

Extraction of Annatto (Bixa Orellana), Vine Spinach (Basella Alba), and Dragon Fruit (Hylocereus Undatus) as Ink Product

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ABSTRACT

Purpose: *The main objective of this research is to determine the effectiveness of the Extraction of Annatto (Bixa Orellana), Vine spinach (Basella Alba), and Dragon fruit (Hylocereus Undatus) as ink products and also to know the absorption, color, odor, and evaporation rate from our ink product, **Methods:** this research used experimental type of method and data were collected through distributing research questions, **Analysis data:** the type of analysis used were weighted mean, ANOVA, mean, and 3-point likert scale, **Result and discussions:** the findings proved that our ink product has effective when writing to the paper while the color was enough in basing reading of people, the odor does not contain toxin properties, and the evaporation rate of the three products was dry quickly when it is applied to the paper. **Conclusion:** The researchers proved it and recommended that it can help people as an alternative or major ink.*

KEYWORDS: *Annatto (Bixa Orellana), Vine spinach (Basella Alba), and Dragon fruit (Hylocereus Undatus) as ink product*

INTRODUCTION

Globally, ink nowadays is not a major problem of our global community needs and producing process of ink is enough in our global market. In fact the global ink market has reached a value of US\$ 19.6 billion in 2018, growing at a Compound Annual Growth Rate (CAGR) 3.6% during 2011-2018 (“Research and Markets” N.D.). Additionally, in 2017, Philippines inkjet printers accounted for 94% of the total Philippine printer market shipments and showed a 14% year-on-year growth (Vicente, 2019). However, the chemical ingredients of making ink and manufacturing process of this was had harmful effects for our environment and to human health. Ink printers and their ink are made up of several ingredients; most of them chemicals that have the potential to be damaging different organisms and the environment and some of these include butyl urea which is not good to human health (Gorman, 2017). The harmful environmental factors of ink cartridges can be felt since they are manufactured. When you produce a new laser cartridge, you consume more than three quarts of oil. For inkjet cartridges, you require about three ounces of oil (“Energy Central”, 2017). Henceforth, another damaging effect of ink is not properly disposing of ink cartridges is that the toner (carbon black) has been classified as a potential carcinogenic by the International Agency for Research on Cancer.

Meaning to say, making ink in terms of chemicals had several harmful effects for us and to our nature. Furthermore, ink is not only made from chemicals like solvents, pigments, dyes, resins, lubricants, solubilizers and etc. Hence, these component if inks also had baleful effect such as headaches, nausea, and dermatitis (Sherber, 2010). Actually, those inks are made from natural are more advantageous in several terms like minimal environmental impact, because they come from natural sources and natural dyes are not harmful to the environment, which makes it so appealing for consumers. Natural dyes are biodegradable and disposing them don’t cause pollution, renewable, natural dyes are obtained from renewable sources that can be harnessed without imposing harm to the environment, color pay-off for a soft hue or soothing shade, natural dyes can help the people achieve that kind of look, and safe some natural dyes, such as carmine found in lipsticks, will not cause harm or health problems when ingested (“Advantages And Disadvantages of Natural dyes”, 2016). Thus, making natural ink is best way to produce ink and we knew that the supply of ink is enough in our global market, but the dangerous effect of this chemical ink is not our need. This is the reason why this study is need to pursue up to the last. Furthermore, Philippine is one of the first who used ink as writing materials (“Plethorist, N.D.”). Additionally, quink ink had desired quality of ink and it was claimed to be quick drying and noncorrosive as ink. Moreover, the commercial ink usually made from particles of carbon black and pigment substances (Velson, 2013).

Likewise, Annatto (*Bixa orellana*) commonly known as “atsuete” in tagalog, this plant is commonly used as food colouring in pastas food in the Philippines. In fact both Aztec and Mayans viewed annatto as body paint (“Annatto seeds, N.D.”). Additionally, annatto was described as various carotenoid pigments, mainly bixin and norbixin, found in

the reddish waxy of the seeds. Vine spinach (*Basella alba*) or “alugbati” in tagalog, vine spinach was known and used as vegetable food in different provinces and cities in the Philippines, but this vegetable contains a unique colour which can be used as colouring ingredients. Factually, in ancient time in China it is used as official ink (Pauser, 2017). Likewise, vine spinach known as thick, fleshy pointed at the tip and the flowers are white, pink or red in shore spikes and are located in the leaf axils (“PFAF, N.D.). Dragon fruit (*Hylocereus undatus*) this fruit was serve as dessert food after a meal in Asian and South American, however this fruit also contains of colour violet and deeply reddish extracts which can be used as natural ink product. Moreover, it has a light sweet taste, an intense shape and colour, and has a texture like kiwi and apple (Biblio, 2013).

Henceforth, all these fruits need to undergo a study and experiment process for making ink product. Thus, objective of this study is to lessen the baleful effects of chemical inks which are made from carbon black which can cause skin cancer according to the International Agency for Research on Cancer in 2017, according to them it contains a very high level of benzo which is listed currently as a carcinogen. Additionally, made a natural ink without any harmful effects for human and environmental health. Furthermore, also give a new study about producing nontoxic inks. Thus, this ink can contribute more affordable ink for our economy markets.

THEORETICAL BASIS

In this part the literatures that are considered relevant to this work and and manifest knowledge on the experimental study of Annatto (*Bixa orellana*), Vine spinach (*Basella alba*), and Dragon fruit (*Hylocereus undatus*) as ink product.

For Annatto Literature

This study is about annatto physical features, according to Raman (2019), Annatto is an orange-red food coloring or condiment made from the seeds of the achiote tree (*Bixa orellana*), which grows in tropical regions in South and Central America. It has several other names, including achiote, achiotillo, bija, urucum, and atsüete. It’s most commonly used as a natural food coloring, as it imparts a bright color that ranges from yellow to deep orange-red, similar to saffron and turmeric. Its color comes from compounds called carotenoids, which are pigments that are found in the seed’s outer layer and many other fruits and vegetables, such as carrots and tomatoes. According to Cariaga 2003, said that Atsüete seeds are coated with a red pigment. The red pigment can be used to make low-cost ink because of its cheapness. After the time has elapsed, the seeds were separated from the solution by a strainer.

This study focuses on the significant quality of annatto, vine spinach, and dragon fruit. Banana sap can also be an ink. Based on Ahmad (2007), entitled “Banana Sap as Natural Ink” that the stalk of the stem of the banana plant. The banana stalk produces one huge flower cluster and dyes. The stalk is usually cut off the plant when the bananas are

plump and ready to ripen. Before it dies there are number of things the banana stalk can be used for. The use of banana sap, as a medium for artwork has never been explored in Malaysia. Banana sap from some parts of the tree contains pigment and dyes, thus not aware of this potential medium is a waste. This material is biodegradable and this research is conducted to test the potential of banana as a pigment and dye to be used as alternative natural ink. They conclude that using banana sap in the form of decoction, is an effective alternative natural ink. Furthermore, he conclude that the banana sap is environment friendly because it is organic and safe to use for humans because there are no side effects in using it aside from the stickiness of it and it might stain their clothing. Compared to the commercial ink, the natural ink is a little watery and it's easier to wash off your hands.

For Vine spinach Literature

This literature is about ability of vine spinach about producing ink, according to Puser (2017), the juice of the fruits was reportedly used in ancient China as ink for official seals. Today, the fruits of the red-stemmed alugbati variety can be used to make ink. Established by Olivera (2012), it states that colored ink for computer printer out of nightshade extract. Alugbati berries can be extracted to produce colored ink for computer ink. Suabjakyon (2011), studied about "Extraction of Natural Histological Dye from Black Plum Fruits(*Syzygium Cumini*)" using various solvents and its staining property on the rat hepatic tissue. The researchers extracted fresh and dried black plums with distilled water and 45% glacial acetic acid and the rat hepatic tissue were processed for paraffin embed techniques. They conclude that black plum fruit dye could stain the nucleus cytoplasm of rat hepatic cells with violet color so that the black plum fruit could be used as alternative natural dye for histological staining and cytotoxicity testing in cosmetic and others.

For Dragon fruit Literature

According to the key features of dragon fruit, according to Dr. Mercola (2016), dragon Fruit one of nature's most unique plants, with a flower like an explosion of flame and a fruit like a pink rosebud. According to Capati (2013), dragon Fruits that are in cactaceae are usually characterized by dark purple color and this kind of pigment is what known to us betalain. Dragon Fruits are has two distinct groups the Betaxanthins and the Betacyanin. Dragon Fruits that are in the group of Betaxanthins have yellow to pale pigment while that in group of Betacyanin produces fruits that have reddish to purple pigments. According to the study of Dehankar (2019), natural dyes can be obtained from the pigments that contained from various parts of plants like leaves, fruit and rind of the plant. The use of natural colorants in textile is attributed to the increased awareness about environmental contamination created by intermediates and harmful chemicals which are used in synthetic dyeing process. The natural colorants are non carcinogenic, easily biodegradable and non toxic for living organism.

The following literature is related study about dragon fruit, considering energy saving and environmental safety, natural dyes have attracted the attention of researchers and industrialists to be used in textiles and other allied industries. Moreover, plants based natural dyes also exhibit antimicrobial, antioxidant, which make these ideal to be used in the textile and other related industries. A lot of techniques are being used to improve dyeing behaviour of natural dyes and modification of fabric either by improving extraction process or by enhancing dye uptake activity of fabric to get good shades and fastness properties. Normally, pitaya peels are discarded as garbage while processing. The flesh and peel is a potential source of colour for food dye and colorant. Dragon fruit peel consists of betacyanin pigment (0.15 %) and pectin (10.8 %) was high in the peel.

According to Condy (2017), before synthetic ink, ink was primarily made from plant dyes, which you can still make today. Different plants produce different dye and ink colours, so be sure to choose a plant that produces a colour you like before you make your ink. Other ingredients, like vinegar and arabic gum, should be added to most inks to make the compound last and stabilize. You can use a variety of different wood barks and wood hearts the inside of the tree to create brown, black or red inks. Oak bark, the inner bark of the white birch and the bark of the Colorado fir all create tan to dark brown ink once crushed and added to water or vinegar. Strawberries, raspberries, blueberries and a variety of other berry fruits are often used to create a wide range of ink colors, including red or blue. Crush rose, lavender or hibiscus petals for a red or pink ink. Lilies of the valley, artemisa and snapdragons can all be used to create a wide range of greens from a pale shade to a darker forest shade.

The following literature is to support the natural ink. According to Willowcrow (2012), entitled "Making Berry Inks (Huckleberry, Raspberry, Blackberry and Pokeberry). Ink making is a wonderful way to use up some of the berries that you can forage for outdoors or grow in your garden. Water washed, use a dip pen and write great letters or use it for various drawing and sketches. He also said that having a ink it made our self allows to be creative while making use of sustainable materials that are locally harvestable. Berries should be ripe or slightly over ripe. Berries that have a nice dark stain when you cut it open and effective. Berry inks are going to be a little more traditional and lighter than a traditional synthetic or processed ink.

According to Antioquina (2012), he conducted a study about the "The Effectiveness of Narra (*Pterocarpus Indicus*) Extract as an Ingredient for Permanent Marker Ink". The extraction of narra bark was done using mortar and pestle with benzal konium chloride solution. According to his study, banzal konium chloride prevents the ink from solidifying and prevents the fungi to grow in the ink. He also utilized other substances such as glycerol and ferrous sulfate to increase the rate of extraction of tannin in the pigment and to disinfect the growth of microorganisms in the ink respectively. Waterproof test of ink was done both on narra ink and a standard ink under the running water for 30 seconds.

HYPOTHESES

The following hypothesis will be proved by researchers.

H₀: There is no significant difference between Extraction of Annatto (Bixa Orellana), Vine Spinach (Basella Alba), and Dragon Fruit (Hylocereus Undatus) as Ink Product.

METHOD

The following were the statistical treatment or methods used in the analysis and interpretation of data:

1. Weighted Mean

This statistical treatment is for research problem number one. It was the sum of the frequencies multiplied by the weight of responses divided by the number of cases. The weighted mean was used to analyze and describe the responses obtained by the respondents through the questionnaire that were distributed and retrieved to them and having the formula written mathematically:

Where x is the weight of re
Where x is the weight of responses,
 n is the population.

U
1-
2-
3-

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

$w \cdot \bar{x}$	Scale
2.34-3.00	Strongly Agree
1.68-2.33	Agree
1-1.67	Disagree

2. ANOVA

This statistical treatment is for research problem number two. The researchers will use ANOVA or Analysis of Variance, is a statistical technique that assesses potential of Annatto (Bixa orellana), Vine spinach (Basella alba), and Dragon fruit (Hylocereus undatus) in terms of color, odor, absorption, and evaporation rate.

3. MEAN

The researchers will use mean, it is implies the sum of a set of data divided by the number of data. Researchers will use this to find the average evaporation rate of Annatto (Bixa orellana), Vine spinach (Basella alba), and Dragon fruit (Hylocereus undatus).

RESULTS AND DISCUSSION

This shows the presentation, analysis and interpretation of data gathered from the study. This serves as basis for providing summary of findings, conclusions and recommendations.

1. Ink Products made of Annatto, Vine spinach and Dragon Fruit

“The every ink with which all history is written is merely fluid prejudice”-Mark Twain.

1.1 Absorption

Absorption refers to the ability of the ink to uptake into the fibers of the paper. The table below shows the description of absorption.

**Table 1
Absorption**

	Annatto Ink		Vine spinach ink		Dragon fruit ink	
	Weighted Mean	Description	Weighted Mean	Description	Weighted Mean	Description
1. It had rapid absorption on the paper.	2.41	Strongly Agree	2.62	Strongly Agree	2.46	Strongly Agree
2. The following absorption of this ink product was the same with commercial ink.	1.86	Agree	1.97	Agree	2	Agree
3. These inks got dry quickly on the paper.	2.21	Agree	2.10	Agree	2.05	Agree
4. These inks absorption were consistent on the paper.	2.59	Strongly Agree	2.57	Strongly Agree	2.57	Strongly Agree
5. These inks were not contains alternating absorption when applied on the papers.	1.70	Agree	1.73	Agree	1.73	Agree
6. The paper did not change its physicals properties after applying the inks on it.	2.24	Agree	2.30	Agree	2.14	Agree
Composite Mean	2.16	Agree	2.14	Agree	2.15	Agree

Table I-A. Description of the ink in terms of absorption.

The data on the average score on the absorption of “**It had rapid absorption on the paper**” shows that the annatto, vine spinach, and dragon fruit ink had a rapid absorption in terms of any paper. Likewise, their verbal description was the same “**Strongly Agree**”, additionally, the weighted mean for annatto ink was **2.41**. Moreover, for Vine spinach ink

with weighted mean of **2.62** which is the highest score among the three inks. Moreover, for Dragon fruit ink with weighted mean of **2.46** which is second highest.

The item as follow is **“The following absorption of this ink product was the same with commercial ink”**, Based on it, the annatto, vine spinach, and dragon fruit ink were almost the same with commercial ink in terms of absorption and these inks absorption was not slow according on the data gathered. Furthermore, their verbal description was the same **“Agree”**, likewise, the weighted mean for annatto ink was **1.86**, for vine spinach ink with mean of **1.97**, and for dragon fruit ink with average mean of **2**.

This statement that follow is **“These inks got dry quickly on the paper”** shows that the annatto, vine spinach, and dragon fruit inks can dry quickly when it was applied to the paper with its verbal description of **“Agree”**. Additionally the weighted mean of annatto ink was **2.21**, for vine spinach was **2.10** and for dragon fruit was **2.05**.

Item **“These inks absorption were consistent on the paper”** with a mean for annatto ink of **2.59**, vine spinach and dragon fruit ink has the same weighted mean of **2.57** which is **“Strongly Agree”**. The Annatto, vine spinach and dragon fruit have a good consistency on the paper.

For this item **“These inks were not contains alternating absorption when applied on the papers”**. Based on the three inks it did not change the standard absorption as ink product. With a weighted mean for annatto ink of **1.70**, the vine spinach and dragon fruit has the same weighted mean of **1.73** it means that the three inks describe as **“Agree”**.

Item **“The paper did not change its physicals properties after applying the inks on it”**. These three inks did not affect the physical properties after applying those inks on the paper. The annatto ink, vine spinach and dragon fruit has the same description of **“Agree”**. The weighted mean of annatto ink was **2.24**, vine spinach ink was **2.30** and for the dragon fruit ink was **2.14**.

Table1.1 shows how the absorption these three inks are followed the standard absorption of ink product the same with commercial ink. Likewise, for overall mean value for annatto ink is **2.16** with verbal description of **“Agree”**, On the other hand, for vine spinach ink with overall mean value of **2.14** describes as **“Agree”**, And for dragon fruit ink with overall mean value of **2.15** with verbal description of **“Agree”**. Henceforth, these three inks are following the standard fast, drying, and consistency of being ink products.

1.2 Color

Color refers to the quality of an object or substance with respect to light, usually determined by visually. The table below shows the description of color.

**Table 2
Color**

	Annatto Ink		Vine spinach ink		Dragon fruit ink	
	Weighted Mean	Description	Weighted Mean	Description	Weighted Mean	Description
1. These inks were enough color as an ink product.	2.35	Strongly Agree	2.65	Strongly Agree	2.17	Agree
2. The color characteristics of Annatto, Vine spinach and Dragon fruit inks were too bright.	1.94	Agree	2	Agree	1.81	Agree
3. The colors of ink were not consistent on its single color.	1.83	Agree	1.78	Agree	1.78	Agree
4. These inks were very colourful than the commercial ink.	2.02	Agree	2.19	Agree	1.89	Agree
5. These inks were still recognizable when applied in any paper.	2.56	Strongly Agree	2.59	Strongly Agree	2.51	Strongly Agree
Composite Mean	2.14	Agree	2.24	Agree	2.03	Agree

Table I-B. Description of the ink in terms of color.

The data on **“These inks were enough color as an ink product”** with a weighted mean for annatto ink of **2.35**, for vine spinach ink was 2.65 and for dragon fruit ink was 2.17 which denotes as **“Strongly Agree”**. Explains that the colors of the three inks was enough to be an alternative ink.

Followed by the item **“The color characteristics of Annatto, Vine spinach and Dragon fruit inks were too bright”** with a weighted mean for annatto ink of **1.94**, for vine spinach of 2, and for dragon fruits of 1.81 that denoted as **“Agree”** explains that the three inks was readable on the papers.

The item as follow **“The colors of ink were not consistent on its single color”** with weighted mean for annatto ink of **1.83**, for vine spinach ink was 1.78 with the same as the dragon fruit inks. That has description as **“Agree”** explain that it is look similar with other ink and it recognizable on the paper through the color of the inks.

Item “**These inks were very colourful than the commercial ink**” explains that the color of annatto ink was colourful than the commercial ink or the color of this ink was the same color with commercial ink and their verbal description was “**Agree**”, with weighted mean for annatto ink of **2.02**, for vine spinach ink with scores of **2.19**, and for dragon fruit ink with weighted mean of **1.89**

Lastly “**These inks were still recognizable when applied in any paper**” shows that these three inks were very colourful because if apply this ink in any paper, the result was can read the written words on the paper. Additionally, their description was “**Strongly Agree**”, with weighted mean for annatto ink of **2.56**, for vine spinach ink with weighted mean of **2.59**, and for dragon fruit ink with weighted mean of **2.51**.

Table 1.2 shows that these three ink were followed the standard color of ink product. Likewise, for overall mean value of annatto ink in terms of color was **2.14** with verbal description of “**Agree**”, for vine spinach ink with overall mean value of **2.24** which denotes as “**Agree**”, for dragon fruit ink with overall mean value of **2.03** denotes as “**Agree**”. Thus, these three inks were having a enough color and this color was recognizable in any paper and it was colourful on the papers.

1.3 Odor

Odor refers to the characteristics of a substance which makes it perceptible to the sense of smell. The table below shows the description of odor.

Table 3
Odor

	Annatto Ink		Vine spinach ink		Dragon fruit ink	
	Weighted Mean	Description	Weighted Mean	Description	Weighted Mean	Description
1. The odor of inks product was too strong as ink product.	1.86	Agree	1.92	Agree	1.87	Agree
2. It consist a unique odor as an ink product.	2.08	Agree	2.11	Agree	2.11	Agree
3. The inks smell like commercial inks.	1.41	Disagree	1.51	Disagree	1.49	Disagree
4. It consist an offensive characteristics odor as an ink product.	1.84	Agree	1.84	Agree	1.84	Agree
5. It contains entice feature as an ink product.	2.27	Agree	2.22	Agree	2.16	Agree
6. These inks had more fragrant than the commercial ink.	2.19	Agree	1.97	Agree	2.19	Agree

7. These inks odor can give toxin properties.	1.57	Disagree	1.43	Disagree	1.46	Disagree
Composite Mean	1.89	Agree	1.86	Agree	1.87	Agree

Table I-C. Description of the ink in terms of odor

Item “**The odor of inks product was too strong as ink product**” explains that these ink odor was having a strong odor as ink product, however this odor cannot affect the user of this ink. Additionally, their verbal description was “**Agree**”, with weighted mean of annatto ink odor was **1.86**, for vine spinach ink with weighted mean of **1.92**, and for dragon fruit ink with scores of **1.87**.

The item as follow is “**It consist a unique odor as an ink product**”, shows that these ink was having a unique odor, because of strong odor of vinegar. Additionally, their verbal description was “**Agree**”, with weighted mean for annatto ink of **2.08**, for vine spinach ink with weighted mean of **2.11**, and for dragon fruit ink with scores also of **2.11**.

Item “**The inks smell like commercial inks**”, explains that the odor of annatto ink was not the same with commercial ink, because the ink smell was the same with odor of vinegar. Furthermore, their verbal description was “**Disagree**”, with weighted mean for annatto ink of **1.41**, for vine spinach ink with weighted mean of **1.51**, and , for dragon fruit with weighted mean of **1.49**.

Item “**It consist an offensive characteristics odor as an ink product**”, shows that these ink were containing offensive odor, because these ink were having a vinegar substance. Moreover, their verbal description was “**Agree**”, with scores of **1.84** for annatto ink, for vine spinach ink with weighted mean of **1.84**, and for dragon fruit ink with weighted mean of **1.84**.

Item “**It contains entice feature as an ink product**”, shows that these inks were more having entice feature, because these ink color were more bright and it were attracted to the eyes of respondents. Likewise, their verbal description was “**Agree**”, with weighted mean for annatto ink, for vine spinach ink with weighted mean of **2.22**, and for dragon fruit ink with scores of **2.16**.

Item “**These inks had more fragrant than the commercial ink**”, shows that these ink were contains also of fragrant odor for respondents, however this ink also contain of strong odor according to the data result above. Moreover their verbal description was “**Agree**” and for annatto ink with weighted mean of **2.19**, for vine spinach ink with weighted mean of **1.97**, and for dragon fruit ink with weighted mean of **2.19**.

Lastly, “**These inks odor can give toxin properties**”, shows that these inks were safe and odor of these inks cannot affect the user of these inks. Moreover, their verbal description was “**Disagree**”, with weighted mean for annatto ink, for vine spinach ink with weighted mean of **1.43**, and for dragon fruit ink with weighted mean of **1.46**.

Table 1.3 shows that the odor of these inks were consists of unique odor as ink product and it was productive result for this ink product. Likewise, for overall mean value of annatto ink in terms of odor was **1.89** with verbal description of “**Agree**”, for vine

spinach ink with overall mean value of **1.86** denotes as “Agree”, for for dragon fruit ink with overall mean value of **1.87** denotes as “Agree”. Henceforth, the odor of this was having strong odor, contains of unique odor and not contains of toxin odor as ink product.

1.4 Evaporaion rate

The rate of how fast the ink dries up.

Table 4
Evaporation rate

This refers to significant differences of annatto ink, vine spinach ink, and dragon fruit ink in terms of their evaporation rate. The table below shows the description of evaporation rate.

Based on the experiment conducted (see appendix E), the average evaporation rate relationship with average time obtained is shown in the table below.

Table 1.4 - Evaporation rate of each ink and its total time.

Inks	Average Evaporation Rate
Annatto ink	7.7 seconds
Vine spinach ink	5.3 seconds
Dragon fruit ink	3.29 seconds

As shown in the table 1, in the annatto ink which contains average **7.7 seconds** evaporation rate with 5 times experiment on the paper. In vine spinach ink which contains **5.3 seconds** evaporation rate with also have 5 times experiment on the paper. While the dragon fruit ink contains **3.29 seconds** evaporation rate and this ink also have 5 times experiment on the paper.

We can observe that those ink are had different average evaporation ink, because it is depend on viscosity and condensing features of each ink. Additionally, according to the conducted experiment the water, vinegar, and salt were had ability to change the specific evaporation rate depends on the particular amount of these substances. Which means the standard amount of water, vinegar, and salt for these inks were significant for each average evaporation rate.

2. Significant Difference among the inks made of Annatto, Vine spinach and Dragon fruit in terms of absorption, color, and odor.

This refers to significant differences of annatto ink, vine spinach ink, and dragon fruit ink in terms of their absorption, color, and odor. The table shows the difference between the Annatto, Vine Spinach, and Dragon Fruit.

Table 5
Anova results

Indicates	P-value
Absorption	.886
Color	.082

Odor	.888
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< 0.05 there is significant difference between the data.

> 0.05 there is no significant difference between the data.

The data on average absorption of annatto, vine spinach, and dragon fruit ink were having value of **.886** which denotes as “**There is no significant difference between the data**” shows that the absorption of annatto, vine spinach, and dragon fruit ink were contain the same consistency, rapid absorption, and dry quickly on the paper.

Furthermore, for average color for annatto, vine spinach, and dragon fruit ink were having value of **.082** with verbal description of “**There is no significant difference between the data**” shows that the color of annatto, vine spinach, and dragon fruit ink were having the same characteristics in terms of color such as these ink were having good color and recognizable color as ink products.

On the other hand, for average odor for annatto, vine spinach, and dragon fruit ink were having value of **.888** with verbal description of “**There is no significant difference between the data**” shows that the odor of annatto, vine spinach, and dragon fruit ink were contain the same features in terms of odor, because according to the process of making these ink, these ink were contains the same substances. Additionally, these inks contain non-toxin properties and not consist an offensive characteristics odor as an ink products.

CONCLUSION

Based on the results and findings of the study, the following were drawn:

1. When it comes to Absorption there is no significant difference among the three inks when it is applied to the paper henceforth it is standard fast, drying, and consistency of being ink product and the liquid of these inks were cannot deform the paper when it were applied.

In terms of the color the vine spinach was the most colorful than the two inks, additionally the vine spinach has a feature of ink was really significant because it is basing of reading of people. Furthermore, more light the color of paper, more bright, clean, and clear the color of inks. Additionally, the color these inks, were having enough color as ink product, based on the data gathered.

The vine spinach was the strongest odor among the three inks henceforth that the odor of this ink was cannot affect the key features of this ink and the odor of these ink were not contains toxin property.

It concludes that the dragon fruit was the fastest in terms of evaporation rate among to the three inks since the color of the ink of the dragon fruit was not totally clear and the evaporation rate were depends on the containing liquid inks.

2. It concludes that annatto, vine spinach, and dragon fruit ink absorption where there is no significant difference between the data.

Furthermore, for annatto, vine spinach, and dragon fruit ink color where also there is no significant difference between the data.

Lastly, for annatto, vine spinach, and dragon fruit ink odor where also there is no significant difference between the data.

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