UNIVERSITI TEKNOLOGI MARA

INDUSTRIAL TRAINING FINAL REPORT

SESSION: MARCH-AUGUST 2022

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Department During Attachment	Product Development and Advisory Services (PDAS)
Duration (Date)	22nd February until 5th August 2022
Lecturer Evaluation	Siti Hajar Anaziah Muhamad

ACKNOWLEDGMENT

In the name of Allah, the most Beneficent and most Merciful, all praises to Allah, Lord of the universe and peace be upon His Messenger. I want to acknowledge Him on top of all for blessing me with patience and tenacity of mind to complete the Internship report. It is undeniably a vital requirement for certified Diploma with flying colours and I have received outstanding helps from many quarters which I would like to put on record here with great pleasure and deep gratitude.

Then, I would express my sincere appreciation to my industrial supervisor, Dr Raznim Arni Bt Abd Razak for her continuous and valuable, encouragement and insight throughout these six months period of my industrial training. The opportunity that she gave to learn and experience to work in research and development department had given me the confidence to be able to work and communicate with the people that I worked with efficiently. She also gave me an opportunity to gain more knowledge in food technology and how important is to do more research and analysis on foods in order to take care the society's health.

Special gratitude to Puan Nur Liyana Syafiqah Senen, the Assistant Research Officer in research lab of Innovative Product Group for her willingness to teach and help during the whole project of free 3-MCPD. She gave me an opportunity to teach me how to run the sample by using the Gas Chromatography (GC-MS) by myself.

ABSTRACT

This industrial training report of Eizleisya binti Eizwar to undergo an industrial training for duration of 6 months which consist of 24 weeks before completing the Diploma courses. Starting industrial training on 22nd February 2022 until 5th August 2022at Malaysia Palm Oil Board (MPOB) which guided by Dr. Raznim Arni Bt Abd Razak. The purpose of this program is to fulfil the course in order to complete the Diploma as well as graduate from the university. The training refers to work experience that is relevant to professional development prior to graduate. In first chapter this report is defining the term of industrial training and description on industrial training objectives. This part explains the details of objectives of industrial training report and industrial report. In second chapter of report is overview of the company and departments. The next chapter describes the summary of the duties and various tasks in weekly of industrial training activities that carried out. The next chapter details on project or task during the industrial training. This training gives students a good experience in the workplace so they can gain real-world experience and increase market credibility. The industrial training assists in developing chemical engineering technician graduates with excellent technical skill and soft skill competency when it comes to preparing the students as engineering technicians. Since all core and elective theories can be utilised in industrial training, it is expected that students would be able to approach problems and projects given to them by supervisors in original and creative ways. Finally, trainee got opportunities to learn more about students' self-confidence and enhances their collaboration and communication abilities. In addition, students are required to practise engineering with a high degree of integrity, ethics, and accountability

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CHAPTER 1: INTRODUCTION OF INDUSTRIAL TRAINING

1.1 Overview

Industrial Training is a program which aims to provide an actual practice training for a student within a specified timeframe. This training is allowed to be carried out either in government organization or in the private sector.

For students are taking a Diploma in Chemical Engineering in Universiti Teknologi Mara (UiTM) Pasir Gudang, they are required to go for an industrial training for 6 months in related field or organization as it is one of the important subjects that need to be taken. The students should be able to find a place for their industrial training program which related with their studies as they can gain experience the actual environment before they enter the real world of engineering field.

I, Eizleisya binti Eizwar, had been accepted by the Malaysian Palm Oil Board (MPOB) branch to conduct my industrial training for 6 months which started from 22nd February until 5th August 2022. I have been placed in Analytical and Quality Development Unit Department (PDAS). During this training, I have been supervised by Dr. Raznim Arni Binti Abd. Razak, Research Officer in this department.

During early month of industrial training period, I have given the task to do a project of Establishment of free 3-MCPD measurement in thermally proceed food. Since this project is quite new to this department or company, it requires a lot of research and method development to analyse and determine the free 3-MCPD in thermally food.

1.1 Objective of Industrial Training

There are many objectives of the industrial training program that have been required for most university's student especially for those who taking a diploma and degree. The main goal of industrial training is to expose students and assist them comprehend real-world scenarios in the organizations and environments relevant to such situations while also accelerating their knowledge of how their skills might be applied practically.

Besides, it provides the exposure to practice and apply the acquired knowledge "hands on" in the working environment. Industrial training also provides a systematic introduction to the ways of industry and developing talent and attitudes, so that one can understand how Human Resource Development works. Moreover, students can gain hands-on experience that is related to the students majoring so that the student can relate to and widen the skills that have been learnt while being in university. Industrial training also exposes the students to the real career world and accustoms them to an organizational structure, business operation and administrative functions.

Furthermore, students implement what they have learned and learn more throughout this training. Besides, students can also gain experience to select the optimal solution in handling a situation. During industrial training students can learn the accepted safety practices in the industry. Students can also develop a sense of responsibility towards society.

Industrial Training Placement

Figure 1.2: Malaysia Palm Oil (MPOB)

1.1.1 Industrial Schedule

Normal working hours	**9 hours**
Day of working	5 days a week
Work in	7:30 am
Break hour	Monday- Thursday 12pm – 2pm Friday 12pm – 2:45 pm
Work out	4:30 pm

1.3.2 Company Supervisor Information

Name:

Position:

Department:

Email:

Phone Number:

CHAPTER 2: COMPANY PROFILE

2.1 Company Background

Malaysian Palm Oil Board (MPOB) is a premier government agency under the Ministry of Plantation Industries and Commodities, entrusted to serve the country's oil palm industry. Its main role is to promote and develop national objectives, policies, and priorities for the well-being of the Malaysian oil palm industry (Board, 2022).

It was incorporated by an Act of Parliament (Act 582) and established on May 1, 2000, taking over, through a merger, the functions of the Palm Oil Research Institute of Malaysia (PORIM) and the Palm Oil Registration and Licensing Authority (PORLA). Each of these respective organizations has been involved in the oil palm industry for more than 20 years and it is to render more effective services as well as to give greater national and international focus to the industry that MPOB was instituted

2.2 Company History

The Malaysian Palm Oil Board (MPOB) was established in 1998 with the passing of the Malaysian Palm Oil Board Act, which led to the merger of two pre-existing agencies, the Palm Oil Research Institute of Malaysia (PORIM) and the Palm Oil Registration and Licensing Authority (PORLA) (Soong, 19 February 2013). The resulting organisation was named the Malaysian Palm Oil Board and officially began operations on 1 May 2000 (News, 2000). The first Director-General of the MPOB was Yusof Basiron who served until 2006. Sime Darby

Plantations' managing director, Mohd Bakke Salleh, was appointed as chairman of the industry regulator and research body for a two-year term effective 31 July 2018.

2.3 Vision and Mission

Vision

To become the premier Nobel Laureate – producing research and development institution, providing leadership and impetus for the development of a highly diversified, value-added, globally competitive and sustainable oil palm industry.

Mission

To enhance the well-being of the Malaysian oil palm industry through research, development and excellent services.

Strategies

- Expand and improve the current uses of oil palm products.
- Find new uses for the products.
- Improve production efficiency and quality of products.
- Optimize land utilization in oil palm areas.
- Promote the use, consumption and marketability of oil palm.

Policy

- To adopt strong market and industry-oriented research and development programs.
- To aggressively undertake transfer of technologies and commercialization of research results.
- To forge and active partnership in technology development and utilization with the private and public sectors.
- To strengthen international linkages and research collaboration in selected areas.
- To promote global awareness, appreciation and demand for Malaysian oil palm and products.

Functions

- Implement policies and development programs to ensure the viability of the oil palm industry of Malaysia.
- Conduct and promote research and development activities relating to the oil palm industry.
- Regulate, register, co-ordinate and promote all activities relating to the oil palm industry.
- Develop, promote and commercialize research findings as well as provide technical, advisory and consultancy services to the oil palm industry.
- Develop and maintain markets for oil palm products as well as promote efficient marketing.
- Liaise and co-ordinate with other organizations inside or outside Malaysia to further enhance the oil palm industry of Malaysia.
- Plan and implement training programs and human resource development in line with the needs of the oil palm industry.
- Be the resource and information centre of the oil palm industry including the publication and dissemination of information on oil palm as well as other oils and fats.

Logo

Figure 2.3: MPOB's logo

The logo of Malaysia Palm Oil Board (MPOB) resembles oil palm fronds, and outline of an oil drop. Moreover, the out-flu formation of fronds represents the diverse function of MPOB which range from research and development of commercialization, registration, licensing, technical advisory, and consultancy. The logo's green stripes also represent MPOB's R&D hiding strategies, maximum exploitation of palm oil, complete utilization of the non-oil

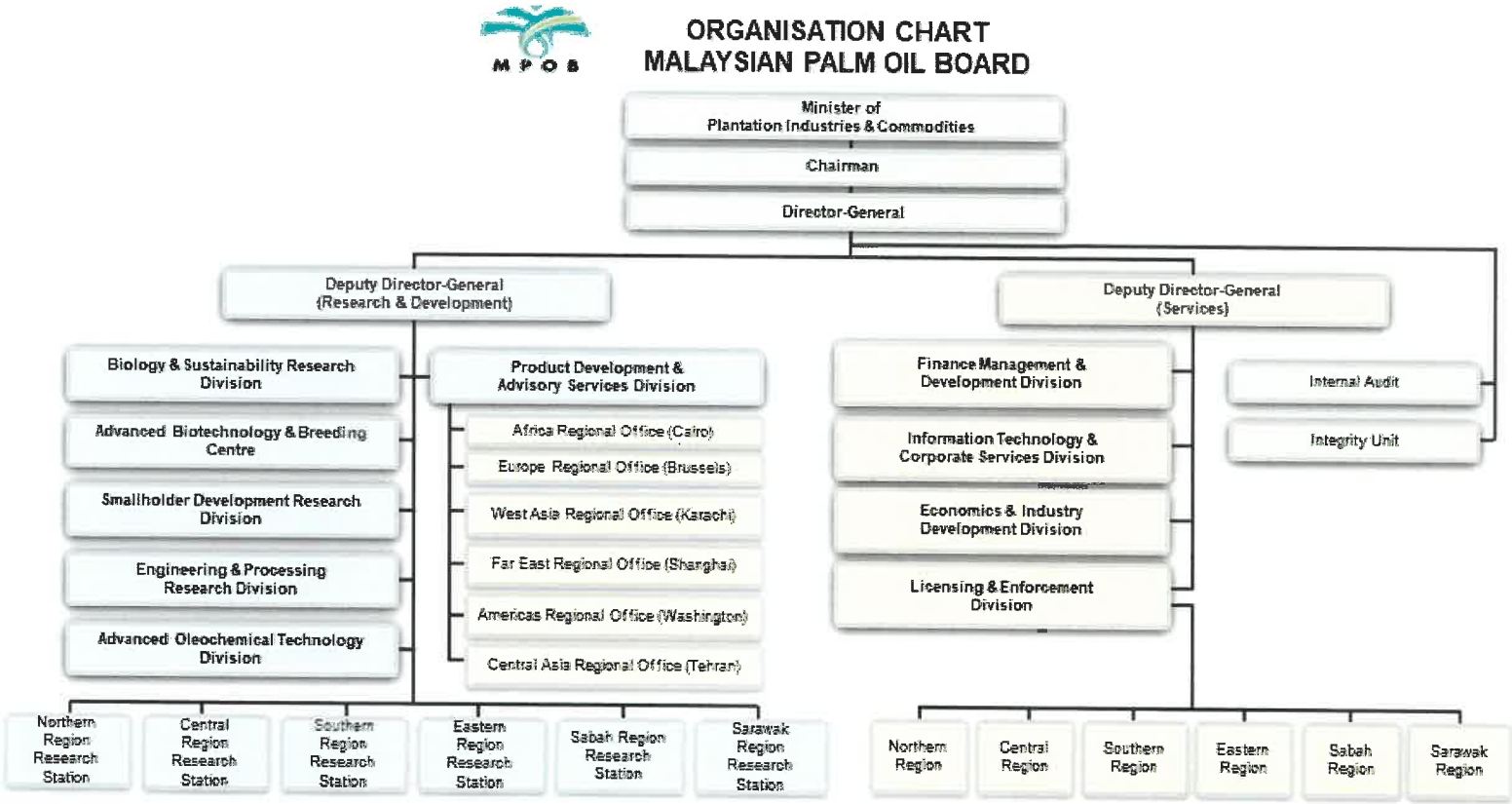
components and full utilization of the land under palm oil. While the golden stripes signify the "golden crop of Malaysia". The logotype in black is symbolic of the strong and bold character of MPOB. The golden stripe and the rounded base of the logo then signify a perpetual dynamic state of the Board characterized by energy and process.

2.4 Organization Chart

The members of the Board are appointed by the Minister of Plantation Industries and Commodities. It comprises of a Chairman, representatives from three ministries; Finance, Plantation Industries and Commodities, and International Trade and Industry; and also representatives from Federal Land Development Authority, National Association of Smallholders, Malaysian Estate Owners Association, Malaysian Palm Oil Association, Malaysian Edible Oil Manufacturers' Association, Palm Oil Millers' Association of Malaysia, Palm Oil Refiners' Association of Malaysia, Malaysian Oleochemical Manufacturers Group, Sarawak State Government, Sabah State Government, East Malaysia Planters' Association and the Director-General of MPOB.

The board is served by several committees in the areas of Research (Program Advisory), Finance & Development, Tenders, Establishment, Registration & Licensing and Audit. The administration and management of MPOB is the responsibility of the Director-General, supported by a Deputy Director-General (Research & Development) and a Deputy Director-General (Services). MPOB's activities are divided into eight divisions headed by Directors. The divisions are Biological Research, Engineering & Processing Research, Advanced Oleochemical Technology, Product Development Research & Advisory Services, Economics & Industry Development, Finance, Management & Development, Information Technology & Corporate Services and Licensing & Enforcement.

ORGANISATION CHART
MALAYSIAN PALM OIL BOARD



FOOD SAFETY GROUP ORGANIZATION CHART

PRODUCT DEVELOPMENT AND ADVISORY SERVICES (PDAS)

↓

ANALYTICAL AND QUALITY DEVELOPMENT UNIT (AQD)

↓

FOOD SAFETY GROUP (FSG)

↓

GROUP LEADER

Muhammad Roddy Ramli

RESEARCH OFFICER

Dr. Raznim Arni Abdul Razak

Norizah Halim

Abdul Niefaizal Abdul Hamid

Dr. Maznah Zainol

ASSISTANT RESEARCH OFFICER

Nur Liyana Syafiqah Senen

Zakarinah Kamaruddin

Nor Asimah Ambok Selong

Nasihah Mohd Sofi

Mohd Khairul Nizam Mohd Nasir

Suraya Abd Rahman

RESEARCH ASSISTANT

Abdullah Abdul Rahman

Hasri Md Ali

Zawawi Yazid

Norazilah Pardi

Razali Mohd Noh

Mohamed Nor Petrus

Hafiz Azrai

Zikri Mat Tahir

Md Nizam Rahimam

Juhairul Ikmal

CHAPTER 3: OVERVIEW OF THE TRAINING

3.1 Introduction

In this chapter, it will be discussed on what I have experience during this industrial training. During 24 weeks of industrial training, variety of task that have been given by MPOB Company include research on literature review, method, and development, and many more. In specific way, I have given a project to develop and validate analytical method for the analysis of free 3-MCPD in thermally foods. This method development requires a lot of research and time. Hence, there are few experiences that I have gained during this project.

3.2 Summary of the training and experience gained

Task 1: Method development of Free 3-MCPD

During this project, the preparation of free 3mcpd requires a lot of modification of methods in the laboratory. Based on the literature review, the preparation of free 3mcpd need to be undergo the liquid extraction and derivation method before analysing into GC-MS. This process can be included weighting the sample, prepare the calibration standard, handling the chromatography column, and operate the nitrogen evaporator, rotatory evaporator, and aluminium block heater. Every procedure that has been establish in this project need to be record in a logbook whether it succeed or not. During this task, I have been supervised by my supervisor, Dr. Raznim and the assistant research project, Puan Liyana.

Task 2: Operate the Gas chromatography–mass spectrometry (GC-MS)

The Gas Chromatography/Mass Spectrometry (GC/MS) instrument separates chemical mixtures (the GC component) and identifies the components at a molecular level (the MS component). It is one of the most accurate tools for analysing environmental samples. The GC works on the principle that a mixture will separate into individual substances when heated. The heated gases are carried through a column with an inert gas like helium. As the separated substances emerge from the column opening, they flow into the MS. Mass spectrometry identifies compounds by the mass of the analyse molecule. It is required to input the condition and parameters of GC-MS before it starts to run. The GC-MS parameters can be included type of GC column, carrier gas, flow rate, injection volume, GC oven program, PTV program, transfer line, mode, mass range and quantification mass. In order to determine the free 3-mcpd

in thermally food, quantitative mass was carried out by monitoring ions at m/z 147 (3-MCPD) and m/z 150 (3-MCPD-d_5). Ions at m/z 91 and 196 (3-MCPD) at m/z 93 and 201 (3-MCPD-d5) were used as qualifiers.

Task 3: Dealing with food supplier.

As mentioned before, the scope of this my project is to develop and validate method for the analysis of free 3-MCPD in thermally processed food. Therefore, searching the food supplier is one of task that had been given to me. Based on the project proposal, 60 kg of fresh chicken and 12 kg of potatoes, and different types of oils need to be used in this project. There is a lot of suppliers that I have found which is Az Zain, MMS Trading, Pasar Borong Seri Kembangan, Mydin, Giant, and Tesco supermarket. I have called each one of the suppliers to ask about the prices, types of delivery fee and all the information requires. However, due to lack of time and the ongoing method development, this task can't continue to proceed.

Task 4: Cutting palm oil kernel

Another task I did during this industrial training was peeling and cutting off the fruit palm oil kernel with the researcher assistants. The total of fruit palm oil that need to extract was around 250 kg. It took quite some time to finish this task due to lack of manpower. This process called threshing. The fresh fruit bunch consists of fruit embedded in spikelet growing on a main stem. Manual threshing is achieved by cutting the fruit-laden spikelet from the bunch stem with an axe or machete and then separating the fruit from the spikelet by hand. Overall, this task is quite new to me, and I gain a lot of knowledge of fruit palm oil.

3.4 Weekly summary

Week 1: Briefing with the officer

In this first week of intern, I was briefed with the officer regarding the company policy and complete all the forms that need to sign. Then, I had meeting with my supervisor, Dr. Raznim regarding the task and project. The name of the project is Develop Method for Analysis of Free 3-MCPD in Thermally Process Food. My supervisor give a task for me to summarize the project proposal and search all the journals and articles that related to the project. My supervisor also given me a tour around the department and introduce me to other employees that I was going to work with.

After that, I had a discussion with the researcher assistant, Puan Yana regarding with my project. From the discussion, it can be obtained that the standard solution of f3-MCPD need to be prepare and find the food supplier for the raw materials in this project which is fresh chicken breast and fresh potatoes. Other than that, my supervisor given the task to meet the staff who is in charge with digestion microwave procedure, Puan Zila. She had given me the procedure for me to study and make summary regarding it. This procedure is important in order to defatted the food sample.

Week 2: Weighting sample and study on GC-MS instrument

In this week, my supervisor given a task to help the researcher assistant to weight scaling oil samples. Each of the samples requires to weigh 0.1 g. The weigh scaling of the sample can be precisely between 0.1000 g to 0.1005 g. The total samples that need to be done were 30 samples. The samples need to be analysed by the GC-MS. Moreover, the researcher assistant had also taught me how to operate the GC-MS instrument. The GC-MS is where free 3-MCPD will be analysed. After that, I met the head of this department, Dr. Azmil to sign "Aku Janj" form and a quick interview with him. Then, Puan Yana, the researcher assistant gave me a task to calculate chemical standard which includes, pentane, propanol, octane, acrolein, pentanal, hexanal, heptanal, trans-2-octenal and 2,4-heptadienal. The calculation was using the formula, M1V1 = M2V2 where M is the mass and V is the volume.

Other than that, I also done some research regarding my project. One of the articles that I found is "A novel method for the simultaneous determination of esterified 2-/2-MCPD and glycidol in foods by GC-MS". This article explains that parameters of the GC-MS given huge impact to analyse 3-MCPD in foods. The GC-MS parameters can be included type of GC column, carrier gas, flow rate, injection volume, GC oven program, PTV program, transfer line, mode, mass range and quantification mass. At the end of the week, my last task is to call food supplier like Mydin, Tesco, Azrin Supermarket and many more.

Week 3: Dealing with the supervisor

In this week, I read an article regarding with my project. The title of the article is "Intermittent frying effect of the French fries in palm oil, sunflower, soybean and canola oils o quality indices 3-moncholoropropane-2-diol ester (3-MCPD) and glycidyl ester (GE) and acrylamide." This article is about to determine the effect of intermittent frying of French fries using four different types of frying media on the media quality as well 3-MCPD and GE in frying oils and acrylamide contents in finished product. The next task that I did is to calculate

the quantity of the raw materials that need to be used in project which is fresh potatoes, fresh chicken breast and five different types of oils). I surveyed all the good brans and also the budget for the cost in this project.

After all the findings on the food supplier, I had discussion with my supervisor regarding the quantity of the raw materials that need to be used in this project. The total mass for fresh chicken and potatoes are 60 kg each. My supervisor also asked me to survey the price for the raw materials including the delivery and manpower. Other than, I conducted the Free Fatty Acids (FFA) analysis and supervised by researcher assistant, Puan Hanisah. The methodology for this analysis was included the preparation of the sample, neutralised the alkali solutions and titration. The reagent that been used for this analysis was 0.02 M of sodium hydroxide (NaOH) and the indicator solution is phenolphthalein. After the titration and collecting the data, the calculation of FFA analysis was done by using excel.

Week 4: Meeting with supervisor

I had meeting with my supervisor, Dr Raznim and the head of the department Dr Azmil. The minute meeting can be concluded that I need to contact the supplier of fresh chicken breast and fresh potatoes to get further details regarding the cost and also how the cutting size of the materials. Besides that, the standard solution needs to be prepared by that week before starting the frying process. The next day, I run the standard solution of 2ppm of heptanal and pentanal in GC-MS instrument. Based on the result in GC-MS, the peak of that compound did not appear. Hence, the standard solution needs to prepare again by using 1ppm of heptanal and pentanal and run the standard solution in GC-MS again.

My next task was to prepare standard solution of 2 ppm, 20 ppm, 200 ppm, and 2000 ppm of octane and acrolein diethyl acetal (ADA) by supervisor Puan Yana. The task continues to prepare other standard solutions like 2,4-heptadoenal, hexanal, and propanol standard solutions. All the standards need to be analysed by GC-MS. The GC-MS will be analysed at which peak and retention time will appear all those compounds.

Week 5: Prepared 3-MCPD internal standard

In this week, I prepared 3-MCPD stock, intermediate, spiking, internal standard, working standard and calibration solution. The 3-MCPD solutions were divided into six different concentration which is 0.00, 0.05, 0.1, 0.5, 1.0, and 2.0 ug/ml. The reagents that have been used in this task is 3-MCPD, 3-MCPD-d5 internal standard, ethyl acetate and 2,2,4-

trimethylpentane. All the solutions that have been prepared was placed in the freezer. My next task is the first for the analysis of free 3-MCPD in defatted food products. The procedure includes homogenized oil samples, added of internal standard, extracted with hexane, acetone mixture, collected liquid phase, evaporated in nitrogen gas stream, derivatized with phenylboronic acid (PBA), dissolved residue in iso-octane and lastly, measurement by GC-MS.

Then, the parameters for GC-MS were applied and saved the method. The ion mass monitoring for 3-MCPD is 146,147, and 149. Meanwhile for 3-MCPD-d5 149, 150, and 201. The next day I applied the different types of parameters in GC-MS for the analysis of free 3-MCPD. The different method GC-MS SIM and SCAN is SIM only can be analysed the selected specific quantifications mass meanwhile for the SCAN can analysed all ion quantifications mass. At the end of the week, I learned how to integrate the peak area and height.

Week 6: AOAC Official method

The second attempt of method development for the analysis free 3-MCPD was conducted during this week. This method called the AOAC Official method. Me and the assistant researcher were tested how the column chromatography works with extrulut, 2.00 ug/ml of calibration standard, Na2SO4 and 100ml of diethyl ether + hexane (1+9). The size of the column chromatography is 40 cm x 3 cm. The procedure for this method was homoginezed the sample, eluted the sample with 80 ml of diethyl hexane in the column, evaporated it by using rotary evaporator and nitrogen gas stream, derivative with PBA, and heated the sample at the block heater. At final step of this method, it should have separation for the final solution. Unfortunately, there are no phases or separation that can observe.

Then, I had a discussion with my supervisor regarding the last procedure. My supervisor explains that instrument's efficiency and preparation of the solvents may affect the result. She gave the suggestion that make sure I practise my pipetting skills when prepare the solutions and also using be more careful when using the instrument.

Week 7: modified method for free 3-mcpd by using SPE

My task continued with the same procedure as last week which is using the AOAC method for the analysis for free 3-MCPD. The calibration standard that has been used was 2.00 ug/ml. The final step of this procedure was removed 2,2,4 trimethylpentane from the mixture, added small amount of NA2SO4, and transfer to the GC vial. The standard was injected to the GC-MS and analysed it by using method SIM. However, the result may not really satisfy.

Another attempt for the free 3-MCPD method development is using the Solid Phase Extraction (SPE). This method was referred to "Determination of total polar compounds – Rapid Method using silica bond elute and polar compound fraction using HPLC-SEC." Instead of using 40 cm of column chromatography, the assistant researcher was given the solution to use SPE cartridge. The Solid Phase Extraction (SPE) has the same function as the column chromatography which is to elute the polar compounds. My last task of the week is to inject the sample then had done before to the GC-MS and analysed the peak for the 3-MCPD and 3-MCPD-d5. However, the result was still not satisfied.

Week 8: Modified method for free 3-mcpd using Doping method

My supervisor had given me a new refence to develop method for free 3-MCPD which is Doping Control Centre by University Sains Malaysia. This similar is quite with the AOAC method especially the solvents have been used which is diethyl ether and hexane. The difference between AOAC and Doping method is the size of the glass chromatography in the liquid extraction, the volume of reagents that have been used and the ions monitoring in the GC-MS. The Doping method is more simplify than the AOAC method. The size of the column chromatography is 20 cm x 3 cm. This method was divided into three parts. The preparation of sample, liquid extraction, and derivation.

The preparation of the standards which included added the internal standard and 2.0 ml 5M of NaCl into the sample, sonicate, vortex and freeze the sample. Then, the sample was eluted with 20 ml of diethyl ether in column chromatograph and extracted in nitrogen gas stream for the liquid extraction part. The last step is the derivation. This step was required to derivatise the sample with PBA, the sample was heated in the oven for 90 minutes at 40 degrees Celsius and washed with sodium bicarbonate NaOH. Lastly, analysed to the GC-MS.

Week 9: Run new method in GC-MS

My task was to run the sample have been prepared in the previous week to the GC-MS instrument. The method for the GC-MS used was SIM. Based on the result, the retention time for 3-MCPD (ion mass:147) is 23.722 min and 3-MCPD-d5 (ion mass: 150) is 23.674 min. the ratio between the two ions is 0.048. Later, my supervisor given a new task which is applied the parameters in GC-MS by using 3-MCOD ester method. This new method was for analyse the free 3-MCPD. The parameters were changed at the flow rates, injection volume and GC oven program.

I conducted again the Doping method to make new calibration standard. The calibration standard that I have been prepared was 2.00 ug/ml. The derivation agent for the derivitse part was freshly prepared by using 1ml p-tolune sulphonic acid (1.25g PBA + 5 ml acetone/H2O). The standard was injected to the GC-MS and run by using 3-MCPD ester method. The peak of the 3-MCPD and 3-MCPD-d5 were appeared.

Week 10: break from Hari Raya Aidilfitri

Week 11: Checked result from GC-MS

I have conducted again the doping method for the analysis of free 3-MCPD. The concentration of calibration standards that I have been prepared was 0.1 and 2.0 ug/ml. I did duplicate of it because my supervisor asked me to run different method in the GC-MS. One was SIM and another one was 3-MCPD ester method. Based on the result, I observe that the 3-MCPD ester method in the GC-MS was clearer and more accurate than using the SIM method. The abundance of the peak for each ion in 3-MCPD ester method than the SIM method. Retention time for peak 3-MCPD is 14.699 min meanwhile for peak 3-MCPD-d5 is 14.645 min. The ratio between that two is 0.07.

Week 12: VOC project.

This week I had given a new task which was to help the researcher assistant, Puan Yana regarding the Volatile Organic Compounds (VOC) project. I prepared 10 ml of blank oils and 50 ml toluene d-8 int the headspace vial. The next task is to run the sample in to the GC-MS. However, the GC-MS had some errors. It was important to do tunning evaluation before starting to run the instrument. The tunning evaluation will display the database whether the GC-MS is in a good condition or not.

On the following day, the GC-MS was in a good condition to run. Therefore, I run the instrument by changing the agitator temperature which was at 18 degree Celsius and time for

1, 3 and 5 min. the samples oils that have been used was Daisy Corn Oil, Nuevida High Oleic Sunflower and Sun Lico Sunflower Oil.

Week 13: Conducted free 3-mcpd analysis

Continue with the free 3-MCPD analysis, I had conducted the calibration standard (2.00 ug/ml) duplicate using the Doping method. However, one of the column chromatography was stuck. The solvent didn't come off from the column. I stopped the experiment and cleaned all the apparatus including dispose the waste into the chemical waste. Due to lack of the 20 cm column chromatography, my supervisor given the suggestion to use 40 cm column chromatography. I conducted again using the 40 cm column along with the 20 cm chromograph. I run both standard into GC-MS instrument using the 3-MCPD ester. Another solution to ensure the column didn't clog again, to wash the column with solvent diethyl ethane + hexane (1:9) and nitrogen gas stream. this is to ensure there is no more substances that stuck in the column.

Week 14: observe result from GC-MS

In this week, I checked and integrate the result in the GC-MS from the previous task. Based on the result of 40 cm column chromograph, retention time for peak 3-MCPD is 14.717 min and for peak 3-MCPD-d5 is 14.635 min. The ratio between that two is 0.082. Meanwhile for 20 cm column chromatograph, retention time for peak 3-MCPD is 14.629 min and for peak 3-MCPD-d5 is 14.559 min. The ratio between that two is 0.07. The ratio of the two columns is slightly different. At the end of this week, I conducted again the calibration curve using the Doping method, but the column was still stuck, meaning the solvents did not come from the column. It may cause due to extralut that had been used in this method. The extralut had the same function as silica to elute polar compounds in the column chromatography. Supervisor given the suggestion to re-do it again by using the polar compound methodology.

Week 15: resolve the column chromatograph problem

In this week, my task was to summarize the determination of polar compound. This method was applied on how to prepare of the slurry of silica. The preparation of silica slurry was one of the solutions to resolve the column chromatography problem. The extralut and silica were weight on the weigh silica. The extralut weigh is 16.825 g while for silica is 16.84 g. The silica and extralut were heated in the oven for four hours at 160 degrees Celsius. This step was to ensure the solids were fully dried. After heated, both solids were placed in desiccator.

Then, I prepared triplicate standard solution of 1.00 ug/ml using Doping method for the analysis free 3-MCPD. There were 3 columns with different preparation. The first column was was rinse with the mixture diethyl ether and hexane and added slurry of non-heated silica (2g silica + 6.4 ml diethyl ether hexane). Then added the standard solution into the column along with 1ml of 5M NaCl. The column was rinse again with the mixture with diethyl ether and hexane at constant flowrate. However, the column was still clogged, and the product didn't come from the column.

Week 16: resolve the column chromatograph problem

My task was continued with the previous week project which is to resolve the column chromatograph problem. The second column was column was rinse with the mixture diethyl ether and hexane and added slurry of heated silica (2g silica + 6.4 ml diethyl ether hexane). Then added the standard solution into the column along with 1ml of 5M NaCl. The column was rinse again with the mixture with diethyl ether and hexane at constant flowrate. Unfortunately, the column was still clogged, and the product didn't come from the column.

The third column was prepared of slurry extralut (2g extralut + 6.4 ml diethyl ether hexane). The column was rinse with diethyl ether and hexane and then added the slurry into the column. After that, the standard was added into the column along 1ml of 5M NaCl. The stopcock was opened, and the solutions went through it. The column was washed with 10 ml of diethyl ether and hexane at constant follow. Continue, elution of polar compounds with 20 ml diethyl ether into the column. Although, the solvent was come off from the column, but it only can be collected ¾ of the solutions. The derivation step was continued until the analysed of the GC-MS. The method for GC-MS was using the 3-MCPD ester method. Nevertheless, based on the result, there was no peak of 3-MCPD and 3-MCPD-d5.

Week 17: resolve the column chromatogram problem

I conducted again the Doping method for the analysis of free 3-MCPD in thermally process food. This time, I prepared duplicate of standard solution using 1.00 ug/ml of calibration solutions. One with 2.0 ml of 5M NaCl and another one without it. Both columns were prepared extralute slurry (2g extralute + 6.4 ml diethyl ether hexane). At the of this procedure, I have managed to inject two standards into the GC-MS using 3-MCPD ester method. Luckily, both columns didn't clog, and the product came off from the column.

Based on the result from GC-MS, for standard with 2.0 ml of 5M NaCl has the same ratio as the one without it, which 0.076. This shows the presence of NaCl may not affect the development method for analysis free 3-MCPD. My task continued to prepare again the calibration standards of 0.5, 1.0 and 2.0 ug/ml using Doping method. Those three columns were not wash with 1 ml of 5M NaCl. The clean-up column procedure was conducted to ensure the column didn't clog for the next use. Since the lack of the column, I continued again to prepare again the calibration standards of 0.0, 0.1 and 2.0 ug/ml using Doping method. At the end of week, I injected all six calibration standards into the GC-MS. The duration time for the GC-MS to operate was 7 hours.

Week 18: Observe result and peeled off the fruit palm oil.

At beginning of the week, I checked and integrated the result from the previous task in the GC-MS. Based on the result, I observed that the ratio between 3-MCPD (147 m/s) and 3-MCPD-d5 (150 m/s) were different among all the calibration standards. The researcher assistant explained that the quality of the internal working standards solutions may affect the results of calibration solutions from the GC-MS. She gave suggestion to prepare a new internal working standards solution. The following day, I continue my task to prepare the new internal working standards solution by diluting 1ml internal standard stock solution with ethyl acetate in 100 ml volumetric flask.

The next task that I conducted was peeled off the fruit palm oil kernel with the researcher assistants. The total of fruit palm oil that need to extract was around 250 kg. It took quite some time to finish this task due to lack of manpower. This process called threshing. The fresh fruit bunch consists of fruit embedded in spikelet growing on a main stem. Manual threshing is achieved by cutting the fruit-laden spikelet from the bunch stem with an axe or machete and then separating the fruit from the spikelet by hand. Overall, this task is quite new to me, and I gain a lot of knowledge of fruit palm oil.

Week 19: Third attempt for method development of free 3-MCPD.

Due to unsatisfied result from the previous week, I did the third attempt for the method development of free 3-MCPD. My supervisor gave some suggestion to adjust or alter the Doping method. The adjustments were removed 2.0 ml of 5M NaCl into the samples and skip sonication and freeze the sample. I conducted again the Doping method on calibration standards of 0.0, 0.1 and 1.0 ug/ml with blank oil. I have injected the calibration standards into GC-MS using 3-MCPD ester method. The result shows the ratio of 3-MCPD (147) and 3-

MCPD-d5 (150) between calibration standard of 0.0 and 0.1 ug/ml were the same which is 0.075. However, for the calibration of 1.0 ug/ml is 0.047. I continued my task to do industrial report which include the introduction, objective, company background, project description and executive summary.

Week 20: Fourth attempt for method development of free 3-MCPD

I continued my task to do calibration standards of 0.0, 0.05, 0.1, and 0.5 ug/ml using the previous adjustment method for the analysis of free 3-MCPD. The adjustment method is the same Doping method but remove 2.0 ml of 5M NaCl into the samples and skip sonication and freeze the sample. I have injected the calibration standards into GC-MS using 3-MCPD ester method. The result showed the abundance peak of 3-MCPD and 3-MCPD-d5 was too low. The next following day, I had a discussion with my supervisor regarding the results. She gave a suggestion to lower the molarity of the NaCl solutions from 5M to 2.5M.

After that, I continued my task to calculate the molarity of NaCl using method, M1V1=M2V2, which is the M is molarity and V is the volume. I prepared 14.6 g of NaCl diluted with 100 ml of H2O and sonicate it for 10 minutes until it fully dissolve. At the end of week, I prepared again the calibration standard of 0.0 and 2.00 ug/ml using 2.5M of NaCl. However, the column was still clogged, and the product didn't come off from the column.

Week 21: Prepared 1M of NaCl

Since the previous task was unsuccessful, I tried to conduct a lower concentration of NaCl solution which was 1.0M. I calculated calculate the molarity of NaCl using method, M1V1=M2V2, which is the M is molarity and V is the volume. I prepared 5.84 g of NaCl diluted with 100 ml of H2O and sonicate it for 10 minutes until it fully dissolve. Moreover, I prepared again the calibration standard of 0.0 and 2.00 ug/ml using 1.0M of NaCl. However, the column was still clogged, and the product didn't come off from the column.

Another solution to solve this project was adjustment method from AOAC and Doping method. The preparation of calibration standard was referred to the AOAC method meanwhile the liquid extraction steps was referred to Doping method. The derivation part was referred to AOAC method, but it only changes at the condition of the heating condition which is 40 degrees Celsius for 90 minutes using oven. I conducted again the calibration standard of 0.0 and 2.0 ug/ml for analysis free 3-MCPD and injected to the GC-MS using 3-MCPD ester method.

Week 22: Conducted six calibration standards for free 3-MCPD

Based on previous week result, ratio between 3-MCPD and 3-MCPD-d5 was constant the same also the abundance peak area was quite high. Due to satisfied result, I conducted all six calibrations which included 0.0, 0.05, 0.1, 0.5, 1.0 and 2.0 ug/ml using the modified method of AOAC and Doping method. As mentioned before, the preparation of calibration standard was referred to the AOAC method meanwhile the liquid extraction steps were referred to Doping method. The derivation part was referred to AOAC method, but it only changes at the condition of the heating condition which is 40 degrees Celsius for 90 minutes using oven. I injected to the GC-MS using 3-MCPD ester. It took 7 hours to finish the GC-MS operates.

After completed the GC-MS, I checked the result and integrate the peak area. Based on the result, I observe that the ratio between 3-MCPD and 3-MCPD-d5 were constantly the same among all the six calculations which is 0.05. The integration of peak area needs to be calculated in the excel for method validation. The purpose for this calculation is to ensure validation the method that have been used for the analysis of free 3-MCPD. The graph of calibration curve of free 3-MCPD are between area ratio of 3-MCPD/3-MCPD-d5 as independent variable and the calibration standards as the dependent variable. Based on the result, it shows that the calibration curves of these contaminants had good linearity, with regression linear, $R^2 \geq 0.99$.

Week 23 and 24: Finishing industrial report and slides presentation

Since the previous was successful accomplish with a good result based on the GC-MS and calibration curve calculation, I discussed with my supervisor regarding on this project. She was satisfied with the result and given the suggestion that I should focus on my industrial training report and slide presentation. I finished up my technical report and need to be done before 1st august 2022.

CHAPTER 4: DETAILS OF EXPERIENCES (Report on Job/Task/Project)

4.1 Introduction

During the industrial training, I had given a small project to establish of free 3-MCPD measurement in thermally proceed food. The presence of ester-bond and free 3-Monochlropropane-1,2-diol (3-MCPD) are widely found in edible oils in their respective ester from food process contaminants. These compounds are potentially toxic to the human body due to the release of 3-MCPD which considered as carcinogen. Figure 4.1 shows the chemical structures of 3-MCPD. The formation of 3-MCPD is due to interaction of triacylglycerol (TAGs) or glycerol with chloride at high temperature (Muhamad Roddy Ramlia, 2015). MPOB had discover the 3MCPD ester has no toxicological data were available in various food products and especially in refined vegetables oils. There are assumptions said that the 3-MCPD ester was transferred into free 3-MCPD. Thus, in order to verify these assumptions, the purpose of this project is to develop and validate analytical method for the analysis of free 3-MCPD in thermally processed food.

In this project, there are two references that had been used to determine the free 3-MCPD; AOAC Official Method and Doping Control Centre by University Sains Malaysia to attempt method development of free 3-MCPD. These two refences were modified in a way to optimize the right method to determine the free 3-MCPD. The methods will be explained in detail in the next subtopic. The GC-MS instrument is where the free 3-MCPD will be analysed based on the ratio between 3-MCPD (147 m/s) and 3-MCPD-d5 (150 m/z) and the integration of peak area.

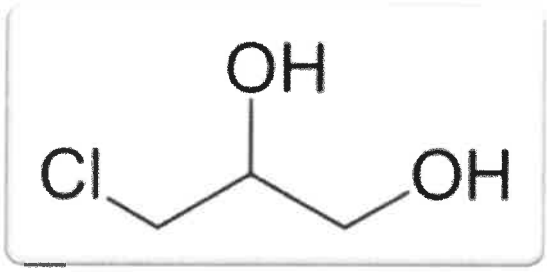


Figure 4.1: The chemical structure of 3-MCPD.

4.2 Details of the training and experience gained

4.2.1 Task 1: First attempt of method development of analysis free 3-MCPD by using AOAC method.

The AOAC Official method is the first attempt to development the method for the analysis of free 3-MCPD. The principle of this methodology is added internal standard 3-chloro-1,2-propanediol-d5 (3-MCPD-d_5) into test sample, followed by salt solution, and the mixture is blended to a homogeneous consistency. After sonication, the content of Extrulut refill pack is added and mixed thoroughly. The mixture is transferred to a glass chromatography column, and the nonpolar components are eluted with mixture of hexane and diethyl ether. The –MCPD is eluted with diethyl ether, and the extract is concentrated to small volume. Apportion of the concentrated extract is derivate and analysed by glass chromatography with mass spectrometric detection (GC-MS). Figure 4.2.1 shows the flowchart of this method. Unfortunately, this method was unsuccessful task because there was no separation for the final product. Therefore, the second attempt of method development of free 3-MCPD need to be done.

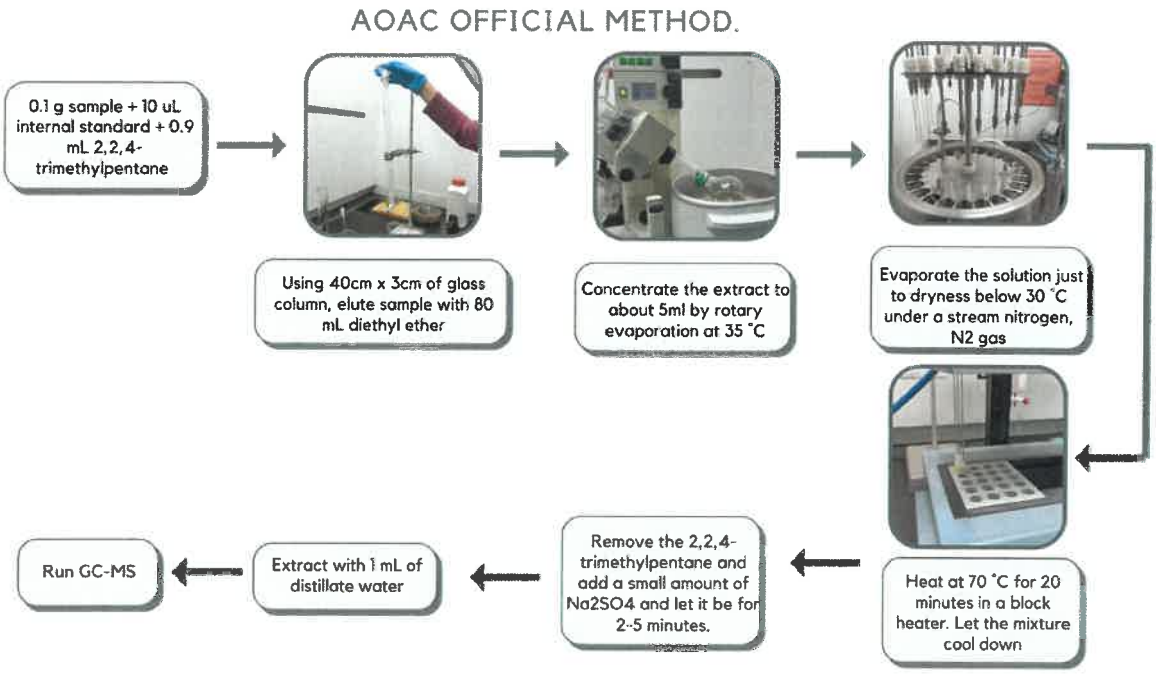


Figure 4.2.1: AOAC official method.

4.2.2 Task 2: Second attempt of method development of analysis free 3-MCPD by using Doping method.

The Doping Control Centre is another method to analysis of free 3-MCPD in thermally process food. The difference between AOAC and Doping method is the size of the glass chromatography in the liquid extraction, the volume of reagents that have been used and the ions monitoring in the GC-MS. The Doping method is more simplify than the AOAC method. The internal standard of 3-MPCD-d_5 that have been prepared in the AOAC method is used in this method. Figure 4.2.2 shows the method of Doping Control Centre. This attempt was unsuccessful because the integration of peak area from GC-MS result. for 3-MCPD and 3-MCPD-d5 were low.

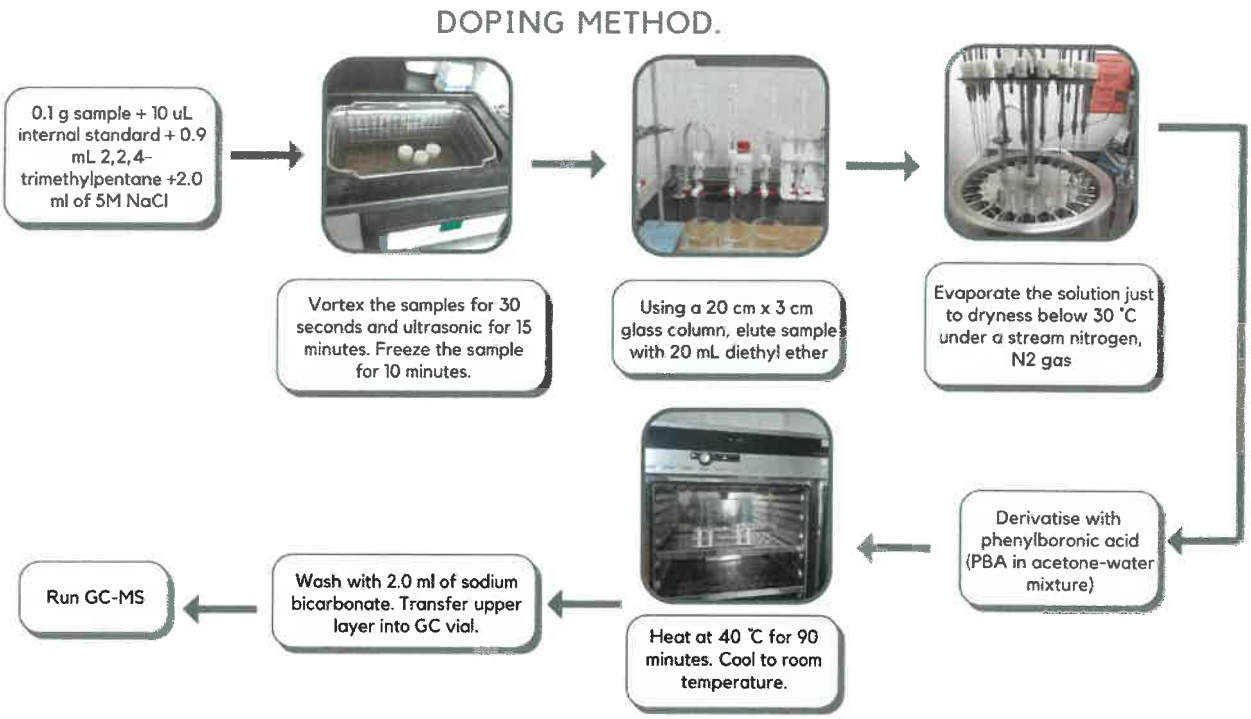


Figure 4.2.2: Doping method.

4.2.3 Task 3: Final modification of method development for analysis free 3-MCPD

After multiple times of try and error between these methods, the GC-MS result shows the peak of free 3-MCPD was appeared. The AOAC and Doping method has been combined for the analysis of free 3-MCPD in thermally process food. The preparation of calibration standard is referred to the AOAC method meanwhile the liquid extraction steps was referred to Doping method. The derivation part was referred to AOAC method, but it only changes at the condition of the heating condition which is 40 degrees Celsius for 90 minutes using oven. Figure 4.2.3 shows the flowchart of the method.

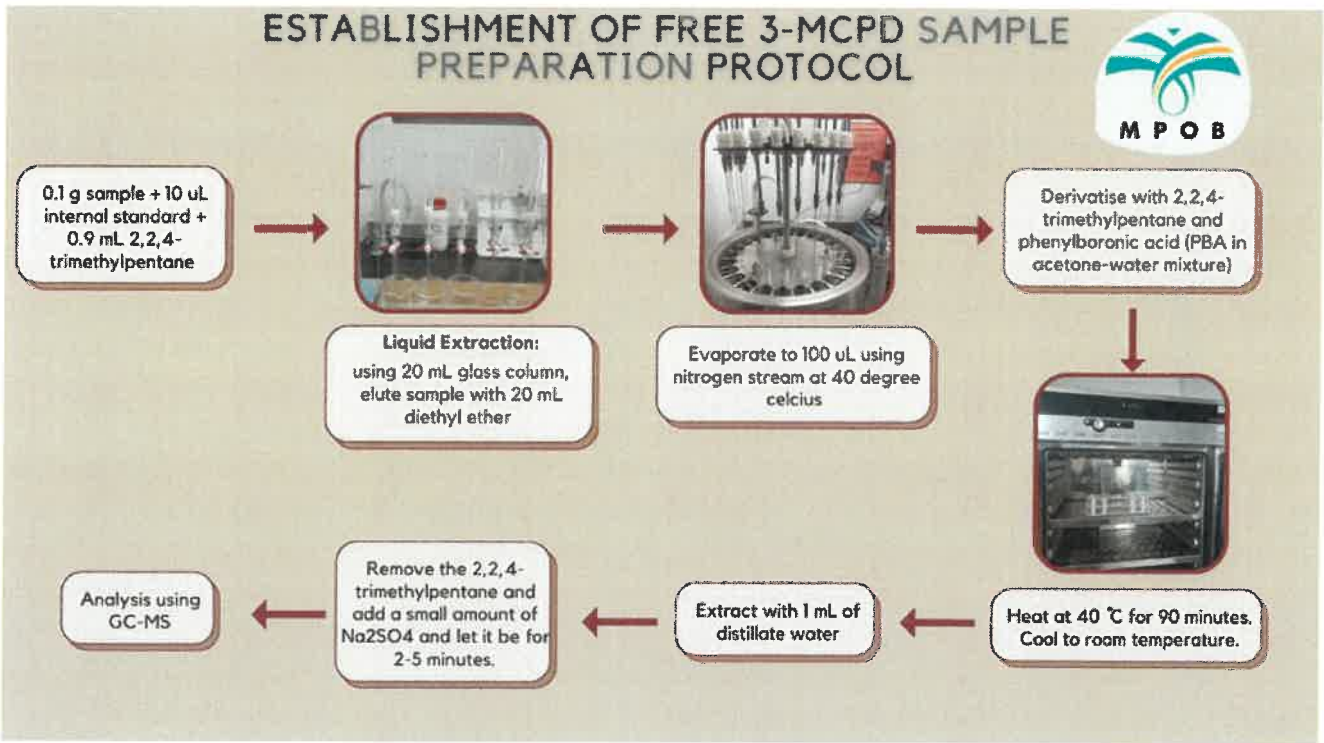


Figure 4.2.3: flowchart of the method

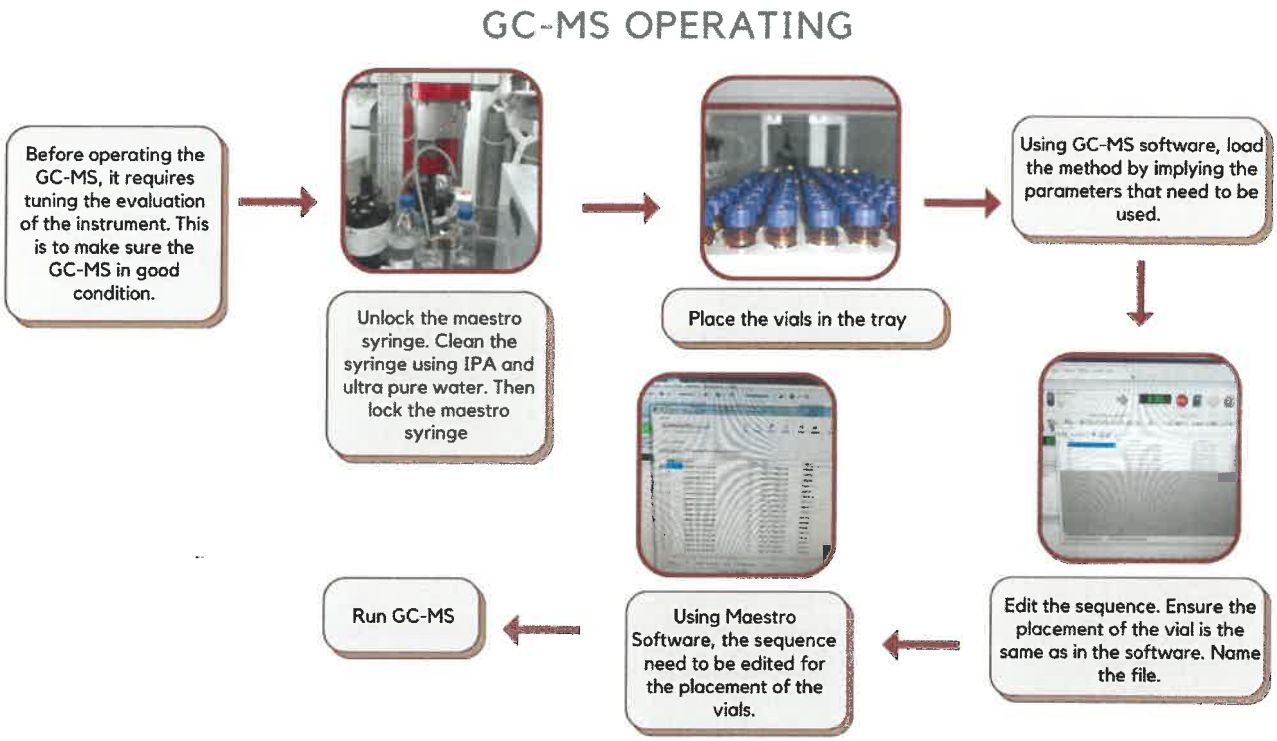
4.2.4 Task 4: GC-MS Parameters and Operating

The GC-MS parameters for this project were based on 3-MCPD ester's GC-MS's condition that have been modified before. The GC-MS parameters can be included type of GC column, carrier gas, flow rate, injection volume, GC oven program, PTV program, transfer line, mode, mass range and quantification mass. Table 4.2 shows the details of GC-MS condition and parameters to determine the free 3-MCPD and Figure 4.2.4 shows the GC-MS instrument. GC-MS chromatography depends on software GC-MS and Maestro. Figure 4.2.5 shows how GC-MS operates.

No.	*GC-MS Parameters*	*Condition*
1.	Gc Column	HP5-MS (30 m x 0.25 mm x 0.25 um
2.	Carrier Gas	Helium 99.99%
3.	Flowrate	0.8 ml/min
4.	Injection Volume	2.0 uL
5.	Gc Oven Program	40 °C (1 min), 10 °C/min to 170 °C for 0 min,3 °C/min to 200 °C for 0 min, 15 °C/min to 300 °C for 15 min
6.	PTV Program	69 °C (2s) to 200 °C in 60 s to 300 °C
7.	Transfer Line	280 °C
8.	Mode	El, 70eV
9.	Mass Range	120 – 210 (total ion monitoring)
10.	Quantification Mass	3-MCPD: 146, 147, 196 3-MCPD-d_5: 139, 150, 201

Table 4.2: GC-MS condition and parameters

Figure 4.2.4: the GC-MS insturmentGC-MS Operating



Flowchart 1: GC-MS Operating

4.3 Report on personal project for industrial training

Calibration curve of free 3-MCPD is linear relationship between calibration standards and area ratio of 3-MCPD/3-MCPD-d5. The area ratio of 3-MCPD and 3-MCPD-d5 were obtain by integration from the GC-MS chromatography result. The ion mass monitor for 3-MCPD is at 147 m/z meanwhile 3-MCPD-d5 is at 150 m/z. Figure 4.3.1 shows the peak of 3-MCPD and 3-MCPD-d5 for calibration standard of 2.00 µg/ml. The difference of retention time between 3-MCPD and 3-MCPD-d5 is remain constant among all the calibration standards, which is 0.05. Based on the result, it shows that the calibration curves of these contaminants had good linearity, with regression linear, $R^2 \geq 0.99$ (Figure 4.3.2). This justifies the method of analysis free 3-MCPD is validate.

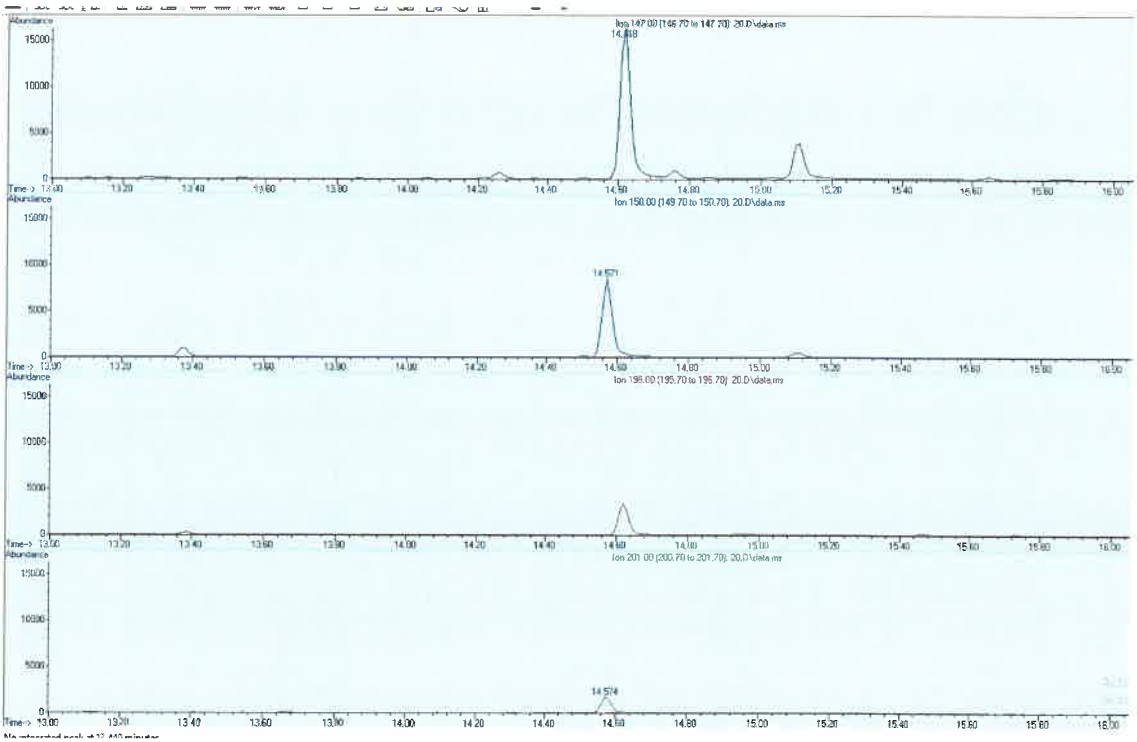


Figure 4.3.1: the peak of 3-MCPD and 3-MCPD-d5 for calibration standard of 2.00 µg/ml.

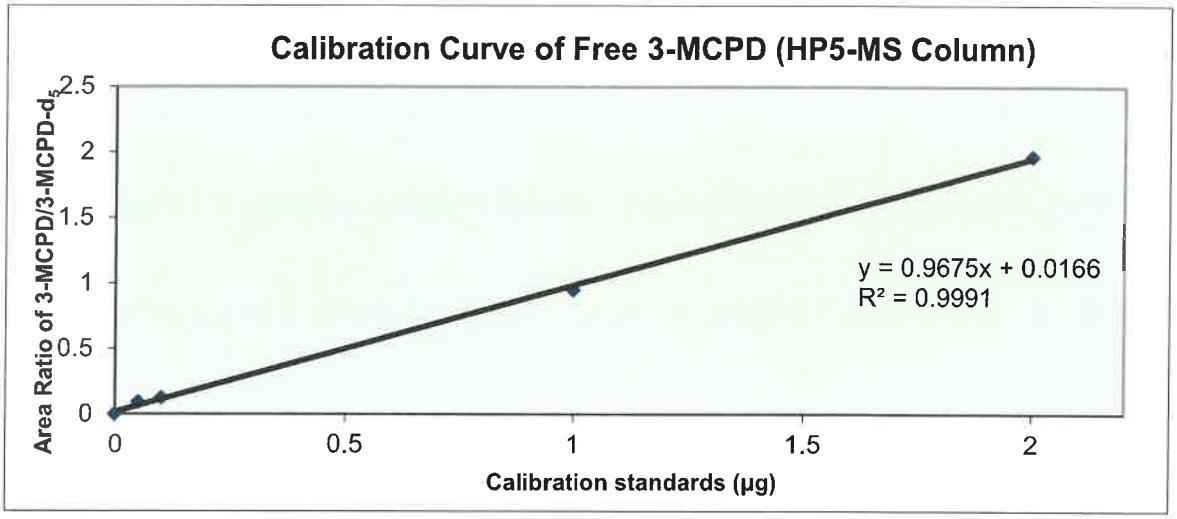


Figure 4.3.2: Calibration curve of free 3-MCPD

4.4 Problem encountered and approach adopted for solving problem

During my internship, there are few problems may be occurred and effected on my project that have been given to me. As mentioned before, my project is to development analytical method in determination of free 3-MCPD in thermally process food. Since this project is still on method development, there are a lot of adjustments and problems that need to optimize the method. One of it is the column chromatography troubleshooting. Column chromatography is simple and the most popular separation and purification technique. Both solid and liquid samples can be separated and purified by column chromatography. Column chromatography consists of a stationary solid phase that adsorbs and separates the compounds passing through it with the help of a liquid mobile phase (Nishi Srivastava, 2021).

The column chromatography is used in AOAC and Doping method in order to elute the free 3-MCPD compound from the sample. The column chromatography can be sometimes clogged, the product wouldn't come off from the column and the separation is not appear. The cause of this problem is because 5 molarity (M) of NaCl have been used to elute the free 3-MCPD in the column chromatography. The high concentration or molarity in the solvent may affect to the flow of the column. At the begging of the project, the solutions to solve the problem is to lower the concentration of NaCl solutions, from 5M to 1M. Using formula of molarity, M = moles of solute, n / liters of solution, ml. mass of NaCl are calculated. 5.584 g of NaCl and 100 ml of H2O were eluted together to become 1M of NaCl.

Other than reducing the molarity of the solution, the column chromatograph procedure clean-up is also the solution to solve this problem. The procedure includes to wash the column with solvent diethyl ethane + hexane (1:9) and nitrogen gas stream. this is to ensure there is no more substances that stuck in the column. However, after two or three times used that solution, the column chromatography still did not come off the product. The last solution to resolve this problem is to eliminate the NaCl solution from the procedure of analysis free 3-MCPD and luckily, the peak of free 3-MCPD from the result GC-MS was good enough.

4.5 Professional and ethical issues

One major ethical issue I encountered was in determining the boundary of respecting my supervisor's experience and when it was okay to challenge someone whose is obviously highly superior to you. I think even as an intern it is important to assert your opinion, as constructive criticism is the only way to effectively learn. I think what is important is the way you assert your opinion. When I would challenge my supervisor or provide her with further suggestions, I always was sure to maintain ethical behaviour. I was provided my insight in a very modest and suggestive manner. One of my jobs as an intern was doing a lot of research and reading journal article regarding to the project that had been given to me. I learned a lot of stuff about food safety and all the information that involves with my project especially on the method development. When my supervisor would discuss method development issue, I was very confident in discussing and sharing with him the knowledge I had learned. I believe my supervisor found this very helpful and constructive that I could speak so knowledgably and confidently about what I had learned.

There were times when I would finish the work that was given to me by my supervisor, but my supervisor would still be mid-meeting. While I would be tempted to pull out my phone or go on Facebook, it was important for me to stay professional while my desk is visible from the conference room. Instead of using this free time as personal time, I would use it to review my work, ask other employees if they needed assistance, and offer clients coffee. In a company there is always work to be done even if it is not directly asked of you. I made it my effort to use empty time constructively. I think ethical behaviour is not only acting professional and offering good customer service to clients, but it is also entails acting as a motivated and determined individual.

Other than my ethics during the industrial training, MPOB has their own policy and ethics as researcher development. I learnt that research should had a lot of integrity and the availability to control emotional and psychological harm or stress. Research development requires a lot of try and error regarding to the projects or task had been given. When researchers are analysing data and writing results, they also have to be ethical. Failure to act ethically in research can lead to scientific misconduct or academic misconduct, and potentially affect the researcher's career.

4.6 Health and environmental issues

Environmental safety is defined by the guidance, policies, and practices enforced in order to ensure that the surrounding environment is free from hazards that will warrant the safety and well-being of workers and employees, residents near industrial operations, as well as the prevention of accidental environmental damage. The surrounding areas include industrial facilities, work areas, and laboratories. Environmental safety is a crucial issue for any industrial activity as negligence and non-compliance heighten the risk resulting in injuries, illnesses, and accidental environmental releases. MPOB company is really concern and take it seriously when it comes to safety and health issues among the employees. However, there are several health and environmental issues that can be discuss during my internship at MPOB.

As is well known, MPOB is a company that values productivity. This company frequently offers training programs to enhance employees' skill sets and understanding of workplace safety in order for this to continuously progress. In addition, they frequently host exhibitions and MPOB sports days as team-building exercises. Such exercises could improve interpersonal connections and communication while also fostering creativity and problem-solving abilities. Additionally, they have a policy for employees that clarifies the standards required of them in all of their professional interactions. It aids employees in defining what is appropriate and inappropriate at work. Overall, employees in this company are productive in completing their assigned tasks, have a pleasant attitude, and assist one another.

Besides that, there were various units of machinery running constantly in MPOB, especially specifically in the Product Development and Advisory Services (PDAS) division. This in turn means that it consumes a lot of energy because instruments like gas chromatography need to operate at maximum peak to last for a long time and prevent any undesired incidents while analysing samples. To prevent the waste of wasted electricity, the instruments must shut down after a prolonged period of inactivity, particularly during the holidays. By doing these kinds of practices in saving the energy, it promotes positive environment aspects. It could reduce the emission of greenhouse gases that could lead to climate change.

Then, handling chemicals hazard and toxic substances. At the beginning of during my internship, I had trained and informed on safety concepts by my supervisor when working in the laboratory. It is important to identify and recognize all the risks and hazards in laboratory. For example, after I have done with my experiment, it is necessary to dispose the chemical

waste in the hazardous waste bottle. It can't be mix with normal office trash and food waste. Other than that, Personal Protective Equipment (PPE) is also important when expose and handling the chemicals. PPE like gloves and lab coats are required in the laboratory working space.

Moreover, noise is one of the health and environment issues that I observe during my internship. Noise is element of the work environment, which has an important role in affecting employee productivity. Too much noise, such as sound from equipment, tool, and people' s conversation, may prevent workers concentrating on their jobs, consequently decreasing their productivity. When working in the laboratory, I've notice that the noise from a chemical fume hood was quite loud and become irritating especially when you were working in a long period of time. It may cause by improper treatment of duct turns and partially closed built-in dampers, and assorted debris left in the duct line during construction. This problem should be resolve as it may affect employee's performance working in the laboratory.

CHAPTER 5: CONCLUSIONS

5.1 Conclusions

As an undergraduate of Diploma in Chemical Engineering in UiTM Pasir Gudang, I would like to say that this training program is an excellent opportunity for me to get to the ground level and experience the things that I would have never gained through going straight into a job. I am grateful UiTM Pair Gudang and MPOB for giving me this wonderful opportunity. The main objective of the industrial training is to provide an opportunity to undergraduates to identify, observe and practice how engineering is applicable in the real industry. It is not only to get experience on technical practices but also to observe management practices and to interact with other employees. It is easy to work with sophisticated machines, but not with people. The only chance that an undergraduate must have this experience is the industrial training period. I feel I got the maximum out of that experience.

Moreover, I learnt the way of work in an organization, the importance of being punctual, the importance of maximum commitment, and the importance of team spirit. Besides that, I learnt how does it feels and work as a researcher development. It requires a lot of integrity and the availability to control emotions and physical. Not to mention the laboratory skills that I have gained during this industrial training, I also had given more exposure in the reality working on analytical and development department. In my opinion, I have gained lots of knowledge and experience needed to be successful in a great engineering challenge, as in my opinion, Engineering is after all a Challenge, and not a Job.

5.2 Suggestions and Recommendations

After 24 weeks of undertake industrial training at Malaysia Palm Oil Board (MPOB), I would like to suggest both institute (UiTM Pasir Gudang) and MPOB must improve to make industrial training even more efficient and challenging in future. First of all, the coordinator or the lectures who is in charge in the industrial training subject, should alert the students more regarding report, presentation and anything that involves with this subject. Although they have a website, but most of the students are quite not noticeable on any information about this subject. Instead of using website, probably they can use Google Classroom or Microsoft teams. Google classroom and Microsoft teams have their own applications in mobile phones which can help the students be more alert and turn on notifications regarding any information in this subject.

Other than that, I want to suggest for the MPOB Company. I would like to suggest for Human Resource to provide a meeting with student weekly or monthly to ensure the welfare of the students are not ignored. It is important for ensuring the health, welfare, and fitness of students in the company. In fact, a lot of new information can be obtained by the students. Besides that, I expect the company will provide a suitable place or room for trainees so that they can have a place to do reports and communicate with other trainees for more knowledge. Moreover, I hope supervisors could improve motivation session to trainees so can be more competitive and motivated. This can improve trainees' skills, general knowledge, and expertise on certain matters.

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APPENDIX

Figure: 1 operating the nitrogen gas stream

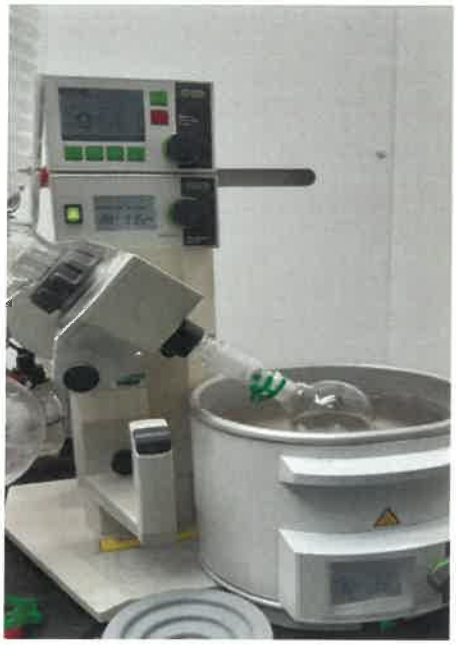

Figure 2: the water vapor to extract the standards solutions from 80 ml to 5 ml concentrated

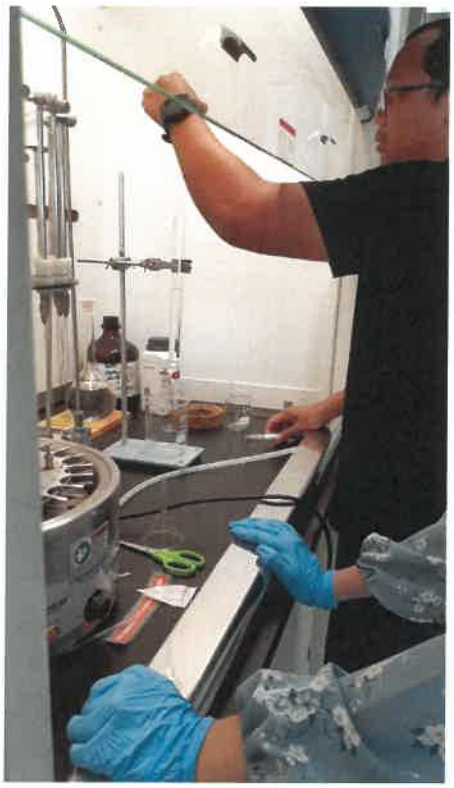

Figure 3: conducted the free 3-MCPD analysis with the help of the researcher asisstants

Figure 4: Cutting and peeling of the fruit palm oil kernel with the researcher assistants

Figure 5: fruit palm oil kernel

Figure 6: Preparing the samples in the laboratory