INDUSTRIAL TRAINING FIELD REPORT

NANOTECHNOLOGY AND CATALYSIS RESEARCH CENTRE

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LI DURATION: 22ND MARCH 2021 – 15TH JULY 2021

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COMPANY ADDRESS: LEVEL 3, BLOCK A, INSTITUTE FOR ADVANCED STUDIES UNIVERSITI MALAYA, 50603 KUALA LUMPUR

VISITING LECTURER: DR. NUR FARHANA MOHD YUSOF

TABLE OF CONTENT

1.0 INTRODUCTION

CHE353 is a course that assigned for chemical engineering student. This course required student to undergo industrial training for 17 weeks. The objective of this course is to give an exposure and opportunity for student in the real-life working experience as chemical engineer. Besides that, to apply the theories that have learnt during diploma years into real world scenarios. Lastly, students can expand knowledge on the current chemical industries.

2.0 COMPANY'S BACKGROUND

2.1 LOCATION OF INDUSTRIAL TRAINING

Nanotechnology and catalysis research center (NANOCAT) is located at Institute for Advanced Studies, University of Malaya, Nanotechnology & Catalysis Research Centre (NANOCAT), Level 3 Block A, 50603 Kuala Lumpur, Federal Territory of Kuala Lumpur.

2.2 COMPANY'S VISION

To be an internationally known and recognized CoE in Catalysis and Nanomaterials.

2.3 COMPANY'S MISSION

To advance technological excellence in multidisciplinary research to address the key challenges of 21st century.

2.4 ORGANIZATION CHART

Figure 1 Organization Chart

2.5 HISTORY OF THE COMPANY

Nanotechnology and Catalysis Research Centre (NANOCAT) has been established since 2001 at University of Malaya as a specialized center of excellence (COE) in nanotechnology and catalysis. Objectives of this company is to develops a comprehensive range of world class catalysis research in Malaysia, to provide expertise in the areas of catalysis needs to develop the national higher skilled manpower and to produce new catalyst and accelerate technology transfer catalysis research into the private sector for marketing.

3.0 NATURE OF BUSINESS

The company is focused on the leadership of the research collaboration and networks of national and international, transfer knowledge in seminar and talks and technical services. the theme of the research that done by the company is catalyst design, chemical catalysis, energy catalysis, environmental catalysis, and smart materials. The activities for transfer of knowledge are they have been doing seminar, talks and workshops at some other universities and company. For the collaboration and networks of national and international research, they have collaborated with few some universities which is Universiti Teknologi PETRONAS, Universiti Tun Hussein Onn Malaysia, Harvard University, University of Surabaya and many more. The technical service is for three groups which is internal, outsider and industry. The difference between these three groups is the price range offered.

Figure 2 The Activities of The Company

4.0 WEEKLY ACTIVITY

Week 1-3 (22nd March 2021- 9th April 2021)

On the first day, I was reporting to my supervisor, and I was given briefly explained about the NANOCAT Centre, my research scope and the organization of the company. Basic safety precaution is also learned during the first week. The first task that I receive was to do some research on article about preparation of activated carbon from biomass and its' application in water and gas purification.

WEEK 4 (12th April 2021 – 16th April 2021)

Learned some new equipment in the research facility, which is Scanning Electron Microscope, Raman Spectroscopy, UV-VIS Spectroscopy, and Vibration Sample Magnetometer. During this session I have studied the safety precautions, handling, and functions of each equipment in the hall.

Figure 3 Machine SEM

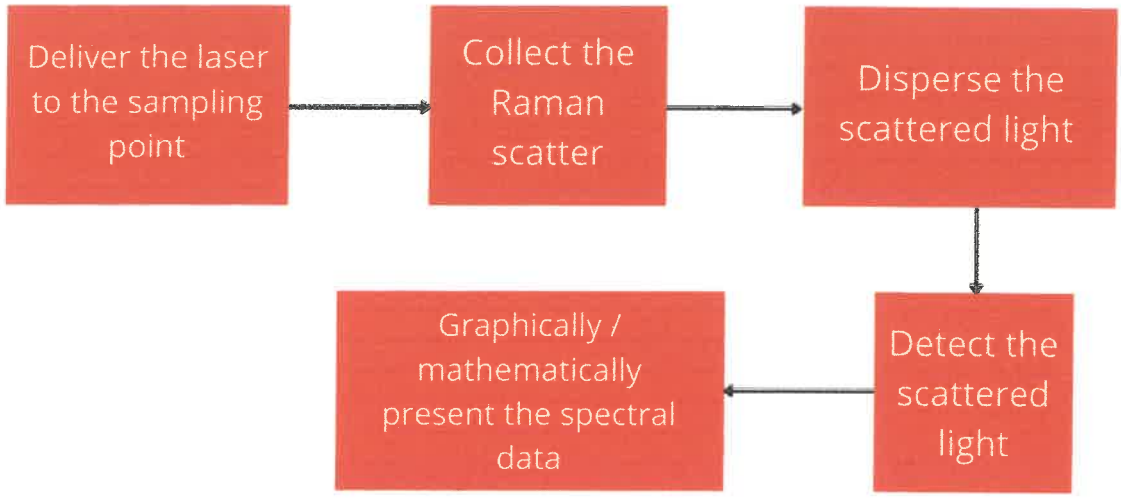

Figure 7 Raman Sample Run Procedure

Figure 6 Taking Sample for Raman Experiment

Figure 8 Taking Example for Raman Experiment

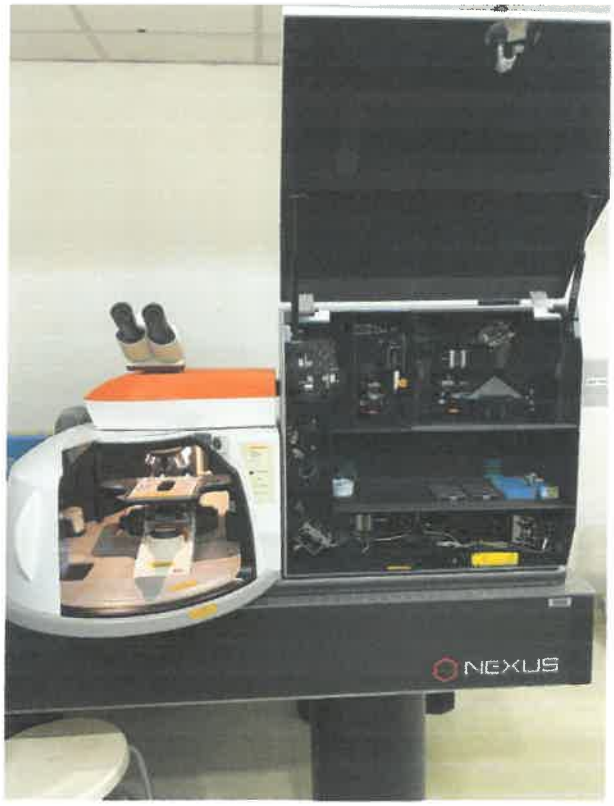

Figure 9 Details of Raman

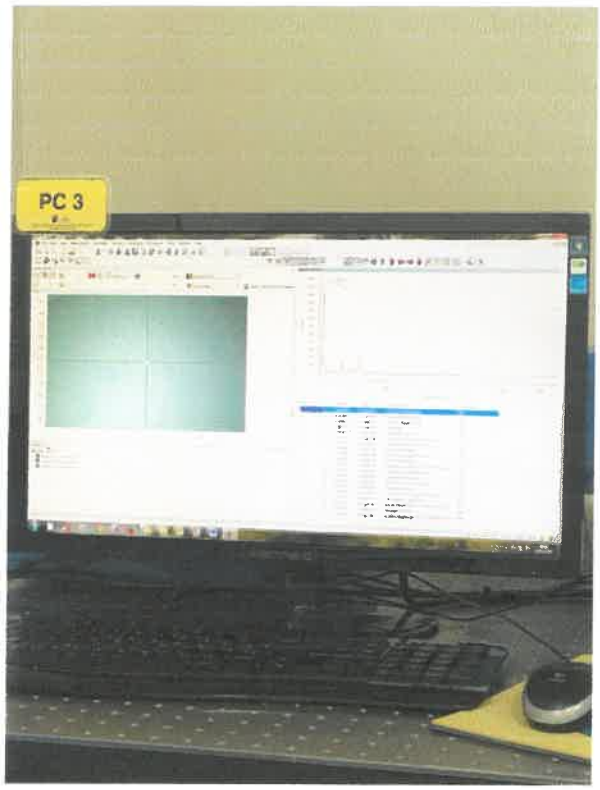

Figure 10 Phase Identification by Raman

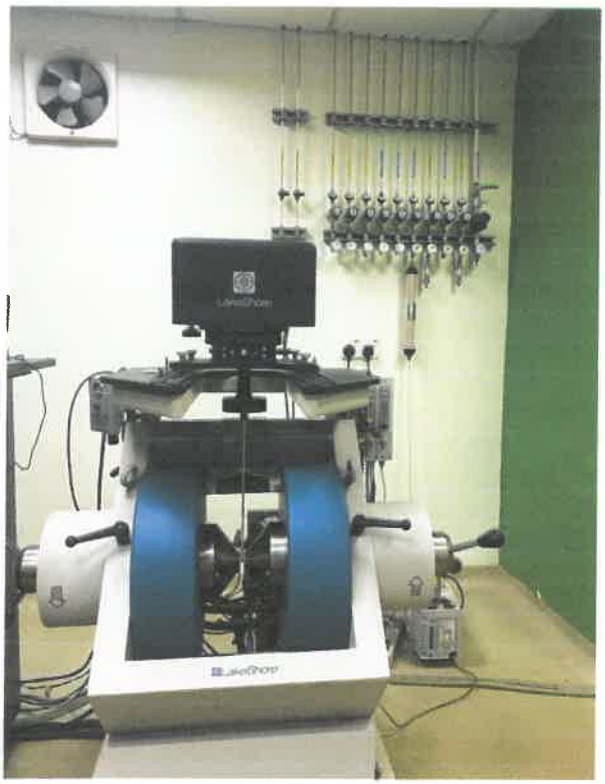

Figure 11 Vibration Sample Magnetometer

Figure 13 UV-Vis Spectroscopy

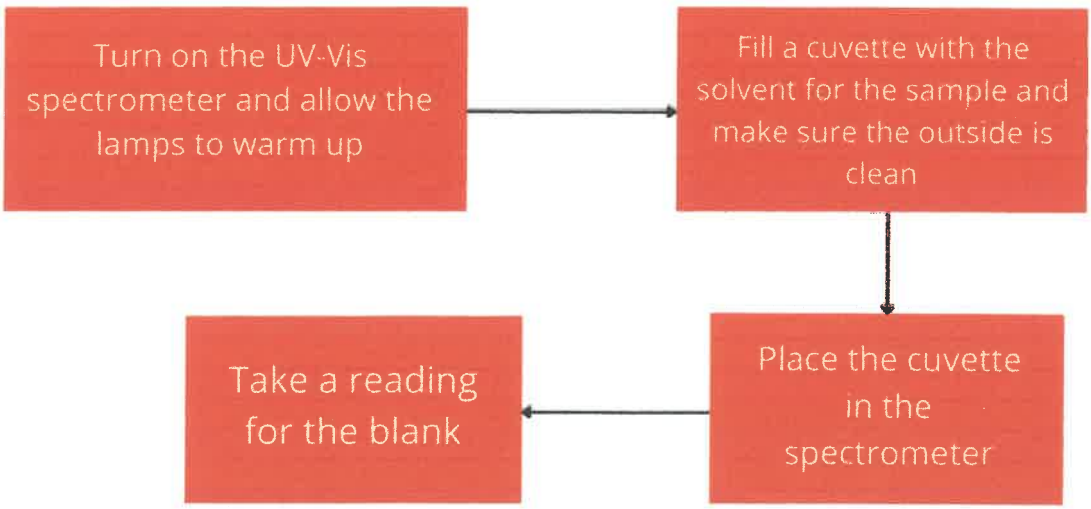

Figure 12 UV-VIS Sample Run Procedure

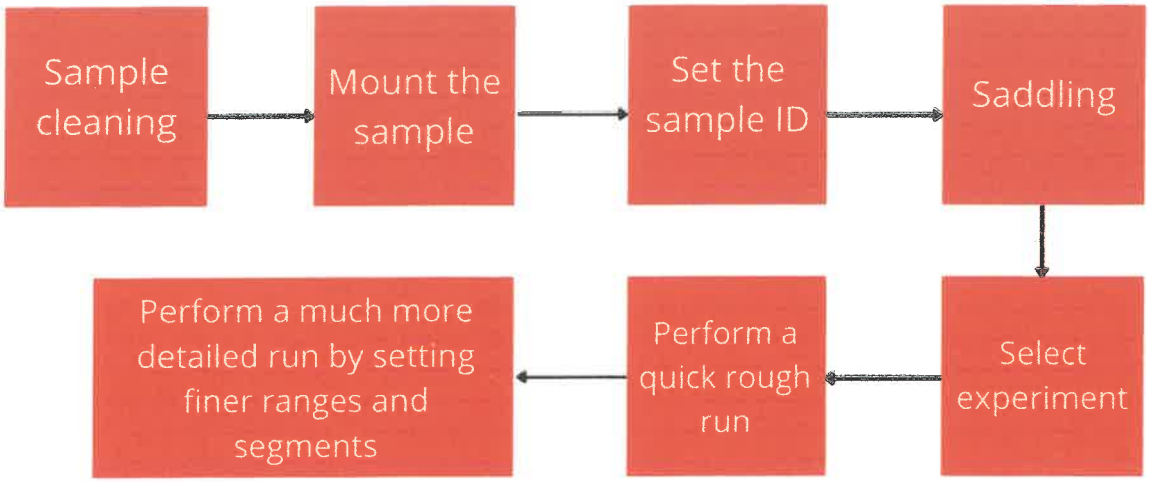

Figure 14 VSM Sample Run Procedure

EQUIPMENT	SCANNING ELECTRON MICROSCOPE	RAMAN SPECTROSCOPY	UV-VIS SPECTROSCOPY	VIBRATE SAMPLE MAGNOMETER
UNCTION	• Microstructure Analysis • Composition Analysis • Elemental Mapping	• Material Identification and Analysis • Phase Identification of Material	• Surface Characterization • Color Measurement • Thermochromism • Composition of opaque • Biological & Geological Specimens • Photometric Analysis	• Characterize the DC magnetic properties of materials as a function of magnetic field, temperature, and time
AMPLE	• Solid	• Solid • Liquid	• Translucent Transparent • Turbid	• Solid • Liquid • Film
OFTWARE	• Microscope XT	• Wire	• UV WinlabTM	• Lake shore VSM

Table 1: Details on Lab Equipment Studies

WEEK 5 (19th April 2021 – 23rd April 2021)

Did some experiment on the preparation of activated carbon and preparation of dye solution. During this session I have implement the knowledge in preparation of activated carbon in making the activated carbon. Other than that, I have studied how to prepare dye solution from nitrophenol and how sensitive nitrophenol to the lights during the experiment. Besides that, I have done some study on application of activated carbon in wastewater treatment. Several journals were studied to find out the correct methodology on applying activated carbon in wastewater treatment in lab scale.

Figure 15 Preparation of Dye Solution

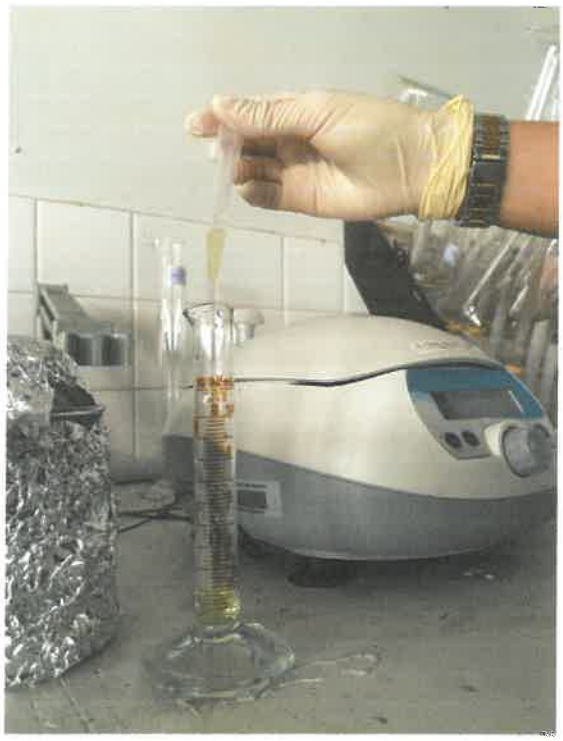

Figure 16 Preparation of Dye solution

WEEK 6-9 (26th April 2021 – 7th May 2021)

During these weeks, I focused on experiment preparation of carbon for wastewater treatment which is based on study before. During the experiment I have studies the concept of oil bath which is used during reflux reaction. Besides that, preparation of dye solution which is nitrophenol was prepared from the standard solution. The hydro sulfuric acid was prepared from the stock solution under the fume hood.

Figure 17 Preparation of Activated Carbon

Figure 18 Preparation of Activated Carbon

Figure 19 Oil Bath and Hot Plate Method

WEEK 10 (24th May 2021 – 28th May 2021)

During this week, I have studies more new equipment in the research facility. The research facility has divided to 3 halls which is spectroscopic hall, x-ray hall and rector hall. Spectroscopic hall is used to determine of physical, chemical structural properties and texture properties for liquid, semisolid, and solid sample. X-ray hall is provided nondestructive technique and used to determine phase composition of solid materials. Reactor hall is focused on catalytic performance screening and testing especially for petrochemical and bio-oil industry.

WEEK 11- 13 (31st May 2021 – 18th July 2021)

During these weeks, I have focused study and do some research on biopolymer. Study biopolymer handbook which is details on history of sustainable bio-based polymers which focuses on silk, cellulose, casein plastics, soy protein plastic, collagen, and chitosan. Gained knowledge on essential oil, natural phenolic and their derivatives.

WEEK 14 – 15 (21st June 2021 – 2nd July 2021)

Carried out study on the fully green bio nanocomposites, where knowledge on green composites such as cellulose fiber, starch crystal and soy protein particle. Research on biopolymer based on nanocomposites which is the experimental methods and material and the biodegradation methods.

WEEK 16-17 (5th July 2021 – 15th July 2021)

On these weeks, I focused do some research on better biopolymers in removing heavy metals from wastewater. I have gained knowledge on the several process of wastewater treatment such as coagulation and adsorption. The better biopolymer to be used is chitin because it is cost efficient, non-toxic biopolymer with potential use in heavy metal removal in industrial wastewater.

5.0 DESCRIPTION OF THE TASK ASSIGNED / MINI PROJECT

During the industrial training, my supervisor has assigned me to do study on the article review that have been published by her. I was tasked to study each topic on the article review and paraphrase the whole article to be submitted to the supervisor. Besides that, I have assigned to do experiment based on the article which is the application of activated carbon in wastewater treatment. Lastly, I was assigned to do some studies on dye removal by adsorption process.

5.1 STUDY OF PREPARATION OF ACTIVATED CARBON FROM BIOMASS AND ITS' APPLICATION IN WATER AND GAS PURIFICATION.

5.1.1 INTRODUCTION

Activated carbon or other name is activated charcoal is a carbon processed to have small low-volume pores that increase the surface area available for adsorption or chemical reactions. Activated carbon is used to purify liquids and gases in a variety of applications including in water and gas purification.

5.1.2 OBJECTIVE

Objective of this study is to study the better process in making activated carbon to be used in removing the pollutants in aqueous and atmosphere. Besides that, to study the application of activated carbon in water and gas purification.

5.1.3 PREPARATION OF ACTIVATED CARBON

The preparation of activated carbon has two basic steps which is the first one is the carbonization and the second one is the activation. Carbonization is done by the pyrolysis or gasification at higher temperature. For the activation process, there are four types which is physical, chemical, physiochemical and microwave-assisted activation. There are differences between these four activation processes especially the activating agents used during the process.

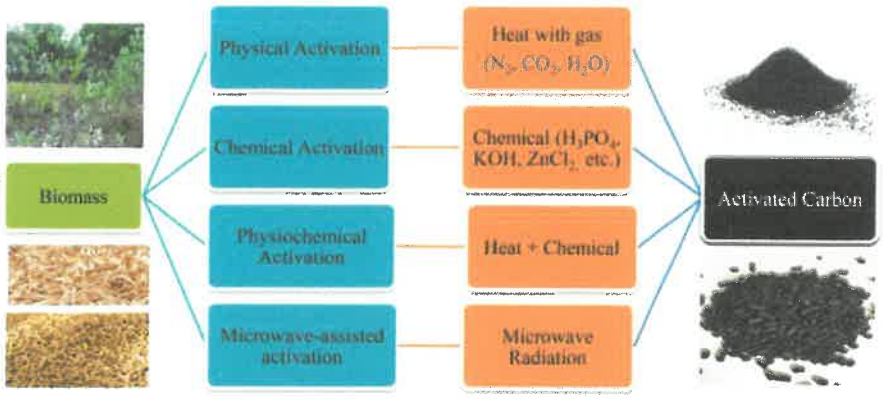

Figure 18 Methods of Activation Process

5.1.4 APPLICATION OF ACTIVATED CARBON

Activated carbon can be used in water purification for the removal of pollutants and contaminants in liquid-phase or aqueous solution. Activated carbon is one of the most effective adsorbents for organic and inorganic pollutants. The flexibility of adsorption capacity, surface zone and permeable structure of activated carbon are the main reason for its application.

Activated carbon can be used in removal inorganic pollutants from water, organic pollutants from water such as dye, phenolic compounds, pesticides, pharmaceutical compounds, and other pollutants from aqueous solution. Other than that, activated carbon also useful in gas adsorption.

5.1.5 CONCLUSION

In conclusion of this study, the chemical activation method is frequently used to simple the process, lower investment, and minimum amount of time in the preparation process.

5.2 STUDY OF DYE REMOVAL BY ADSORPTION

5.2.1 INTRODUCTION

Dye are colored compounds which are usually used in textiles, printing, rubber, cosmetics, plastics, leather industries to color their products result in generating large amount of colored wastewater. Mainly dyes are classified into anionic, cationic. And non-ionic dyes. Wastewater effluents contain dyes which may cause a potential hazard to the environment. Due to the environmental and health concerns, different separation techniques have been used in the removal of dyes from aqueous solution. The dye removal techniques are physical, chemical, and biological methods. This study going to focus on dye removal by adsorption process.

PHYSICAL METHODS	CHEMICAL METHODS	BIOGICAL METHODS
Adsorption	Fenton reagent technique	Aerobic degradation
Ion exchange	Ozonisation	Anaerobic degradation
Filtration	Photocatalytic methods	
coagulation		

Figure 19 Dye Removal Methods

5.2.2 OBJECTIVE

The objective of this study is to investigate the removal of dye from aqueous solution by an activated carbon.

5.2.3 ADSORPTION PROCESS

Adsorption is a high-quality treatment process for removing dissolved organic contaminants from industrial wastewater, such as dyes. The concentration of materials on the surface of solid substances is known as adsorption. Adsorption is a surface phenomenon that involves the use of surface forces principally. When a solution containing an absorbable solute, also known as adsorbate, is introduced into a system, it is referred to as adsorption. When an absorbable solute in a solution, also known as an adsorbate, meets a solid, also known as an adsorbent, with a porous surface structure, liquid-solid intermolecular forces of attraction cause the solute to be concentrated at the solid surface. Adsorption is one of the unit activities in chemical engineering processes for separating industrial wastewater pollutants.

5.2.4 CHARACTERIZATION OF ACTIVATED CARBON

Activated carbon is well known as an adsorbent characterized by its huge surface, its permeable structure, and its thermostability, which is broadly utilized in an assortment of applications such as evacuation of toxins and odor from fluid and vaporous stages, medical uses, catalysis, gas capacity, anode materials in electrochemical gadgets, and expulsion of natural poisons from drinking water and in the wastewater treatment. Adsorption on activated carbon has been proven to be a particularly effective technology for removing dye from wastewater due to its capacity to adsorb a wide range of contaminants, quick adsorption kinetics, ease of design, and low cost.

5.2.5 CONCLUSION

In conclusion of this study, most used method for the removal of both organic and inorganic pollutants from industrial wastewater is dye removal by adsorption. Dye removal from wastewater using activated carbon is effective method but in industrial processes it was restricted

due to its high operational and investment costs. Besides that, adsorption material available from various sources such as natural sources, agricultural, and industrial wastes.

6.0 CONCLUSION

In conclusion, the experiment and research that I have done during my industrial training in Nanotechnology and Catalysis Research Centre, it was build me to improve myself. The skills that I have obtained during the industrial training is communication skills, teamwork skills and technical skills. Other than that, I have gained some knowledge how to do some research and how the report written in the real industry.

Lastly, I feel grateful because I can complete my industrial training in NANOCAT. There are a lot of new knowledge and skills that I have gained to improve my ability to do the research and experiment. I really hope the experiences that I gain, will be applied in my future career, and built a good identity as a chemical engineer.