UNIVERSITI TEKNOLOGI MARA

INDUSTRIAL TRAINING FIELD REPORT

CENTRE FOR ENVIRONMENTAL SUSTAINABILITY AND WATER SECURITY

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ACKNOWLEDGMENT

In the name of Allah, The Most Gracious and The Most Merciful. All praises and thanks to Allah whom are ultimately depend on for sustenance and assistance. With His's blessing, I am able to successfully complete my training in Centre of Environmental Sustainability and Water Security (IPASA).

The internship opportunity that I had with IPASA was a great chance for learning and professional development for myself. Therefore, I consider myself as a lucky person as I be able have the chance to be part of IPASA even in a short period of time. I am so grateful for having a chance to meet and socialize with so many successful and great passionate people in their profession who led and thought me so much during my internship period.

I want to express my deepest thanks to my supervisor, Prof. Ts. Dr. Azmi Aris for accepting me in proceeding my 17 weeks of Industrial Training at the IPASA, which is one of a great company for student who came from the same background as me to undergo the industrial training in order to fulfilled the requirement needed in completing my Diploma in Chemical Engineering course.

Last but not least, a special appreciation and thanks to both my mentor Fatema and Dr. Ihsan whom have led and thought me in understanding the mini project assignment and gave me a great opportunity to contributing in succeeding the project. Both of you have been a tremendous mentor for me by showing your passion and affection towards the project.

I would like to express my gratitude and deep regards to my family that never stop support and incented me to strive towards my goal. I surely will use gained skills and knowledge in the best possible way. Under great supervision and guidance from Prof. Ts. Dr. Azmi Aris, Dr. Ihsan, and Fatema, I have successfully completed my 17 weeks of internship despite the pandemic of COVID-19.

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Contain of The Report

1.0 INTRODUCTION

1.1 Introduction to Industrial Training CHE353

Industrial Training CHE353 is a final course for student Semester 6 in Diploma Chemical Engineering at Universiti Teknologi MARA (UiTM) that was established with the objective to produce a well-rounded and expose students to actual working environment to apply what they have learned in the university while enhancing their knowledge and skills. Other than that, industrial training program is to increase student's self-confidence in finding their own proficiency and cultivate student's responsibility and leadership ability to perform and execute the task given. Before stepping into the real working life, each student is required to seek and apply for an internship application at any company that related to chemical engineering field.

In order to move along with the vision, Student Industrial Training program been conducted for minimum 17 weeks to fulfil total of 7 credit hours and a compulsory for all Semester 6 student in order to complete their diploma studies with a host company that relevant to the course. The 17 weeks duration training is compulsory as it is helps student to fulfil the requirement by the Board of Engineers Malaysia (BEM) for the Engineering Technology Accreditation Council (ETAC) for undergraduate students.

1.2 Job Scope of Industrial Training

I was assigned to IPASA that has been established under the umbrella of Research Institute for Sustainable Environment (RISE) in Universiti Teknologi Malaysia (UTM) Skudai, Johor. I was given two project that been implemented by a postdoctoral researcher, Dr. Ihsan, and a PhD student, Fatema. Both Dr. Ihsan and Fatema have been assigned under my supervisor, Prof. Ts. Dr. Azmi Aris and I have been assigned to assist Dr. Ihsan and Fatema continue their research.

2.0 CONTENTS

2.1 ORGANIZATIONAL CHART AND COMPANY BACKGROUND

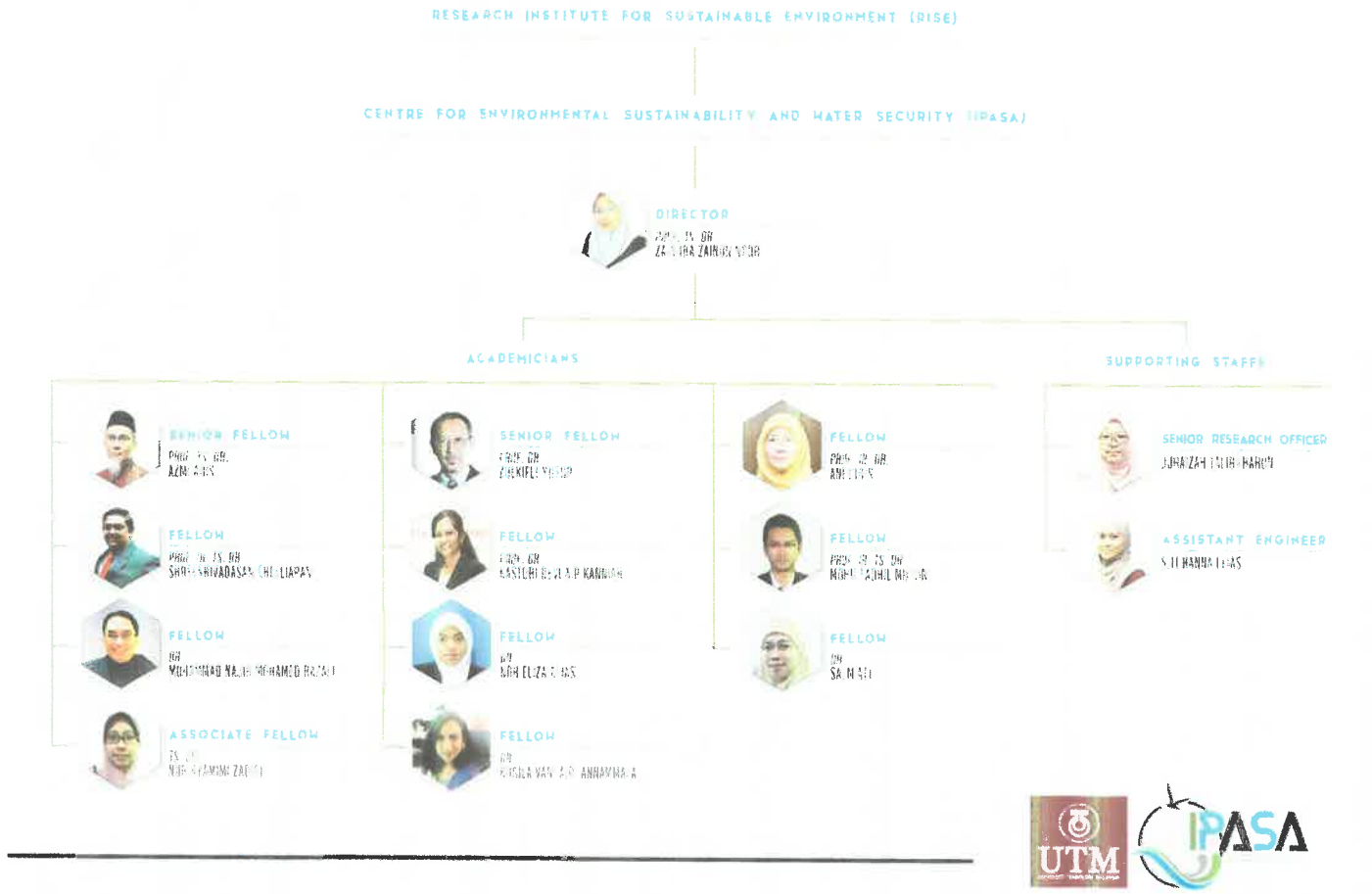


Figure 1: *The organizational chart of IPASA in UTM Skuda*

IPASA is an integrative centre that integrates many expertise in various field in UTM to helps in solving problems that related to the environment with the provided flexible organisation, which response to new issue as they arise. For IPASA, its main task is in research, publication, consultation and services, continuing education, post graduate supervision, and promotion of environmental awareness. Back in 2017, IPASA has secured about RM6.5 million research grant from both government and industries which helps IPASA has an excellent track record in providing services to various private and public agencies. IPASA's team of engineers and scientists constantly successfully delivered various environmental solutions through application of leading the edge of technologies, especially to water and wastewater industries.

In research, IPASA undertakes both basic and applied research in order to provide practical and sustainable solutions in environmental related areas. IPASA currently do research regarding the flood mitigation, climate change impact, green technology, life cycle assessment (LCA), carbon and water footprint, water and wastewater treatment technology and etc. These researchers have been funded either by public or private agencies that sometimes do a collaboration with other researchers from other countries such as Japan, United Kingdom, Denmark, Sweden, Indonesia, and Cambodia. There are some examples of research produced by IPASA's researchers,

- Characterization of resin extracted from cactus (Opuntiaficusindica) as natural coagulant for water purification.
- Micro-pollutants Removal using Combined Membrane Filtration, Advanced Oxidation Process and Adsorption for Safe Drinking Water.
- Rainwater Harvesting in UTM Campus.
- Combining Instream Routing and Satellite Imagery for Integrated Flood Early Warning System.

Other than that, there are also some examples of journals published by IPASA's researcher, such as,

- "*Characteristics of developed granules containing selected decolourising bacteria for the degradation of textile wastewater*" by Ibrahim Z. et al. (2010)
- "*Complete electrochemical dichlorination of Hazardous Material chlorobenzenes in the presence of various arene mediators*" by Jalil, A.A. et al. (2010)
- "*Tolerance of the antibiotic Tylosin on treatment performance of an up-flow anaerobic stage reactor (UASR)*" by Sreesivadasan Cheliapan et al. (2010)

IPASA provides consultancy services in environmental related areas with the help of its wide range of expertise such as,

- Development of Malaysia Environmental Performance Index, Ministry of Natural Resources and the Environment, 2010-2015
- Study on Impact of Climate Changes on Water Resources for Selected Plantations Areas in Malaysia for Paddy, Rubber and Oil Palm, National Hydraulic Research Institute of Malaysia (NAHRIM), 2014
- HAZOP, Modelling and Review of Wastewater Treatment Plant, EVYAP SABUN MALAYSIA Sdn. Bhd., 2013
- Environmental Impact Assessment, Risk Hazard Assessment and Quantitative Risk Assessment in Langsat Bulkers Biodiesel Tank Farm, Tanjung Langsat Industrial Park, Johor Bahru, Johor, Tanjung Langsat Port Sdn. Bhd., 2013

2.2 PROCESS FLOW

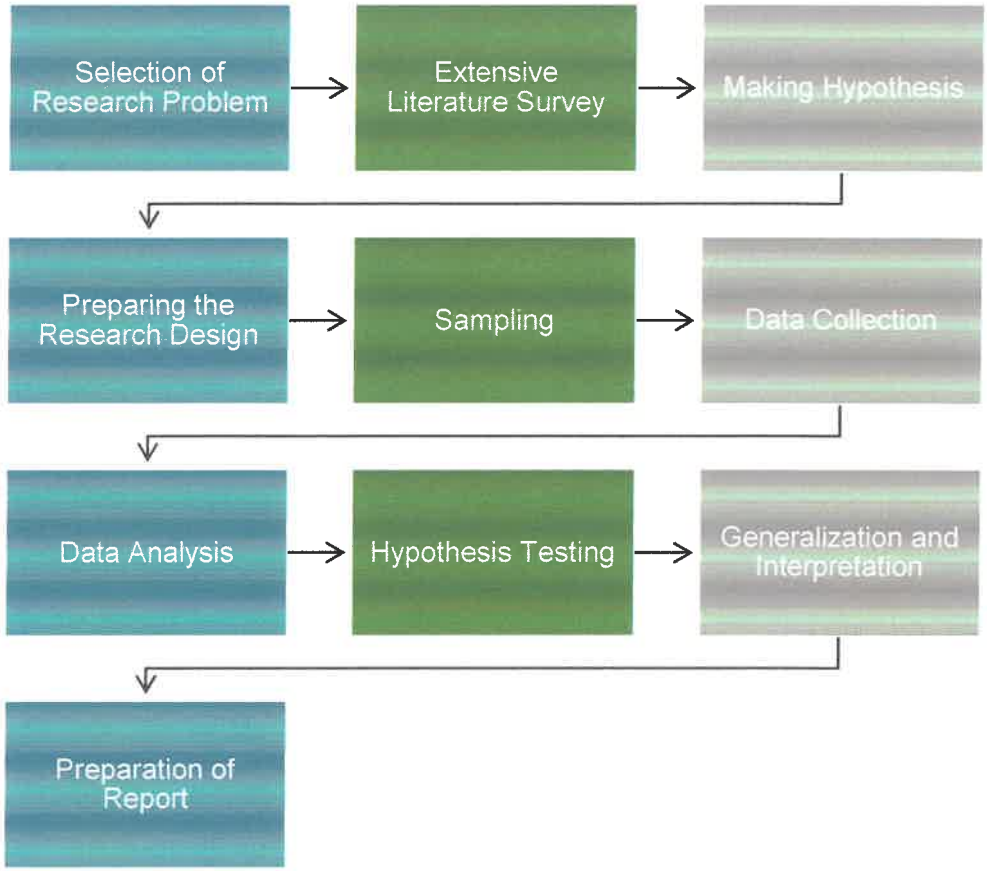


Figure 2. *The Process Flow in Research Process*

Selection of Research Problem

Selection of topics for research purpose is one of crucial job for researcher since the selected topics need to be make the other activities be easy to proceed. In order to choose and understand the topics better, it is important to discuss with colleagues, friends or experts. The chosen topic needs to be practical, feasible, relatively important, politically, and ethically acceptable. The selection of research problem also can help researcher to identify each and every step required for the research process such as design studying, sampling, research instrument, and also analysis.

Extensive Literature Survey

Extensive Literature Survey or know commonly known as Literature Review is the second step after identify the research topic. This availability of this steps helps researcher to gain understanding from existing research regarding the chosen topics through scientific manuscript, academic journal, conference and government report, and library.

Making Hypothesis

The development of hypothesis is to ensure the research methodologies are scientific and valid. It is a technical work that depends on the researcher experience. The hypothesis is to draw the positive and negative causes that can affect the problem. It is just not only to discover a relationship between variables, but also predict a relationship based on theoretical guidelines or empirical evidence. With the help of hypothesis, researcher can narrow down the area of research and keep the research on track.

Preparing the Research Design

After the hypothesis formulation, researcher required to prepare a design for their project. Any type of design can be done which commonly depends on the nature and purpose of the study. This designation needs sources, skills, time, and cost to be taken into consideration.

Sampling

The aim of this is to gather data and information from specific areas or universe.

Data Collection

This process is the most important in researching work. The collection of information collected must base on facts and suitable data collection method. There are two types of data collection, which is Primary Data Collection and Secondary Data Collection. Primary data collection can be collected through experiment, questionnaire, observation, or interview. Meanwhile, secondary data collection is from literature review, official and non-official reports, or library approach.

Data Analysis

Do a data analysis on data collected.

Hypothesis Testing

Hypothesis testing a process where researcher is going to test the hypothesis is either related to the facts or not, or the hypothesis being accepted or rejected based on data analysis or result obtained.

Generalization and Interpretation

After the hypothesis successfully tested, it is possible for researcher to reach generalization which is making theory. Some research does not require hypothesis which is this process known as interpretation where it based on the theory made.

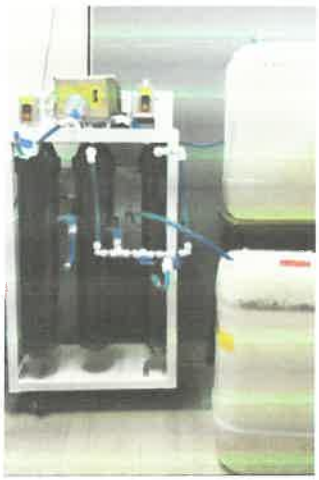
Preparation of Report

2.3.2 Weekly Task

Week 1 – Week 3	• Site visit
Week 3	• Zoom meeting with Dr. Zul regarding the "Citizen Science Participation with Teras Berkat"
Week 4	• Exploring river and lake in UTM with IPASA' staff
Week 5-	• Attend meeting regarding the water footprint survey for service sector
Week 6	• Testing out the River VR and AR Powered Book for the "Citizen Science Participation with Teras Berkat"
Week 5 - Week 7	• Fill up Floating Treatment Wetland (FTWs) holding tank • Have a short meeting and discussion with mentor and supervisor
Week 1 & Week 8	• Sampling session for Sand Filtration project

Week 1 – Week 3

Go site visit after a quick briefing with supervisor and mentor.



Sand Filtration project

Floating Treatment Wetland project

Week 4

During week 4, I was invited to join IPASA's staff in exploring the river and lake in UTM. This exploration is to study and observe the condition of UTM's river and lake that some part of it has been affected by the domestic waste that came from the cafes and hostels.

Figure 6. *The exploration of river and lake with IPASA's staff in UTM Skudai*

Week 5

Water Footprint Assessment: Malaysia's Progress Towards Water Stewardship is a program where water footprint is an indicator of water used that affect both direct and indirect water use such as the amount of water consumed in our daily life and growing plants. From this project, students that engaged in this program are required to do some interview or survey to collect all the data regarding the water consumed by Malaysia tourism industry (hotel) such as the electricity and water bills, the amount of raw meat used in their daily cooking, and etc. From the survey, we can study the amount of water footprint used in Johor tourism from drinking/food, transportation and accommodation aspects.

Week 6

In Week 6, the VR and AR technologies for the" Citizen Science Participation with Teras Berkat" program have been finalized and ready to use by the public. I be able to test out the River VR and River AR and experience myself the journey of the river in the VR visual.

Figure 7. *The River VR setup*

Figure 8. *The River AR setup*

Week 5 – Week 7

In my past 3 weeks of internship, I was assigned to fill up the holding tank for the floating wetland setup as the water in holding tank can hold until one week only, so, I was required to fill up the holding tank once a week using a generator and water pump.

Figure 9. *SOP for generator*

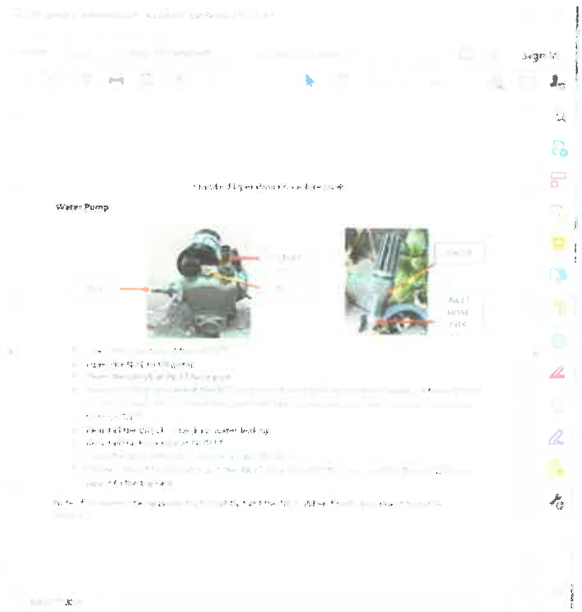
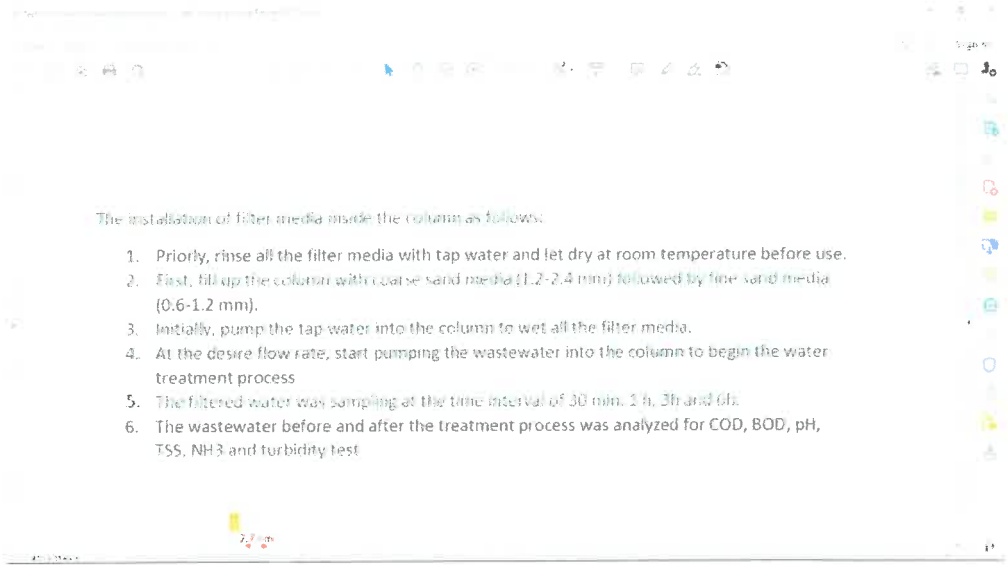


Figure 10. *SOP for water pump*

Figure 11. *Generator and water pump used for fill up floating wetland holding tank*

Week 1 and Week 8

In order to collect sample for sand filtration project, I was offered to join Dr. Ihsan to go sampling. In week 1, the sampling session was held inside the UTM Sewage Treatment Plant (STP), meanwhile, in week 8, the sampling session was held in Indah Water Konsortium, IWK in Taman Teknologi Johor, Jalan Teknologi 1.



The installation of filter media inside the column as follows:

1. Priorly, rinse all the filter media with tap water and let dry at room temperature before use.
2. First, fill up the column with coarse sand media (1.2-2.4 mm) followed by fine sand media (0.6-1.2 mm).
3. Initially, pump the tap water into the column to wet all the filter media.
4. At the desire flow rate, start pumping the wastewater into the column to begin the water treatment process
5. The filtered water was sampling at the time interval of 30 min, 1 h, 3h and 6h.
6. The wastewater before and after the treatment process was analyzed for COD, BOD, pH, TSS, NH3 and turbidity test

Figure 14. *Technical Process of Sand Filtration Project*

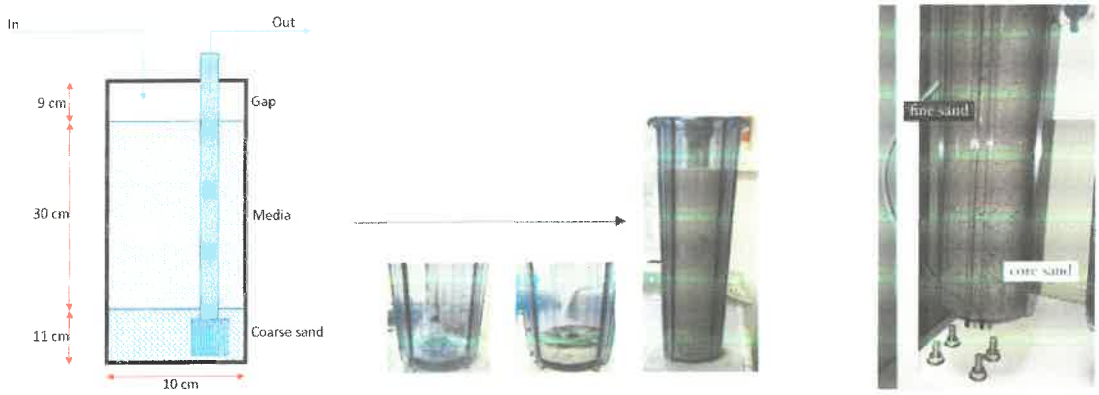


Figure 15. *System Setup of Sand Filtration*

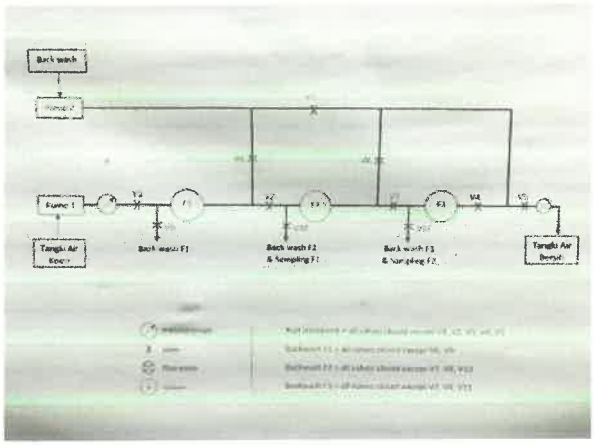


Figure 16. *PFD of sand filtration setup*

The selection of proper filter media is a mandatory to ensure the required quality of wastewater treatment be able to obtain based on the basis of the particle sizes, bed depth porosity of surface and toughness. The media used operate as the same basic principle of its nature ground water filtering. Poor selection of filter media for filtration sand can lead to poor performance of system.

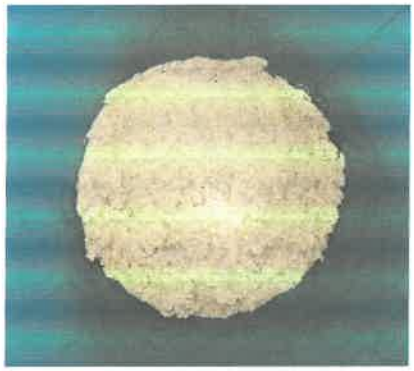


Figure 17. *Fine sand*

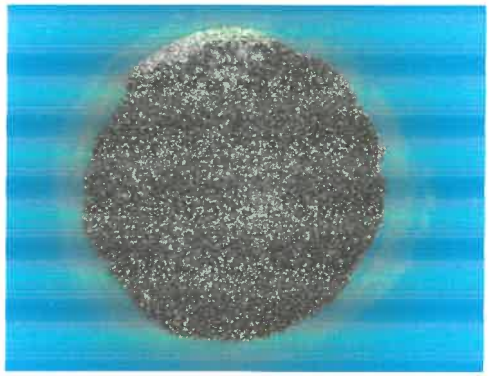


Figure 18. *Activated carbon*

For this project, the media arrangement is gap > media > coarse sand. For system optimization, the media arrangement is coarse sand > media > coarse sand. The media type used is sand (white and river) and activated carbon. White sand use can retain in removing suspended solid, colloidal particles, microorganisms, organic matter, odor, chlorine, and heavy metal ions effectively and river sand is one of the most common media uses in sand filtration. Next, activated carbon commonly used an adsorbent which activated carbon helps is effective in removing certain organics matter such as unwanted taste, micropollutant, and odor. Activated carbon also helps eliminating chlorine and fluorine.

Figure 19. *Water sampling in Sewage Treatment Plant 3 (STP-3) in UTM*

In order to test the efficiency of the system, the system need to run while using wastewater as the variable. This is where sampling session take places in order to collect the sample. The first sampling session was held at the Sewage Treatment Plant 3 (STP-3) in UTM. There are two types of common sampling, which is grab sampling and composite sampling. Grab sampling is where the water sample is collected at one time that shows the performance of the wastewater only at one point of time. Meanwhile, composite sampling is samples that been collected at numerous individual discrete samples that taken at regular intervals over a period of time, which is usually 24 hours. The analysis for composite sampling represents the average performance of a wastewater treatment plant during the sampling period. For this project, the method that been used for sampling is grab sampling, which is the water been taken as much as we want at one time for analysis study in the laboratory.

The analysis has been done to both before the sample treated by the sand filtration and after the sample been treated by the sand filtration. From the grab sampling, analysis of specific types of unstable parameter such as Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Total Suspended Solid (TSS). The purpose of the analysis is to study the wastewater quality through the COD, BOD and TSS parameter. The quality of the sewage wastewater sample being analyse before and after filtration.

Figure 20. *BOD Analysis*

Figure 21. *COD Analysis*

Figure 22. *TSS Analysis*

BOD analysis is to study the amount of oxygen consumed by aerobic biological organisms to oxidize organic compound in the water. Research state that sewage water that contain high BOD can cause a decrease in oxygen received by water that can cause to the death of aquatic life. Next, COD analysis is to study the amount of oxygen that required in water to breakdown the organic substances in water. Sewage water that contains higher COD means a greater amount of oxidizable organic will reduce the dissolved oxygen (DO) of water, which also can lead to higher BOD amount and threaten aquatic life. Meanwhile, TSS analysis is one of important parameter in increase the water quality of the sample. The presence of TSS can cause the water temperature and decreasing the oxygen that creates unfavourable environment for aquatic life.

From the analysis result obtained, we cannot see significant difference between the quality from the water before and after filtration process and some system optimization This undesired result occurs due to the Movement Control Order (MCO). Since the MCO have been announced by Prime Minister, order restrictions being introduced where the student are not allowed to stay in the college. This is where the quality of the water is cleaner than usual condition of wastewater when the college are fully occupied. Due to this issue, another sampling session being held in Indah Water Konsortium, IWK in Taman Teknologi Johor, Jalan Teknologi 1. Later, the sample will undergo the same process for BOD, COD and TSS analysis.

Figure 23. *Water sampling in Indah Water Konsortium, IWK in Taman Teknologi Johor, Jalan Teknologi 1*

2.4.2 Floating Treatment Wetlands (FTWs)

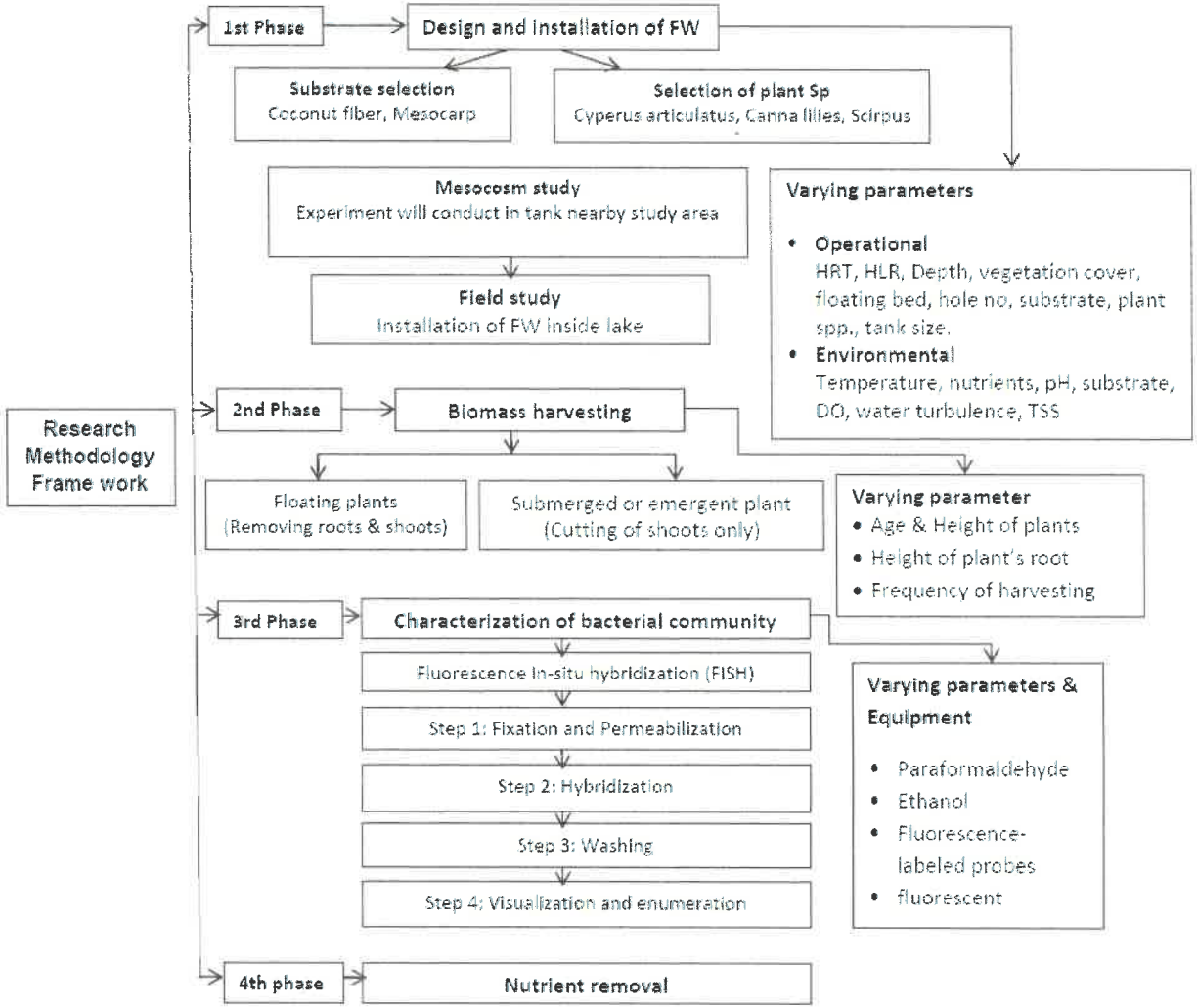


Figure 24. *Research Methodology Frame Work*

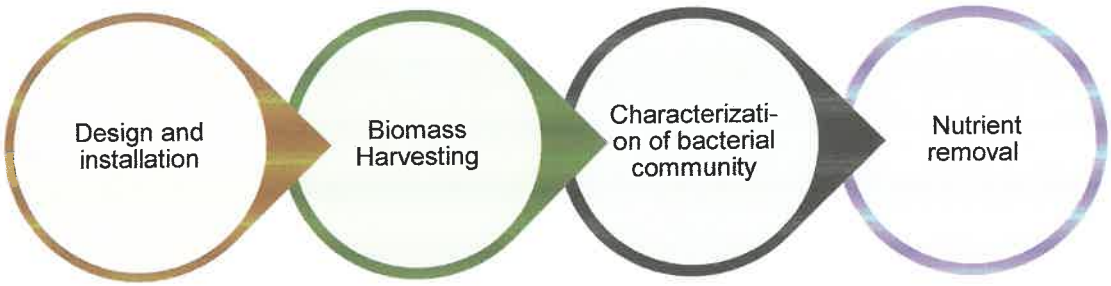


Figure 25. *Flowchart for Floating Wetland Project*

The second mini project that I was assigned for my internship is Floating Wetland which is conducted and run by a mentor, Fatema which is a PhD student. For this project, I was assigned to helps Fatema in order to run the floating wetland system and do some problem-solving regarding difficulties we face in order to succeed the project. This project also been supervised by Prof. Ts. Dr. Azmi Aris which is a senior fellow for IPASA academicians. This project involved four phase which is design and installation, biomass harvesting, characterization of bacteria community, and nutrient removal. Since our project is facing some trouble regarding the pipeline of the setup. As for that, it results us stuck at the first phase, which is the design and installation of the system and we cannot proceed for the second, third, and fourth phase. Figure 24 shows the details for full research methodology frame work for this project.

Figure 26. *Floating Wetland in Large Scale*

Floating wetland is container garden that float on the water surface. Other than helps in beautifying the lake, the wetland also acts as a system to purify the lake water quality. From **figure 1**, we can see that the plant grows on the surface of the water as the plant roots grow into the water, they will absorb excess nutrient from lake through their roots. Other than

that, the plant roots and floating material also provide extensive surface areas for microbes to grow-forming a slimy layer of biofilm, which plays an important role in help cleaning up the river. By removing the nutrients and other pollutants from the water reduces the incidence algae, fish kills and choking weeds. The floating bed makes the water underneath it cool and shady, also providing habitat for fish and other beneficial organisms. This project is to study the efficiency of floating wetland in nutrient removal in UTM river.

Figure 27. *Floating Wetland Design and Installation*

Figure 28. *Floating Wetland (Plant with carrier)*

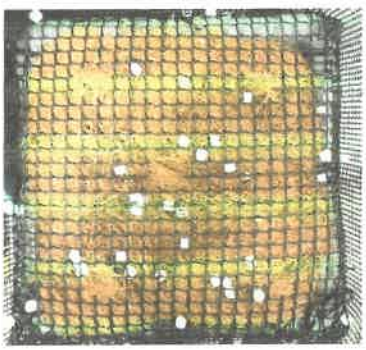


Figure 29. *Floating Bed (No plant, with carrier)*

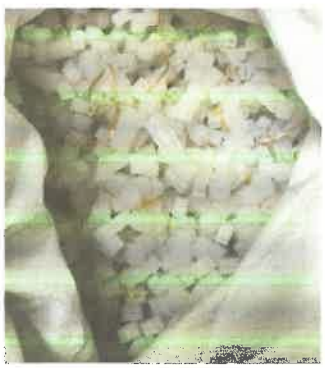


Figure 30. *Biofilm Media (Carrier)*

In order to analyse the nutrient removal easier, a manageable scale of floating wetland being build which is the first phase of the research. **Figure 1** shows that the system for floating wetland analysis project. The system has been set up by the riverbank of UTM Skudai River as the river water is the source for the floating wetland study. The system consists of a 500L holding tank, which hold or keep river water sample and four 150L red bucket to hold the floating wetland filled with river water. Each bucket will consist of for different types of apparatus. The first bucket will be put the floating bed that contain the plant and carrier. Second bucket will be containing with floating bed with plant, without carrier.

Third bucket contain carrier but without the floating bed and plant, and lastly, the fourth bucket will only be filled with river water, without any plant or carrier.

In constructing floating treatment wetlands, biofilm carriers are widely used in water purification. With the presence of biofilm in floating wetland, it can enhance the nutrient removal efficiency for the floating wetland. Choosing the suitable biofilm carrier can be a tough task since there is wide range of different types, material and shape has been developed. EM-Biofilm-F10 as shown in figure 30 has been chosen as the carrier for this project. This biofilm has a high hydrophilicity which has good adsorption unease to fall off. Biofilm also helps in increasing nitrogen and phosphorus removal as the biofilm is 30 to 50 percent more efficient than Activated Sludge.

For the floating bed, coconut fiber has been chosen as the substrate as shown in figure 29, and it is an eco-friendly product that made from coconut husk which can be safely compost or recycled. Coconut fiber also an ideal material for naturalistic terrarium type of setup incorporating amphibians, invertebrates and reptiles. Compared to other common natural fibers, coconut fiber has a higher lignin and offers variety of valuable properties that make it suitable in this project, which is coconut fiber have a such good strength, resilience, resistance to enduring, and also have a high extension to break.

After done with the material choosing for the floating wetland design and installation, I was assigned to ensure that the water flowrate at each red bucket inlet is constant at 21ml/min as our target for this project as to ensure that the water in the holding tank can last for a week. This is the tricky part for this phase as we still unable to get the constant flowrate at 21ml/min. A few changes and discussion have been done in order to find the solution, and the pipeline of the system have been changed to more sensitive and adjustable pipeline since the original valve's pipeline is unable to reach the water droplet form in order to reach the desired flowrate. We decided to use a flow restrictor to the new pipeline, figure 32, as flow restrictor is a device that commonly being use in restrict the flow of the water inlet and we be able to make the water flow in droplet form as in order to get the desired flowrate, for 21ml/min, the water is in droplet form. Other than pipeline changing, some experimental been done on the flowrate checking, and due to MCO, we unable to continue the flowrate setting work and the project have been left hanging until my internship period ended.

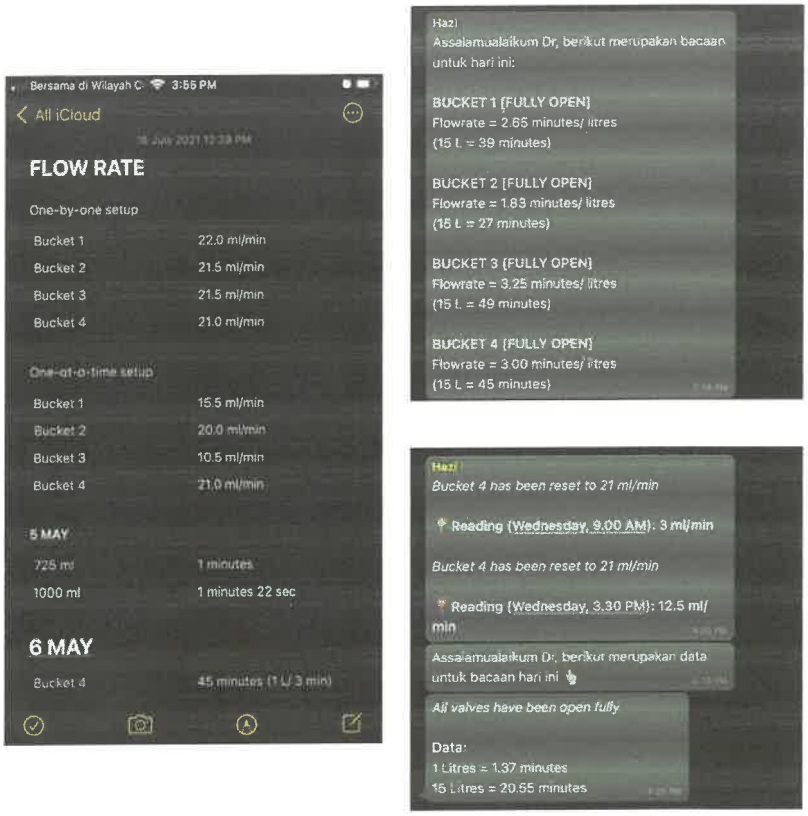


Figure 31. *Flowrate checking experimental results*

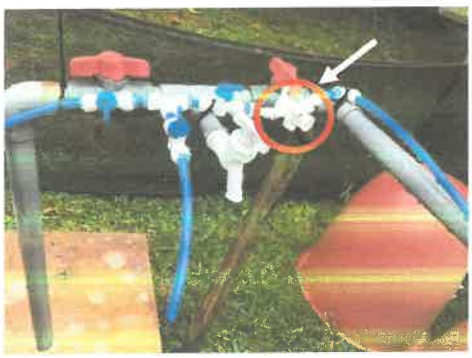


Figure 32. *New pipeline (White and Blue)*

Figure 33. *Flowrate Checking*

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

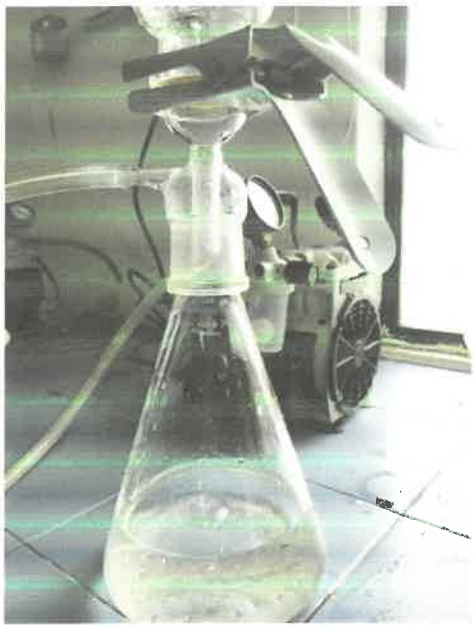
In order to reach the Universiti Teknologi MARA (UiTM) objective in producing a well-rounded student with great academic achievements, enhanced communication skills and leadership, the student enrolment in industrial training successfully give the student the opportunity to engage in real-life working experience and gain more knowledge.

From these opportunities, I have learned a lot of things especially on the Research and Development (R&D) job scope. Being in this department has given me a golden opportunity in gain more knowledge and learn more in researching world. In mean time, I be able to apply what I have learned during semester 5 regarding the environmental subject. These opportunities also give me that chances to run the BOD, COD and TSS analysis in real life as we already know that my semester 5 is in online learning, so during that semester, I was not be able to run the analysis in the laboratory. Other than receiving new skills, I was be able to improve my time management and communication skills especially with my colleagues.

3.2 Recommendations

- Based on my opportunities, I feel like IPASA is one of suitable company for student that undergoes an internship since it can help student to know more about our environment and apply what we have learn. I recommended IPASA for student that will undergo an internship.
- The FTWs mini project can be applied in UiTM itself in order to give more exposure to student regarding the environmentally friendly method in order to save our lake besides the mudball program that currently being practiced by UiTM itself.
- To more efficient work environment, it is better for the student was assigned a specific or well-organized schedule. It is to help student prepare or study first the task before hand and wear the suitable attire for task assigned.

APPENDICES



STUDENT WEEKLY PROGRESS REPORT