The Comparison of Colour Coefficient from Plant-Extracted Colour on Different Types of Paper for Painting

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Abstract

The objective of this study was to compare the values of colours extracted from plants with different solvents and the fastness of colours on five different types of painting papers. The three-colour groups from different kinds of plants are including Yellow: *Gardenia jasminoides* J.Ellis (fruits), *Coscinium fenestratum* (Goetgh) Colebr (climbers), *Nelumbo nucifera Gaertn* (pollen); Red: *Smilax corbularia Kunth* (rootstocks), *Caesalpinia sappan* L. (heartwood), *Bixa orellana* L. (seeds), and Blue: Fresh *Strobilanthes cusia* (Nees) Kuntze (fresh leafs and branches), Clitoria ternatea L. (flowers), Fermented Strobilanthes cusia (Nees) Kuntze. Plants were extracted by ethanol and water as solvents in a ratio of 1:5 (plant: solvent). The materials were dipped into resulting colours and compared for fastness using colourimeters to determine the values of L*a*b* or CIELAB. The results revealed that *Coscinium fenestratum* (Goetgh) Colebr in ethanol and water provides the highest luminance - L* and *Gardenia jasminoides* J.Ellis in ethanol provides the highest b* value in yellow group. In red group, *Smilax corbularia Kunth* in ethanol provides the highest luminance - L* and *Bixa orellana* L. in ethanol provides the highest a* value. In blue group, Fresh *Strobilanthes cusia* (Nees) Kuntze in ethanol and water provides the highest luminance - L* and *Clitoria ternatea* L. in water provides the highest -b* value which is higher than in ethanol. With water, Fresh Strobilanthes cusia (Nees) Kuntze produced highest luminance - L*. After the comparison of colour value, it is found that these 3 following plants provide the different highest colour value on 300 gsm Cotton 100% paper. *Gardenia jasminoides* J.Ellis in ethanol provides the highest b* value at 81.73 in yellow group. Bixa orellana L. in ethanol provides the highest b* value at 47.30 in red group. *Clitoria ternatea* L. in water provides the highest -b* value at -18.65 in blue group.

Keywords: Colour value, Extraction, Natural colour, Painting, Solvent

Introduction

To create works of art like painting, the use of colour impacts on the feelings toward and about the image. The colours are an integral part representing artist's expression. Painting conveys a particular type of work onto a flat surface in 2-dimensions. Tatiya (2004) states that humans can see the colours of objects according to the light that hits the object which reflects the light to the eye which is then seen in colour. Colour has a psychological effect as it influences emotions and feelings. The colour that is seen by the eyes will be transmitted to and perceived by the brain to feel emotions as influenced by colour such as feeling happy, fresh, hot, exited, sad, etc. Today, colours that are used by artists although

easily available are synthesized and contain several types of chemicals that might cause health effects to users. In this light, the researcher is interested in finding colours from different kinds of plants suitable to be used to create paintings. Some artists now use plant colours to create their works of art. For example, Yanawit Kunchaethong, an artist who creates graphic art using natural colours. One colour is extracted from the flowers of the Mexican Calabash plant. His inspiration came when he was removing the seeds and his hands were stained with the colour and he could not easily wash it off. He was then interested in trying to use the colour to create graphic art as he believed that every kind of plant can be used as colour depending on whether they are attractive in producing graphic art. Trial and error in extracting natural colours suggested that thousands of plants have not yet been discovered so they need to be studied to see if they contained usable pigments. However, it is important that these plants are preserved since they provide natural colours that can be used to create art and painted works (Ruenpiromjai, 2015). Ruenpiromjai (2015) also mentioned another artist, Walaikorn Smatthakorn who discovered colours extracted from flowers and has long used colours produced from flowers rather than made from chemicals. She extracted colours by grinding up flower petals with a small amount of hot water to obtain colour. Fruits such as sweet pepper or Ceylon spinach were ground up without using water. Leaves were pounded and filtered with a filter cloth to obtain coloured water. Barks were boiled to extract colour which can be concentrated or treated to make different colours by leaving them overnight or placing them on colour palettes for several days. The resulting colours from plants will finally turn discoloured because they were from nature. Natural colours can also be used in art therapy such as in the works of Anupan Pluckpankhajee, an anthroposophist painter of art therapy who was attracted and fascinated with natural colours. He also used natural colours with art works to heal people. Moreover, artists also regard quality colours, with every colour used in therapy being categorized as appropriate to the clients. Colours from plants do not mean colours only from flowers but also from roots, barks, trunks, leaves, flowers, fruits and skins. Colour extraction from plants also involves how colours from each part of the plant being used to promote balances among human being, and different parts of the same plants being extracted offer different colours. It is the happiness in making colours and it is creativity to use colours with the clients in therapy. The power of life inhibited in plants and nature make people high-spirited. However, each kind of plant involves different process of colour extraction and removal without using any chemicals, so their storage life is only 6 – 7 months. (Sivirach, 2015)

The aforementioned artists are thus focusing on improvement to prolong colour storage life. Colours from nature vary in their tones and change with natural conditions. Colours extracted from the same kind of plant might be different depending on environmental conditions, weather, young or old age of plant. Colours derived from nature are all charming and beautiful in their own way.

In the current research, the researcher used natural colours from plants in painting various works which required an extraction process in order to obtain the intended colours for purposive use. Colours derived from nature are attractive in their quality and beauty, and are even easy to find. Making use of natural plants will also benefit in terms of the preservation of diverse kinds of plants from extinction.

Literature Review

Soonthornchai (1998) explained about natural colours that colours from plants as natural colours though they are not that vivid but they are as well not livid. Because of the liveliness and splendor of natural colours from plants, over the past long period of time up until today human persist to invent new things and new colours from nature, and to improve durability of colours. They employed scientific

principles to analyze, test, and try out so that the colours can be well utilized and also harmless to human. It may require somewhat complicated production process and take time to extract colours. Importantly, to make use of natural colours from plants is to establish a body of knowledge from natural resources locally available, to carry on local wisdom, and to appreciate the value and benefits of plants in nature. This is a way to raise awareness when utilizing natural resources while at the same time better preserving diverse kinds of plants. In here the researcher extracted colours with water and ethanol commonly used to extract pigments from nature. Tuisakda, & Khamnuansin (2011) in his research on traditional wisdom of natural cloth dyeing, using dyes from tree bark, branches, and leaves of indigo. The methods and procedures included selecting bark of astringent taste from trees aged 5 years old or more; cutting or chopping them finely to release colour as much as possible; boiling water, adding mordant and bringing barks or parts of plant to simmer for 1-2 hours to release sap and obtain rich or desired colours, and finally removing bark from water. Dyeing with water can be both hot or cold dyeing. For cold dyeing, colour water was left cold after boiling bark to obtain rich or desirable colour, cotton threads were then dyed in colour water by squashing them with hand in water colour and then bring to hang-dry. Colour extraction with water as solvent has long been widely used especially for dyeing cloth. However, there is another researcher who also examined other solvents to extract colours for using in art works. For example, Mari Selvam et al. (2015: 84) conducted a study on extraction of natural dyes from Curcuma longa, Trigonella foenum graecum and Nerium oleander, plants and their application in antimicrobial fabric. Dyes were prepared using aqueous, acidic, alcoholic, and alkaline extraction techniques. The aqueous and alcoholic extraction of Nerium oleander was able to inhibit the growth of many fungal strains including Tricoderma spp., Tricophyton rubrum, Candida albicans, Aspergillus niger, Cladosporium spp. etc. The antimicrobial property of the dyes was used in developing antimicrobial fabric.

Methods and Materials

In order to achieve the research objectives, research procedures were defined as comparing between colours extracted with ethanol and water solvents, and fastness of plant colours on different types of paper. The research processes are detailed below.

1. The selection and identification 3 groups of plants was carried out. Different parts of the plants were used to extract the 3 colours, i.e. red, yellow and blue as they are primary colours commonly used in works of art. The three kinds of plants from which each colour was extracted are listed below:

Yellow : *Gardenia jasminoides* J.Ellis (fruit)
Coscinium fenestratum (Goetgh) Colebr (climbers)
Nelumbo nucifera Gaertn (pollen)

Red : *Smilax corbularia Kunth* (rootstock)
Caesalpinia sappan L. (heartwood)
Bixa orellana L. (seed)

Blue : Fresh *Strobilanthes cusia* (Nees) Kuntze (fresh leaves and branches)
Clitoria ternatea L. (flowers)
Fermented *Strobilanthes cusia* (Nees) Kuntze.

2. Examining solvents commonly used for colour extraction; here the researcher selected 2 types of solvents, i.e. water and ethanol as solvents to extract plant colours, and used the same proportion of each kind of plant. Two experiments were performed.

2.1 Water solvent

2.1.1 Use 100 g. of plant to 500 ml. of water.

2.1.2 Put the plant into 500 ml. of water and bring to boil at 100 ºC, then leave to cool down for 7 days, after that dip each of the 5 types of paper into the coloured water for 5 seconds.

2.2 Ethanol solvent

2.2.1 Use 100 g. of plant to 500 ml. of ethanol.

2.2.2 Immerse the plant into ethanol contained in a plastic jar, close the lid and set aside for 7 days, after that dip each of the 5 types of paper into the coloured liquid for 5 seconds.

Figure 1 Extraction of colour with ethanol solvent

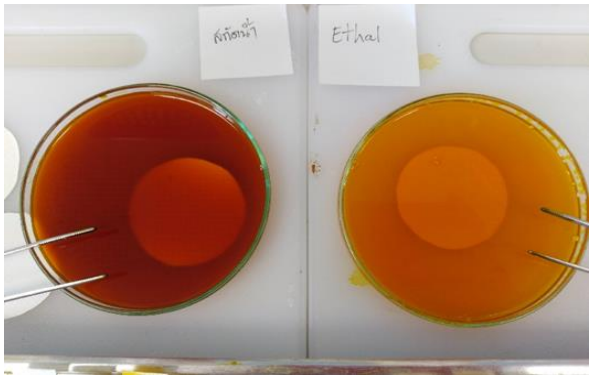


Figure 2 Papers dipped into colours

Figure 3 Coloured papers were air dried and arranged by types of paper for further measuring colour value.

3. All of the 5 types of drawing and painting papers were dipped into each colour; papers were cut into round shape of 4 cm in diameter.

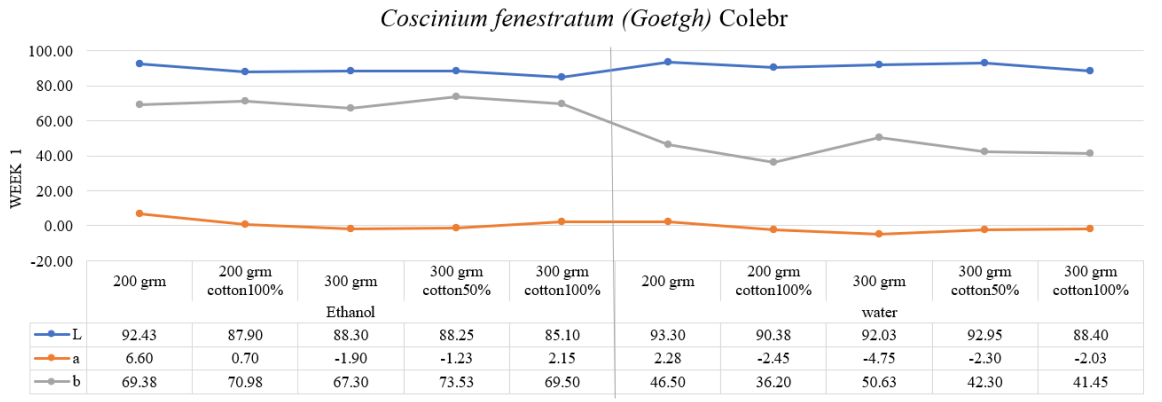
4. This step measured colour values on colour-dipped papers to compare colour intensity; colour fading; L* value or CIELAB in colour system i.e. lightness from low to high as 0-100; and a* and b* values indicating the direction of colour i.e. +a* in red direction, -a* in green direction, +b* in yellow direction, and –b* in blue direction. Colour measurement was defined in 1-month period, and colour fading measurement in 6-month period.

Results and Discussion

Each kind of plant produced differences in colours as shown on Table 1. As observed, extraction with ethanol provided greater saturation and hue than with water, and yellow colour from Gardenia jasminoides J.Ellis with water and ethanol extractions provided greatest saturation.

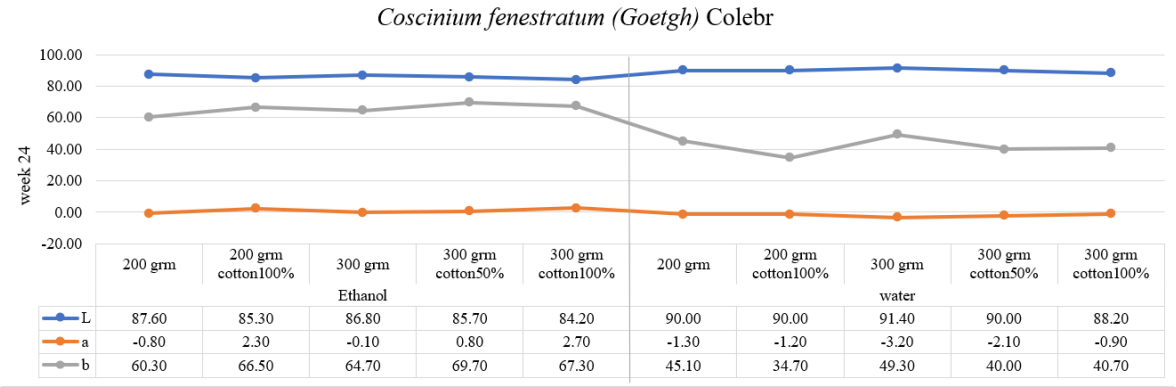
Table 1 Yellow colour group comprising *Coscinium fenestratum* (Goetgh) Colebr extracted with ethanol and water solvents, on 5 different types (gsm) of paper.

extracted	*Coscinium fenestratum* (Goetgh) Colebr				
	Paper				
	200 gsm	200 gsm Cotton 100 %	300 gsm	300 gsm Cotton 50 %	300gsm Cotton 100%
Ethanol					
Water					



	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%
	Ethanol					water				
L	92.43	87.90	88.30	88.25	85.10	93.30	90.38	92.03	92.95	88.40
a	6.60	0.70	-1.90	-1.23	2.15	2.28	-2.45	-4.75	-2.30	-2.03
b	69.38	70.98	67.30	73.53	69.50	46.50	36.20	50.63	42.30	41.45

Figure 4 shows the comparison of different colour values from the extraction of *Coscinium fenestratum* (Goetgh) Colebr in the first week. It is found that +b value in yellow shade from the extraction by ethanol provides the highest value at 73.53 on 300 gsm Cotton 50% paper and the extraction by water provides the highest value at 50.63 on 300 gsm paper.



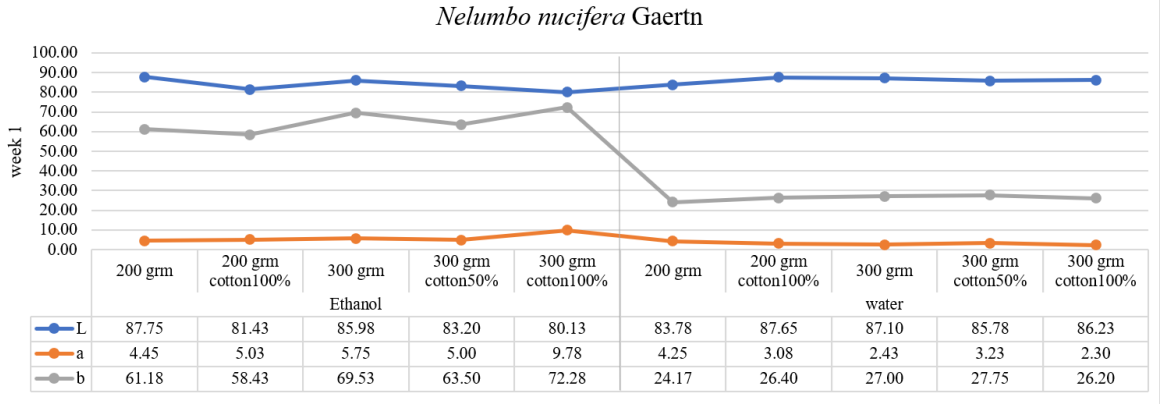
	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%
	Ethanol					water				
L	87.60	85.30	86.80	85.70	84.20	90.00	90.00	91.40	90.00	88.20
a	-0.80	2.30	-0.10	0.80	2.70	-1.30	-1.20	-3.20	-2.10	-0.90
b	60.30	66.50	64.70	69.70	67.30	45.10	34.70	49.30	40.00	40.70

Figure 5 shows the comparison of different colour values from the extraction of *Coscinium fenestratum* (Goetgh) Colebr in the twenty-forth week. It is found that +b value in yellow shade from the extraction by ethanol provides the highest value at 69.70 on 300 gsm Cotton 50% paper and the extraction by water provides the highest value at 49.30 on 300 gsm paper.

Table 2 Yellow colour group comprising *Nelumbo nucifera Gaertn*, extracted with ethanol and water solvents, on 5 different types (gsm) of paper.

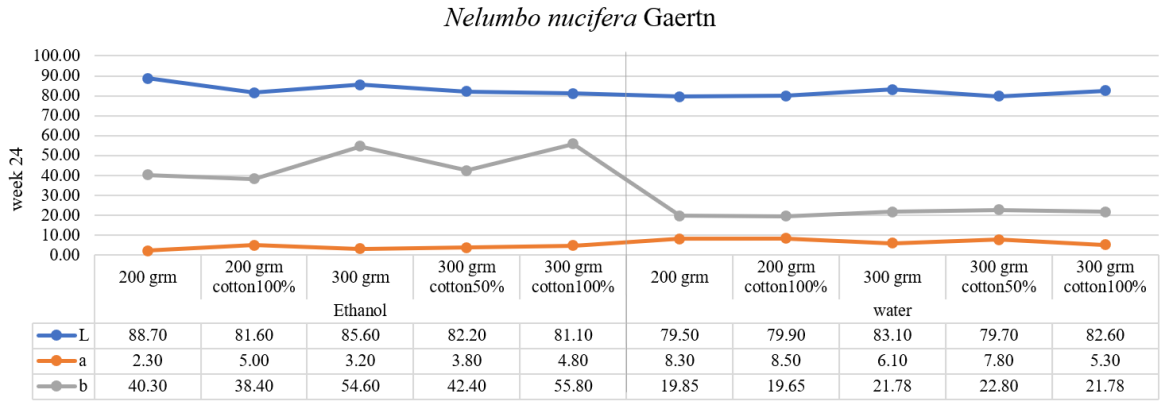
Nelumbo nucifera Gaertn

extracted	Paper				
	200 gsm	200 gsm Cotton 100 %	300 gsm	300 gsm Cotton50 %	300gsm Cotton 100%
Ethanol					
Water					



	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%
	Ethanol					water				
L	87.75	81.43	85.98	83.20	80.13	83.78	87.65	87.10	85.78	86.23
a	4.45	5.03	5.75	5.00	9.78	4.25	3.08	2.43	3.23	2.30
b	61.18	58.43	69.53	63.50	72.28	24.17	26.40	27.00	27.75	26.20

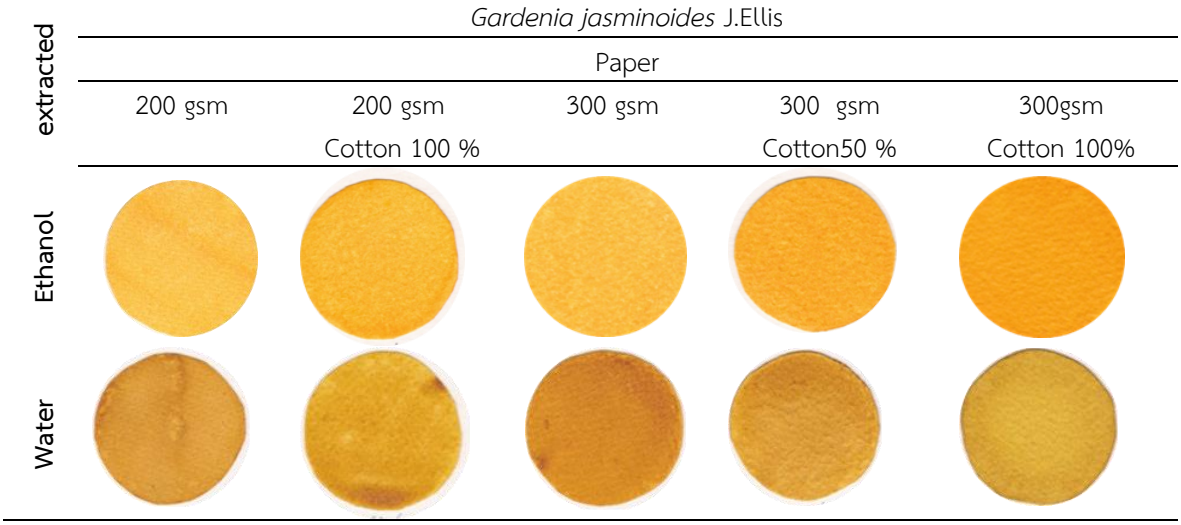
Figure 6 show the comparison of different colour values from the extraction of *Nelumbo nucifera Gaertn* in the twenty-forth week. It is found that +b value in yellow shade from the extraction by ethanol provides the highest value at 72.28 on 300 gsm Cotton 100% paper and the extraction by water provides the highest value at 27.75 on 300 gsm Cotton 50% paper.

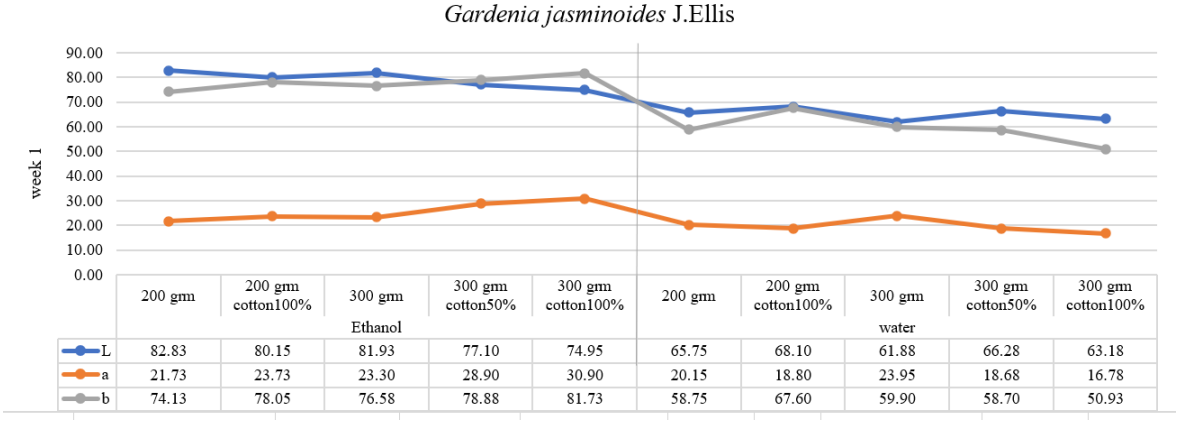


	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%
	Ethanol					water				
L	88.70	81.60	85.60	82.20	81.10	79.50	79.90	83.10	79.70	82.60
a	2.30	5.00	3.20	3.80	4.80	8.30	8.50	6.10	7.80	5.30
b	40.30	38.40	54.60	42.40	55.80	19.85	19.65	21.78	22.80	21.78

Figure 7 shows the comparison of different colour values from the extraction of *Nelumbo nucifera Gaertn* in the twenty-forth week. It is found that +b value in yellow shade from the extraction by ethanol provides the highest value at 55.80 on 300 gsm Cotton 100% paper and the extraction by water provides the highest value at 22.80 on 300 gsm Cotton 50% paper.

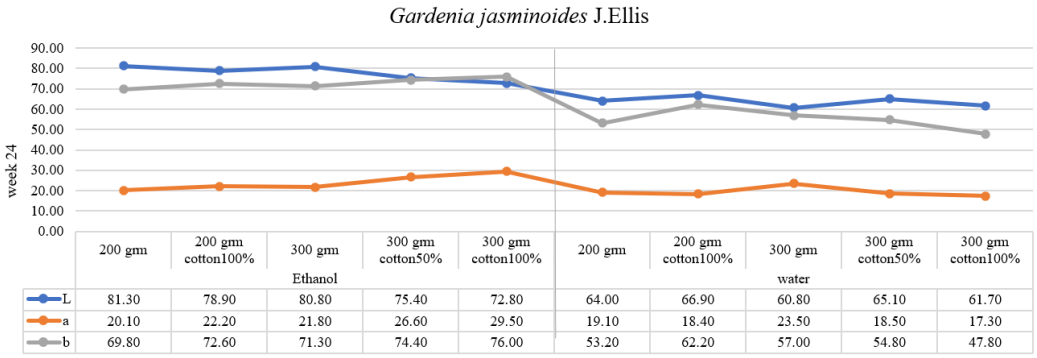
Table 3 Yellow colour group comprising *Gardenia jasminoides* J.Ellis extracted with ethanol and water solvents, on 5 different types (gsm) of paper.





	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%
	Ethanol					water				
L	82.83	80.15	81.93	77.10	74.95	65.75	68.10	61.88	66.28	63.18
a	21.73	23.73	23.30	28.90	30.90	20.15	18.80	23.95	18.68	16.78
b	74.13	78.05	76.58	78.88	81.73	58.75	67.60	59.90	58.70	50.93

Figure 8 show the comparison of different colour values from the extraction of *Gardenia jasminoides* J.Ellis in the first week. It is found that +b value in yellow shade from the extraction by ethanol provides the highest value at 81.73 on 300 gsm Cotton 100% paper and the extraction by water provides the highest value at 67.60 on 200 gsm Cotton 100% paper.



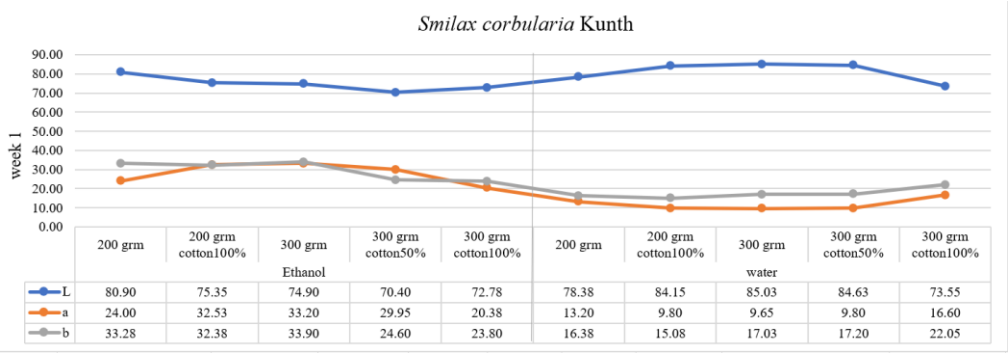
	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%
	Ethanol					water				
L	81.30	78.90	80.80	75.40	72.80	64.00	66.90	60.80	65.10	61.70
a	20.10	22.20	21.80	26.60	29.50	19.10	18.40	23.50	18.50	17.30
b	69.80	72.60	71.30	74.40	76.00	53.20	62.20	57.00	54.80	47.80

Figure 9 shows the comparison of different colour values from the extraction of *Gardenia jasminoides* J.Ellis in the twenty-forth week. It is found that +b value in yellow shade from the extraction by ethanol provides the highest value at 76.00 on 300 gsm Cotton 100% paper and the extraction by water provides the highest value at 62.20 on 200 gsm Cotton 100% paper.

Each kind of plant produced differences in colours as shown on Table 4 Table 5 and Table 6. As observed, extraction with ethanol provided greater saturation and hue than with water, and red colour from Bixa orellana L. extracted with ethanol provided high saturation in orange-red colour.

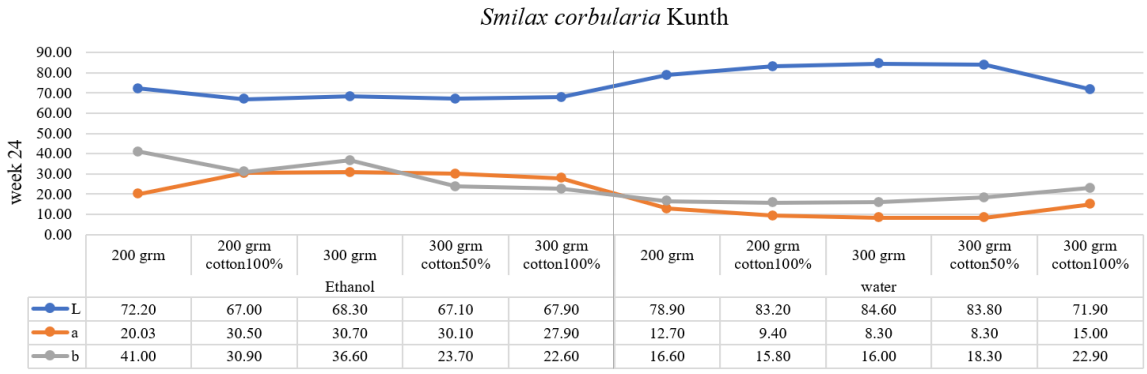
Table 4 Red colour group comprising *Smilax corbularia Kunth*, extracted with ethanol and water solvents, on 5 different types (gsm) of paper.

extracted	*Smilax corbularia* Kunth				
	Paper				
	200 gsm	200 gsm Cotton 100 %	300 gsm	300 gsm Cotton50 %	300gsm Cotton 100%
Ethanol					
Water					



	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%
	Ethanol					water				
L	80.90	75.35	74.90	70.40	72.78	78.38	84.15	85.03	84.63	73.55
a	24.00	32.53	33.20	29.95	20.38	13.20	9.80	9.65	9.80	16.60
b	33.28	32.38	33.90	24.60	23.80	16.38	15.08	17.03	17.20	22.05

Figure 10 shows the comparison of different colour values from the extraction of *Smilax corbularia Kunth* in the first week. It is found that +a value in red shade from the extraction by ethanol provides the highest value at 33.20 on 300 gsm paper and the extraction by water provides the highest value at 16.60 on 300 gsm Cotton 100% paper.

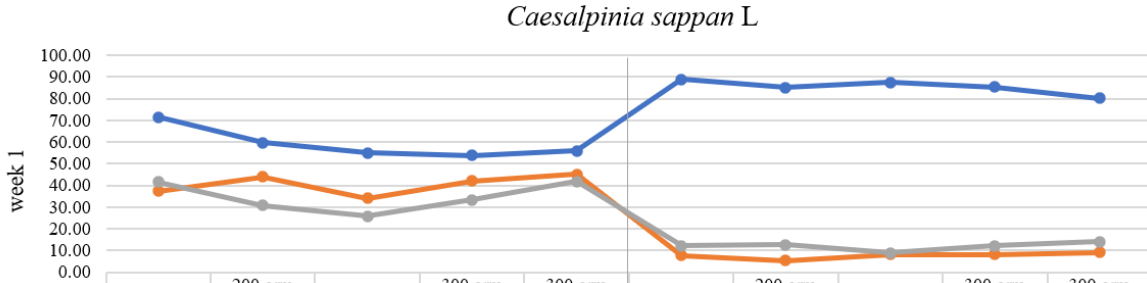


	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%
	Ethanol					water				
L	72.20	67.00	68.30	67.10	67.90	78.90	83.20	84.60	83.80	71.90
a	20.03	30.50	30.70	30.10	27.90	12.70	9.40	8.30	8.30	15.00
b	41.00	30.90	36.60	23.70	22.60	16.60	15.80	16.00	18.30	22.90

Figure 11 shows the comparison of different colour values from the extraction of *Smilax corbularia Kunth* in the twenty-forth week. It is found that +a value in red shade from the extraction by ethanol provides the highest value at 30.70 on 300 gsm paper and the extraction by water provides the highest value at 15.00 on 300 gsm Cotton 100% paper.

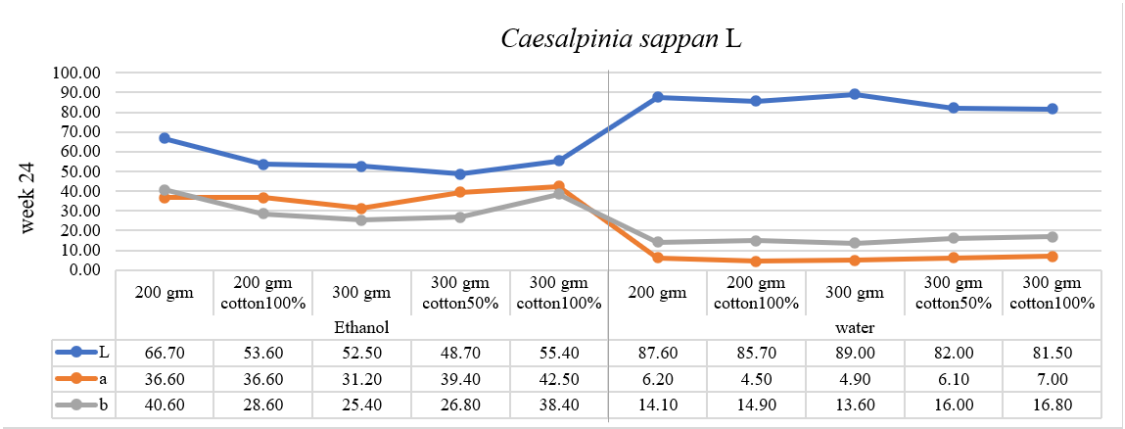
Table 5 Red colour group comprising *Caesalpinia sappan* L. extracted with ethanol and water solvents, on 5 different types (gsm) of paper.

extracted	*Caesalpinia sappan* L.				
	Paper				
	200 gsm	200 gsm Cotton 100 %	300 gsm	300 gsm Cotton50 %	300gsm Cotton 100%
Ethanol					
Water					



	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%	200 grm	200 grm cotton100%	300 grm	300 grm cotton50%	300 grm cotton100%
	Ethanol					water				
L	71.52	59.73	55.08	53.78	56.00	89.03	85.13	87.48	85.50	80.10
a	37.28	43.93	34.18	42.18	45.20	7.80	5.30	8.30	8.30	9.23
b	41.73	30.78	25.93	33.30	41.90	12.30	12.60	8.98	12.25	14.05

Figure 12 shows the comparison of different colour values from the extraction of *Caesalpinia sappan* L. in the first week. It is found that +a value in red shade from the extraction by ethanol provides the highest value at 45.20 on 300 gsm Cotton 100% paper and the extraction by water provides the highest value at 9.23 on 300 gsm Cotton 100% paper.

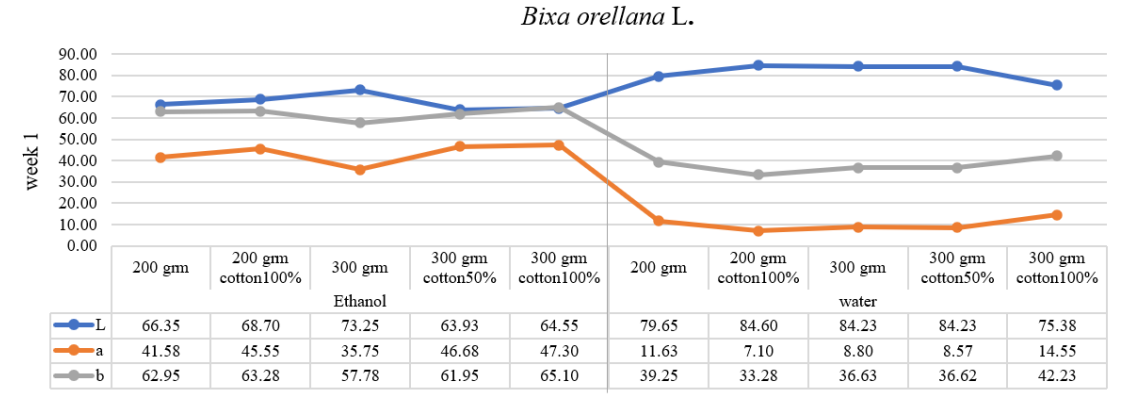


	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%
	Ethanol					water				
L	66.70	53.60	52.50	48.70	55.40	87.60	85.70	89.00	82.00	81.50
a	36.60	36.60	31.20	39.40	42.50	6.20	4.50	4.90	6.10	7.00
b	40.60	28.60	25.40	26.80	38.40	14.10	14.90	13.60	16.00	16.80

Figure 13 shows the comparison of different colour values from the extraction of *Caesalpinia sappan* L. in the twenty-forth week. It is found that +a value in red shade from the extraction by ethanol provides the highest value at 42.50 on 300 gsm Cotton 100% paper and the extraction by water provides the highest value at 7.00 on 300 gsm Cotton 100% paper.

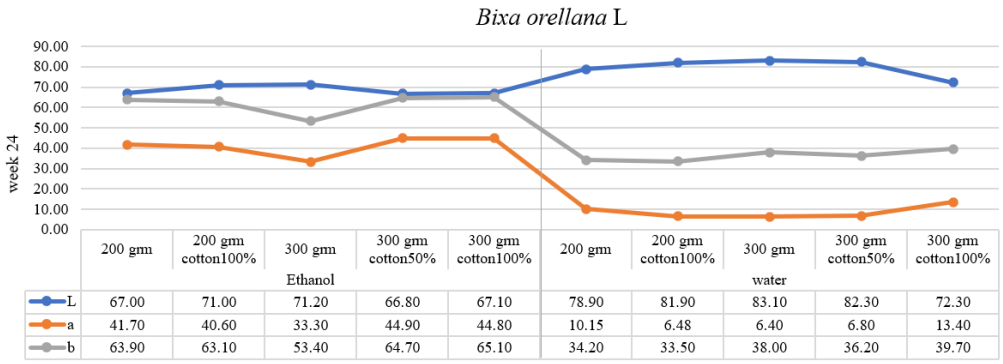
Table 6 Red colour group comprising *Bixa orellana* L. extracted with ethanol and water solvents, on 5 different types (gsm) of paper.

extracted	*Bixa orellana* L.				
	Paper				
	200 gsm	200 gsm Cotton 100 %	300 gsm	300 gsm Cotton50 %	300gsm Cotton 100%
Ethanol					
Water					



	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%
	Ethanol					water				
L	66.35	68.70	73.25	63.93	64.55	79.65	84.60	84.23	84.23	75.38
a	41.58	45.55	35.75	46.68	47.30	11.63	7.10	8.80	8.57	14.55
b	62.95	63.28	57.78	61.95	65.10	39.25	33.28	36.63	36.62	42.23

Figure 14 shows the comparison of different colour values from the extraction of *Bixa orellana* L.in the first week. It is found that +a value in red shade from the extraction by ethanol provides the highest value at 47.30 on 300 gsm Cotton 100% paper and the extraction by water provides the highest value at 14.55 on 300 gsm Cotton 100% paper.



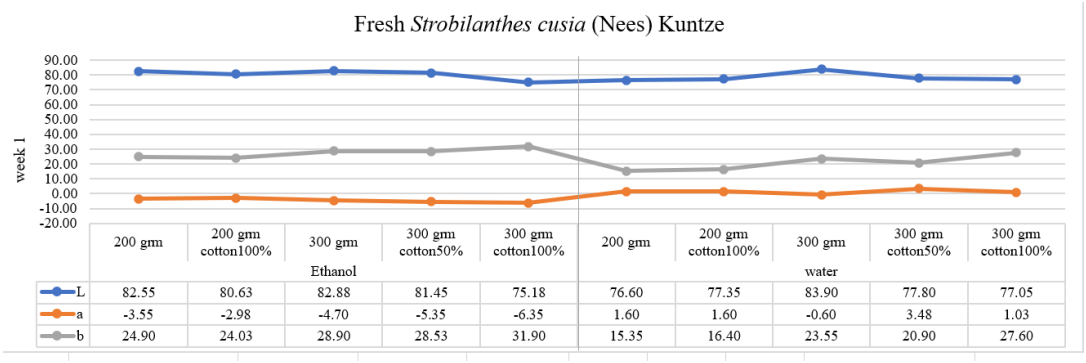
	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%
			Ethanol					water		
L	67.00	71.00	71.20	66.80	67.10	78.90	81.90	83.10	82.30	72.30
a	41.70	40.60	33.30	44.90	44.80	10.15	6.48	6.40	6.80	13.40
b	63.90	63.10	53.40	64.70	65.10	34.20	33.50	38.00	36.20	39.70

Figure 15 shows the comparison of different colour values from the extraction of *Bixa orellana* L. in the twenty-forth week. It is found that +a value in red shade from the extraction by ethanol provides the highest value at 44.90 on 300 gsm Cotton 50% paper and the extraction by water provides the highest value at 13. on 300 gsm Cotton 100% paper.

Each kind of plant produced differences in colours as shown on Table 7 Table 8 and Table 9. As observed, extraction with ethanol and water provided a light blue colour and blue colour from Fresh *Strobilanthes cusia* (Nees) Kuntze ,*Clitoria ternatea* L. and Fermented *Strobilanthes cusia* (Nees)

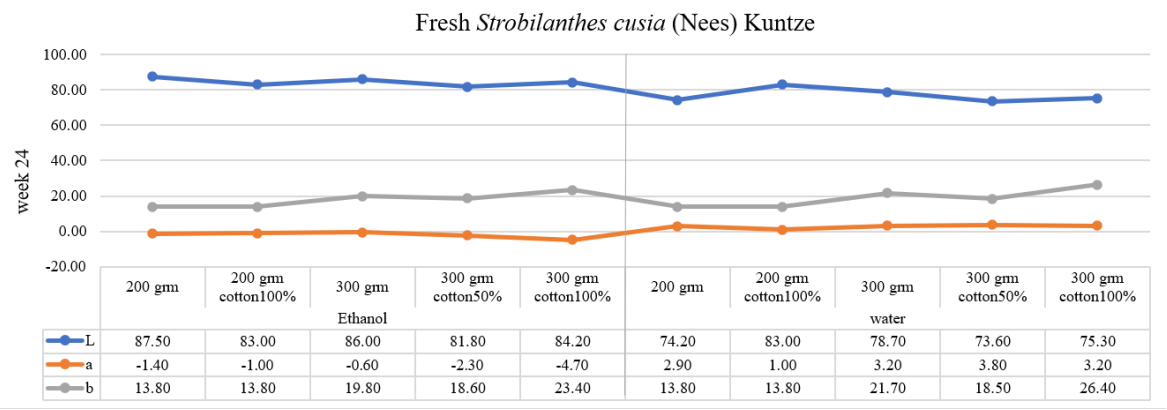
Table 7 The blue colour group comprising Fresh *Strobilanthes cusia* (Nees) Kuntze, extracted with ethanol and water solvents, on 5 different types (gsm) of paper.

extracted	Fresh *Strobilanthes cusia* (Nees) Kuntze				
	Paper				
	200 gsm	200 gsm Cotton 100 %	300 gsm	300 gsm Cotton50 %	300gsm Cotton 100%
Ethanol					
Water					



	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%
			Ethanol					water		
L	82.55	80.63	82.88	81.45	75.18	76.60	77.35	83.90	77.80	77.05
a	-3.55	-2.98	-4.70	-5.35	-6.35	1.60	1.60	-0.60	3.48	1.03
b	24.90	24.03	28.90	28.53	31.90	15.35	16.40	23.55	20.90	27.60

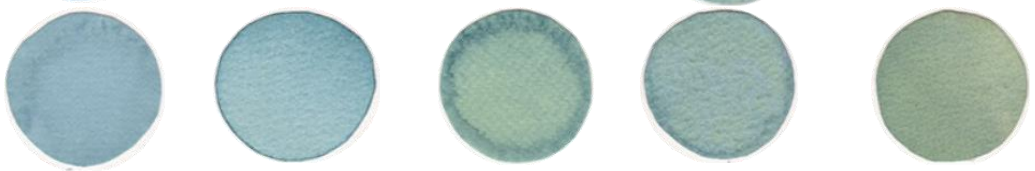
Figure 16 shows the comparison of different colour values from the extraction of Fresh *Strobilanthes cusia* (Nees) Kuntze in the first week The -b value in blue shade is not found in both extraction by ethanol and water.

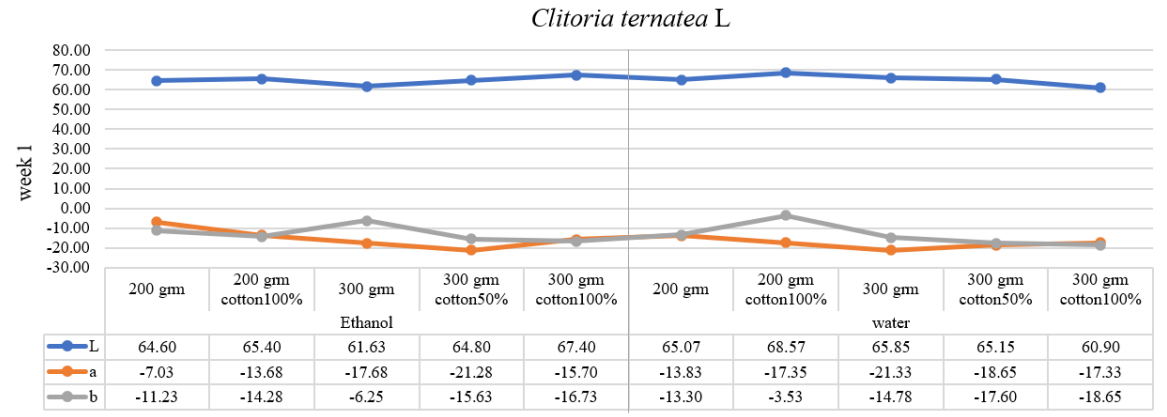


	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%
			Ethanol					water		
L	87.50	83.00	86.00	81.80	84.20	74.20	83.00	78.70	73.60	75.30
a	-1.40	-1.00	-0.60	-2.30	-4.70	2.90	1.00	3.20	3.80	3.20
b	13.80	13.80	19.80	18.60	23.40	13.80	13.80	21.70	18.50	26.40

Figure 17 shows the comparison of different colour values from the extraction of Fresh *Strobilanthes cusia* (Nees) Kuntze in the twenty-forth week. The -b value in blue shade is not found in both extraction by ethanol and water.

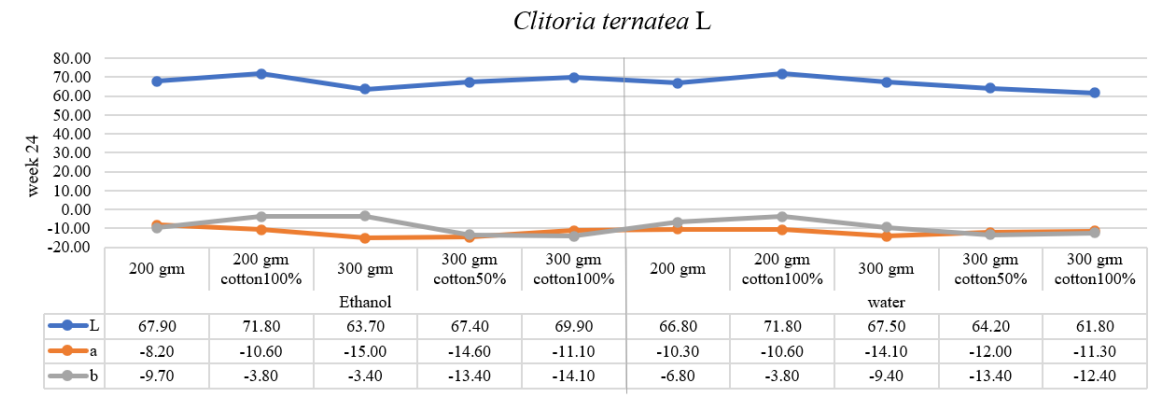
Table 8 Blue colour group comprising, Clitoria ternatea L extracted with ethanol and water solvents, on 5 different types (gsm) of paper.

extracted	*Clitoria ternatea* L				
	Paper				
	200 gsm	200 gsm Cotton 100 %	300 gsm	300 gsm Cotton50 %	300gsm Cotton 100%
Ethanol					
Water					



	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%
			Ethanol					water		
L	64.60	65.40	61.63	64.80	67.40	65.07	68.57	65.85	65.15	60.90
a	-7.03	-13.68	-17.68	-21.28	-15.70	-13.83	-17.35	-21.33	-18.65	-17.33
b	-11.23	-14.28	-6.25	-15.63	-16.73	-13.30	-3.53	-14.78	-17.60	-18.65

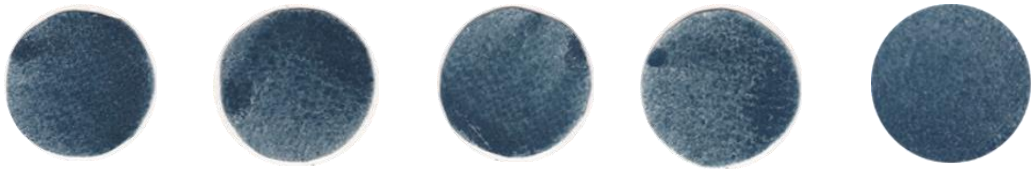
Figure 18 shows the comparison of different colour values from the extraction of *Clitoria ternatea* L. in the first week. It is found that -b value in blue shade from the extraction by ethanol provides the highest value at -16.73 on 300 gsm Cotton 100% paper and the extraction by water provides the highest value at -18.65 on 300 gsm Cotton 100% paper.

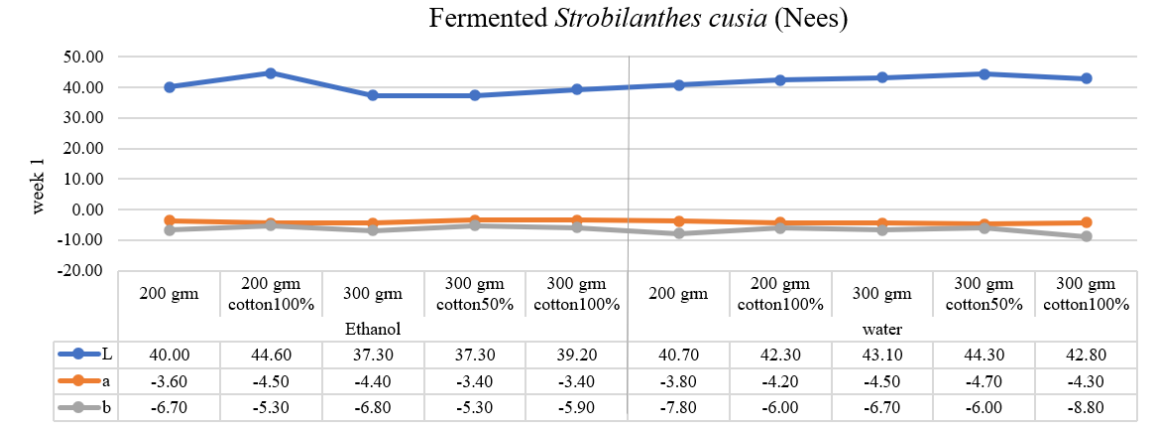


	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%
	Ethanol					water				
L	67.90	71.80	63.70	67.40	69.90	66.80	71.80	67.50	64.20	61.80
a	-8.20	-10.60	-15.00	-14.60	-11.10	-10.30	-10.60	-14.10	-12.00	-11.30
b	-9.70	-3.80	-3.40	-13.40	-14.10	-6.80	-3.80	-9.40	-13.40	-12.40

Figure 19 shows the comparison of different colour values from the extraction of *Clitoria ternatea* L. in the twenty-forth week. It is found that -b value in blue shade from the extraction by ethanol provides the highest value at -14.10 on 300 gsm Cotton 100% paper and the extraction by water provides the highest value at -13.40 on 300 gsm Cotton 50% paper.

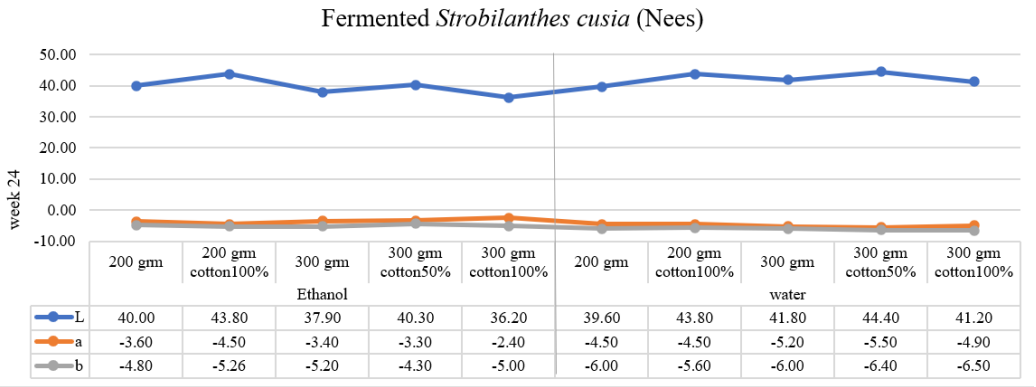
Table 9 Blue colour group Fermented Strobilanthes cusia (Nees) Kuntze extracted with ethanol and water solvents, on 5 different types (gsm) of paper.

extracted	Fermented *Strobilanthes cusia* (Nees)				
	Paper				
	200 gsm	200 gsm Cotton 100 %	300 gsm	300 gsm Cotton50 %	300gsm Cotton 100%
Ethanol					
Water					



	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%
	Ethanol					water				
L	40.00	44.60	37.30	37.30	39.20	40.70	42.30	43.10	44.30	42.80
a	-3.60	-4.50	-4.40	-3.40	-3.40	-3.80	-4.20	-4.50	-4.70	-4.30
b	-6.70	-5.30	-6.80	-5.30	-5.90	-7.80	-6.00	-6.70	-6.00	-8.80

Figure 20 shows the comparison of different colour values from the extraction of Fermented *Strobilanthes cusia* (Nees) in the first week. It is found that -b value in blue shade from the extraction by ethanol provides the highest value at -6.80 on 300 gsm paper and the extraction by water provides the highest value at -8.80 on 300 gsm Cotton 100% paper.



	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%	200 gm	200 gm cotton100%	300 gm	300 gm cotton50%	300 gm cotton100%
	Ethanol					water				
L	40.00	43.80	37.90	40.30	36.20	39.60	43.80	41.80	44.40	41.20
a	-3.60	-4.50	-3.40	-3.30	-2.40	-4.50	-4.50	-5.20	-5.50	-4.90
b	-4.80	-5.26	-5.20	-4.30	-5.00	-6.00	-5.60	-6.00	-6.40	-6.50

Figure 21 shows the comparison of different colour values from the extraction of Fermented *Strobilanthes cusia* (Nees) in the twenty-forth week. It is found that -b value in blue shade from the extraction by ethanol provides the highest value at -5.00 on 300 gsm Cotton 100% paper and the extraction by water provides the highest value at -6.50 on 300 gsm Cotton 100% paper.

Conclusion and Suggestions

The present research compared colour extraction from plants to be used in painting works, compared among colours extracted from different kinds of plants using different solvents, and also compared the fastness of colours on different types of paper. The researcher extracted 3 colour groups from different kinds of plants including Yellow: Gardenia jasminoides J.Ellis (fruits), Coscinium fenestratum (Goetgh) Colebr (climbers), Nelumbo nucifera Gaertn (pollen); Red: Smilax corbularia Kunth (rootstocks), Caesalpinia sappan L. (heartwood), Bixa orellana L. (seeds), and Blue: Fresh Strobilanthes cusia (Nees) Kuntze (fresh leaves and branches), Clitoria ternatea L. (flowers), Fermented Strobilanthes cusia (Nees) Kuntze. Ethanol and water were used as solvents. The results indicated the following. In the yellow colour group, Coscinium fenestratum (Goetgh) Colebr in ethanol and water solvents produced the highest luminance - L* and: Gardenia jasminoides J.Ellis in ethanol solvent produced colour coefficients of +b* which was highest in the yellow colour group. In the red colour group, Smilax corbularia Kunth in the ethanol solvent produced the highest luminance - L* and Bixa orellana L. in ethanol solvent produced the colour coefficient of +a* which was highest in the red colour group. In the blue colour group, Fresh Strobilanthes cusia (Nees) Kuntze in ethanol and water solvents produced highest luminance - L* and Clitoria ternatea L. in water solvent produced a colour coefficient of -b* which was higher than in the ethanol solvent and highest in blue colour group. With water solvent, Fresh Strobilanthes cusia (Nees) Kuntze produced highest luminance - L*.

Figure 22 depict the fadedness of artwork using ethanol extracted colours.

After the comparison of colour value, it is found that the following 3 plants provide the highest colour value on 300 gsm Cotton 100% paper. Gardenia jasminoides J.Ellis in ethanol provides the highest b* value at 81.73 in the yellow group. Bixa orellana L. in ethanol provides the highest b* value at 47.30 in red group. Clitoria ternatea L. in water provides the highest -b* value at -18.65 in blue group. However, the aforementioned colours have to be reconsidered for painting because some colours are sticky and hard to dissolve in water. (Narongdecha & Soodsang, 2021) The fruits of Gardenia jasminoides J.Ellis provide the highest yellow colour value. However, when it was used in painting, it has the highest fadedness in terms of colour value after 2 years passed. Besides, it is found that the extracted colour from the fruits of Gardenia jasminoides J.Ellis colouring on 2 types of paper is viscous and takes a long time to dry. Thus, this could make different kinds of stain both in painting and on other kinds of artwork.

For the recommendation, natural colour extraction could be developed for screen inks in the works of Trirat (2017) regarding the development of screen inks from natural mordant by using banana sap, papaya latex, and rubber latex to examine the mordant with the best durability on the material. The usage of natural mordant and colorant is how effective the natural resources are used and how to reduce pollution as well as being eco-friendly. The plant extraction is a spotlight of interest and study. Besides, the aforementioned process initially plays an important role. Even though the usage of plants is also a part of plant and forest destruction, the process also saves the balance of nature. This is because the clear results from the extraction of plants comes out with the benefit of plants, the principal chemical substances, and the portion of plants used appropriately. This is also in accordance with the study of Sathaporn (2012) regarding the creation of printmaking art with natural dyes from plants in Nakhon Si Thammarat Province. This also shows artwork production according to local wisdom. With the process of printmaking art, natural colours are blended with fresh rubber latex and Cassave Starch. Then, these will be tested with natural mordants including the water of Garcinia, red lime, ashes, alum and fresh water. Thus, my study of colours extracted from various plants with unlike extraction provided different colours for the comparison of colour value on the 5 types of water-coloured paper is beneficial especially in the field of artwork as painting because of their fair colouring and safety toward painters. Even though the fastness of plant extracted colours could not be compared and replaced to the entire chemical colours, this is unique attraction of mentioned colour used in painting and could be an alternative for further study, experiment, and development of these in advanced quality. (Narongdecha & Soodsang, 2019) In terms of the eco-friendly approach and the creation of artwork with different patterns, this aforementioned colour is easy and safe to use, as well as convenient to experiment with for research purposes. Additionally, the results also confirm the artist's interest regarding the value of art made with various plants because they stimulate the economy of natural resources in local areas. Moreover, exploring new kinds of hues leads to the discovery of colour making from the best plants for use in future art painting. Besides, this is also an advantage in terms of the natural usage and effects on the development of a human being's life which affiliates with the natural environment as well as raising the awareness of plant conservation.

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