[81] Lestari D W and Satria Y 2017 Pemanfaatan Kulit Kayu Angsana (Pterocarpus indicus) sebagai Sumber Zat Warna Alam pada Pewarnaan Kain Batik Sutera. Dinamika Kerajinan dan Batik. 34(01) 35–42.
[82] Sachan K and Kapoor V P 2007 Optimization of extraction and dyeing conditions for traditional turmeric dye. Indian J Tradit Knowl. 6(2) 270–8.
[83] Oktiarni, Dwita (2012) Pemanfaatan Ekstrak Daun Jambu Biji (Psidium guava), Daun Dewandaru (Eugenia uniflora), dan Daun Rosella (Hibiscus sabdariffa L.) Sebagai Pewarna Alami Tekstil Pada Kain Katun dengan Mordan Belimbing Wuluh. In: Prosiding Seminar Nasional dalam rangka Semirata BKS-PTN Wilayah Barat Bidang MIPA Universitas Negeri Medan, Medan, pp 109-114.
[84] Sanjeeda I and Taiyaba A N 2014 Natural dyes: their sources and ecofriendly use as textile materials Journal of Environmental Research And Development 8(3A) 683.
[85] Arora J, Agarwal P, and Gupta G 2017 Green and Sustainable Chemistry 7(1) 35-47.
[86] Maulik SR, Bhowmik L, Agarwal K 2014 Batik on handloom cotton fabric with natural dye. Indian Journal of Tradititional Knowledge 13 788–794.