INDUSTRIAL TRAINING FIELD REPORT

UCS CHEMICAL SDN BHD

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LI Duration	22 MARCH 2021 – 16 JULY 2021

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Table of Contents

1.0 Introduction

Industrial training is a mandatory course for all diploma students of Chemical Engineering at Universiti Teknologi MARA, Campus Pasir Gudang. In preparing for the real working environment as engineers, industrial training helps to produce engineering graduates with technical and soft skills competency. I have selected UCS Chemical Sdn. Bhd. for my internship place because I trust this company will introduce me to another side of Chemical Engineering scope of work other than manufacturing sectors. For the past 17 weeks, I am exposed to the professional skills and experiences in industrial engineering practices especially related to boiler and cooling tower water treatment. This document contains experiences that were practiced during my internship period in the sixth semester. For this report, I only included the vital information regarding my activities during my internship and excluded all the private and confidential information relating to my task at the company. Under the great supervision and guidance of Encik Muhammad Hazwan, I had successfully completed my 17 weeks of industrial training despite the pandemic COVID-19. Lastly, I would like to express my deepest thanks to everyone, staffs, lecturers and parents for all the directly or indirectly precious guidance which were extremely valuable for my study during my internship period.

2.0 Content

2.1 Organization chart and history of the company

2.1.1 Company history

UCS Chemical Sdn. Bhd. was incorporated in 2014 after taking over United Chemical Services which was established in August 1986, a company specialised in supplying speciality chemicals and consultancy services to the water treatment industry.

As they continue with what the company was doing all this while, their services are tailored to meet the individual needs of their customers. For almost 30 years, this company has established a significant foothold in gaining the complete trust and confidence from their customers. This stems from its dedication and commitment to render the best service, reliability, quality control and price competitiveness. Currently they are servicing clients with country-of-origin form Japan, USA, Taiwan, India and so on.

2.1.2 Company mission

Customer's satisfaction has always been the main objective of their company philosophy. Their mission is not only to solve problems; they strive to understand their customers' needs. As today, they have five Technical staffs who are Chemist, Chemical Engineer or Microbiologist.

To further enhance their excellent customers support, they have established on joint venture basis a chemical testing laboratory namely Allied Chemists Laboratory Sdn. Bhd. in Johor Bahru. The laboratory has been accredited under ISO IEC G25 for water and wastewater analysis.

2.1.3 Nature of business

UCS Chemical Sdn. Bhd. provides a variety of services for the convenience of their customers.

Company main business activities include:

- Boiler and cooling water management.
- Raw and wastewater management.
- Supply of speciality chemical for boiler and cooling water treatment.
- Heat recovery system for boilers and furnaces.
- Supply of flocculants and another speciality chemical for wastewater treatment.
- Supply of softener and ion exchange resin.
- Supply of water testing kit for water quality analysis.

Figure 1: Chemical supply

Figure 2: Supply of ion exchange resin

Figure 3: Consultation

2.1.4 Organization chart

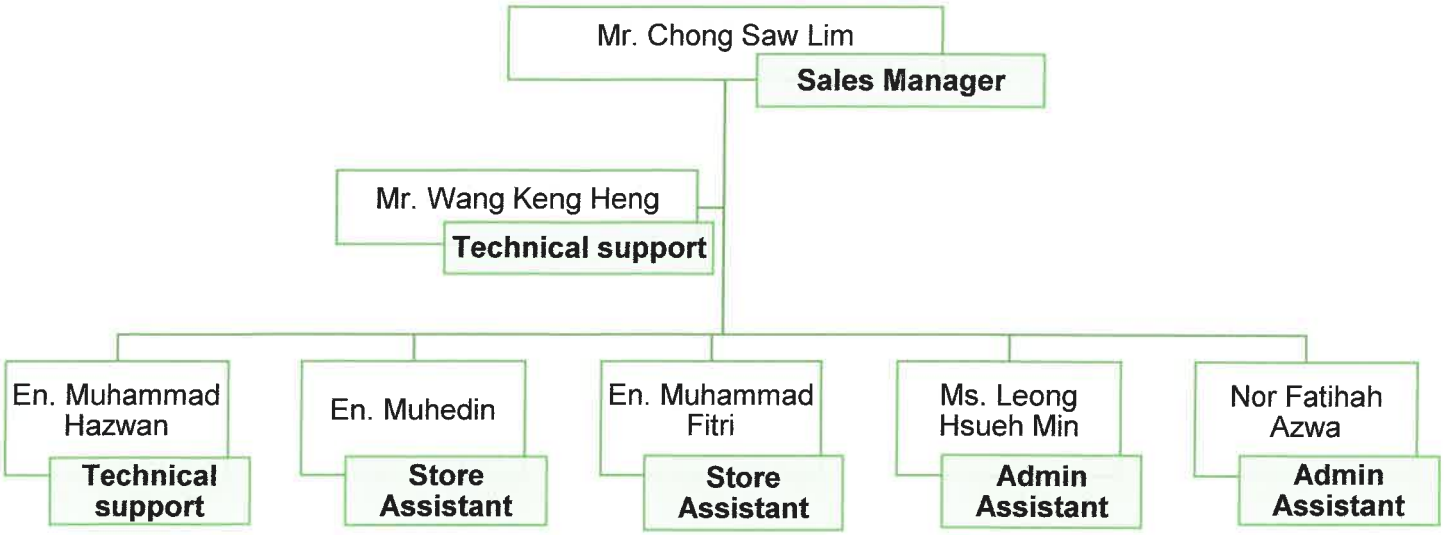


Figure 4: Organization chart of company

2.2 Process flow

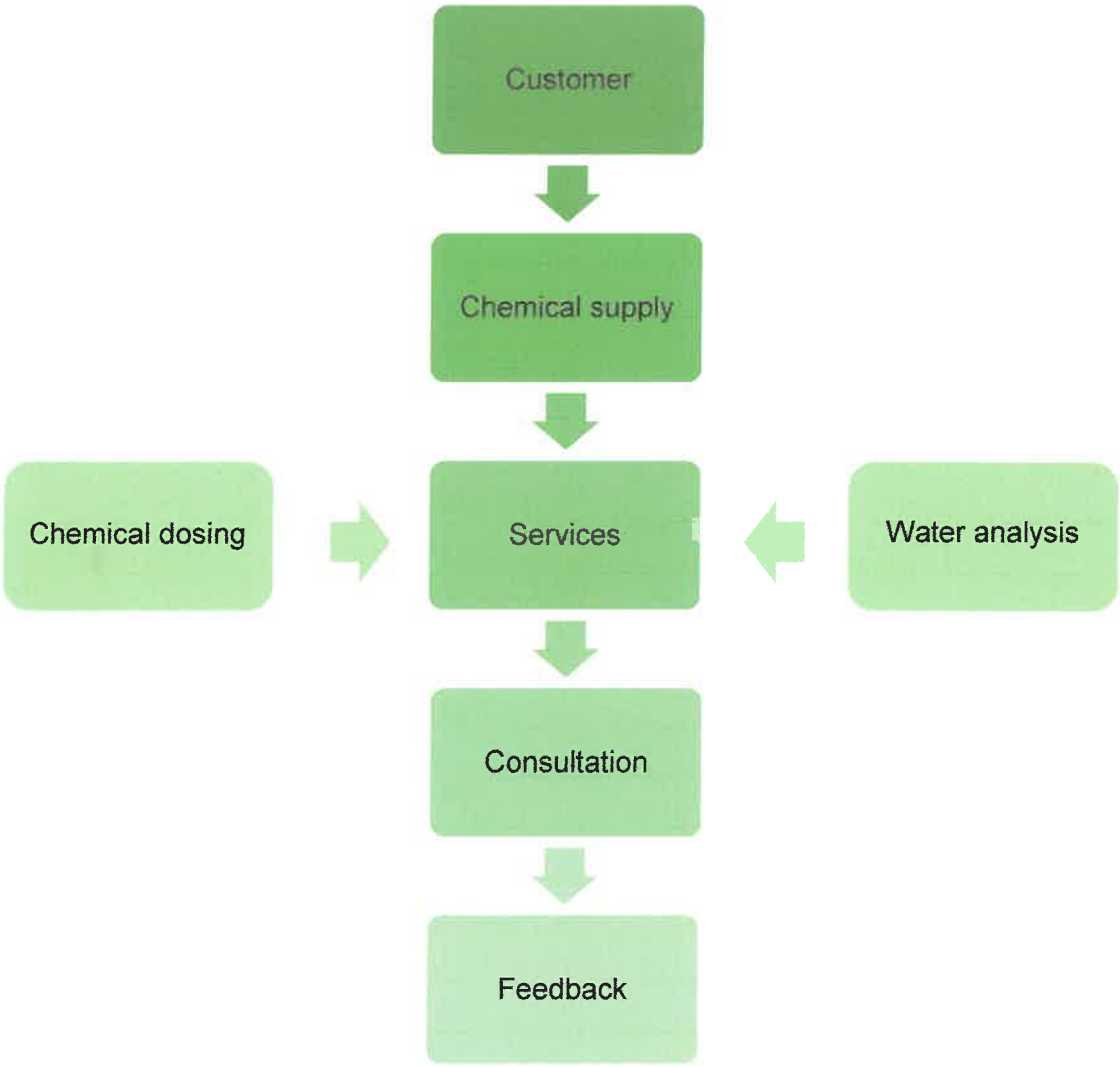


Figure 5: Process flow of company

2.3 Weekly activities

2.3.1 Week 1 (22nd March 2021 – 26th March 2021)

I reported on duty at 8.30 a.m. on Monday, 22nd March 2021. Right after, my supervisor briefs me about the work flow, job scope and the outcomes from the training period that I will gain after my internship ended. During briefing, I was exposed to the working principle of boiler, cooling tower and chiller. Other than that, a have been told about the importance of water treatment for these equipment. On the first week, I was given some documents and assigned to study about the principle of boiler water treatment, water treatment test method, and chemicals catalogue.

Overall, for the first week, I was able to see an overview and the theories of what I would be doing throughout my industrial training period.

2.3.2 Week 2 (29th March 2021 – 2nd April 2021)

On 29th March 2021, I assisted my supervisor to Global Eco Chemical Malaysia Sdn. Bhd. to see the real fire-tube boiler. Since the boiler was in cleaning process, therefore I was able to see and learn about the fireside and waterside of the boiler.

Figure 6: (a) Fire side of boiler (b) Waterside of boiler

Moreover, I have been exposed to the softener, brine tank and sand filter. So, for the rest of week, I learn and make some research about the sand filter and softening process. I get to know how these two things contribute to boiler water treatment. Sand filter is used to remove suspended matter as well as floating and sinkable particles, while softening is a process of removing Calcium, Ca^{+} and Magnesium, Mg^{2+} that cause hardness in water.

Figure 7: (a) Sand filter (b) Softener and brine tank

On the 2nd April 2021, I assisted my supervisor to Mena Jaya Sdn. Bhd. This is my first experience saw how in-situ water quality analysis was run. I just observed and learnt from what my supervisor did. I have been explained about what needs to be done step by step and also the purpose of each water quality parameter.

2.3.3 Week 3 (5th April 2021 – 9th April 2021)

For the third week, I started to do the water quality analysis on my own in laboratory. On 5th April 2021, I was assigned to do the cooling tower water analysis for Tomypak Flexible Packaging Sdn. Bhd. Before I start, my supervisor explained to me once again about the procedures and apparatus that will be used for the water quality test. I was guided from the beginning to the end as it was my first time did it. On the next day, I assisted my supervisor to Zublin Precast Industries to do in-situ water quality analysis for water-tube boiler. After do the water test, my supervisor explained to me how water-tube boiler operates. I get to know the difference between fire-tube and water-tube boiler. For the remaining days of the 3rd week, I study about the function of all of the chemical supply that supplied from the company.

2.3.4 Week 4 (12th April 2021 – 16th April 2021)

On Monday, I was assigned to practice running a water quality test so that I am more confident when doing it next time. It is because the accuracy of pipette reading during titration was very important. So, by practicing it many times, I became more confident about the colour changes of the solution and stop the pipette and the right time. From Tuesday until Thursday, I study about the importance of sulphite test for boiler water. I do some research about the reaction occurs. On 16th April, I assisted my supervisor to Frezruta Food Industries Sdn. Bhd. It was my first time running in-situ water quality test on my own.

2.3.5 Week 5 – Week 7 (19th April 2021 – 7th May 2021)

Every day, I assisted my supervisor to our customers' factory or plant and continue my routine to do water quality analysis for boiler and taking water sample for cooling tower. Besides, I also attend a boiler inspection by the Department of Occupational Safety and Health (DOSH) officer for a few times. I was able to see how the inspection process is carried out. The reason we need to attend the inspection is because we need to answer any question regarding to the boiler condition.

Figure 8: Boiler inspection

Other than that, I also assisted my supervisor and other two colleagues to do chemical dosing for chiller and cooling tower. It has to do manually because unlike boiler, these two equipment does not have a pump to supply chemical inside the equipment.

Figure 9: Chemical dosing for chiller and cooling tower

2.4 Task assigned

2.4.1 Boiler water analysis

2.4.1.1 Sulphite

Fresh water contains dissolved oxygen. Oxygen together with high temperature is highly corrosive for the steel piping used in the boiler. So, Alkagen H107 is used to remove all traces of dissolved oxygen. It is necessary to regulate the dosage of Alkagen H107 in order to maintain the sulphite level at a minimum of 30 ppm.

Procedure for sulphite test:

1. Pipette 25ml of the sample into a plastic beaker.
2. Add 1 mL of sulphuric acid, H_2SO_4 and 3 drops of starch indicator
3. Titrate with Potassium Iodide, KI until a faint permanent blue colour develops in the sample.
4. Record the volume of Potassium Iodide, KI used.

Calculation:

Sulphite = Volume of Potassium Iodide used × 25.4 (1)

2.4.1.2 Total hardness

Total hardness is the total amount of dissolved calcium and magnesium in the water. Hardness can be remove from boiler feed water by the softening process. Therefore, it is very important to regularly monitor the efficiency of the softening plant to ensure that it is functioning properly.

Water softening is the removal of calcium and magnesium in hard water through a process called ion exchange. Both calcium and magnesium have reverse solubility which means the higher the temperature of the water, the more it will solidify and harden into solid deposits inside the boiler, pipes or fittings. This process causes scaling and can decrease the efficiency of heat transfer and eventually destroying the equipment. A water softener is made up of two components; a resin tank, and a brine tank.

Figure 10: Resin tank and brine tank

Hardness indicator produces a purple colour when hardness is present in the sample. The appearance of a blue colour is taken as the endpoint of the titration. The volume of titrating solution represents the total hardness (calcium and magnesium) present. The recommended limit for total hardness is not more than 150 ppm.

Procedure for total hardness test

1. Pipette 25ml of the sample into a plastic beaker.
2. Add 2 drops of hardness indicator.
3. Titrate immediately with 0.01M EDTA solution until the sample turns to blue.
4. Record the volume of 0.01M EDTA used.

Figure 11: (a) Before titration (b) After titration

Calculation:

Total hardness = Volume of EDTA used × 40 (2)

2.4.1.3 Chloride

The chloride test is used to regulate boiler blowdown and bleed off of cooling tower. It is necessary to keep solids from building up to the level where they might cause scale and carryover.

Potassium Chromate, K_2Cro_4 indicator produces a yellow colour when chloride is present in the sample. The appearance of a reddish brown colour is taken as the endpoint of the titration. The volume of titrating solution represents the amount of chloride present. The recommended limit for the chloride value is not more than 500 ppm. If the value exceeds the recommended limit, we may suggest to the boilerman or person-in-charge to increase the blowdown rate of the boiler.

Procedure for chloride test:

1. Pipette 25ml of the sample into a plastic beaker.
2. Add 3 drops of Potassium Chromate, K_2Cro_4 indicator into the sample.
3. Titrate with Silver Nitrate, $AgNO_3$ until the yellow colour is tinted with reddish brown. The initial reddish colour is to be taken as the end point.
4. Record the volume of Silver Nitrate, $AgNO_3$ used.

Figure 12: (a) Before titration (b) After titration

Calculation:

Chloride = Volume of Silver Nitrate used × 40 (3)

2.4.1.4 Phenolphthalein alkalinity

This test is carried out to find out the presence of alkaline in boiler water. Boiler water systems typically should be operated in alkaline conditions to prevent corrosion.

Phenolphthalein indicator produces a pink colour due to the presence of base. If the sample does not turn pink after addition of Phenolphthalein indicator, report as nil or zero ppm. The volume of titrating solution represents alkalinity value. The recommended limit for the alkalinity value is not more than 450 ppm.

Procedure for phenolphthalein alkalinity test:

1. Pipette 25ml of the sample into a plastic beaker.
2. Add 3 drops of Phenolphthalein indicator.
3. If the sample turns pink, titrate with sulphuric acid, H_2SO_4 until the pink colour just disappears.
4. Record the volume of sulphuric acid, H_2SO_4 used.

Calculation:

Chloride = Volume of sulphuric acid used × 40 (4)

2.4.1.5 Total dissolved solid (TDS)

Total dissolved solids (TDS) consist of both suspended and dissolved solids. Total dissolved solids generally include sulphates, chlorides, magnesium, potassium, calcium and many others more.

The increases in TDS concentration can leads to the scale formation or deposition on the tube surface, which will decrease the efficiency of heat transfer from flue gases to the water. Then, it will further lead to the overheating of the tubes. So at the initial stages of boiling, bubbles are formed and there comes a point where the bubbles reach the surface of the water of the boiler. So, due to the presence of TDS in water, these solids are carried over with the bubbles formed during the boiling process. Carryover of these solids with the steam will reduces the quality of steam and also damages the boiler parts such as control valves and steam line. The recommended limit for TDS is not more than 2000 ppm.

Procedure for TDS:

1. Fill the cell with sample to at least 1/4" (6mm) above the upper electrode.
2. Press the black button.
3. Read the dial value indicated by the pointer to determine parts per million (ppm) TDS.

Figure 13: TDS meter

2.4.1.6 pH

Maintaining correct pH levels for your tower is critical to preventing scale and corrosion. The suitable pH for the equipment is between 10 and 12.

Procedure for pH test:

1. Pipette 25ml of the sample into a plastic beaker.
2. Put the probe into the sample.
3. Read and record the pH measurement of the sample.

Figure 14: pH meter

2.4.2 Cooling tower water analysis

2.4.2.1 Total alkalinity

Same like phenolphthalein alkalinity for boiler, this test is carried out to find out the presence of alkaline in cooling tower water.

Unlike phenolphthalein indicator, the methyl orange indicator produces an orange colour due to the presence of base. The volume of titrating solution represents alkalinity value. The recommended limit for total alkalinity is same like boiler which is not more than 450 ppm.

Procedure for total alkalinity test:

1. Pipette 25ml of the sample into a plastic beaker.
2. Add 3 drops of Methyl Orange indicator.
3. Titrate with sulphuric acid, H_2SO_4 until the orange colour change to reddish brown.
4. Record the volume of sulphuric acid, H_2SO_4 used.

2.4.2.2 Total dissolve solid (TDS), pH, chloride and total hardness

The other four water quality parameters; TDS, pH, chloride and total hardness have the similar function, procedure and recommended limit as boiler water analysis.

3.0 Conclusion

Overall, my industrial training which started from 22nd March 2021 to 16th July 2021 is really a good program and very recommended. It has given me a chance to learn numerous informative knowledge and experience as a trainee. Since I did not have the chance to conduct the water quality analysis during my Semester 5 due to the MCO, the opportunities on preparing and practicing it during my internship give me an eye opener of the theories that I learnt from the subject Introduction to Environmental Engineering (CHE 332) in my diploma of Chemical Engineering.

They provide me with several accommodations such as Wi-Fi, working area and allowances. Despite all the hardships and difficulties that I had faced during this pandemic Covid-19, UCS Chemical Sdn. Bhd. have provided me a strong foundation in building a bright successful career in the future. This company allows me to have an overview about the consultancy related to the scope of work on Chemical Engineering (Environmental).

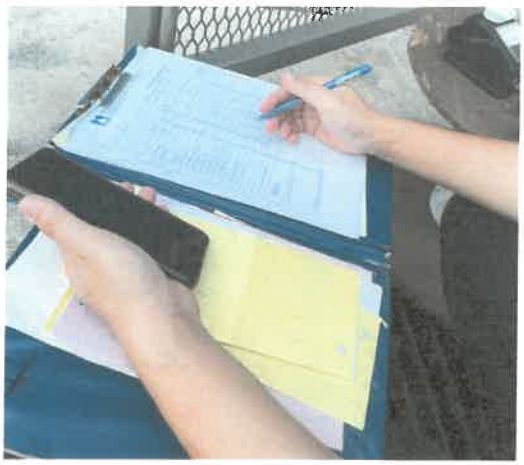
As for the recommendation, I just hope the company can give me some task during the Work From Home (WFH) for me to capitalize more time to explore and learn more during my internship period.

As a mean of gratitude, I am grateful and thankful to my supervisor, Encik Muhammad Hazwan for the experiences and guidance whenever I am in need. Last but not least, it is my pleasure to say thank you to other co-workers who have also give me support and guidance in this field. Their presence has taught me the importance of having soft skills such as time management and interpersonal communication which could be an important element in real life working environment.

In a nutshell, it was a great opportunity for me to have my industrial training in UCS Chemical Sdn. Bhd. I have never regretted to have my industrial training in such a great company.

Figure 2: Mini lab

Figure 3: Water testing kit for boiler water quality analysis



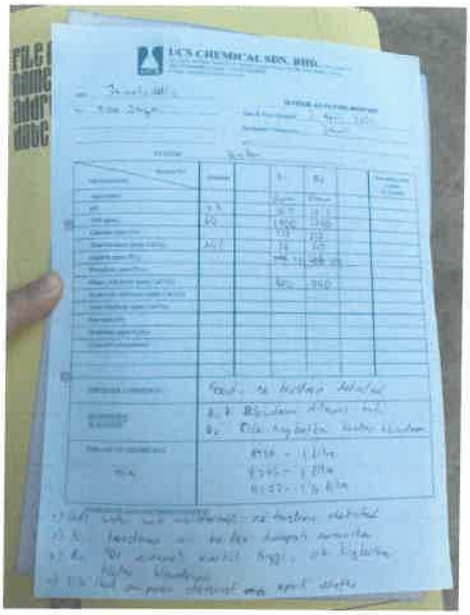


Figure 4: On-site report