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THE EXTRACTION OF DRAGON FRUIT PERICARP AS COLOURING AGENT FOR PAINTING

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ABSTRACT

Dragonfruit pigment is the new colouring agent of this era and proves to be rich in its natural magenta pigment. The strong pigment and high stability has inspired the researcher to come up with a specific test on the credibility of the colours and as an alternative colouring agent to be used on paintings and textiles. The results from this scientific experiment on the pigment proved that it had the strength and stability needed. Although it has not been processed but the role of it being a new colouring agent is as good as synthetic dye that has been established in the market. The specific experiment on artistic test has proved that this pigment also acts as a versatile colouring agent. This could be seen on the compatibility on this pigment and its reaction towards other medias such as canvas, fabric and paper as test on colour stability. As the new colouring agent, it is hoped that the dragonfruit pigment will be given serious consideration as this natural source should be exploited and the uses variated for future use.

1. Introduction

The term medium is a substance that binds the pigment in paint has various meanings. A medium can also be something used to change the consistency of the paint, for example, a gel medium is used to thicken paint for impasto. In the context of painting, medium can also refer to the binder, or mixture of binder and vehicle, added to paint to facilitate its application without diluting color intensity. Dragonfruit is the fruit of several cactus species, especially of the genus Hylocereus, but also known as Stenocereus. It is also known as pitahaya, huǒ lóng guǒ, strawberry pear, nanettikafruit, or thanh long. Native to Mexico and Central and South America, these vine-like epiphytic cacti are also cultivated in Southeast Asian countries such as Vietnam and Malaysia. They are also found in Taiwan, Okinawa and southern China. There are three species of dragon fruit in the genus Hylocereus and one species in the genus Selenicereus. The fruit comes in three types, all with leathery, slightly leafy skin:

Image 1. Hylocereus undatus(White flesh with pink skin)

Image 2. Hylocereus undatus (Red flesh with pink skin)

Image 3. Selenicereus megalanthus (White flesh with yellow skin)

The tie between art and science has always been strong, with science producing chemicals and materials which can be turned into objects of beauty and value. Paint, that simple product of chemistry has an interesting history that goes back to the birth of human intelligence.

Many people say a picture is worth a thousand words. To paint a picture we require paints with colours, and herein lays a scientific catch which has made life difficult for artists in ancient times to express themselves - how to make paints colourfast.

If we look at a simple colour like red - red could easily be obtained by using blood, which gives a red colour due to the iron which is specially bound in the protein haemoglobin. However, as blood dries, the conditions surrounding these proteins change and so the shape of the protein changes and eventually, the iron is released from the state that makes it look red and instead gives a rusty brown dry blood colour. So, for an artist trying to capture the bright red of a rose, another source of colour would have to be found to carry the memory of that rose to eternity.

Chemistry has advanced in recent years to such an extent that there are now thousands of pigments that can be synthesised to give almost any colour imaginable. To use modern paint on an ancient artwork which is being restored, is however not acceptable as this alters the character and value of the painting.

This research will look at aspects of the history of colour paint and how, prior to the modern chemistry driven era, people got colour in their art to last. In the research we will look at the modern science of colour and how pigments are designed and synthesised today.

2. Methodology

This is an experimental research. A sample of dragonfruit pigment was collected and processed. These are the following procedures to do the experiment:

Procedures:

- Collection of Data
- Analysis of Data
- Data arrangement and Process

Collection of data involved primary and secondary data. Primary data was obtained from the dragonfruit plantation around the state of Kedah. The researcher investigated, visited and documented the locations considered such as plantation area and residential village area. Dragonfruit plantations in Merbok, Kedah cultivate the specific commercial species such as hylocereus polyrhizus (red flesh). On the other hand, species of dragonfruit such as Hylocereus undatus, (white flesh) and Hylocereus polyrhizus (red flesh) are found in residential village areas. Firstly, the researcher collects the pigment from the pericarp with a few procedures and techniques. The artistic test was done on various surface such as paper, canvas, linen, silk and others. The researcher also used variant handmade paper in order to test the quality and absorbent value of the pigment. Findings of artistic had brought to the scientific test in Faculty of Applied Science, UiTM Shah Alam.

The first method is to focus on a particular part such as pericarp. To collect a adequate quantity of pigment liquid the researcher needs a large amount of the fruits. This method produces a thick colour pigment with a transparent effect and easy to apply on using brush on various surfaces. The second method was a process of chopping, blending, sieving and applying to the surface that produce different effects and techniques in making artworks. The reseacher also uses several of handmade papers such as sugar cane fibre, wood fibre, canvas, papers and variant of fabrics in order to check the absorbance of colour pigment.The first task is to classify the pericarp according to the species of the dragonfruit. After the process of collecting, storing and labelling, an artistic test was conducted based on the researcher's own experience as an artist. The main objective in artistic test is to test the uses of dragonfruit pigment as a medium for painting. The focus of the test is on the colour, opacity, transparency and fastness of the medium. From the artistic tested observation, the researcher will be able to know how effective the dragonfruit colour extraction as an alternative medium for painting.

This scientific test was conducted in order to get result regarding colours and mordants. This scientific experiment was conducted to identify the potential of dragonfruit pigment as a dye using laboratory equipment and chemical. The dragonfruit pigment was tested on various surface of clothes such as silk, cotton, paper and canvas. The experiment is the basis in certain standards of testing clothes and dye in Malaysia. The report regarding to the scientific tests and exercises were recorded in the form of writing table and photographs.

Image 4. Slicing the pericarp

Image 5. The mashed pericarp after blended

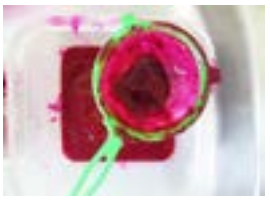

Image 6. Seiving the pigment

Table 1. The report on testing raw and cooked pigment

Medium	Raw pigment	Cooked pigment (100 celcius)
canvas	 Slow absorbent Brilliant colour reflected Permanently magenta within long period	 Slow absorbent Reddish magenta reflected Colour changed a bit darker after a few days.
satin	 Fast absorbent Pink colour reflected Permanently pink for a week	 Fast absorbent Red-brownish reflected Permanently red-brownish for a 4 month
cartridge paper	 Solw absorbent Pink colour reflected Permanently pink for a month	 Slow absorbent Red-brownish reflected Permanently red-brownish for a month
polymer	 Fast absorbent Pink-brownish reflected Permanently red-brownish for a 4 weeks	 Fast absorbent Red-brownish reflected Permanently red-brownish for a week

3. Result

Scientific Test

Scientific test is also vital in determining the potential of a tested sample for future utilization and commercialization. It is important since the result of this experiment will determine whether the dragonfruit sample can be used after undergoing tests for stabilization, reactivity towards PH value and its endurance towards heat and light. To gauge the potential of dragonfruit pigment sample through scientific methods, a test was conducted in the textile laboratory under supervision of Prof Dr. Wan Yunus Wan Ahmad who is a senior lecturer cum the textile colouring scientist at the Faculty of Applied Science UiTM, Shah Alam.

Before the scientific research was carried out, a discussion between the researcher and Dr. Wan Yunus was held to identify the method and testing mechanism that best suit the sample to be tested. The result of this scientific test will provide a synthesis of the sample in term of its relevance for commercialization product in painting.

Colourfastness to light test is a reinforcement test towards colour stability on all surfaces such as textile, paper and others. A scheme of test has been standardized by SIRIM (MS ISO 105-B01: 1996). It is a lab test which is effective to get natural pigment colour stability as well as for synthetic dye due to its endurance towards factors such as heat and light.

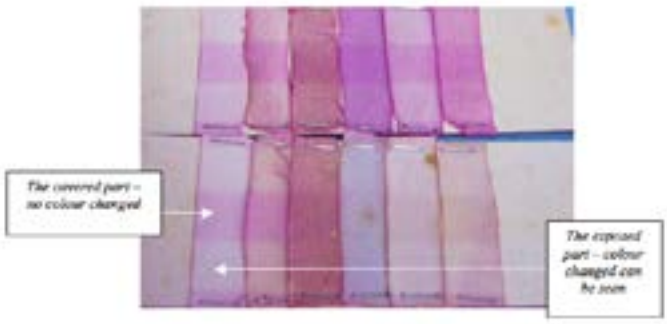

Image 7. The result of the last specimens testing after 12 hours

The scientific test conducted on the dragonfruit pigment specimen produces the best result in experimental test of a new media as colouring agent for future use. With the lab test conducted on the specimen, the researcher was able to determine the stability factor which is an important asset in natural dye. This is to determine through product variation such as colouring as well as textile dying.

After the dragonfruit pigment specimen is put through vigorous testing procedures it can be concluded that the pigment existing in dragonfruit has high stability factor through its endurance towards heat light eventhough it has not been fully stabilized. This is clearly seen from the rate of change in specimen tested in the lightfastness tester where the specimen did not show any changes in the first 3 hours. The changes can only be seen after 12 hours. The long duration of testing prove that the pigment specimen has stability factor eventhough it is at the raw pigment.

The discovery of betacyanin that is the red/magenta hue pigment which is strongly present in the dragonfruit pigment as a natural asset needs to be further explored. Though this research is limited to the pigment strength as a colouring agent in painting, future detailed research need to be carried out as a continuity to this research. It may result in the dragonfruit pigment being used as a multipurpose product for all consumers.

Artistic Test

This experiment concentrates on the three objectives of this research in which one of it is to test the credibility of dragonfruit pericarp colour pigment and medium to create artworks. By this stage, dragonfruit pericarps have been processed into liquid form in order to find whether the pigment can be utilized as an alternative medium as colouring agent for painting.

This experiment aims to create and provide new alternative medium as colouring agent using indigenous materials. In the process of experimentation the researcher will examine the application of pericarp pigment on various surface of artwork that is effective. The researcher tested on various medias such as on textiles, canvas, cartridge paper and others as well as focus on to the character of medium and the way to handle them effectively.

Image 8. Artistic result A – on paper

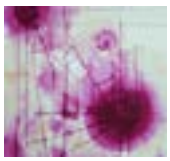

Image 9. Artistic result B – on canvas

Image 10. Artistic result C – satin silk

Image 11. Artistic result D – on cotton

The multifunctional of dragonfruit pigment is the new colouring agent that is comparable with other synthetic dye. It is not only functional towards media painting, but effective as a colouring agent in batik industry as well. The tone and hue produced is equal to dye stuff used in batik designing process. The dragonfruit pigment's credibility should be at the right place as a substitute as well as equal quality with synthetic dye in the future.

4. Discussion

An experimental study on dragonfruit pericarp extraction proved that pigment of dragonfruit can be used as a colouring agent to create an artwork on various two dimensional media. The media can be in the form of papers, canvas, fabrics and other possibilities to be used on different materials or media.

Merbok is the main location to get the raw materials of dragonfruit pigment. Dragonfruit pigment is collected from the pericarp of Hyleocereus polyrhizus (red flesh). The strength and stability of the red/magenta pigment in the dragonfruit indirectly has made is a starting point of the research. The researcher noticed that the colours of the pigment had stuck to his fingers while he was cutting the fruit. Based on this first experience, a detailed orientation experiment which combined both arts and science has been developed through a narrowed experiment on the dragonfruit pigment itself.

The dragonfruit pigment also contained antocyanin which is a type of pigment that dominated the red colour which later on is devided into betacyanin and betalain that will combined and ensure the stability of the red colour in the pigment. According to Prof Dr. Wan Yunus Wan Ahmad from Faculty of Applied Science, the red/magenta pigment created is at par with other pigments that comes from other fruits such as beetroot, berry and coloured fruits however the latest scientific experiment showed that the red/magenta pigment from the dragonfruit proved to be the best based on the stability of the pigment as if could last longer and could withstand high temperature. (Dr. Reinhold Carle - University of Hohenheim, 2006).

Other then the strength and stability of the colours in the dragonfruit pigment, it is noticable that it also consist of other important aspects such as its high medicinal properties and could be used as an agent of anti-oxidant, anti-cancer and others similar of it.

Dragonfruit pigment also needs a proper storage in a cool place, otherwise the organic materials will produce an unpleasant odour and also fungus. In order to analyze the pigment there are two types of test that needed to be conducted which is artistic and scientific test. Both tests are important to get the validity of dragonfruit pigment as a new colouring agent. These specific tests were also helped the researcher to identify and determine the credibility and potentials of the pigment in terms of the test and techniques.

Table 2. Findings of Scientific Test

MEDIA	Natural Mordant (2gm)				Chemical Mordant (2gm			RESULT
	Paddy husk	**Sodium chloride**	**gypsum**	**Wood ash**	**alum**	**iron**	**tin**	
Unprimed Canvas	magenta	Light red	Light red	Light red	Light red	Brownish red	Light red	**Paddy husk (mordant) showed the best result according to the colour reflected. The colour stayed permanent reddish magenta after being exposed for 12 hours in lightfastness tester.**
Satin silk	Light magenta	Light red	Light red	Light red	Blur red	Light brownish red	Blur red	Paddy husk (mordant) showed the best result according to the colour reflected. The colour stayed permanent light magenta after being exposed for 12 hours in lightfastness tester.
Polyster	Blur red	Blur red	Blur red	Blur red	Blur red to white	Blur red to white	Blur red to white	The media reflected blur red to white to every mordant due to instability of mordant on polyster
Cotton	Light red	Light red	Light red	Light red	Light red	Brownish red	Light red	Most of the media reflected very light red after being exposed for 3 hours in lightfastness tester
Linen	Light red	Light red	Light red	Light red	Blur red	Light brownish red	Blur red	Linen showed permanent light red after being exposed for more than 3 hours in lightfastness tester.
Paper	magenta Light	Light red	Light red	Light red	Light red	brownish magenta	Blur red	Paper showed a good result on paddy husk mordant after being exposed for more than 12 hours in lightfastness tester.

Table 3. Findings of Artistic Test

Name of test	Surface	Mordant	Method	Effect on surfaces
Experiment 1	Catridge paper & watercolour paper	Paddy husk	Raw pigment directly applied to the media. Watercolour technique applied.	**The effect reflected as same as watercolour ordinary product. The reddish magenta colour reflected. The colour stayed permanently reddish.**
Experiment 2	canvas	Paddy husk & tin	Cooked pigment applied on canvas by watercolour technique.	**Slow absorbent due to thick of canvas texture. The bright brilliant reddish magenta reflected permanently on canvas. Canvas reflected colour successfully.**
Experiment 3	Satin silk	Paddy husk & kapur	Raw pigment Tie & dye technique	**Tie & dye technique reflected a successful effect of reddish colour. The reddish change to permanent pink after dry due to to the mixing with turmeric and nescafe liquid.**
Experiment 4	Satin silk	Paddy husk, tin & iron (separately)	*Tjanting* batik technique. Cooked pigment on satin after tjanting done.	**A good effect of various pink/magenta reflected on satin silk. The effect was also as good as the synthetic dye that used in batik. Pink/ magenta stayed permanently after dry.**

5. Conclusion And Recomendations

• The extraction from the dragonfruit pigment has been proven to be a new effective colouring agent through scientific and artistic experiment conducted by the researcher.

• The dragonfruit pigment also has a high concentration of red/magenta hue through antocyanin agent that can be endure high temperature without affecting the content of red/ magenta hue.

• The stability of the red/magenta hue has a high quality even though it has not been mixed with a binding agent like mordant.

• The versatility factor of the dragonfruit pigment is also compatible with various types of medias such as paper, canvas, fabric and others as the new product mechanism that should be given appropriate attention.

• The strength and stability of the colour is also on par with synthetic dye which is dominated the current world market and it needs to be commercialized thoroughly as a new competitive product.

6. Suggestion For Future Research

• With this research, it is hoped that a safe ready made product from the dragonfruit pigment can be produced and also used especially to the lower and higher education community.

• Other research that can be conducted based on this research is an alternative research on the dragonfruit pigment as a food colouring agent to replace the synthetic food dye which has a higher risk.

• Another research that can be done is to produce more potential and multi-functional pigment in the cosmetic field and also other critical fields such as medical field because the dragonfruit pigment also contains high value medicinal properties which is natural anti-oxidant that is well known to be effective to fight cancer, heart diseases and blood pressure.

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References

Albert, Reins. (2007). Acrylic painting : Crystal Reference Encyclopedia. New York: Crystal Reference Systems Limited.

Andreas, M. PAPAS (1999). Antioxidant Status, Diet, Nutrition and Health. London: CRC Press.

Berns, Roy S. (2000). Billmeyer and Saltzman's Principles of Color Technology, 3rd edition. Wiley, New York. ISBN 0-471-19459-X.

Bober, Phyllis Pray. (1990). Art, Culture, and Cuisine: Ancient and Medieval Gastronomy. Chicago: University of Chicago Press.

Bourriaud, Nicolas. (1998). Esthétique relationnelle. Dijon: Presses du réel.

Boyer RF, (2000). Modern Experimental Biochemistry. 3rd ed.,Benjamin Cummings, Redwood.

Boyd, W. (1998). Ingredients update: what's new with natural colourants? Cereal Foods World, 43, 720]722.

Castino, Kuth. (1991). Spinning and Dyeing the Natural Way. New York: Van Nostrand Reinhold Co.

Charles. David. (1970). Vegetable Dyeing,151 Color Recipies For Dyeing Yarns And Fabrics with Natural materials, New York Watson: Guptil Publications.

Cindy, (2007). Cultivation and Extraction of Natural Dyes for Industrial Use in Natural Textiles Production. New York: Harper Press.

Collins, P. & Stich, E. (1998). Black carrots: established raw materials for the manufacture of Carantho1 food colour and Exberry1 vegetable juice colours (stability application). Swadlincote: Overseal Foods Ltd.

Cormier, F. (1997). Food colorants from plant cell cultures. Functionality of Food Phytochemicals 201]222. New York: Plenum Press.

D. B. MacDougall. (2002). Colour in Food—Improving Quality, Cambridge:Woodhead Publishing.

Dean, Jenny (1999). Wild Color. New York: Octopus Publishing Group Ltd.

Desobry, S. (1998). Preservation of b-carotene from carrots.Critical Reviews in Food Science and Nutrition, 38,381]396.

Duane Preble, Sarah Preble. (2002). Art Forms: An Introduction to the Visual Forms,7th edition, New Jersey: Prentice Hall, Upper Saddle River.

G. A. F. Hendry, J. D. Houghton (1996). Natural Food Colorants, 2nd edition, London: Blackie Academic Press.

Gablik, Suzi (1995). "Connective Aesthetics: Art After Individualism" in Suzanne Lacy [ed.], Mapping the Terrain: New Genre Public Art. Seattle: Bay Press.

Harivaindaran, K.V., O.P. Rebecca. S. Chandran, (2008). Study of optimal temperature, pH and stability of dragon fruit (Hylocereus polyrhizus)peel for use as potential natural colorant. Pak. J. Biol. Sci., 15: 11: 2259-2263. DOI:10.3923/pjbs.2008.2259.2263

Hansen, C. (1999). The advantages of natural colours in food products. Food Marketing and Technology February, 99, 12]15.

http://www.chemcenter.org/ichc

http://www.dragon fruit (thing)@Everything2_com.mht

http://www.urbaneagle.com/ue/ue-dyebooks.html

http://www.wikipedia, the free encyclopedia.htm

Khalili, R.M.A., A.H. Norhayati, M.Y. Rokiah, R. Asmah, M.T. Mohd Nasir. M. Siti Muskinah, (2006). Proximate composition and selected mineral determination in organically grown red pitaya (Hylocereus sp.). J. Trop. Agric. Food Sci.,34: 269-275. DOI: 10.2202/1556-3758.1519

Le Bellec, F., F. Vaillant and E. Imbert, (2006). Pitahaya (Hylocereus spp.): A new fruit crop, amarket with a future. Fruits, 61: 23725OI:10.1051/fruits:2006021

Marmion, Daniel M. (1984). Handbook of U.S. Colorants for Foods, Drugs, and Cosmetics. New York: Wiley.

Plumbly, J. & Collins, P. (1997). Increasing the stability of natural colours] recent developments. Swadlincote: Overseal Foods Ltd.

Rita J. (1968). Natural Dyes and Home Dyeing, New York: Dover Publications, Inc.

Rodriguez-Saona, L.E. (1998). Anthocyanin pigment composition of red fleshed potatoes. Journal of Food Science, 63, 458]465.

Watson, R. H. J. (1981). “The Importance of Colour in Food Psychology.” In Natural Colours for Food and Other Uses. London: Applied Science Publishers.

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