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The Analysis of Printing Quality of Offset - Printing Ink with Coconut Oil Base

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***Abstract*—**The objectives of this research are to produce prototype coconut oil based solvent offset printing inks and to analyze a basic quality of printing work derived from coconut oil based solvent offset printing inks, by mean of bringing coconut oil for producing varnish and bringing such varnish to produce black offset printing inks. Then, analysis of qualities i.e. CIELAB value, density value, and dot gain value of printing work from coconut oil based solvent offset printing inks which printed on gloss-coated woodfree paper weighs 130 grams were done. The research result of coconut oil based solvent offset printing inks indicated that the suitable varnish formulation is using 51% of coconut oil, 36% of phenolic resin, and 14% of solvent oil 14%, while the result of producing black offset ink displayed that the suitable formula of printing ink is using varnish mixed with 20% of coconut oil, and the analyzing printing work of coconut oil based solvent offset printing inks which printed on paper, the results were as follows: CIELAB value of black offset printing ink is at L* = 31.90, a* = 0.27, and b* = 1.86, density value is at 1.27 and dot gain value was high at mid tone area of image area.

***Keywords*—**Offset Printing, Coconut Oil, Printing Ink, Printing Quality.

I. Introduction

THE objectives of offset printing quality [1] aimed to provide good standard printing work and to afford quality as original. In this regard, if the printing possesses a good preparation, result will all so be good which includes costs saving since there was no obstacles to interrupt printing process.

Colors on substrate material were expressed by a printing ink and also by offset ink. In this case, offset ink [2] was categorized as oil based ink. On the other hand, there was no the water based ink because when water combined with fountain, the ink cannot be stick on specific area of plate. The main compositions of offset printing ink were similar to that of letterpress ink consisting of oil color powder and solvent.

There are various type of solvents used for producing printing ink depended on type of the ink. However, petroleum based may cause affect to health, e.g., skin, respiratory tract and digestive system. The point was if did not only irritate these organs but it also caused carcinogens such as skin cancer or digestive system cancer etc. Thus, the idea of using vegetable oil based ink to replace petroleum based offset printing ink has been discussed in order to solve mentioned problems.

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Vegetable oil based printing ink is the ink using oil extracted from vegetables as solvent for example; soy bean oil, sunflower oil instead of petroleum extracting oil. Natural oil helped reducing 80% of VOCs using. With using such oil, printing unit can be cleaned by water mixing detergent. As a result, the usage of VOCs solvent for cleaning purpose tended to decrease. [3]

Coconut oil [4] is able to use for both for edible use such as frying oils, drugs and healthy food products and for inedible use such as material for producing wash and laundry products, soaps, energy and cosmetics.

As background and problems mentioned above, researcher realizes the importance of using extracted vegetable oil to replace petroleum oil based used in current printing inks in order to relieve environmental problems. With this regards, the researcher chose coconut oil to use as an ingredient of printing offset since there are a large number of coconut yields in Sumut Songkram Province. Thus, the researcher emphasized on conducting a test to increase usage of coconut oil in offset printing ink industry and then, analyzing a quality of printing work from obtained printing ink comparing with general offset printing ink. That is the reason of the analysis of printing quality of offset printing ink with coconut oil base has occurred.

II. Objective Research

1) To produce prototype coconut oil based solvent offset printing inks.
2) To analyze a basic quality of printing work from coconut oil based solvent offset printing inks.

III. Scope of Research

This research aimed to analyze the quality of printing work from coconut oil based solvent offset printing inks which the details of scope of research are as follows:

1) Produce coconut oil based solvent offset printing inks (Black Ink)
2) Methods of testing the quality, e.g., finding CIELAB value, density value, and dot gain value on gloss-coated woodfree weighs 130 grams by finding from Test Form designed by the researcher according to format of Printing Institute, GATF sizes A3 (42 x 21 cm)
3) Variableness

- Independent variable is offset printing ink with coconut oil Base.
- Dependent variable is quality of printing work from coconut oil based solvent offset printing inks.

The first commitments; coconut oil that using as based

solvent produced from Sumut Songkram Province and producing offset printing ink using formulation from printing factory in Thailand.

IV. Research Methodology

The details of analyzing the quality of printing work from coconut oil based solvent offset printing inks are as follows:

1) Find the details regarding materials, equipment and tools to be used in the research which colleting from related text books and research.
2) Extract coconut oil from dried coconut by meaning of dry process.
3) Bring extracted coconut oils into the ink production process by using coconut oils as ingredient of varnish and mixing others ingredients used in producing offset printing ink such as solvent, resin, additional chemical mixed by ink crushing tool according to formula from printing factory in Thailand and then, printing ink was obtained for printing on gloss-coated woodfree weighs 130 grams for analyzing quality of printing work.
4) Designing Test Form for printing according to GATF Form, consisting of digital color bar, Urgra control bar, wedge, control strip, gray balance, various type of image according to designing of testing shown in Fig. 1.
5) Collect information for printing preparation by specifying all materials and tools from certain sources according to ISO 12647-2 standard for gathering the most correct information.
6) Print offset printing ink obtained on Test Form as designed on gloss-coated woodfree paper weighs 130 grams.
7) Collect data by using spectrophotometer under light source D65 and by collecting data of CIELAB value, density value, and dot gain value printed on gloss-coated woodfree paper weighs 130 grams from the best sheet work for analyzing quality of printing work.
8) Summarize and report results of analysis

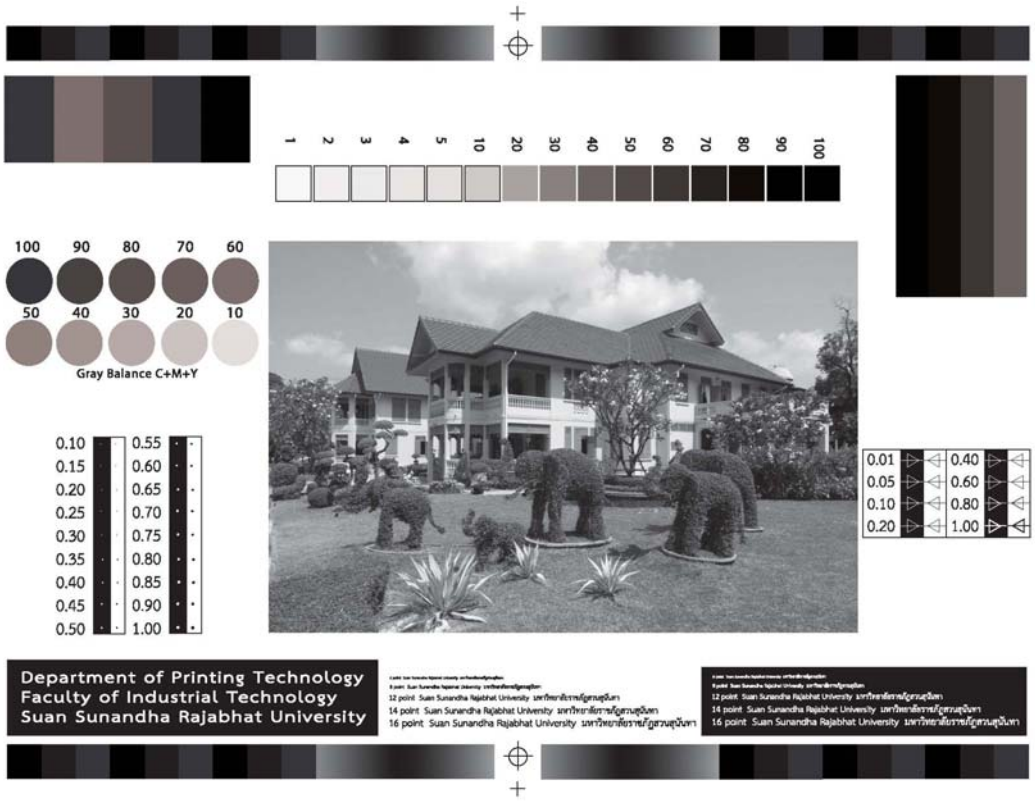

Fig. 1 Test Form according to GATF Form

V. Results

A. The Result of Producing Prototype Coconut Oil Based Solvent Offset Printing Inks

Production of a prototype coconut oil based solvent offset printing inks used coconut oil as ingredient for preparing varnish can be summarized as appeared in Table I.

TABLE I
FORMULATION VARNISH

No.	Ingredients	Wt.(%)
1	Coconut oil	50.00
2	Phenolic resin	36.00
3	Solvent oil	14.00
	Total	100.00

As shown in Table I, the result of mixing varnish showed that the suitable formula was to use 50% of coconut oil, 36% of phenolic resin and 14% of solvent oil. As a result, the mixing varnish was a part of offset ink formula as indicated in Table II.

TABLE II
FORMULATION BLACK INK

No.	Ingredients	Wt.(%)
1	Modified phenolic Varnish	50.00
2	Coconut oil varnish	20.00
3	Pigment Blue 27	2.00
4	Pigment Black 7	17.50
5	Pigment Blue 1	0.50
6	Wax	4.00
7	Drier1	0.20
8	Drier2	0.05
9	Anti Oxidant	0.05
10	Solvent Oil	0.05
	Total	100.00

As shown in Table II, the results of testing pointed out that the suitable formulation of black offset printing ink consisted of 70% of varnish which can be separated into 50% of modified phenolic varnish, 20% of coconut oil varnish , and 20% of pigments which can be separated into 27% of pigment Blue 2, 17.50% of pigment black 7, 0.50% of pigment blue 1, and 4.3 % of additional chemicals referred to 4.00% of wax 4.00%, 0.05% of drier 1, 0.05% of drier 2, and 0.05% of solvent Oil.

B. The Results of Analyzing a Basic Quality of Printing Work from Coconut Oil Based Solvent Offset Printing Inks

The results of analyzing a basic quality of printing work derived from coconut oil based solvent offset printing inks via collected data in aspects of CIELAB value, density value, and dot gain value printed on gloss-coated woodfree paper weighs 130 grams were as follows:

The result of CIELAB value on gloss-coated wood-free paper weighs 130grams) having average CIELAB value at L* = 93.25, a* = -0.41, and b* = -3.57) showed that CIELAB value complied with the standard of ISO 12647-2, getting CIELAB value of black printing ink under light source D65 is at L* = 31.90, a* = 0.27, and b* = 1.86.

The result of density value on printed gloss-coated woodfree paper weigh 130grams, indicated that density value is at 1.27.

The result of dot gain value on printed gloss-coated woodfree paper weighs 130 grams was shown in Table III and Fig. 2.

TABLE III
DOT GAIN

Percent of screening on publishing	Dot gain value (%)
10	4.73
20	16.63
30	18.27
40	20.90
50	18.77
60	17.50
70	13.37
80	9.37
90	4.87
100	0.00

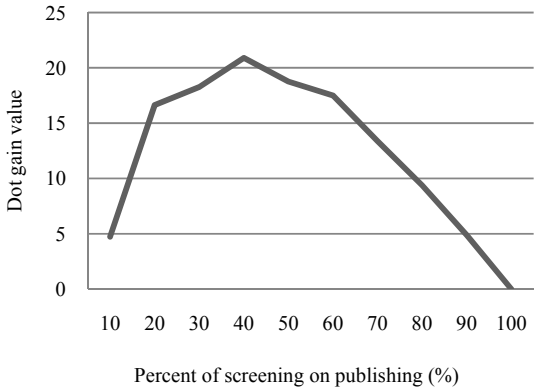

Fig. 2 Dot gain value

As shown in Table III and Fig. 2 dot gain value was high in range of percent of screening on publishing at 80-20 in mid tone area of image area.

VI. CONCLUSION

The suitable formula of black offset printing ink consisted of 70% of varnish separated into 50% of modified phenolic varnish, 20% of coconut oil varnish, and 20% of pigments which can beseparated into 27% of pigment blue 2, 17.50% pigment black 7, 0.50% of pigment blue 1, and 4.3% of additional chemicals 4.3 referred to as 4.00% of wax, 0.05% of drier 1, 0.05% of drier 2, and 0.05% of solvent oil.

The results showed that the analysis of a basic quality of printing work from coconut oil based solvent offset printing inks via collected data in aspects of CIELAB value, density value, and dot gain value printed on gloss-coated woodfree paper weighs 130 grams as follows; CIELAB value of black printing ink is at L* = 31.90, a* = 0.27, and b* = 1.86., density value was at 1.27 and dot gain value was high in range of percent of screening on publishing at 20-80 at mid tone of image area.

VII. DISCUSSION

As the result of a basic quality of printing work from coconut oil based solvent offset printing inks via collected data in aspects of CIELAB value of black printing ink printed on gloss-coated wood-free paper weighs 130 grams, the value was at L* = 31.90, a* = 0.27, and b* = 1.86 showing that

CIELAB value of black offset printing ink was not correspondence with the standard according to ISO 12647-2 under light source D65 specified at L* = 18, a* = 0, and b* = -1. Printed color of coconut oil based solvent offset printing inks was paler than usual comparing with soy oil based solvent offset printing inks which is vegetable-oil-based ink used instead of petroleum oil-based ink as the most used in commercial, because coconut oil based solvent offset printing inks having more L*.i.e., light value notification than soy oil based solvent offset printing inks which have value at L* = 16.25, a* = 0.38, and b* = 0.12.

In aspect of color difference (ΔE) between coconut oil based solvent offset printing inks and soy oil based solvent offset printing inks; the value was at 15.71 which were much different. The obtained color was consequently paler than usual since density value is less than standard DIN [5].

Dot gain value of coconut oil based solvent offset printing inks printed on gloss-coated wood-free paper weighs 130 grams having high value in range of percent of screening on publishing at 20-80 in mid tone of image area, this was correspondence with the standard of ISO 12647-2. Having dot gain value less than soy oil based solvent offset printing inks derived from the fact that viscosity value of coconut oil was better than soy oil based solvent offset printing inks.

VIII. Suggestion

1) Further research should be done on in finding printed quality of printing work by changing type of paper.
2) Coconut oil should be used to produce printing ink in other systems as alternatives in printing industry.
3) Other vegetable oils should be used to produce printing ink as alternatives in printing industry.

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