Printmaking Process by Plant Extract that is Harmless to the Environment for Creative Printmaking

Kunjana Dumsopee, King Mongkut's Institute of Technology Ladkrabang, Thailand

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Abstract
This research is aimed to investigate the tropical natural plants as to use in printmaking process in order to create new body of knowledge for basic printmaking system. Printmaking presently, confronting chemicals problems occurred during its creative process which eventually affect artists and environment. Consequently, the concept of exploring the tropical natural plants was developed. The four acid fruits were selected to be experimented by extracting their pH measurements. The natural extracts were tested on wax pencil drawing aluminium foil. The results of applying natural acid from fruits are strongly concentrated that can be used in replacing other general chemicals in basic printmaking process. The outcome of the experimental artworks are clear and sharp as well as be able to reprint as much as required.

Keywords : printmaking process, reprint, plant extract substance, environment, tropical natural plants

Introduction

Printmaking is one of the expression media that has various techniques for example, etching, lithography, collograph, and silk screen. Each technique requires chemicals and solutions to produce a block, however, these chemicals and solutions could have health and environmental impacts. Alternatives in printmaking process are therefore required to create art projects that are non-toxic to health and environment. This project plans to gather data and review researches to gain understanding from the experiments to achieve effective and qualified printmaking works.

Objectives

- To collect data on natural tropical plants.
- To conduct an experiment on using plant extracts as a result of data collection in printmaking process.
- To create lithograph works.

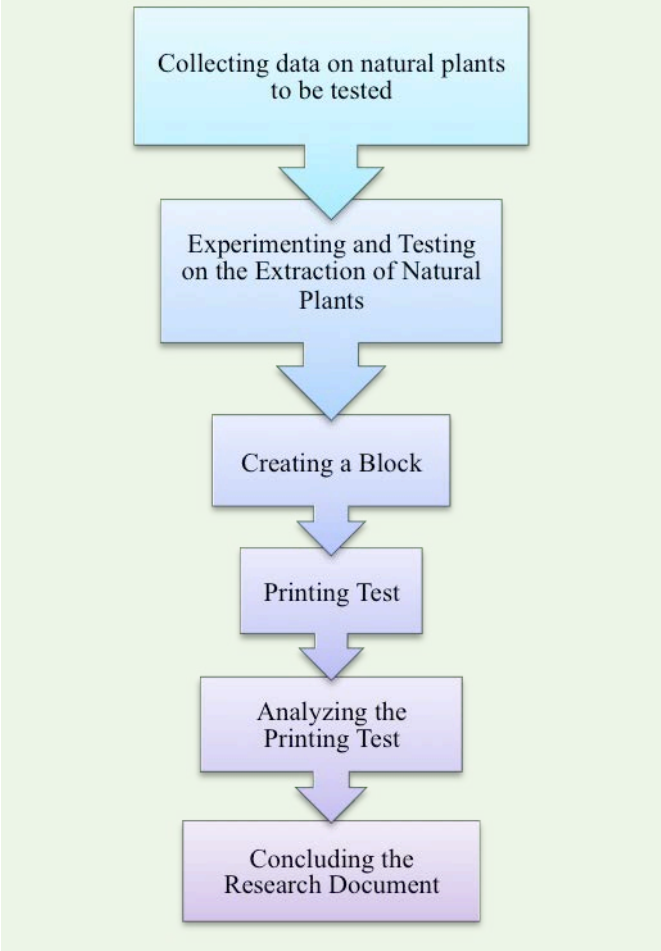


Figure 1: Research Plan

Research Methodology

Natural resources in Thailand are abundant. Various natural plants are presented and the land is suitable for cultivation and agriculture. A distinct climate condition creates diversity and therefore tropical fruits are distributed to the market continuously throughout the year. Fruit cultivation area in various regions of Thailand covers more than 9.68 million rais. Thai fruits are recognized as the important economic plants of Thailand.

Fruits are the superb natural foods that create health balance. They can be easily absorbed to the body and good for digestive system. We can utilize all parts of the fruits, including flesh, seeds, and peels, depending on the requirements. Some can be used to produce medicine, or adapted for cosmetic products, as well as extracted to be used as health supplements and thirst quenching drinks. Thailand is located in tropical zone where varieties of fruits are presented with diverse properties. Fruits are cheap, easily cultivated with high yield, and all parts of fruits can be used. For naturopaths, fruits are ambrosia and they have no damaging energy and are true food for human.

Passion fruit is a tropical fruit that can be eaten fresh. Medicinally, it has various active ingredients, for example, flavonoid. Its leaves contain alkaloid and harman, which help reduce blood pressure. Flower of passion fruit is mild sedative that helps improving sleeping habit. It has high concentration of vitamin A that reduces cholesterol and remedies bladder infection. Carotenoid and vitamin C in passion fruit are higher than those of lime. It is important to note that passion fruit extract has anti-cancer property.

Orange is shrub or small tree plants in Genus Citrus in Family Rutaceae. There are hundreds of species of oranges growing around the world. Most of them have essential oil in leaf, flowers, and fruits. Orange has strong aroma. When looking through sunlight, orange leaves contain large number of dots, which are the sources of oil. Various types of oranges are edible. Taste of orange fruit is sour or sweet. It contains exceptional levels of calcium, potassium, vitamin A, and vitamin C.

Roselle is one-year biennial crop that is popular for the use of its flower for boiling as roselle drinks. Other parts that can be used are leaf and tip that are cooked as food; while flower is used as food coloring agent and drinks. Roselle has polyphenol ie protocatechuic acid which is an anti-oxidant that prevents cancer, anti-aging, and soften blood vessel. Roselle drink helps to refresh the body as it contains citric acid.

Fruit acids are organic acids having common chemical structure compounds comprising hydroxyl group at adjacent alpha carbon. They are usually called alpha hydroxy acids (AHAs). Common fruit acids are lactic and malic acids. Most of AHAs are water soluble compounds, however, some of them eg mandelic and benzylic acids are appropriate for controlling skin condition eg oily skin, while poly AHAs and AHAs help contain moisture. With true understanding, AHAs can remarkably help remedy and prevent various diseases. Skilled practitioners had studied and found that AHAs have abundant properties that can be used in daily life. For example: Pomegranate: Not only phytonutrients, pomegranate contains ellagic acid which prevents the change of cells in human body, as well as inhibits irregular cell expansion that could develop to cancer cells. US National Cancer Institute emphasizes that ellagic acid in pomegranate could considerably prevent cervical cancer in women.

Indian Gooseberry: Indian gooseberry is another species that contains ellagic acid. It has high level of vitamin C as well that it could be recognized as a vitamin C abundant fruit. It also contains phyllemblic acid and phenols that indicate that it has an anti-cancer property.

Other than using various parts of plants eg. flower, leaf, and fruit, in daily life, they can be used to create artworks that has feeling, content, and emotional values that make the audiences to imagine and perceive a distinct form of beauty. From the research of Yanawit Kunchaethong in his "Prints from Reserved Forest", the artist realized that decreasing forest area due to deforestation had an effect on physical changes and biological changes, thus impacted on soil, water, air, wildlife, and environmental conditions. The artist adopted the interest in tree conservation from his father who established a forest plantation concept in a 108 rais area in Cha-um District, Petchaburi Province as a community learning center. This forest area is a great value heritage that builds natural conservation awareness and makes people feel the happiness of the abundant "Pa Sa-nguan" (reserved forest), where Sa-nguan is the name of the artist's father. This place is a valuable treasure built by the artist's father that inspires the artist to create the arts in various dimensions eg paintings, mixed media arts, conceptual arts, and printmaking which is his specialty. This forest was therefore an important source of raw materials that he used to research and created his following works. The artist was interested in the creation of non-chemical arts. Using natural materials for printmaking was the answer that complied with his life style. The artist found a new printmaking technique namely "Organic Print", using planographic process to paint the block using natural coloring agents, and print with intaglio process. The theory of natural color printmaking is coating the metal block with mixed glue and let dry. Natural extracted colors are mixed with appropriate amount of honey and painted on the block. Organic compounds in natural coloring agent react with acacia glue during this period. When the block dries, it can be printed with etching press. Before printing, the paper must be dampened. A high solubility of acacia glue on the block would help the paper to absorb the natural coloring agents on the block and transfer the picture to the paper, creating a natural printing art (Kunchaethong, 2014)

Figure 2: Photo during collecting data of Yanawit Kunchaethong

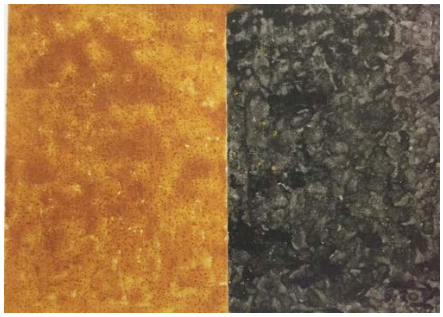


Figure 3: “Pa Sa-nguan (Day and Night)” Printing Natural Colors: Ebony Tree and Curcumin. Dimension 108x79 cm, 2013

Procedure and Methodology

- Material preparation
- Experimentation
- Conclusion

Fruits and flower, depending of type, of pineapple, passion fruit, roselle, and kumquat with good appearances and not spoiled were selected in order to get sufficient amount of non-rancid juice. Fiber and seeds were separated from the extracted juices because this experiment used only acidic solutions extracted from the fruits. Selection of fruits is also an important process. In this experiment, we selected the fruits having fresh skin, green and hard stem, no bruises or dark skin, and were even in sizes. Ants presented on the stem or fruit meant there were no residual toxic substances.

Our five senses could be used in fruit selection. Sight: We can look at the size, shape, appearance, appropriate proportion (not too small or to large according to specific species), with even and vibrant colors. The fruits should be fresh, clean, no bruise or breakage, no spot from disease or insects. Hearing: Some fruits can be selected by hearing the sound from tapping, knocking, or shaking. Smell: The smell of fruits should be good. Some fruits have specific smell and it should be appropriate smell, not rancid. Taste: Taste and texture of fruits should be appropriate for their kinds. For example, orange should be sweet and juicy, not having hard texture or sour like lime. Touch: The fruits should feel soft or dense depending on their kinds. Some fruits could be nearly spoiled if soft (Natui, 2009)

Pineapple selection: The pineapple should have yellowish peel, distant space between eyes. The opening of sepals that cover the eyes indicates that the fruit is fully ripe. When tapping by a stick or finger thumping and shallow grooves occur, it also indicates the ripeness of pineapple. Leaking juice on the skin indicates spoilage. When press, the skin should not cave in. Leaf tips and stem should be fresh, not wither.

Passion Fruit Selection: The fruit should be bought when it begins to ripe, ie having yellow peel, the fruit is plump and not wither, and is large in size. Appearance: The peel should have slight wrinkles with dark purple color which indicates the most ripeness of the fruit. The softer the skin, the riper the fruit. Shaking: Passion fruits should be shaken to compare between fruits. The one having feeling of more liquid or internal pressure indicates that there are more seeds and juice. Smell: Smelling could identify the taste of the passion fruit. The strong smell of tropical fruit indicates good taste. If there is no smell, the fruit could be too sour or tasteless (Australia Reader’s Digest, 2017)

Roselle Selection: Roselle flower can be harvested both during budding or after full bloom or wilted. Naturally, budding roselle flower is less sour than when the flower is fully bloomed and producing seeds. All roselle flowers cannot be harvested at the same time as each flower in the same stalk blooms nonsimultaneously. Therefore, the flowers at the stalk base must be harvested first (Medthai,2013)

Kumquat Selection: Kumquat fruit has sphere shape. Young fruit is small with dark green color. The color of ripe kumquat is greenish yellow, yellowish orange, to orange when fully ripe. When gently squeeze, the fruit is generally soft, not hard. Kumquat can be gradually harvested until the fruit is larger and the color is change to yellowish orange to more than 50% orange. Kumquat juice has less acid value than lime, but the sour taste is comparable. Compared with lime, vitamin C in kumquat is approximately 10% higher than that of lime (Changprasert,2016)

Figure 4: Pineapple

Figure 5: Passion Fruit

Figure 6: Roselle

Figure 7: Kumquat

Experimental Process: Researcher selected 4 types of fruits likely to have high acidic level to seek for the maximum acid concentration of each type of fruit. The experiment comprises the following processes. Acidity of solution is measured and presented as pH values, scaling from 1-14, using indicator. An indicator is a substance used for testing chemical reactions and presenting as color change. Acid-base indicator is used to test for hydronium ion (H_3O^-) and hydroxide ion (OH^-). Acidic solution has higher concentration of hydronium ion than that of basic solution. Acid is a hydrogen compound that forms hydronium ion in aqueous solution. Base is a hydroxide of metal or radical metal equivalent that forms hydroxide ion in aqueous solution. Each type of indicator can test different ranges of acidity of solution. Two common indicators are litmus paper and universal indicator.

Litmus paper is a well known indicator. It has 2 colors ie red and blue. Litmus paper can be produced by immersing white paper in butterfly pea solution, creating blue litmus paper; while immersing in pink bougainvillea (paper flower) will create red litmus paper. After being dried, they can be used to test the acidity of solution. Litmus paper can identify 3 types of solutions as provided below.

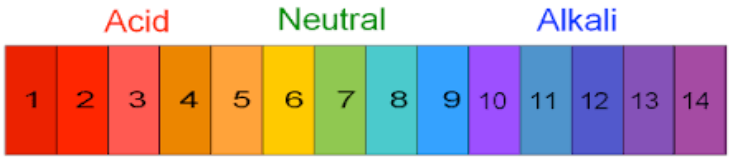


Figure 8: Color Range of Acid-base Values


Figure 9: Universal Indicator Paper

- Acid solution changes litmus paper from blue to red.
- Basic solution changes litmus paper from red to blue.
- Neutral solution does not react to both blue and red litmus papers, therefore it does not change color.

Universal indicator changes colors for almost all pH values, therefore, it is good to present the pH test results. There are both paper indicator and solution indicator. Lower value shows that such solution has high acidity property, while higher value shows higher basicity property of the solution. pH between 1-6 is categorized as acidic condition, while pH 8-14 is categorized as basic condition. pH 7 is not acid nor basic, thus recognized as neutral. In this experiment, the researcher use universal indicator for acidity testing (Scimath, 2014)

Juice Extraction Process: Selected

Pineapple was peeled, extracted, and tested using universal indicator. Acidity test was undertaken 3 times to find the exact acidity value.

Passion fruits were cut into halves, seeds were taken for testing using universal indicator. Acidity test was undertaken 3 times to find the exact acidity value.

Roselle flowers were extracted and tested for pH using universal indicator. Acidity test was undertaken 3 times to find the exact acidity value.

Kumquat fruits were cut into halves, extracted, and seeds were separated. Acidity test was undertaken 3 times to find the exact acidity value.

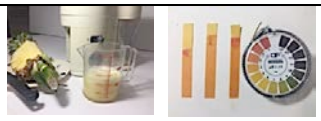
Fruit	Photo of pH Testing	pH	Fruit	Photo of pH Testing	pH
Pineapple		ph 3	Passion Fruit		ph 4
Roselle		ph 1	Kumquat		ph 1

Table 1: Summary of Acidity Values

From the acidity testing of samples, acidity of the fruits from high to low is provided below.

- Kumquat: ph 1
- Roselle: ph 1
- Pineapple: ph 3
- Passion Fruit: ph 4

Acidity results from the experiment will be used for testing with printing block in the following process to find out which fruit acid is able and appropriate to etch the block and make a strong print works.

Artwork Creation Process

Artwork creation process must be applied in order to see a clear result of acidity test of 4 types of fruit, which is the main objective of this research. This experiment adopted the basic printmaking process as follows.

- Block making
- Block etching
- Printing

Block making is the first step of printmaking artwork creation. Issues to be considered include result of the experiment and the beauty of the final artwork created by a well-drawn block. The block is prepared by placing aluminum foil (same type as those used for cooking purpose) on an acrylic sheet, and press to remove all air bubbles for drawing convenience. This step must be undertaken carefully since the foil is very delicate and easily broken. The foil is then sanded with sandpaper to create a slightly rough surface for well adsorption of grease pencil or CD marker. It is important to avoid direct contact between hands and aluminum foil due to the fact that sweat and grease from hands could tarnish the block and

create an undesired stain. Gloves must be worn to prevent such possible mistakes. When the block is ready, picture was drawn using grease pencil or CD marker. Care must be taken both in terms of cleanliness and hand pressure since it might damage the foil.

Figure 10: Clear acrylic sheet

Figure 11: Aluminum foil

Figure 12: CD marker

Figure 13: Cellophane tape

Figure 14: Gloves

Figure 15: Sandpaper No.800

Block making requires careful operation to prevent stain during placing aluminum foil onto clear acrylic sheet because sweat from hands could tarnish the block. Gloves are therefore required to prevent any invisible stain that will eventually appear during ink rolling in printing process.

Figure 16: Aluminum Foil, Size 30x30 cm.

Figure 17: Placing Aluminum Foil Neatly onto Acrylic Sheet

Figure 18: Sanding with Sandpaper to Create Rough Surface

During block drawing, care must be taken to prevent any invisible stain. Paper pad is required to prevent any direct contact between hands and aluminum foil.

Block etching is a very important step to prove that fruit acids could be used as etching agent which produces an appropriate and durable printing block. This experiment also aims to identify the type of fruit that could keep all details of the drawing. Block etching comprises the following steps.

Acid Etching Equipment

- 4 acid extracts including pineapple, passion fruit, roselle, and kumquat
- Rabbit hair paint brush
- Cellulose sponge
- Water container

Figure 19: Passion Fruit and Pineapple Extracts

Figure 20: Roselle and Kumquat Extracts


Figure 21: Rabbit Hair Paint Brush


Figure 22: Cellulose Sponge


Figure 23: Water Container

Printing and Printing Equipment

Printing is the last step to prove the effectiveness of acid etching whether or not it presents a clear printed work, and to prove how long-lasting of the block after multiple printing.


Figure 24: Black ink used for printing


Figure 25: Ink knife, used for scraping the ink on the roller

Figure 26: 8 inch rubber roller, used for rolling the ink

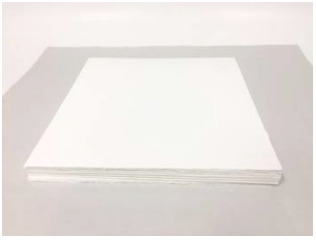


Figure 27: Fabriano paper, used for printing the work

Figure 28: Proof paper, used for print testing

Figure 29: Cotton cloth, used for cleaning the block before any printing operation

Figure 30: Clear plastic, used for covering damping paper

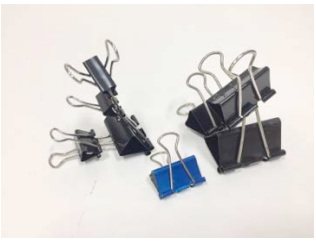


Figure 31: Paper clips, used for clipping damping paper cover

Figure 32: Newspaper, used for damping the printing paper

Figure 33: Cellulose sponge, used for damping the block to remain moistened at all times.

Figure 34: Water activated tape, used for securing the edges of the artwork onto wood board to stretch the artwork after printing

Figure 35: Water container, used for containing water during printing

Figure 36: Felt, used during printing with printing press

Figure 37: Printing press, used for printing the work

Figure 38: Wood board, used for stretching the work after printing of each artwork

Printing process of 6 blocks and conclusion of the printmaking

During printing, 5 replicates were printed for each block to ensure the quality of the block that it can continuously create similar prints. The resultant prints were different in a certain block due to various factors during printing process as concluded below.

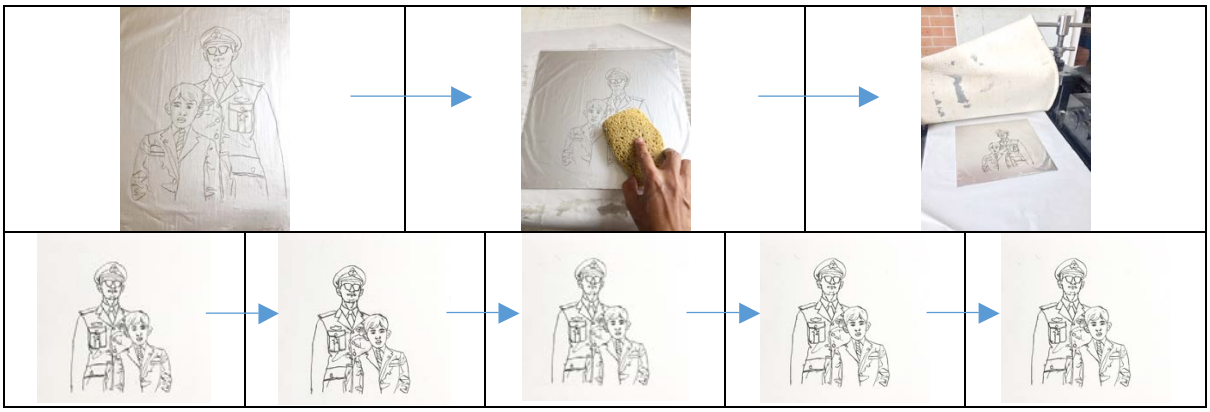


Table 2: Block No.1

Block No.1: This block was drawn using Mitsubishi 7600 grease pencil in line art format for etching convenience and easily proven result after print testing. The block was etched with kumquat acid for 1 minute to make 5 prints. Resultant lines were not clear. There were stains other than the drawn lines as seen on Test Print No.2 due to short etching period. Therefore, 1 minute etching of kumquat acid is not enough, however, the acid is strong enough to etch the block.

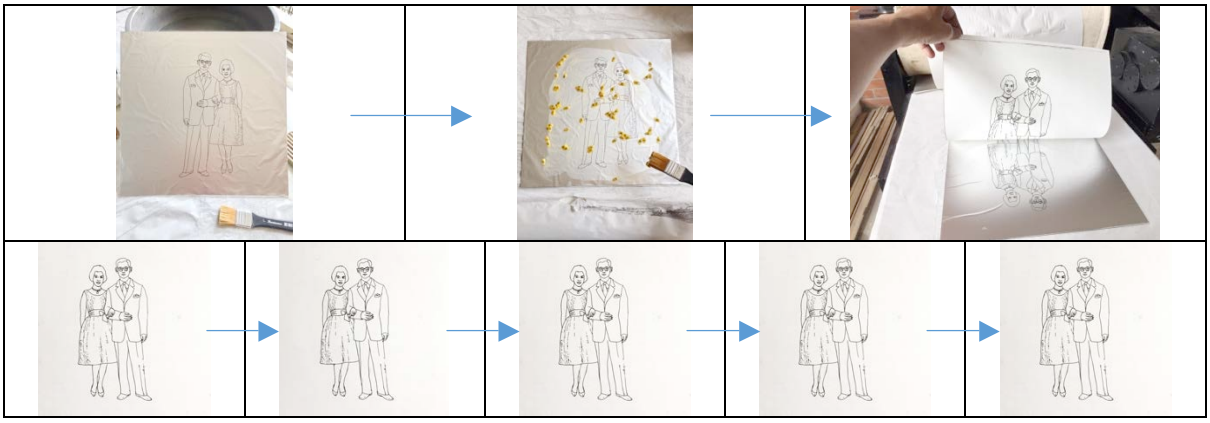


Table 3: Block No.2

Block No.2: This block was drawn using CD marker, which is permanent and water insoluble. The picture was drawn in line art form which was not complex nor weighing on contour for a distinct result. The block was etched with passion fruit acid for 2 minutes, to increase contact time of acid etching. The results of 5 prints show that the fruit acid is efficient for block etching so that it create a strong and clear line. No stains other than the lines drawn on the block. Therefore, this fruit acid is appropriate and can be used for block etching.

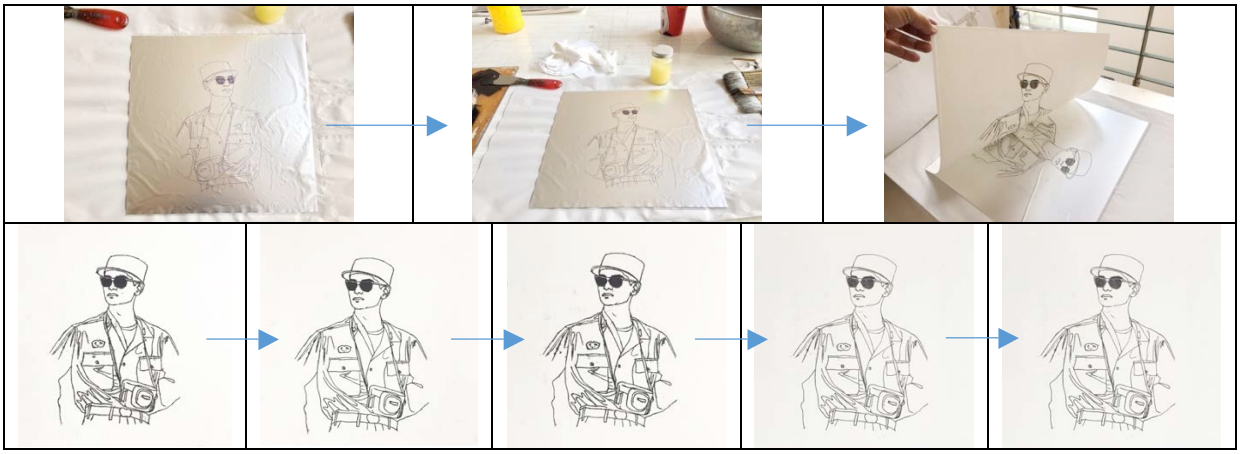


Table 4: Block No.3

Block No.3: This block was drawn to present stories using CD marker. The picture was drawn in simple line art form, not complex nor diverse in terms of drawing media. The block was etched with pineapple acid for 2 minutes. The results of 5 prints were slightly different. It might be a result of stains during block drawing, creating some blemishes. After applying acid to remove the blemishes for another 1 minute, the resultant picture was clear and distinct. Therefore, this pineapple acid can be used for block etching.

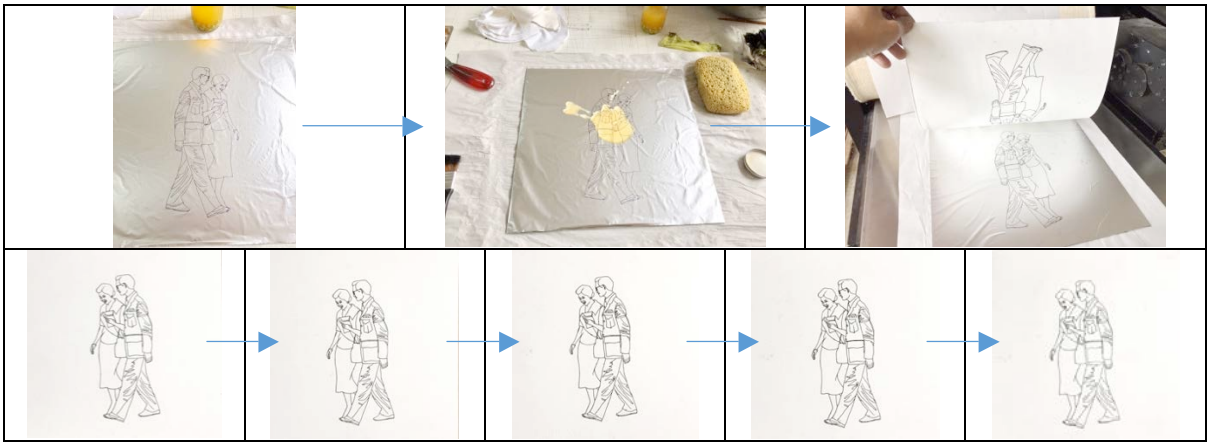


Table 5: Block No.4

Block No.4: This block was drawn using CD marker, which is permanent and water insoluble. The picture was drawn in line art form which was not complex nor weighing on contour for a distinct result. The block was etched with kumquat acid for 2 minutes. The results of 5 prints show that the fruit acid is efficient for block etching so that it create a strong and clear line. No stains other than the lines drawn on the block. Therefore, this fruit acid is appropriate and can be used for block etching.

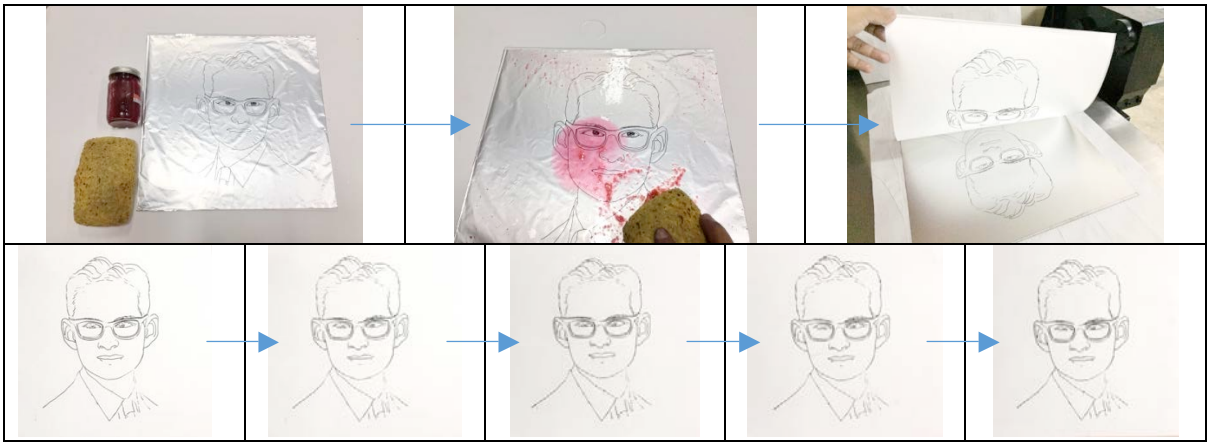


Table 6: Block No.5

Block No.5: This block was drawn using CD marker, which is permanent and water insoluble. The picture was drawn in line art form which was not complex nor weighing on contour for a distinct result. The block was etched with roselle acid for 2 minutes. The results of 5 prints show that the fruit acid is efficient for block etching so that it create a strong and clear line. No stains other than the lines drawn on the block. Therefore, this fruit acid is appropriate and can be used for block etching.

Table 7: Block No.6

Block No.6: This block was drawn using CD marker, which is permanent and water insoluble. The picture was drawn in line art form which was not complex nor weighing on contour for a distinct result. The block was etched with kumquat acid mixed with pineapple acid for 2 minutes. The results of 5 prints show that the fruit acid is efficient for block etching so that it create a strong and clear line. No stains other than the lines drawn on the block. Therefore, this fruit acid is appropriate and can be used for block etching.

Conclusion

From the experiment to seek fruit acid alternatives for printmaking that are not toxic to health and environment, 4 types of fruits including pineapple, passion fruit, roselle, and kumquat were selected and extracted for acidity test . All of these fruits can be found in Thailand and are not expensive. Results of the test show that their acidity levels were in the same range, ie between pH 1-4. They reacted well for the block drawn by grease and CD marker on aluminum foil. This experiment tested for etching duration between 1-2 minutes, and found that the appropriate contact time was 2 minutes. The duration of 1 minute resulted in an undesired stain which disappeared when contact time increased. Throughout the printmaking process starting from block preparation, stain that could occur during attaching aluminum foil on clear acrylic plate was an issue of concern due to the fact that sweat on hands could create a stain on the block. During this step, cloth gloves were required to prevent the stain. During drawing the block, unobserved stain must be avoided, therefore, paper pad was required to prevent contact between hands and aluminum foil. Appropriate contact time for block etching was 2 minutes. Printing was the last step to prove that fruit acid could create a clear print and the block was durable enough for multiple prints. This experiment result showed that the block could be used to create more than 5 prints. Details of the block were still clear and the block could be used for further printing. Number of printable works is a printmaking technique required for the working process mentioned before.

Recommendations

The 4 types of fruits used for this experiment are good alternatives for art creation. Similar process can be adopted for other acidic fruits, which could be seasonal local fruits, for example, garcinia, tamarind, madan, star gooseberry, etc. Extraction method depends on type of fruit including hand squeezing, using blender, hand kneading, boiling, and using pestle, in order to get the extracts that do not scratch the block during etching in case there are seeds, peels, or hard parts remained. Fiber of the fruit should be separated after extraction. The extracts should be used to etch the block immediately after extraction for the freshness and effective result of the acid.

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Contact email: kunjana@hotmail.com