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A Short Review of Irradiated Peanut Ink Tinjauan Ringkas Dakwat Kacang Tanah Tersinar

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Abstract: Today's ink is not a good choice for long-term use because it contains higher levels of volatile organic compounds (VOCs). Surprisingly, the notion of making ink out of vegetable oils was one of the best inventions in the development of ink in the world because it was an environmentally friendly ink. The impact of radiation on the qualities of peanut oil and its utility as a consumer product will be discussed and information will be provided in this review study. The qualities of the oil will be improved by using radiation, and it can be used in community products. Radiation technique helps in enhances the properties of oil. Nonetheless, while this sort of ink made from peanut oil is less harmful, its capabilities needed to be enhanced.

Keywords: Irradiated, peanut, ink, consumer

1. Introduction

The invention of ink in the early era of human civilisation has become one of the most significant expansions in human history. Various substances have been used to make ink since prehistoric times. Earlier in 1457, the printing revolution began to take pace. Today, ink is employed in a variety of commercial industrial advances, including book and newspaper printing, food packaging, and clothing printing. However, the use of today's ink, which is largely petroleum-based, has negative consequences for the environment. It has several negative consequences for our bodies and the environment. Traditional petroleum-based inks are dangerous to the environment. It contains volatile organic compounds (VOCs) such as toluene C_7H_8, benzene C_6H_6, and xylene C_8H_{10}, which are organic substances with a high vapour pressure at ordinary room temperatures. These substances have the potential to be extremely hazardous to the environment, wildlife, and humans. Solvent inks contain volatile organic compounds (VOCs), which when released into the atmosphere and reacting with nitrogen oxides can produce ozone pollution. Asthma, emphysema, and bronchitis are all symptoms of the reaction, therefore printing workers are regularly exposed to health risks unless offered protection (Osman Şimşeker, 2007). Furthermore, when compared to vegetable-based ink, the ink is typically opaque and drab in colour, necessitating the use of more ink to get a dynamic look, posing a cost-effective issue.

To deal with the issues, another sort of ink, based on the content of vegetables, was introduced into the world. It can provide a smaller range of colours that are suited for producing vibrant saturated colours in prints. When applied, the vegetable-based ink also has a strong ability to cover up ink (Aydemir et al., 2018). When ink is printed on a coated paper using a combination of materials or polymer to achieve a few desired characteristics such as weight and smoothness, the colours become more vibrant to view (Tuan D. et al., 2018). This type of ink can reduce the intensity of colours, allowing for more printing mileage. There are fewer pigments in vegetable-based inks that can cover the same optical impact of colours (Aydemir, 2018). The oil from the vegetables that will be processed as the major element in the manufacture is extracted utilising several analytical procedures. The beans (Fabaceae) family is the ideal

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vegetable category to utilise in the production of this ink since the oil it produces contains 60% polyunsaturated fat and 24% monounsaturated fat, making it a heart-healthy oil (Erhan, 1992). Thus, the development of ink made from peanut oil would undoubtedly boost the green printing industry while also preserving the environment from dangerous elements. This review summarises the findings of a study on the suitability of peanut oil for ink production. As a result, this can achieve the goal by pursuing the following objectives: studying the physical and chemical features of beans, as well as evaluating the effect of peanut oil during the pre- and post-irradiation conditions. As a result, the eligibility of peanut oil from the Fabaceae species as oils that provide benefits for consumer products may be determined.

2. Literature Review

This section will describe the experimental literature review on the production of vegetable-based ink from peanut oil. It will cover the basics of vegetable-based ink, the properties of the grease used in the production of vegetable-based ink, and irradiation of peanut oil.

2.1 Vegetable-Based Ink

Vegetable-based ink was initially introduced 50 centuries ago in ancient China, where it was created by combining vegetable oil and soot. Colorants such as dye or pigments to give it colours, and additives that serve to strengthen the ink's powers such as resin and a carrier, which distinguishes this form of ink from petroleum-based inks, make up the compositions of ink (Osman Şimşeker, 2007). Furthermore (José, 2006). Nonetheless, each oil generated brought distinct benefits, such as soybean oil's brilliant qualities, which created a more vivid colour than petroleum-based oils. In that case, let’s see if peanut oil can be used to make environmentally friendly ink.

2.2 Elemental Compositions of Peanut Oil

Peanut oil is one of the most important ingredients in the production of inks. The oil was classified as part of a group of fats that includes nuts, fruits, and seeds. Triglycerides TAGs make up roughly 95% of peanut oils, with mono and diglycerides accounting for less than 5% of the total, sterols accounting for up to 1%, fat-soluble vitamins, pigments, waxes, and phosphatides making up the remaining 5%.

The small portions make up little more than 2% of the raw oil. Surprisingly, pigments that form colours can be found in the minor sections of this oil. TAG, the main component, is made up of three fatty acids linked to one molecule of glycerol (Mello, 2013). To make a simple TAG, three fatty acids of the same size must be combined, but the most common shape is one that combines two or three types of fatty acids in the molecule.

2.3 Physical and Chemical Properties of Peanut Beans

Chemical qualities were determined when a change in the molecular structure occurred, whereas physical attributes depicted components that could be grouped without changing their chemical identities. Marcio de Barros and Sandra Helena Prucendio did research for this study in 2016 and uncovered the qualities of beans that were popular in different parts of Brazil. Saracura, Juriti, Perola, IAPAR 31, IAPAR 81, Carioca, and Colibri were the seven types of beans used. To determine the chemical and physical qualities of the beans, the researchers used eight tests.

The beans were tested based on their sizes which then concluded that their average sizes are small through their weight. They used the weight of 100 units of each pellet to classified it according to the class size. They also evaluated the colour of the beans according to the color parameter by using the Gardner Colorimeter model 45/0. They measured the hardness of the beans using the TA-XT2 Texture analyzer in the units of Newtons (N), then the raw beans undergo a water absorption test when it is on a maceration process (Mørkbak, 1996). The maceration process is a test that aims the decreasing of time for the pellets to cook because when heated the water will favor the deportation of heat.

It is also certified by the cooking time required and the beans' integrity when heated. They determined the mineral content of the beans by digesting raw beans with a nitric perchloric acid-based chemical solution. They use the proximate composition to determine the total carbohydrates of each bean for 100 grammes of sample to learn about the bean's moisture, lipids, and protein. The experts concluded that Saracura, which has a high mineral content, is the ideal bean for processing in the sector. This excellent discovery demonstrates the appropriateness of peanut oil as a key ingredient in ink production. This is because peanuts have a higher mineral content.

2.4 Irradiation of Peanut Oil by Gamma Rays

The samples were chosen to be irradiated at doses of 0, 1, 2, and 3 kilo Gray of gamma irradiation based on the quality parameters of oil derived from gamma-irradiated peanut (Arachis hypogea L.). In order to determine the features of irradiation peanut oil, the researchers employed three methods: treatments and analysis, physiochemical and statistical traits (Tolle, 2000). The researchers kept the non-irradiated and irradiated samples at room temperature for a year, keeping the relative humidity constant. After a 12-month period, the qualities of both samples were examined. The fatty acid determination using a GC-17 A Shimadzu chromatograph, chemical analysis, and colour measurements using an Ava Spec Spectrometer Version 1 were all used to determine the attributes of grease in a physiochemical test. When he studied the data, he discovered that the radiated samples of peanut oil after being stored for twelve months have a lower fatty acid content and a higher fatty acid content, indicating that the oil is more nutrient-dense than the irradiated one. The samples' Thiobarbituric acid related substances (TBARS) were examined, and the results for both samples are shown.

Both exhibit a rising value of TBARS after being tested. He also investigated the effects of irradiation and storage time on the colour of the oil, finding that irradiation reduced the colour of the oil and reduced the amount of light. The study's findings revealed that acid, TBARS, and iodine readings were below ideal limits while stored in two conditions: radiated and non-radiated for a period of around twelve months. Nonetheless, it is thought to be one of the most helpful oils to use.

3. Methodology of Peanut Ink

According to the researchers, one kilogramme of peanuts must be cleaned of any foreign matter to verify that the samples do not include a heavy metal that could contaminate the substance. The cleaned peanuts will be cooked in a shallow pan with a Bunsen burner for about an hour at a temperature below 50 ºC for the next step. To eliminate any undesired material and foreign materials, the sample was heated (Jessica et al. 2020).

Using a 1500W CZR109 automatic oil press machine and a 304 stainless steel peanut presser with 110V, the peanut beans under the presser will be pressed to collect the oils. To avoid contamination of the sample, all of the apparatus, such as the spatula, were washed and rinsed with acetone or isopropanol before beginning with the oil extraction. A 50 m test sieve was used to sieve the sample of peanut beans, resulting in 50m of oil with no other mixing of other substances. The peanut beans that were too big to remove the sample were crushed again to attain the necessary size until all of the samples passed through the 50m test sieve. The sample will then be set aside for a while to ensure that the oil and other compounds are separated according to their densities.

Aside from that, the extracted oil will be combined with pigment, resins, and waxes as carriers. To make the black printing ink, the carriers were heated to 65 to 70 degrees Celsius and then blended with 1 percent butylated hydroxytoluene (BHT) and 6 to 20% carbon black. It was crucial to dissolve the BHT at a temperature that was inflated.

The pigment was then disseminated for five to seven hours using a Shar High-Speed Disperser, Model D-10P, which spins at 2500-3000 rpm. A Shar High-Speed Disperser, Model D-10P, was used to premix colour pigments, carriers, and additives at 2500 rpm for around 20 to 30 seconds (Erhan, 1992). The colours were diffused for about 10 minutes in an Eiger Mini Mill, which is packed with 2-mm chrome steel balls and runs at 3500 rpm. Bentone 128 was mixed to the ink in an amount of 0.5 to 2.0 percent to modify the viscosity dependent on the needs and to boost the brightness of the ink, Hydrite R was added to the solutions around 20% of it to increase the clotting of the ink.

The viscosities will need to be measured with the Laray Falling Rod Viscometer, Model MV.01. The viscosity of the ink was measured to see if it could produce a higher adhesiveness that wasn't easily melted when used for printing. The Quick Peek colour proofing kit was used to ensure that the colour inks were identical to one another. The extracted peanut oil that was utilised to make a vegetable-based ink must be examined for its pre- and post-irradiation gamma condition. The GC-17 A Shimadzu Chromatograph is used to determine the amount of fatty acids under both situations. The AvaSpec Spectrometer Version 1 was also used to analyse the colours of samples while they were radiated and when they were not.

4. Properties of Ink

When it comes to offset printing, the properties of vegetable-based ink are superior to petroleum-based ink. Vegetable colour manufacturing has provided the tiniest colour difference, demonstrating its ability to produce bright colours on prints. Contrary to popular belief, the petroleum oil utilised ink produced a colour that faded with time. The petroleum oil is naturally hazy, which affects the colour pay-off.

(a) (b)

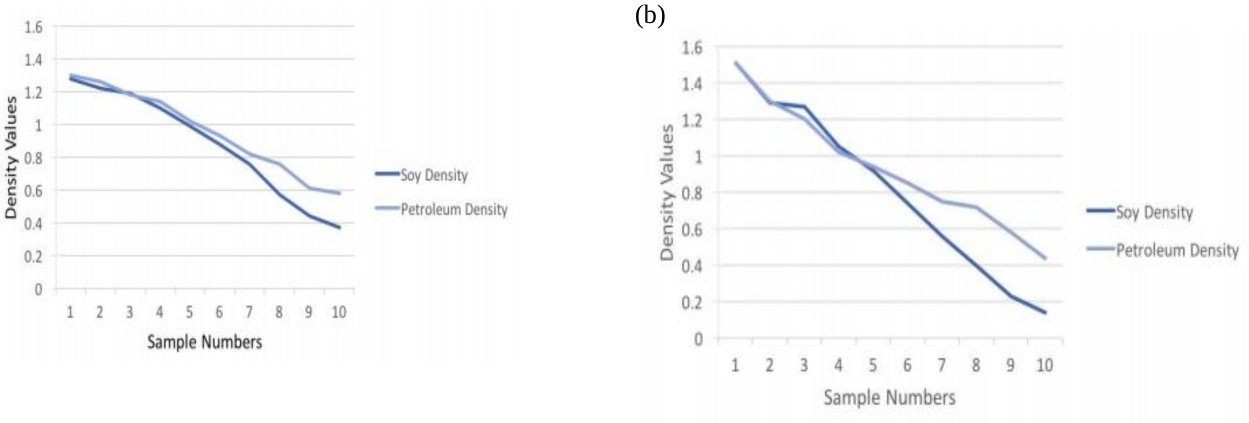

Fig. 1- The ink density values of vegetables-based and petroleum-based ink printed on (a) newsprint (b) supreme gloss (Christopher, 2015)

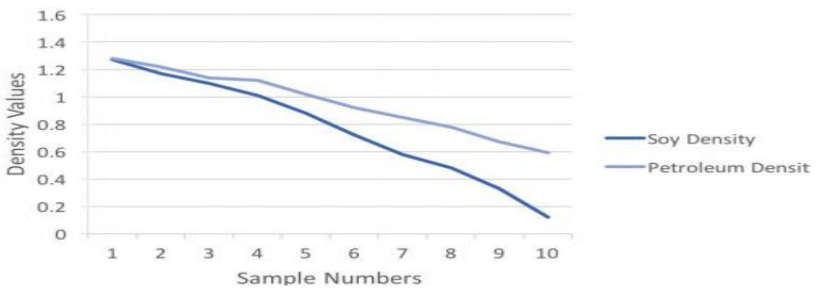

Fig. 2 - The ink density values of vegetables-based and petroleum-based ink earncliffe (Christopher, 2015)

When applied on a printed paperboard, the ink has better rub resistance and does not smudge. It does not have many flaws, which adds to its ability to tolerate friction. In comparison to petroleum-based ink, vegetable-based ink has a higher potential for adherence to the substrate.

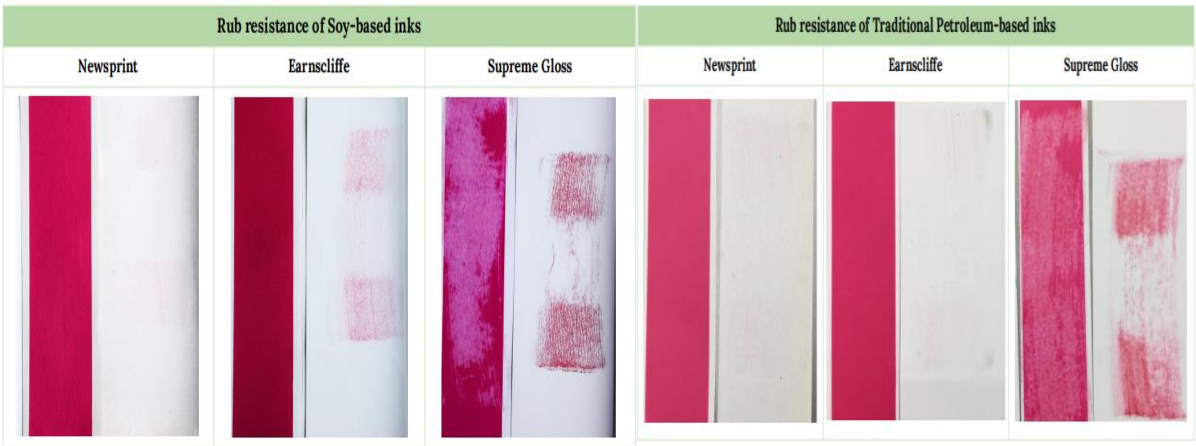

Fig. 3 - The ink rub resistance of the soy-based ink and traditional petroleum-based inks (Christopher, 2015)

Beans with small size, lighter colours, higher levels of proximate and mineral composition such as copper (Cu), ferum (Fe), and potassium (K) together with medium hardness after cooking, lower cooking time, water absorption capacity, and greater integrity after cooking were found to be good choices. Researchers previously investigated the influence of peanut oil on acid, TBARS, and iodine readings before and after irradiation. Peanut oils were rated as good oils to utilise for human requirements, according to the study's findings. Table 1 shows a proximate composition of bean varieties. Carbohydrates have a higher composition compared to proteins, lipids and ash. For moisture, Pérola have high moisture content. While for table 2 shows effect of gamma radiation from 1-3 kGy and storage period on biochemical properties of peanut oil. The range value of least significant differences (LSD) 5% shows 5.46 for saponification value.

Table 1- Proximate composition of bean varieties (Marcio & Sandra, 2016)

Varieties	Moisture	Proteins	Lipids	Ash	Carbohydrates
Carioca	12,09±0,16[d]	22,30±1,32[b]	1,19±0,29[b]	4,04±0,19[a]	72,47[a]±1,19[a]
IAPAR81	12,25±0,09[d]	23,48±0,94[ab]	1,81±0,29[ab]	3,88±0,18[ab]	70,83±0,77[ab]
Saracura	13,28±0,22[bc]	22,03±1,11[b]	1,87±0,14[ab]	4,00±0,10[a]	72,10±1,08[ab]
Juriti	12,52±0,39[dc]	22,49±0,57[ab]	1,99±0,54[a]	4,05±0,12[a]	71,4±0,90[ab]
Pérola	13,51±0,11[b]	24,76±0,77[a]	1,47±0,14[ab]	3,89±0,04[ab]	69,89±0,95[b]
Colibri	13,44±0,55[b]	24,86+0,60[a]	1,26±0,16[ab]	3,76±0,09[ab]	70,08±0,57[ab]
IAPAR31	14,47±0,20[a]	24,23±0,52[ab]	1,38±0,21[ab]	3,66±0,07[b]	70,73±0,47[ab]

[1]Average of three replications ± standard deviation
[2]Averages accompanied by the same letter in the same column do not differ significantly at p£0,05
[3]Results expressed on dry basis (d.b.), except for moisture, in g/100g of sample.

Table 2- Effect of gamma radiation and storage period on biochemical properties of peanut oil (Mahfouz, 2015)

Treatment storage period (weeks)	Control	1 kGy	2 kGy	3 kGy	LSD 5%
Acid value (mg KOH g^{-1} oil)					
0	1.78 ± 0.02	1.79 ± 0.00	1.78 ± 0.02	1.76 ± 0.01	**0.02**
12	3.44 ± 0.04	3.30 ± 0.06	3.37 ± 0.03	3.32 ± 0.07	**0.10**
LSD 5%	**0.07**	**0.10**	**0.05**	**0.11**	
Peroxide value (mEqO_2 kg^{-1} oil)					
0	4.07 ± 0.04	4.47 ± 0.08	4.51 ± 0.01	4.71 ± 0.04	**0.09**
12	10.78 ± 0.07	11.24 ± 0.25	11.70 ± 0.42	12.17 ± 0.28	**0.54**
LSD 5%	**0.13**	**0.43**	**0.67**	**0.46**	
TBA value (mg MDA kg^{-1} oil)					
0	0.018 ± 0.002	0.021 ± 0.001	0.019 ± 0.002	0.018 ± 0.001	**0.002**
12	0.028 ± 0.001	0.027 ± 0.001	0.028 ± 0.001	0.026 ± 0.001	**0.001**
LSD 5%	**0.001**	**0.002**	**0.001**	**0.001**	
Iodine number (g I2 100 g^{-1} oil)					
0	107.24 ± 0.06	104.95 ± 1.03	104.08 ± 0.13	116.76 ± 1.17	**1.48**
12	98.64 ± 1.83	101.21 ± 0.33	100.90 ± 2.11	100.11 ± 0.37	**2.67**
LSD 5%	**2.93**	**1.74**	**3.40**	**1.97**	
Saponification value (mg KOH g^{-1} oil)					
0	191.21 ± 1.09	188.58 ± 1.81	184.77 ± 5.37	187.69 ± 0.52	**5.46**
12	190.11 ± 0.19	190.04 ± 0.13	191.04 ± 0.51	190.60 ± 0.23	**0.57**
LSD 5%	**1.77**	**2.90**	**8.65**	**0.91**	

5. Conclusions

Finally, because it contains a higher level of mineral content, peanuts can be classified as the best beans to use. Second, peanut oil can be considered a helpful oil for ink production since it has low ideal limitations for both radiated and non-radiated situations. When imprinted on surfaces, the ink generated from peanut oil produced better colours, lower rub resistance, and lower VOCs. Ink made from peanut oil is safe to use in food packaging. Because it is an environmentally friendly ink, it may help to create a clean and pleasant environment for humans while also having a number of positive benefits on the printing industry, demonstrating that it is a necessary for consumer products.

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