Relationship of Tobacco Weight in Commercial Cigarettes to Nicotine Levels

Mariany Razali[1], Muhammad Taufik[2], Evi Dayatul Atiqah[3], Rid Wanto[3], Anny Sartika Daulay[3], Desi Ardilla[4], Endang Susilawati[5] and Afniwati[5]

[1]*Department of Pharmacy, Universitas Tjut Nyak Dhien, Medan, Indonesia*
[2]*Department of Chemistry, Universitas Sumatera Utara, Medan, Indonesia*
[3]*Department of Pharmacy, Universitas Muslim Nusantara Al Washliyah, Medan, Indonesia*
[4]*Department of Agricultural Technology, Universitas Muhammadiyah Sumatera Utara, Medan, Indonesia*
[5]*Department of Nursing, Poltekkes Kemenkes, Medan, Indonesia*

Keywords: Nicotine, Cigarettes, Electrosynthesis, Paper Chromatography, UV Spectrophotometer.

Abstract: Nicotine is a substance contained in tobacco leaves which is used for the manufacture of cigarette raw materials. Nicotine will come out of tobacco in the process of smoking or inhaling second hand smoke. In cigarettes the nicotine content should not exceed 1.5 mg. Nicotine is very dangerous for health and is addictive. This study aims to determine the effect of tobacco weight on nicotine levels and to analyse the nicotine contained in commercial cigarettes by applying the paper chromatography method and UV-Vis spectrophotometry. In this study, an experimental method was used, the experimental method was developed on electro synthetic coupling maceration with variations in sample weights of 0.3, 0.6, 0.9, 0.12, and 0.15 grams. The qualitative test results obtained in the Paper Chromatography method were nicotine positive because the Rf value of the sample was close to the Rf value of the standard solution and was reddish yellow, using electro synthetic coupling maceration with qualitative tests with Cyanogen bromide, the best results were marked by abundant greenish yellow colour . Using the UV-Vis spectrophotometry method, it was obtained that in each increase of 0.3 to 1.5 grams of tobacco, the concentration would increase by 0.4 ppm. Paper Chromatography Methods and UV-Vis Spectrophotometry can be used to analyse nicotine and produce the best results.

1 INTRODUCTION

Tobacco leaves contain the alkaloid nicotine, a type of neurotoxin (Baranska, Kaczor, and Chruszcz-lipska 2012). This substance is often considered evil, which makes tobacco products banned. Nicotine will come out of tobacco in the process of smoking or inhaling secondhand smoke or chewing (Rahmat Nur Hidayat, Adam M. Ramadhan 2016). In pristine leaves, nicotine is bound to organic acids and remains bound to acids when the leaves are slowly dried. Tobacco is deadly when consumed 60 mg at a time. It is the same as when the body receives water consumption that exceeds the capacity that is usually tolerated. In the case of cigarettes, the nicotine absorbed in the body is 10% of the nicotine content in a cigarette. If the weight of tobacco in a cigarette is 0.76 g, with 2% nicotine content in tobacco leaves, then the cigarette contains 15 mg of nicotine and 10% is absorbed by the body or the equivalent of 1.5 mg (Solarino et al. 2009).

Nicotine is the main pharmacologically active component of tobacco, and is also found in large quantities in other species in the Solanaceae family (Wiencek et al. 2019). At low concentrations nicotine is a stimulant, namely nicotine increases activity, alertness, and memory. This is one of the factors that contribute to the dependence on tobacco smoking. Nicotine can increase heart rate, blood pressure, and reduce appetite. At high doses, nicotine acts as a depressant or suppressant (Rahmat Nur Hidayat, Adam M. Ramadhan 2016).

Cigarettes are one of the tobacco products that are intended to be burned, smoked or inhaled, including clove cigarettes, white cigarettes, cigars or other forms produced from the nicotiana tabacum, nicotiana rustica, and other species or synthetics whose smoke contains nicotine and tar. , with or

Razali, M., Taufik, M., Atiqah, E., Wanto, R., Daulay, A., Ardilla, D., Susilawati, E. and Afniwati, .
Relationship of Tobacco Weight in Commercial Cigarettes to Nicotine Levels.
DOI: 10.5220/0010614800002775
In *Proceedings of the 1st International MIPAnet Conference on Science and Mathematics (IMC-SciMath 2019)*, pages 621-625
ISBN: 978-989-758-556-2

without additives (Fidrianny 2004). Cigarettes are usually cylindrical of paper with a length of between 70 and 120 mm (varies by country) with a diameter of about 10 mm which contains chopped tobacco leaves (Hamdan 2018).

Extraction is the process of separating materials from the mixture using a suitable solvent (Gupta and Kothari 2014). The extraction process is stopped when an equilibrium is reached between the concentration of the compound in the solvent and the concentration in plant cells. After the extraction process, the solvent is separated from the sample by filtration (Rusevska and Zdravkovski 2011). The initial extract is difficult to separate through a single separation technique to isolate a single compound. Therefore, the initial extract needs to be separated into fractions that have the same polarity and molecular size (Jahed, Hamidi, and Galehassadi 2020).

Nicotine extraction from cigarettes can be done in several ways, namely maceration extraction, reflux, and distillation. Extraction by maceration provides the advantage of undamaged samples and more yields (Rusevska and Zdravkovski 2011). Maceration is a simple method of extraction. Maceration is done by soaking the simplicia powder in a liquid filter. The fluid will penetrate the cell wall and enter the cell cavity containing the active substance, the active substance will dissolve because of the difference in concentration between the active substance solution in the cell and the one outside the cell, the concentrated solution is pushed out. These events are repeated so that there is a balance of concentration between the solution outside the cell and inside the cell (M Taufik et al. 2018).

The extraction of nicotine from cigarettes can be done by means of electrosynthetic maceration because it is a way to synthesize or produce a substance which is based on electrochemical techniques (Muhammad Taufik et al. 2021). In this method, there is a change in the element or chemical compound into the desired compound (Taufik, 2016).

Hidayat (2016) has analyzed nicotine using the ultraviolet spectrophotometric method, where the extraction of cigarettes is carried out with methanol which is then stirred for 30 minutes. Then add 2M of NaOH and aquadest then stir again for 5-10 minutes on the hotplate with a temperature of 700C. Add zinc acetate and potassium ferro cyanide before being centrifuged for 10 minutes at a speed of 3000 rpm. The supernatant obtained is added with petroleum ether and separated using a separating funnel and the fraction of petroleum ether is extracted. The determination of the nicotine content of cigarette samples was carried out by ultraviolet spectrophotometry at a wavelength of 262 nm with different concentrations of 20,40,60,80,100, 120 and the absorbance of 0, 0.5, 1, 1.5, 2, 2.5 in order to obtain the equation regression $y = 0.019 + 0.067$ at a price of $R2 = 0.983$ (Rahmat Nur Hidayat, Adam M. Ramadhan 2016).

Hidayat (2015) has reported that accurate information is obtained regarding the nicotine content of herbal cigarettes, a research on the identification of secondary metabolites and analysis of nicotine levels in herbal cigarettes was carried out using the UV-Vis spectrophotometer method at a wavelength of 262 nm. The materials used in this study included samples of herbal and conventional cigarettes, methanol, aquadest, petroleum ether, 2 M NaOH, zinc acetate, and potassium. Cigarette extraction was carried out with methanol plus 2 M NaOH and aquadest on a hotplate with a temperature of 70°C. Zinc acetate and potassium ferrocyanide were added before being centrifuged for 10 minutes at 3000 rpm. The supernatant obtained was added with petroleum ether and separated using a separating funnel and the petroleum ether fraction was taken. The results obtained by herbal cigarettes have a higher nicotine content than conventional cigarettes. Even though the nicotine levels listed on the herbal cigarette packaging are very low, even close to 0 (Hidayat, Siradj, and Selatan 2015)

Commercial cigarettes are cigarettes that are sold in the market. This cigarette product is a cigarette product that is in great demand by the public. Due to advertising promotions that do not explicitly invite or persuade someone to smoke. Thus increasing the target consumer to have smoking behavior. The tendency of society to understand that commercial cigarettes are no more dangerous. Actually, commercial cigarettes are the same as other cigarettes, only differentiating the way of promoting these cigarettes (Muhammad Taufik et al. 2017).

The effect of nicotine levels in tobacco found in cigarettes greatly affects health, so it must be known the levels contained in each gram of tobacco weight in cigarettes. This study aims to determine the effect of tobacco weight on commercial cigarettes on the levels of nicotine produced, to analyze the qualitative nicotine in commercial cigarettes using the Paper Chromatography method, and to analyze the nicotine contained in cigarettes using the UV-Vis Spectrophotometric method.

2 METHODS

Analysis of nicotine in cigarettes using experimental methods. The experimental method was carried out using electro synthesis with a time of 15 minutes and using variations in sample weight successively 0.3 g, 0.6 g, 0.9 g, 0.12 g and 0.15 g. Samples were analyzed qualitatively using Cyanogen bromide until a greenish yellow color was obtained and tested using the paper chromatography method. The quantitative test was carried out using the UV spectrophotometer method.

2.1 Materials

The materials used in this study were filter cigarettes, reagent pH, methanol, chloroform, aquadest, dragendroff reagent, aluminum foil, filter paper, and paper chromatography. The tools used in this research are glass tools in the laboratory such as measuring cups, beaker glass, test tubes, petri dishes, Erlenmeyer, a set of electro synthetic tools, a set of paper chromatography tools and a UV-Vis spectrophotometer.

2.2 Collecting Sample

Samples were collected used purposive sampling method, it was carried out deliberately by directly selecting researchers who met the sample criteria. The part of the cigarette that is taken is the cigarette part of the filter

2.3 Preparation

2.5 grams of nicotine standard solution is put into a 1000 ml measuring flask. Gradually dissolve with methanol while shaking, until it reaches the marking line. From this solution, a dilution is made with a concentration of 0.5 ppm, 1 ppm, 1.5 ppm, 2 ppm and 2.5 ppm.

2.4 Extraction

Filter cigarettes as samples were weighed with successive variations of 0.3 g, 0.6 g, 0.9 g, 1.2 g, and 1.5 g, put the sample into a 100 ml glass beaker plus methanol solvent macerated electro synthesis with a time of 15 minute. The results of electro synthetic coupling maceration were filtered with filter paper and then put into a petri dish, allowed to evaporate until the nicotine was obtained. The nicotine obtained was dissolved with 20 ml of methanol and then measured the pH (pH 9).

2.5 Paper Chromatography

Chromatography paper is made horizontal lines on the bottom edge of 2 cm and the top edge of 3 cm. Creepage distance is 10 cm. The standard solution (nicotine) and the test solution were spotted on the chromatography paper that had been activated beforehand. The marking is carried out on a horizontal line on the bottom edge of the paper chromatography with a spacing of 2 cm. The volume of the solution is 5 µl, the diameter of the dots should not be more than 0.5 cm. Then insert the chromatography paper into the chamber, and closed. Mobile phase: methanol: chloroform (50: 50). Left and observed until the spot rises and the solvent surface reaches the 10 cm limit mark. Then remove the chromatography paper plate and dry it. Observed the appearance of spots on paper chromatography using dragendroff reagent. The colored spots give a reddish yellow color, then the spots are marked from the standard solution and the test solution. The Rf value is calculated based on existing data.

2.6 UV Spectroscopy Analysis

The sample of filter cigarettes as a result of electro synthetic coupling maceration was analyzed quantitatively using UV-Vis spectrophotometry. Where the working conditions in spectrophotometric analysis are as follows:

1. The cuvette used was a glass cuvette with a thickness of 10 mm in a square shape.
3. The wavelength used in nicotine analysis is 262 nm.
4. The cuvette containing methanol is inserted into the spectrophotometer and press the blank button with a wavelength of 262 nm.
5. The cuvette containing methanol was replaced with a sample of the nicotine solution from the maceration results.
6. Wait for the absorbance reading on the spectrophotometer to stop and show a fixed number.

3 RESULTS

3.1 Preparation

The standard solution used is a solution containing the precisely known concentration of the element. The process of making standard solutions is carried out by diluting with five concentrations, namely 0.5, 1.0, 1.5, 2.0, and 2.5 ppm.

3.2 Preparation

Smoker's saliva preparation was carried out in the laboratory of the University of North Sumatra, Medan. The samples used were 10 ml of active smoker's saliva with the addition of chloroform solvent, in the smoker's saliva there is a nicotine compound that comes from cigarette consumption, which is directly exposed to cigarettes and cigarette smoke through the mouth where saliva is contained. Smoker's saliva has 2 layers perfectly where the bottom layer of nicotine and the top layer of the saliva remains. Non-smoker's saliva does not have a perfect 2-layer separation so it takes 5 minutes to let the saliva and solvent split into two layers.

3.3 Extraction

The extraction process by means of electro synthetic coupling maceration has a very important role in the compounds contained in the filter cigarette sample. Optimization is carried out through continuous observation of the aspects that affect the inclusion of active compounds in the sample to be analyzed. In this method, the electro synthetic coupling maceration takes 15 minutes for the maceration process.

In this electro synthetic coupling maceration extraction method, a chemical element or compound changes into the desired compound. The use of methods in synthesizing materials is based on the various advantages offered such as the equipment required is very simple, which consists of two or three electrode rods connected to an electric current source.

3.4 Paper Chromatography

Paper chromatography is an analytical method used to separate colored chemicals, especially pigments. Apart from being easy and cheap, chromatography also has the advantage that the resulting spots appear directly on the chromatography paper. Spraying is done using dragendroff so that the spots are clearer. In this study, the results of the paper chromatography test were used to identify the Rf value of the test sample, where the sample was said to be positive for nicotine, if the Rf value of the sample was the same or close to and the Rf value of the standard solution. In addition, it is said to be positive for nicotine when the spots are reddish yellow. This can be seen in the following **Figure 3.1.** :

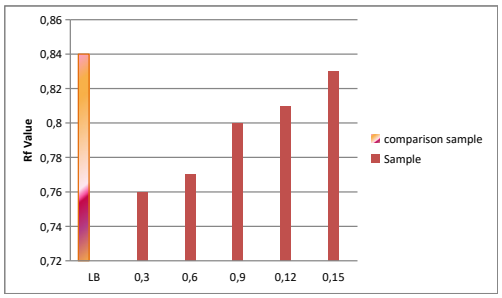

Figure 3.1: The results of the analysis used paper chromatography.

Figure 3.1 shows that the Rf value in the standard solution is 0.84 and in samples with 5 variations in sample weight, namely the sample 0.3 with an Rf value of 0.76, for a sample 0.6 with an Rf value of 0.77, for a sample 0.9 for an Rf value of 0.8 , sample 1.2 Rf value 0.81, sample 1.5 Rf value 0.83 and the average Rf value obtained is 0.80. From these data it can be said to be positive for nicotine because the Rf value of the standard solution is close to the Rf value of the sample solution. In addition, the resulting spot color is orange.

3.5 UV Spectroscopy Analysis

Tthe wavelength at a concentration of 2 ppm and an absorbance of 1.046 with a wavelength of 262 nm.

In this study, the calculation of the concentration of quantitative analysis by UV-Vis spectrophotometry was carried out using the regression method, namely by using a regression equation based on the standard concentration of nicotine and the absorption rate. The results of the regression equation can be seen in Figure 3.2. the following:

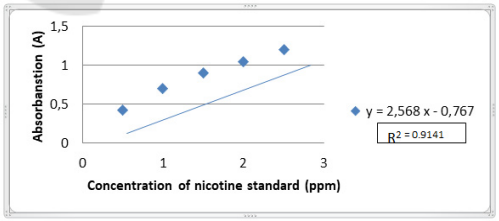

Figure 3.2: The regression equation in nicotine cigarettes analysis.

Figure 3.2. shows that the regression equation for filter cigarettes and non-filter cigarettes is Y = 2.568x - 0.767 and R2 = 0.9141. The regression equation can be used to calculate the nicotine concentration in filter cigarettes. The results of the sample concentration can be seen in Figure 3.3 the following:

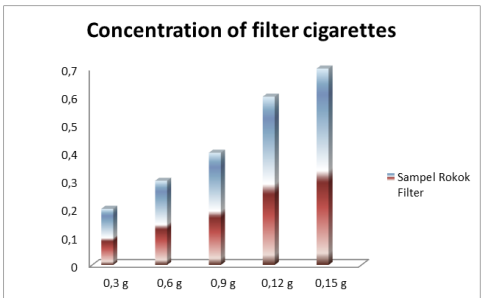

Figure 3.3. The concentration of the filter cigarette sample.

Figure 3.3. shows that the heavier the sample the heavier the nicotine concentration and each gram of the sample has a different nicotine concentration. Therefore, every tobacco that is in a cigarette has a different nicotine content. Nicotine levels in cigarettes have a very negative impact on health and can become addictive. From these data shows the highest yield of nicotine at a sample weight of 0.15 g, obtained by the micro synthetic coupling maceration method with a concentration of 0.7 ppm. However, in this study, we obtained a model on a lab scale that in each increase of 0.3 to 1.5 grams of tobacco, the concentration will increase by 0.4 ppm.

4 CONCLUSION

Preparation and extraction of nicotine in cigarettes using the electro synthetic coupling maceration method with time variations and methanol solvent produced nicotine compounds with a positive greenish yellow color in the qualitative test of cyanogen bromide. The Paper Chromatography method can be used to analyze nicotine with positive results for the presence of nicotine because the Rf value of the standard solution is close to the Rf value of the sample besides the resulting spot color is orange. However, UV spectroscopy can be used to analyze nicotine with the result that each increase of 0.3-0.15g of tobacco yields a concentration of 0.4 ppm using the Y = 2.568x - 0.767 line.

REFERENCES

Baranska, M., Kaczor A., Chruszcz-lipska K. 2012. Tobacco Alkaloids Analyzed by Raman Spectroscopy and DFT Calculations. Journal of Raman Spectroscopy 43 (December 2019): 1065–73. https://doi.org/10.1002/jrs.3127.

Fidrianny, I. 2004. Analisis Nikotin Dalam Beberapa Organ Mencit Jantan Yang Telah Menghirup Asap Rokok Analysis of Nicotine in Various Organs of Male Mice after Inhalation of Cigarette Smoke. Majalah Farmasi Indonesia 15 (4): 207–10.

Gupta, A., Kothari V. 2014. Modern Extraction Methods for Preparation of Bioactive Plant Extracts. International Journal of Applied and Natural Science s (IJANS) 1 (1): 8–26.

Hamdan, S.R. 2018. Pengaruh Peringatan Bahaya Rokok Bergambar Pada Intensi Berhenti Merokok. Mimbar 31 (June 2015): 241–50. https://doi.org/10.29313/mimbar.v31i1.1323.

Hidayat, A.S., Siradj M. 2015. Sertifikasi Halal Dan Sertifikasi Non Halal Pada Produk Pangan Industri." Ahkam XV (2): 1–12.

Jahed, F.S., Hamidi S., Galehassadi. M. 2020. Dispersive Micro-Solid Phase Extraction for Sensitive Determination of Methotrexate from Human Saliva Followed by Spectrophotometric Method. Research Article 21 (1): 1531–38. https://doi.org/10.31557/APJCP.2020.21.6.1531.

Rahmat N.H., Adam M.R, Rolan R. 2016. Analisis Kadar Nikotin Rokok Herbal Indonesia. Prosiding Seminar Nasional Kefarmasian Ke-3, 1:20–21.

Rusevska, K., Zdravkovski Z. 2011. Simple Extraction Method For Detecting Exogenous Substances In Scalp Hair By Gc-Ms. Journal of Hygienic Engineering and Design 3: 1–9.

Solarino, B., Rosenbaum F., Rießelmann B., T Buschmann C.T., Tsokos M. 2009. Death Due to Ingestion of Nicotine-Containing Solution : Case Report and Review of the Literature. Forensic Science International 195 (November): 18–22. https://doi.org/10.1016/j.forsciint.2009.11.003.

Taufik, M, D Ardila, M Razali, and A Ghozali. 2018. Physical Properties of Lard in Tuna Processed Products in Order to Oncrease Halal Food Safety. Proceeding International Conference of Sustainable Agriculture and Natural Resources Management 2 (1): 10–15.

Taufik, M., Ardilla D., Daulay A., Wanto R., Rahmawati E, Alfian Z, Cahyady B., Razali M.. 2021. Exploration of Maceration Methods for Extracting of Lard from Industrial Food Products Exploration of Maceration Methods for Extracting of Lard from Industrial Food Products. AIP Conference Proceedings 020006 (April): 1–6.

Taufik, M., Wanto R.,, Cibro S.R., Ardilla D., Razali M, Tarigan D.M. 2017. Studi Pendahuluan Maserasi Coupling Elektosintesis Dalam Mengekstraksi Nikotin Yang Terkandung Dalam Puntung Rokok. Prosiding Seminar Nasional Kimia Unmul, 182–90.

Wiencek, J.R., Gehrie G.A, Keiser A.M., Penny C., Johnson-davis K.L., Booth G.S.. 2019. Detection of Nicotine and Nicotine Metabolites in Units of Banked Blood. AJCP 1 (1): 516–21. https://doi.org/10.1093/AJCP/AQY176.