

# Production Offset Inks, Solvent Base with Coconut Oil of Samut Songkhram Province for the Environment

Krairop Charoensopa, Weera Chotethammaporn

**Abstract**—This research aimed to produce offset printing inks from Samut Songkram's coconut oil and to test properties of the printing inks comparing with commercial offset printing inks. One of the ingredients in the process of mixing varnish is coconut oil – used to produce black offset printing inks which were the subject of testing issues in order to compare with commercial offset printing inks. Based on the results of research, the best formula for mixing varnish was 50% of coconut oil, 36% of phenolic resin, and 14% of solvent oil. At the same time, the best formula in producing black offset inks was mixing varnish with 20% of coconut oil 20%. Consequently, the result of testing of properties of coconut oil based solvent offset printing inks regarding viscosity, tack and ink flow, showed that offset printing inks with oil based solvent had the properties less than commercial offset printing ink. Additionally, the result of testing also indicate that the rate of properties in aspects of ink spread and setting time of coconut oil based solvent offset printing were higher than that of commercial offset printing inks.

**Keywords**—Offset Printing Inks, Varnish Oil.

## I. INTRODUCTION

PRINTING business operations of the trade are related to printing services in all sectors. The goal is to provide organizations with a competitive edge. Customer response is very important for profitable operation of the business. The printing business is critical to the development of the country. With the continuous development, the study of communication and support exports is very important by participating in the creation of value-added printing business. The offset printing is the world's most used system nowadays since it possesses both fine and high quality printing works with reasonable costs so that the method is suitable for printing all advertising products. [1] The offset printing applied the repulsion technique. On a printing plate, they had two areas, i.e., the water intake area that does not have image and the image area that having chemicals combined with printing inks therefore, the printing ink is the important component in printing system. [2] The printing ink express its colors influencing on human vision; however, compositions of screen printing inks such as solvents, resins or chemical additives which all consisted of various chemicals causing the problems when operating works as screen inks produce bad smell according to chemical compound which is possibly harm users and pollute the environments as well. Samut

Krairop Charoensopa is with the Faculty of Industrial Technology, Suan Sunandha Rajabhat University, Bangkok (Tel 0 2160 1460 Facsimile 0 2160 1470-1; e--mail: Krairop.ch@ssru.ac.th).

Assistant Professor Weera Chotethammaporn is with the Faculty of Industrial Technology, Suan Sunandha Rajabhat University, Bangkok (Tel 0 2160 1460 Facsimile 0 2160 1470-1; e-mail: Weera.ch@ssru.ac.th).

Songkham Province, the place for planting coconuts which the key area is located at Amphur Amphawa and in 2002, the total of areas for planting coconuts is at 53,000 Rai.

The process of producing coconut oils is as below: Firstly agriculturists cleave coconuts, then dry the meats, sell dried coconut meats to coconut's factories. Samut Songkham Province is the place where there are a lot of plants of coconuts. The coconut oil from these plants is one of the most important ingredients for producing biodiesel as the alternative energy source to replace diesel oil. [3] Presently, the development of printing technology and new compositions are regularly applied so the subsequent matter is importing materials especially varnish oils causing higher costs for producing offset printing inks. [4] In addition, the costs of diesel oil are continuously increasing. Because the costs of transportation are rising, it also causes the higher costs of producing offset printing inks. As the problems occurred, project of producing varnish from coconut oil in Samut Songkham Province has been operated in order to replace petroleum by coconut oil – based on solvent to produce offset printing inks.

## II. THE OBJECTIVES OF RESEARCH

1. To produce offset printing inks with coconut oil based.
2. To test properties of the printing inks comparing with commercial offset printing inks.

## III. RESEARCH METHODOLOGY

Producing and testing offset printing inks in order to make coconut oil based solvent offset printing inks which processes of production were as followed:

- 1) Prepare coconut oil by using heat extraction process.
- 2) Prepare varnish by using coconut oil as ingredient.
- 3) Mix offset printing inks according to formulas of printing inks.
- 4) Weigh chemicals and other ingredients according to printing ink formula by using delicate measuring scale
- 5) Mix all chemicals together.
- 6) Test these following qualities of black printing inks
  - a. Viscosity
  - b. Tack
  - c. Ink spread
  - d. Ink flow
  - e. Setting time

## IV. RESULT OF RESEARCH

Using coconut oil as the ingredient for preparing varnish can be summarized the results as follows:

As the results of mixing varnish test, the best ingredients formulas is using coconut oil 50%, phenolic resin 36%, and solvent oil 14% and then bringing varnish obtained to be used as the ingredient for producing black offset printing inks.

TABLE I  
FORMULA OF MIXING VARNISH FROM COCONUT OIL

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

TABLE II  
VARNISH TEST

Properties	Commercial Varnish	Coconut Oil Varnish
Color of varnish	Yellow	Yellow
Tack Value (400 rpm 90o F 1 min.)	7.5	5.2
Spread Flow 15 Sec (Mm.)	38	42
60sec (Mm.)	46	50
Flow Plate 5 min(Cm.)	17.1	17.9
10min (Cm.)	23.1	23.8
15 min (Cm.)	27.2	28.4
Viscosity 25° C (Pa.s)	14.30	6.64

The results of the test are as below:

- Tack value: Digital ink O meter 400 rpm, 90°F 1 min.
- Spread flow: Spread flow meter, room temperature.
- Flow plate: Flow on plate, room temperature, ink
- Viscosity (Pa.s): Laray viscometer 25°C

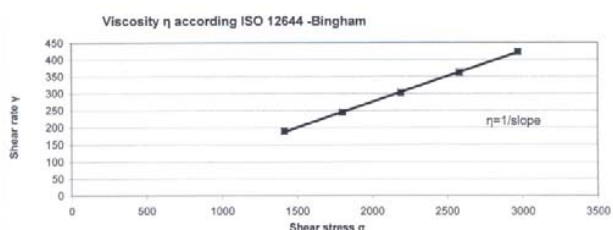


Fig. 1 Viscosity of Coconut oil varnish

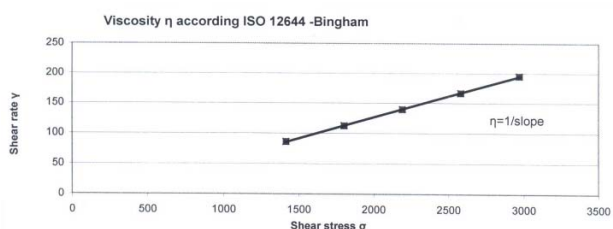


Fig. 2 Viscosity of Commercial varnish

TABLE III  
FORMULA OF MIXING BLACK PRINTING 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 the results of testing, research found the suitable formula of black offset printing ink should be 70% of varnish derives from 50% of modified phenolic varnish, 20% of coconut oil varnish. With 20% of pigment consisting of 2% of pigment blue 27, 17.50% of pigment black 7, 0.05% of pigment blue1, and all 4.3% of additional chemicals such as 4.00% of wax, 0.05% of drier 1 0.05%, 0.05% of Drier 2, 0.05% , and 0.05% of Solvent Oil 0.05

Testing of properties of printing ink before printing can be summarized the results as follows:

TABLE IV  
TESTING OF PROPERTIES OF BLACK PRINTING INK

Properties	Commercial Offset Printing Ink	Coconut Oil Offset Printing Ink
Viscosity (Pa.S)	205.81	59.24
Tack Value	13.6	10.9
Spread Flow 15 Sec (Mn.)	28	31
60sec (Mn.)	34	35
Flow Plate 15 min(Cm.)	8	12.5
60 min (Cm.)	11.5	16.5
Setting Time (Min.)	11	14
Fines of grind (μm)	3.0	3.0
Drying time (hr.)	13	13
% Water pickup	24.46	30.66

The results of the test are as below:

- Tack value: Digital ink O meter 400 rpm, 90°F 1 min., ink volume~1.32 ml.
- Flow plate: Flow on Plate, Room temperature, ink volume 0.5 cc.
- Viscosity (Pa.s): Laray viscometer 25°C
- Spread flow: Spread flow meter, room temperature, ink volume 0.5 cc
- Setting time: Check by RI Tester ink volume 0.2 cc. on coated art paper
- Drying time: Check by drying time meter
- Fines: Grind gauge
- % Water Pickup: Printing ink 50g: Fountain (4.5-5.5), mix 90 rpm. 5 min

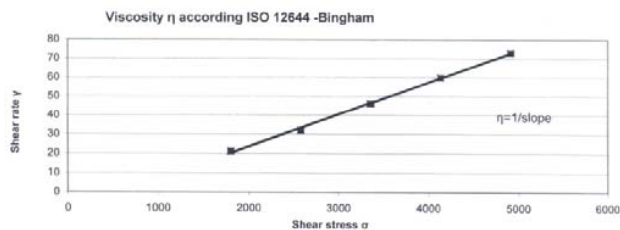


Fig. 3 Viscosity of coconut ink

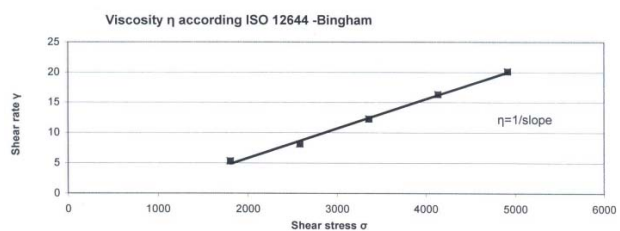


Fig. 4 Viscosity of commercial ink

The testing results of properties of printing ink before printing referred to test viscosity value of black coconut oil based solvent offset printing inks by using Laray Viscometer at 25 degrees Celsius. Researcher has found that the viscosity of black coconut oil based solvent offset printing inks was at 59.24 Pa.s, while black commercial offset printing ink was at 205.81. In subsequent, Tack testing by using digital machine ink o meter rpm 90 degrees Fahrenheit for 1 minute indicated that the value of black coconut oil based solvent offset printing inks was at 10.9, while black commercial offset printing ink was at 13.6. The testing of ink spread value designated that black coconut oil based solvent offset printing inks had the value at 15 seconds which was equal as 31 millimeters or at 60 seconds was equal to 35 millimeters, while such value of black commercial offset printing ink was at 15 seconds as equal as 28 millimeters or at 60 seconds as equal as 34 millimeters. Consequently, the testing of ink flow property showed that the ink flow of black coconut oil based solvent offset printing inks was at 15 seconds which was as equal as 12.5 millimeters or at 60 seconds was as equal as 16.5 millimeters while black commercial offset printing ink was at 15 seconds which was as equal as 8 millimeters or at 60 seconds was as equal as 11.5 millimeters. Besides, the testing of setting time property by using RI TESTER tool pointed out that the setting time of black coconut oil based solvent offset printing inks was as equal as 14 minutes, while black commercial offset printing inks was as equal as 11 minutes.

#### V. DISCUSSION AND CONCLUSION

This research aimed to find the way to invent offset black coconut oil based solvent offset printing inks by employing heat extracting dried coconut to produce coconut oil in order to mix with varnish by using 50% of coconut oil which is a suitable proportion for preparing varnish mixing in printing ink. Next was to mix coconut oil varnish with black offset printing ink by using 20% of coconut oil varnish and test the

properties of printing ink in these following qualities as followed. The viscosity value of coconut oil based solvent offset printing inks was less than that of the commercial offset printing ink, while the tack value of coconut oil based solvent offset printing inks was also less than the commercial offset printing ink. Ink spread value of coconut oil based solvent offset printing inks was higher than that of the commercial offset printing ink, while ink flow value of coconut oil based solvent offset printing inks was less than the commercial offset printing ink. Setting time of coconut oil based solvent offset printing inks was longer when compared to commercial offset printing.

Research results producing coconut oil based solvent offset printing inks from Samut Songkhram Province for the environment showed that the oil could produce varnish used for producing offset printing ink. This fact which was compatible to the research namely "production of varnish oil from purging nuts for producing printing ink for offset printing". It mentioned that such printing inks were quite low in probably, due to the improper proportion and time limit in experiments [5]. Other than that, researcher also found that setting time value of coconut oil based ink was higher than that of commercial offset printing ink. This fact was in consistent with the research namely, "The production of sun flower oil base printing inks" [6] which mentioned that setting time of natural printing inks was slower than mineral oil printing inks.



Fig. 5 Color of commercial ink and coconut ink

## VI. SUGGESTION

1. It is able to use coconut oils for producing printing ink in other systems as for an alternative of printing industry.
2. Coconut oil based solvent offset printing inks obtained slow setting time therefore this should be improved before bringing to produce printing ink for getting better setting time.

## ACKNOWLEDGMENT

The researchers would like to thank Suan Sunandha Rajabhat University and Research and Development Institute for helping financial assistance and would like to express thanks Chalermchaichan Co., Ltd. for supporting instruments and chemicals therefore, this research article, coconut oil based solvent offset printing inks from Samut Songkham Province for the environment has been throughout completed according to specific time.

## REFERENCES

- [1] Kriangkrai Jongjitsook and Kritiya Ismael.2003, the production of soyoil based solvent screen inks. [Master of Industrial Education and Technology], Thesis, King Mongkut's University of Technology Thonburi, Page Khor.
- [2] Weera Chotithammaporn. 2555. Basic Printing Technology. P 70-75.
- [3] Prapapron Khuntisoomboon. 2004. Business of producing coconut oil in Samut Songkham Province, Chiang Mai University, Pages 1-4.
- [4] Suppanee Riablerthiran (2009). Printing Materials Unit: 1-7. Nonthaburi: Sukhothai Thammathirat Open University. pp. 1-68 to 1-74.
- [5] Suchada Dissandorn and Pornpimol Sukwattakul. 2003, production of sunflower oil based solvent offset printing inks, [Master of Industrial Education and Technology], ThesisKing Mongkut's University of Technology Thonburi, Pages 91-92.
- [6] Prasobporn Wiratphokee, Sithima Phutichat, Thitisak Kritpol.1997, Production of varnish from soy oil and lime acids, [Master of Industrial Education and Technology], ThesisKing Mongkut's University of Technology Thonburi , Pages 94-95.