INDUSTRIAL TRAINING (CHE 353)

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Programme: Diploma of Chemical Engineering (EH110)

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LI Duration: 17 Weeks

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ACKNOWLEDGEMENT

First and foremost, I would like to thank to Allah, The Most Gracious and Most Merciful for granting me this strength and patience to complete my final semester in Diploma Chemical Engineering. Praise be to Allah for His endless blessing that helped me throughout my industrial training journey. I believe that my accomplishment today is because of His great graces.

I would like to express my deepest gratitude to my supervisor, Mr Amri Bin Md Zain, a Senior Executive of Quality Control and Quality Assurance at KCC Paints Sdn Bhd. I could not have successfully done my industrial training without his support and guidance. Every advice and constructive comment he gave helped me to execute the work given. Thanks to my supportive colleagues who had been helping me in performing my task and project.

My appreciation goes to my lecturer, Madam Salmi Nur Ain Binti Sanusi who kept on helping me from the first day of searching places to perform my industrial training until today. She was the one I will refer to every time I face any problem regarding my internship. Lastly, I appreciate every support and recommendation given by my parents, family members, and friends throughout my industrial training. All of their support, encouraging opinions and understanding had kept my focus to complete both my industrial training and report.

ABSTRACT

In order to accomplish the final semester in Diploma of Chemical Engineering, students are required to perform industrial training at a chosen company that offers them a job related to their studies and write a report regarding the knowledge and experience they gain during at the workplace. Faculty of Chemical Engineering at Universiti Teknologi Mara (UiTM), Pasir Gudang Branch, has assigned that all the registered students need to attend the course CHE 353 starting from 21st March 2021 until 15th July 2021. Students must have prepared all the document required prior their internship starts. Besides, interns need to inform their industrial training coordinator regarding their company details and the supervisor. This report is based on the experiences gained during the 17 weeks of industrial training at KCC Paints Sdn Bhd, Kota Kemuning, Shah Alam. KCC Paints Sdn Bhd was chosen as the company provided the best opportunities. For instance, the company offered a related job scope that helps students to maximize their knowledge application and to gain skills associated with chemical engineering studies during the internship. The assigned supervisor had been governed to provide the students with daily tasks or duties which is involved their knowledge and physical ability. Both of the tasks and projects are given were expected to be linked to course outcomes of the industrial training. The summary of the daily routine at the workplace should be stated on the student's logbook. Hence, this report is aimed to precisely elaborate on student's commitment and responsibility during their internship journey.

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1.0 INTRODUCTION

The industrial training course programme is a stepping stone for students to expand their knowledge and enhance their practical skills in actual industry. Hence, students need to successfully attend the course CHE 353 as this course not only to ensure students complete their studies in Diploma of Chemical Engineering but also to help the students to make preparation of themselves. In pursuance of making the students ready to step in the actual workplace, students must perform their industrial training not less than 17 weeks.

Industrial training is not merely on implementation of knowledge that students gain from the university, it is more to commitment, responsibility and communication. Indeed, these three elements have been exposed to students during their study time, however, student still need to face the real situation that requires them to entirely focus on their work. Undoubtedly that some students are really excellent in their studies, but they lack these three elements. Thus, the university assigns this course program to build up students with these qualities that will surely be in demand for the future.

Apart from that, students have the opportunity to face the real challenges at the workplace since the environment of both university and worksite are different. Students must be well prepared for their physically and mentally before they decide to choose a place to execute their industrial training. Therefore, performing industrial training requires high determination and consideration.

1.1. OBJECTIVES OF THE INDUSTRIAL TRAINING

The industrial training or known as accommodate for students in Diploma of Chemical Engineering is a fundamental course programme as it is classified in one of the requirements which is assigned by Universiti Teknologi Mara (UiTM) for students to graduate. Industrial training programme under Faculty Chemical Engineering is called CHE 353. Students will be exposed upon the new environment which helps them to start learn fresh skills and knowledge.

The aim for course programme of CHE 353 is to discover student's abilities during their industrial training. Student's performances throughout their study time in university might be different with internship training. Internship help students to develop or enhance their professional and practical skills in real working environment. All the chemical engineering studies they obtained should be applied theoretically or practically during the industrial training. The daily tasks given by their supervisor allows the students to refine their skills and knowledge. Moreover, some students who performed well during their training get offered to become as permanent staff.

On top of that, the objective of industrial training is to improvise student's communication with their supervisors and colleagues at workplace. Students had been introduced to communication skill during their presentation, talk and forum at university, indeed there is still a lot of students having difficulty to communicate with new people. Attending the industrial training programme helps the students to develop their communication skill by having frequent interaction with the people at their workplace. Communication skill is important because students will be getting their tasks through communication as well as solving problems. Hence, students can straightforwardly refer to their supervisor or colleagues because of the good communication among them.

Lastly, industrial training is aimed to help students in developing their critical thinking by solving the problems. Solving problems at workplace requires the students to do both prompt decisions and actions. Each problem exists during their industrial training help the students to simultaneously exercise their brain and body. Critical thinking is not solely just applied during their internship but it can be applied through their actual life. Hence, this will help to produce students with active and strong in mentally and physically.

2.0 INDUSTRIAL TRAINING CONTENT

2.1. BACKGROUND OF THE COMPANY

Korea Chemical Co. also known as KCC is the largest paint and chemical company in Korea and KCC Paints Sdn Bhd is one of the represents overseas subsidiaries of KCC Corporation, which has an international presence around different parts of world. KCC Corporation is originated from South Korea in 1958 meanwhile KCC Paints Sdn Bhd was founded in 1997. The lists of global represents under KCC Corporation are shown below:

- Malaysia
- Singapore
- Japan
- China
- Vietnam
- Korea
- Indonesia
- India
- United Arab Emirates
- Turkey
- Germany
- United Kingdom

In the early stages, KCC Paints Sdn Bhd started merely to cater for the marine, protective coatings sector, service several industrial applications and shipbuilding. Soon after, KCC Paints Sdn Bhd has a significant presence in both the retail and project market segments. KCC Paints Sdn Bhd presently has expanded their business by not only focusing in producing paints but they are also have a lot of specialized departments to help the company's growth. Indeed, KCC Paints Sdn Bhd in Malaysia plays an important role in supporting the other South East Asian countries such as Brunei, Singapore, Combodia, Vietnam and Indonesia. The departments in KCC Paints Sdn Bhd in Malaysia are listed below:

- Manufacturing
- Research & Development (R&D)
- Distribution
- Sales and marketing

KCC Paint Malaysia is located in Kota Kemuning, Shah Alam, Selangor has three different factories which are assigned to individual functions. Thus, the Factory 1 is assigned for specialised in solvent-based paints, the Factory 2 specialising in water-based paints meanwhile Factory 3 is a temporary product store. Moreover, both solvent-based and water-based paints have two types of paints which are ready coloured paints and base paints. Following to the accomplishment in making quality paints, KCC Paints Sdn Bhd has a team that involves high qualified chemists and researchers who are consistently improving and developing their products to meet the market's demands and needs. Research and Development (R&D) of KCC Paint Malaysia also cooperates with Korea's KCC Central Research Institute (C.R.I).

KCC Paints Sdn Bhd is a company that produces both water-based paints and solvent-based paints. These two types of paints have different unique formula developed in Research and Development (R&D) department. Water-based paints is a paint manufactured with water. Water-based paints contain filler, pigments and binder where it dissolved in water. Moreover, it contains a low level of volatile organic compound and that makes water-based paints are more environmental friendly paint than solvent-based paint. Therefore, water-based paints are more suitable to be used nearly any application requirement.

The solvent-based paints contain organic compounds as solvent. The solvent-based paints are built with the thicker texture compared to water-based paints but it helps in beautify the imperfections on walls by demanding a persistent dry time. It is more efficient to be used during freezing temperature or extreme weather conditions. The level of volatile organic compound in solvent-based are higher than water-based paints that can causes severe effects such as troubles breathing, strong headaches and being unwell. However, solvent-based paints is an ideal choice for exterior coating than the interior.

As mentioned above, there are two types of paints for both solvent-based and water-based paints. Ready-made paints have both coloured paints and plain white paint meanwhile, base paints have four types of bases paints. For instance, base paints consist of Base 1, Base 2, Base 3 and Base 4. All of these paints are developed with different advantages and performances. Hence, the ready-made paints and base paints are required different methods in handling them during quality control measurement.

At present, KCC Paint Malaysia is known as one of the best manufacturers of paints that able to bring forth abundant solutions of painting or coating needs. The production of paints at KCC Paints Sdn Bhd are solvent-based which good for the exterior meanwhile water-based paint is advisable to be used as interior paint. Hence, the following lists are instances of both solvent-based and water-based paints at KCC Paint Malaysia:

- Decorative Paints
- Architectural Coatings
- Protective Coatings
- Polymeric Floor Systems
- Functional Coatings

The vision and mission of KCC Paint Malaysia are to provide the solution in protecting and beautifying properties. Therefore, KCC Paint Malaysia eagers in making the best products with compatible, uncompromising quality and affordable price to ensure all colour lovers deserve the better paints and coatings. The consistency of researching and refining the products and services are to help both the community and environment.

Lastly, the establishment of KCC Paint Sdn Bhd due to the global network of KCC Corporation around the world. The determination of KCC Corporation in expanding their business has granted them today with the creation of high value products in areas of specialised paints and chemical engineering.

2.2. INDUSTRIAL TRAINING DETAILS

Privilege is given to students for them to choose a company that related to their respective course. Therefore, student has chosen KCC Paints Sdn Bhd as a place to perform industrial training for 17 weeks. Figure 1 below show the actual location of KCC Paints Sdn Bhd in Kota Kemuning, 40460 Shah Alam, Selangor Darul Ehsan.

Figure 1: Location of KCC Paints Sdn Bhd via Google Maps

2.3. ORGANIZATION CHART

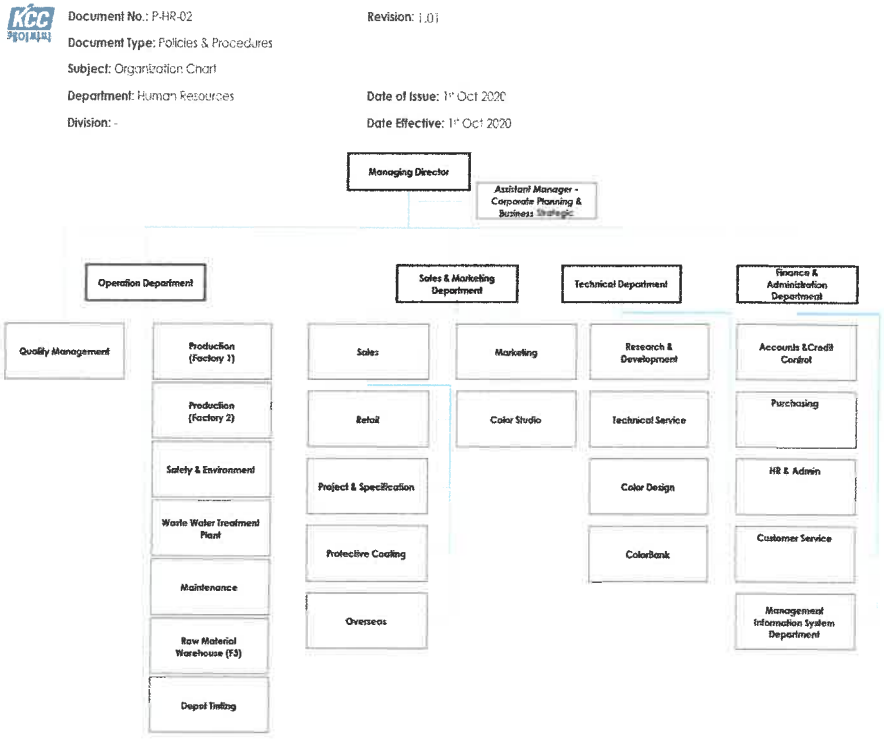


Figure 2: KCC Paints Sdn Bhd Organization Chart

2.4. PROCESS FLOW

Despite using different raw materials, the manufacturing of both solvent-based and water-based paints at KCC Paints Sdn Bhd has similar process flows which involved planning, production, checking and packing. Each of the process flow is explained below:

I. Planning: Each paint has different unique formula developed for it in the laboratory. During the formula development stage, all the aspects of the paint's quality are thoroughly tested as the laboratory is taking the responsibility for inspecting all the raw materials prior to their production. Therefore, the laboratory department also involves in observing the quality during the production process. It does help with research and development upon both the new raw materials and methods. This laboratory department is also known as Research and Development (R&D). Furthermore, all the formulas are written on paper called a work ticket. The work ticket consists of every detail of the paint such as the name of the paint, their batch number, the composition of raw materials and specification checking for quality control. On top of that, the work ticket indicates the production steps that require the paint-maker to follow. The work ticket will be handed out to the production department afterward. However, the operator needs to ensure that all the raw materials are available and the tank/mixer are cleaned before proceed to the next process.

II. Production: The followings are the production process for both solvent-based and water-based:
    a) Measurement of ingredients: The raw materials are measured and weighed accurately on scales by using calibrated vats.
    b) Preparation: The weighed raw materials will be transported close to the tank/mixer.
    c) Mixing and dilution: Mixing in water-based occurs in two steps. In the first step (very high speed mixing) all inorganic materials dispersing agents, and wetting agents are mixed thoroughly. In the second one, polymer, glycol, freeze thaw agent are added and mixed at low speed.
    d) Dispersion: Resin and additives help broken down the powders from sticking together. Industrial paint mixer machines are used to combine and disperse the pigments.
    e) Let down: Resin, solvent, and additives are combined in a large vat. The mill-base is stirred in during this phase. Any final additions are added during this stage, if necessary.

III. Checking: Every paint will be prompt checked in Quality Control room. This step requires a bit sample to be taken from the mixture for further inspection. The followings are the specifications:

Quality Control Measurements
Dispersion
Bar down
Drying time
Non-Volatile Matter
Specific Gravity
Viscosity
pH
Colour Difference
Gloss at 60~ or 80~
Contrast Ratio

Table 1: Water-Based and Solvent-Based Specifications Inspection

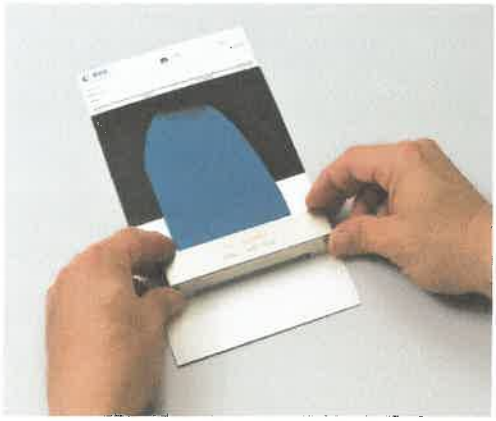
IV. Packing: The ready paints are filtered in a filter net to remove non-dispersed pigments and any entrained solids before it is poured into can or drum according their volume. The containers are labelled and packed accordingly to their batch before moved to storage.

2.5. DAILY ACTIVITY

2.5.1. WORK-FROM-OFFICE (WFO)

KCC Paints Sdn Bhd had assigned a supervisor among of their employees to manage the trainee once the students are officially accepted at their company. The first day of internship on 22nd March 2021 started by company briefing, 'ice-breaking' season and initial practises conducted by supervisor. The following table shows students' daily activities at KCC Paints Sdn Bhd starting on 23rd March until 31st May 2021:

Activity	Elaboration
1. Preparation	• Trainee should ensure all the equipment are ready and cleaned • Each of the equipment should be promptly calibrated before can be used. Hence, this will help to avoid misreading the value.
2. Dispersion	• Paint maker will hand in a cup of sample for each paint for trainee to check 30 minutes after mixing and dilution. • In solvent-based, dispersion is done by adding resin or additive together with the sample to dilute the sample. Other than that, dispersion for solvent-based paint have 3 different method. The examples are shown below: i. Bar-down paper method ii. 100 micron stainless steel rectangular rod iii. Dissolved method • Each of the method is used based on the requirements written on the work paper. • For solvent-based paints, bar-down paper and 100 micron stainless steel rectangular rod method are using the same sample. For instance, the same sample used for bar-down paper will be used for 100 micron stainless steel rectangular rod. Meanwhile the dissolved method is a direct method where quality control checker will need to go directly to the mixer/tank by using a long rectangular glass to check either all the raw materials are well mixed. • For water-based paints, the dispersion at quality control is easier where it only consists one method which is bar-down paper method. The small amount of the sample is poured off onto the bar-down paper and slowly drag the stainless steel bar down.

	• Next, the bar-downed paper will be placed in the oven. The drying time is at least 30 minutes. Once the bar-downed paper is thoroughly dried, trainee will check either all the raw materials are well dispersed. Production can continue to the next step if the bar-downed is approved but if it is not approved, the mixer need to continue stir for certain time.  *Figure 3: Bar-down method*  *Figure 4: 100 micron stainless steel rectangular rod method*
3. Taking sample	• Trainee is required to take the sample from tank/mixer once the let-down process is done. • The samples taken are accordingly to their types of paints. For instance, there are two types of paints produced at KCC Paints Sdn Bhd which are ready-made paints and bases paints. However, the ready-made paints consist of coloured paints and plain white paints. Thus, taking samples is based on the types of the paints. • In water-based quality control, the sample of coloured paints is taken by using a plastic paper cup before pouring it off into a 500ml plastic container, meanwhile the plain white paint is taken into the smallest size of the plastic container. Next, the bases

	500ml=y. The 'y' will be considered as the volume of the base paints sample. iii. Pour the required volume of the base paints sample into the same tint colour container. iv. Close the plastic container with the cap. v. Shake the container using the shaker machine as to ensure the base paints sample and tint colour are well mixed. vi. Take out the container after 5 minutes of mixing. vii. Pour a small amount of both previous and the latest sample onto the bar down paper. The previous sample will be poured off on the left side meanwhile, the right side is indicated for the latest sample. This helps the trainee to differentiate between the two of them. viii. The first bar down paper will use the 300~ stainless steel bar applicator. This paper will be used for colour differences. Therefore, the trainee will write the name of the product on top of the paper as to specify that the paper is bar-downed by using 300~. ix. The second bar down paper will use the 100~ stainless steel rod applicator because it will be used to check for contrast ratio. x. Repeat the steps of number i-ix for the previous batch of base paints sample. *The trainee is required to use two previous batches of base paints sample for solvent-based paints. • For ready coloured and plain white paints, the bar down steps are similar. The steps are shown below: i. Take a small amount of the latest ready-made paints sample by using a wood stick and place it on the right side of the bar down paper meanwhile, the other side is for the previous batch.

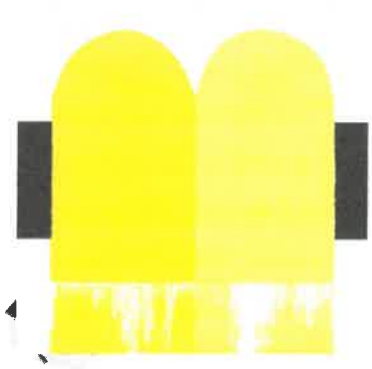
	ii. Use two pieces of the bar down paper as there are two different angles of the stainless steel bar applicator to be used which are 300~ and 100~.  *Figure 5: Bar-downed paper* *Figure 6: Bar down applicator at 300 angles*  *Figure 7: Bar down applicator at 100 angles*
5. Wet Rub	• This method applicable for base paints only. • The trainee will do a circular motion on the wet bar-downed paper of base paints. This step is to see either the colour will change when it is spread. However, the wet rub step is done just for the latest sample. • On top of that, it is important to not put pressure while performing the wet rub method, wet rub requires a light circular motion just to spread the paints. If the pressure is applied while wet rubbing the sample, it can only ruin the colour. • The wet rub method is done only at a small spot of the bar-downed sample. For instance, the bar down paper has two parts which are the white side and black side, the wet rub is done on the surface of the paint between the two sides.

	 *Figure 9: The defect of sample that contains water*
7. Non-Volatile Matter	• Non-Volatile Matter is a method to measure the particulate material remaining following evaporation of the volatile solvent which contains the material. Moreover, this method helps to measure the amount of micro-contamination on the surface of an item. • The trainee needs to calibrate the non-volatile matter meter prior to the process as to avoid the prop misreading the value. The calibration is performed by putting a small amount of any paint on top of aluminium foil paper and turn on the prop. The trainee can proceed to use the prop for another sample inspection of non-volatile matter. • This method is same for both solvent-based and water-based paints regardless to any types of paints. Every type of paints will undergo the same steps. The steps of non-volatile matter measurement are shown as below: i. Cut a small piece of aluminium foil paper and place it on the plate of the non-volatile matter appliance. ii. Pour the amount of 0.300g to 0.500g sample by using the wood stick on the surface of the aluminium foil. The trainee should ensure that no sample is spilled off the aluminium paper. iii. Turn on the non-volatile matter appliance. • The period of non-volatile matter measurement usually is around 15 to 17 minutes. Therefore, the non-volatile matter is done promptly than the other specification in order to save more time. The trainee will record the value exhibited on the prop soon as the prop stops cremating. The trainee shall repeat this step at least 2 times to get an accurate reading by using different

	value amount of the sample but still need to follow the range given as mentioned above. • Hence, the measurement of non-volatile matter is fundamental in manufacturing of chemical paints.  *Figure 10: The non-volatile matter appliance*

8. Specific Gravity	• Specific gravity is to measure the density of the paint and it is generally expressed in terms of weight per gallon. The ddensity is determined by the ratio of solid raw materials that comprise the paint solution and can be influenced by improper thinning, environmental conditions, and mixing ratios. • The specific gravity method is measured by using a pycnometer. The trainee needs to ensure that the stainless steel cup that will be used is completely dried and cleaned to avoid a reading error. Next, the sample is poured off in the stainless steel cup until it reaches the top line. The stainless steel cup is then placed on the specific gravity appliance. It is important to wipe off the excess paints using dry tissue and get ride the bubbles off the sample by humming the stainless steel cup until the bubbles appear on the surface, then use the stick to rupture the bubbles. Hence, the reading can be much lower with the presence of bubbles in the paints meanwhile, the excess paints coat the stainless steel cup can make the reading higher. Both of these errors should be avoided in order to obtain an accurate value in measuring the specific gravity. • The value exhibited on pycnometer will be recorded on the work ticket.  *Figure 11: The pycnometer appliances*
9. Viscosity	• The viscosity measurement performed in quality control of paint industry is an essential step where it is to measure of how resistant a paint is to spreading. This specification is very important to be performed in quality control. • Furthermore, the trainee needs to cool down the sample temperature prior to the upcoming measurement. The goal of cooling process is to cool the temperature to 25~C. The temperature of the sample is cooled down by storing the sample in the cool box that contains cold water. The trainee also needs

	to ensure that the temperature of cold water is below 18~C or below than that because the trainee needs to change the water with new ones once the temperature of it rises. • The cooling period is based on the volume and the current temperature of the sample. It takes longer to cool down the temperature of the sample if the volume is larger and the current temperature is higher. In the meantime, the trainee was required to frequently take the sample out from the cool box and stir the sample using the stick to ensure the sample temperature can be uniformly spread. However, the trainee needs to make sure that the temperature of the sample does not go below 24~C or the trainee needs to change the sample with a new sample and repeat the cooling process which takes a longer time. The trainee checks the temperature of the sample by using the infrared thermometer. • The trainee can proceed to check the viscosity of the sample once the temperature reaches 25~C by placing the container that contains the current sample under the viscometer. The viscometer will start stirring for 60 seconds and the value will be exhibited after it stop stirring.  *Figure 12: Viscometer used in paint industry*
10. pH	• PH measurement is compulsory in the specification of quality control because it is to avoid profound effects on many other paints properties. • The trainee performed the pH quality control measurement by placing the container under the pH meter. Next, the value exhibited on the pH meter needs to be monitor until the value shown is constant and it is considered as acceptable.

	 *Figure 13: The pH meter uses in quality control department*
11. Colour Difference	• The colour difference is measured in quality control inspection is to compare the colour of the current sample with the previous sample. Although the difference in the colour for both samples can be seen by using bare eyes, it still needs to be checked using the software installed on the computer called as DataColor. The colour difference measurement is to avoid the colour drifting and it is used for colour approval or adjustment. • Measurement of the colour difference is by using the bar downed paper which used the 300~ angled applicator. • The bar downed paper will be placed at the colour difference tool and the software on the computer will exhibit the value of delta a, delta b, delta c and delta E. All of these values will be taken into consideration. Each of the values has a different role in making decisions either the colour should be proceed to approve or adjust. Usually the value of delta E for water-based paints can be considered acceptable at 0.5 or below meanwhile, for solvent-based paints the value of delta E can be considered at 0.5 until 1.0 as solvent-based products barely achieved the value below 0.5.  *Figure 14: The colour different appliance*

12. Contrast Ratio	• Next, the contrast ratio is to measure the apparent reflectance of the material backed by a perfectly absorbing surface (black) divided by its apparent reflectance when backed by a white surface. • Therefore, the contrast ratio is measured by using the bar downed paper that used 100~ angled applicator. • The contrast ratio is checked using the similar steps as the colour difference measurement.
13. Gloss at 60~ or 80~	• The last quality control measurement that the trainee should check is gloss specification. • The gloss is measured by using the glossmeter. Thus, each product is checked at different degrees which is based on the work ticket. • The procedure of checking the gloss specification is very easy which only requires the student to place the glossmeter on the bar downed paper and the value of the sample gloss will be exhibited. The trainee should use the bar downed paper that used the 300~ angled applicator to check for the gloss.  *Figure 15: The glossmeter uses in paint industry*

The values obtained from each of the quality control specification measurement will be recorded on the work ticket for further purpose because the products are either proceed to the packing stage or undergo the adjustments. It is very important to record all the values obtained to compare for the next quality control measurement. After all the specifications have been checked, the trainee will refer to the supervisor for approval. The products usually are considered passed once all the specifications are in the range. Once the products are approved, the trainee will proceed to record the values on the computer. There is a format used to keep all the data for each products. Therefore, the trainee was required to send the ticket to packing department.

In addition, the trainee had practiced all the safety requirements during performing the quality control measurement. It is compulsory for the trainee to wear personal protective equipment (PPE) throughout the process. For instance, the trainee was not allowed to enter the factory if the trainee did not wear the safety boots. Moreover, the trainee was required to wear the laboratory coat, hand gloves and eyes protector during handling the task. The trainee practiced the safety measurements to avoid severe accident.

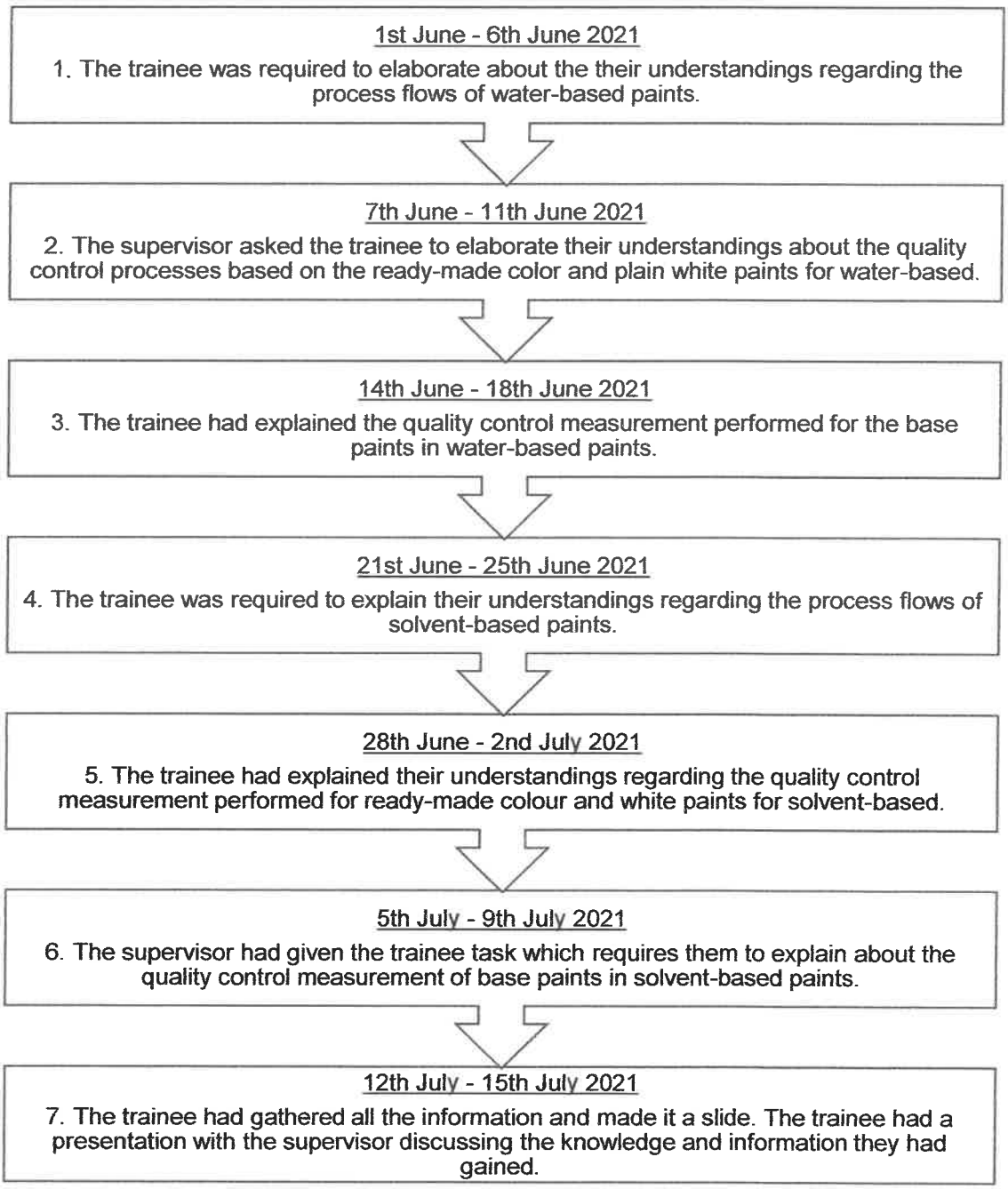
The quality control measurements are all carried out accordingly to the requirement written on the work ticket to avoid the waste of time. Thus, the quality control measurement for water-based paints usually takes only 1 hour to finish meanwhile, the solvent-based paints take longer to complete the quality control measurement as it can take up to 2 or 3 hours for one product to completely finish. KCC Paints Sdn Bhd has a key performance indicator (KPI) for the quality control measurement.

Moreover, each appliance or equipment used during the quality control measurement is immediately cleaned by the trainee to avoid the permanent stains on the equipment that can affect the upcoming measurement. The trainee was informed to ensure that all the equipment are all cleaned at the end of the working day because the following days will use the same equipment for the quality control measurement. The cleanliness at workplace should be prioritized.

Therefore, all the quality control measurement performed by the trainee during the industrial training is to meet the KCC Paints Sdn Bhd vision and mission. The specifications are checked thoroughly to avoid further complaints from customers. The work ticket has written the value range of each quality control specification. Thus, products will undergo adjustments if the result obtained for any quality control measurement did not meet the requirement or is not included in the value range. The products will be adjusted at least three times, if the result remains, the sample of the products will be sent off to the research and development (R&D) department for further inspection.

2.5.2. WORK-FROM-HOME (WFH)

On the other hand, the daily activities of the trainee had changed due to the lockdown enforcement announced by the government which requires all the factories to be shut down effective on 1st June 2021. Thus, it was prohibited for the trainee to attend the work physically during the lockdown. The supervisor of the trainee had given the work-from-home (WFH) tasks for the trainee to perform. The followings are the trainee working timeline starting from 1st June 2021 until 15th July 2021:



As mentioned on the above, the work-from-home (WFH) tasks are well elaborated on both process flow and daily activity 1. The WFH tasks are just to strengthen and enhance the trainee knowledge and understandings theoretically through research. The trainee had to perform proper research regarding all the tasks to ensure that the trainee understand the task and job they had performed before the lockdown enforcement.

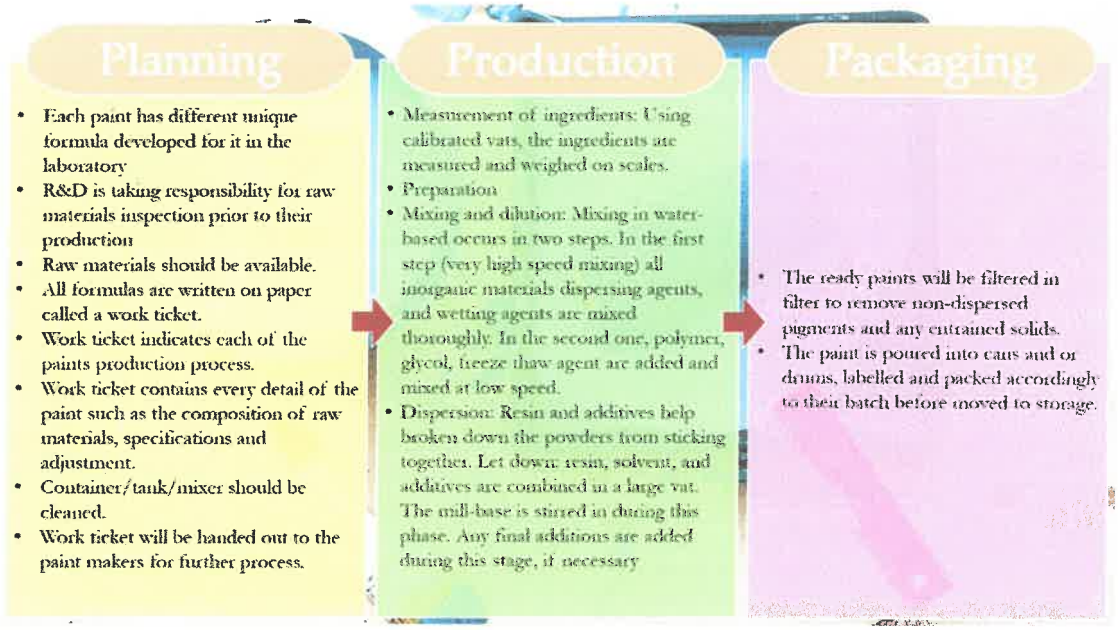


Figure 16: The work-from-home task

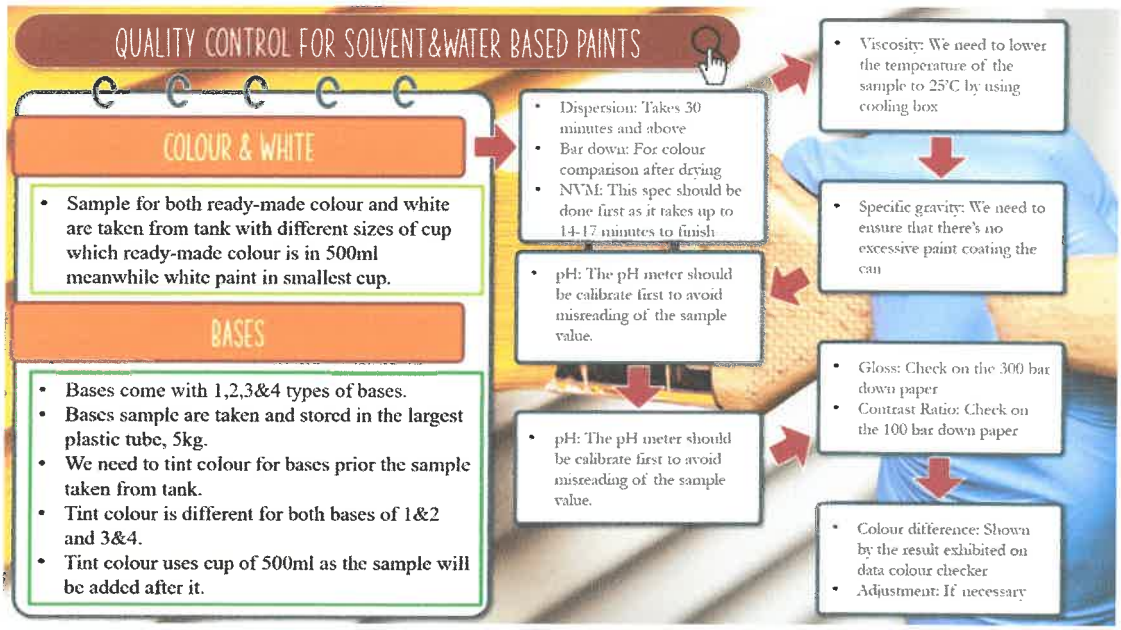


Figure 17: The work-from-home task

2.6. MINI PROJECT

The trainee had been given a mini-project to execute during the industrial training at KCC Paints Sdn Bhd. Thus, the mini project is called 'Pot Life' Moreover, the trainee conducted this mini project for 5 days starting from 24th May 2021 until 31st May 2021 and it only required one product for each day. It was required to perform only for certain solvent-based paints which means not all products at KCC Paints Sdn Bhd need to be performed the 'Pot Life' project. On top of that, the trainee had performed the 'Pot Life' for 5 products of solvent-based paints as shown below:

- Korepox 509-Indian Red 1416
- Korepox 509-Dark Green 1458
- Korepox 509- Paradise Blue 1465
- Korepox 509-Signal Red 0402
- Korepox 509-White 9102

2.6.1. OBJECTIVE OF MINI PROJECT

'Pot Life' is a term used to describe two packs coatings that cure through chemical reactions such as epoxies and most polyurethanes. This mini project consists of two base components which are called Part A and Part B. Part A is known as the solvent-based paints meanwhile, the Part B is known as the hardener of the Part A. The purpose of conducting the 'Pot Life' project is to measure the time taken for the hardener or Part B takes to harden the Part A. The mixing of these two parts resulting the chemical curing reaction which the molecules of the base and hardener come into contact and start reacting together.

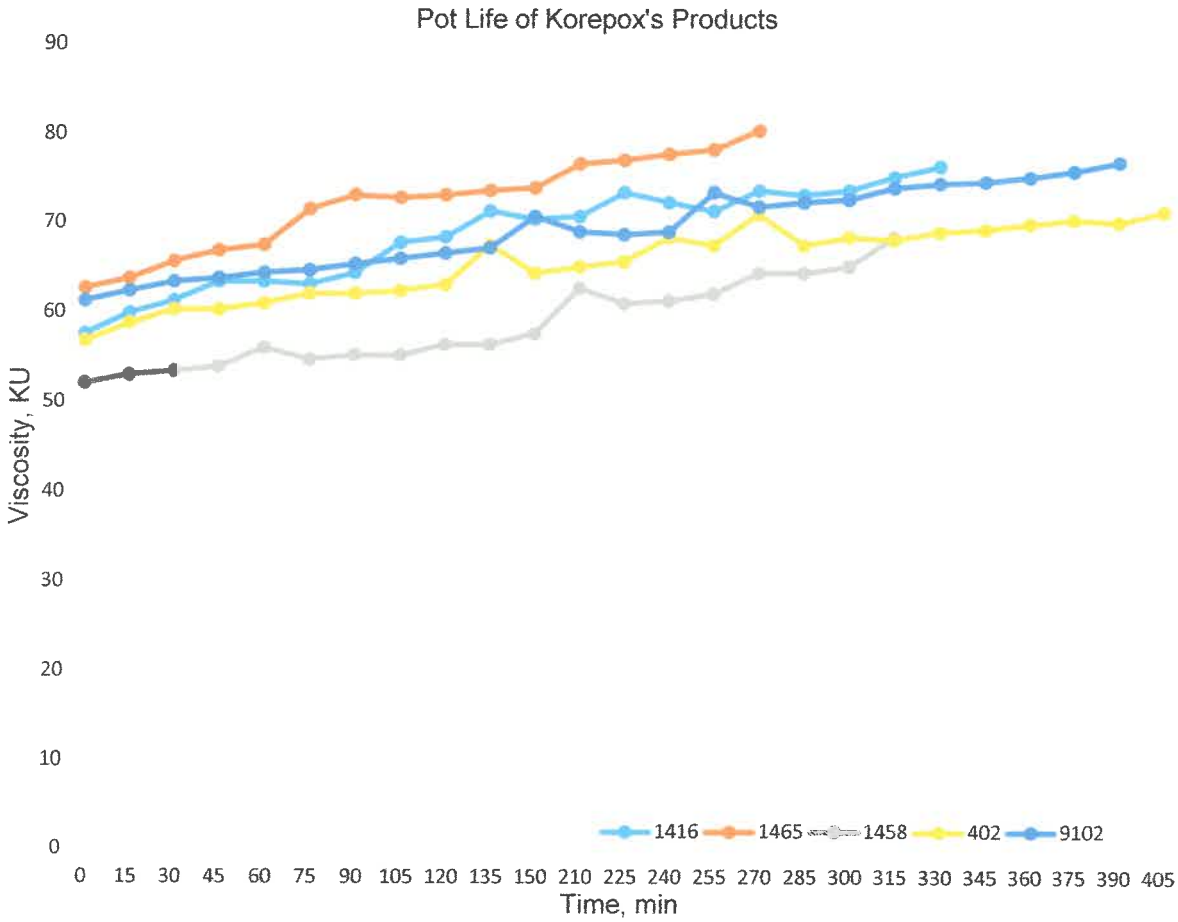
2.6.2. PROCEDURES OF CONDUCTING POT LIFE

1. The trainee needs to calculate the volume of each part by using the formula of:
    - Part A – (Specific Gravity Part A x Ratio Based on Paint x Volume Required)
    - Part B – (Specific Gravity Part B x Ratio Based on Paint x Volume Required)
2. Pour off both Part A and Part B in the same stainless steel container accordingly to each volume.
3. Next, gently stir the mixture using a stick and place the container that contains both parts under the viscometer.
4. Start stirring for 60 seconds and wait until the value of is exhibited.
5. Record the value exhibited on the viscometer.
6. Repeat the same steps 15 minutes after the first value obtained and stop once the value is obtained is doubled the first ones or the mixture cannot longer be stirred.

2.6.3. DATA AND RESULTS

Product	Korepox 509-Indian Red 1416	Korepox 509-Paradise Blue 1465	Korepox 509-Dark Green 1458	Korepox 509-Signal Red 0402	Korepox 509-White 9102
Time, min	Viscosity, KU	Viscosity, KU	Viscosity, KU	Viscosity, KU	Viscosity, KU
0	57.6	62.7	52.1	56.8	61.3
15	59.9	63.8	53.0	58.8	62.4
30	61.3	65.7	53.4	60.3	63.4
45	63.4	66.9	53.9	60.3	63.8
60	63.4	67.5	56.0	61.0	64.4
75	63.1	71.5	54.7	62.1	64.7
90	64.4	73.1	55.2	62.1	65.4
105	67.8	72.8	55.2	62.4	66.0
120	68.4	73.1	56.4	63.1	66.6
135	71.3	73.6	56.4	67.5	67.2
150	70.4	73.9	57.6	64.4	70.7
210	70.7	76.6	62.7	65.1	69.0
225	73.4	77.0	61.0	65.7	68.7
240	72.3	77.7	61.3	68.4	69.0
255	71.3	78.2	62.1	67.5	73.4
270	73.6	80.3	64.4	71.0	71.8
285	73.1	Too high	64.4	67.5	72.3
300	73.6		65.1	68.4	72.6
315	75.1		68.4	68.1	73.9
330	76.3		Too high	69.0	74.4
345	Too high			69.3	74.6
360				69.9	75.1

375				70.4	75.8
390				70.1	76.8
405				71.3	Too high
420				Too high	



2.6.4. DISCUSSION AND CONCLUSION OF MINI PROJECT

The 'Pot Life' project is considered completed once the mixture of Part A and Part B cannot longer be stirred because at one time the curing reaction will have reached a point that the mixture will either have become too thick to spread or the paint and hardener resins will have reacted in bulk to the point that they are unable to form a proper network.

As shown on both data and chart, Korepox 509- Paradise Blue 1465 has the highest value of viscosity which is 80.3 and its Pot Life completed at the minute of 270, the earliest among the others Korepox's products. Meanwhile, the longest time taken to get the highest value of viscosity is Korepox 509-Signal Red 0402. In conducting the 'Pot Life' project, there are some of the parameters that can affect the results of the Korepox's products. For instance, the Part B or hardener used can fasten the curing process resulting the paint harden faster. Moreover, the Pot Life can be affected with the volume and temperature.

On the other hand, the Pot Life's results are difference because there were might have slight mistakes made by the trainee during conducting the project. The time gap at minute of 150 and 210 are bigger because the 60 minutes were taken for lunch break of the traineeThe Pot Life is determined by evaluating the dried film. Although there are time gap difference for each Korepox's product, it does not equivalent to the quality of the product. Hence, it is just a simply measurement to help customer in estimating the time to use the paints once they have mixed both of the parts.

Therefore, KCC Paints Sdn Bhd had performed the Pot Life in order to eliminate or reduce the coating failure due to exceeding pot life. There are some of the defects of coatings such as delamination of coatings because of the lack chemical bond between coating and substrate, grittiness of the finish due to grains od polymerised material within the mixed material and many more. Pot Life is a feedforward control mechanism to help customer in choosing their paints.

Figure 18: Coating failures due to the exceeding of pot life

3.0 DISCUSSION

The quality control department of KCC Paints Sdn Bhd is working towards of producing high quality products to satisfy the customer's needs. In addition, the quality measurements are required to be performed by the trainee respectively to the current work ticket which means each of KCC Paints's product has the specific quality control measurement. Indeed, the quality control measurement for paint industry is the key of ensuring the product's qualities. All of the KCC Paints products will be undergo the quality control measurement as to avoid the further inconvenience

Furthermore, KCC Paints Sdn Bhd is a leading company in producing the chemical paints which requires a lot of techniques and refining throughout the journey. Hence, by testing out the sample of each of their products gives them a lot of benefits such as less of customer's complaints, time saving and high production rate. The data of each sample tested in the quality control departments will be saved for further references which can save a lot of time and energy. The presence of quality control department helps the research and development (R&D) and production department works become easier.

The followings are shown the failures of the products:

 *Figure 19: Fine crack*	Defects: Checking. Probable Causes: Typically a formulation or/and specification problem. As with cracking, stresses are developed that cause the surface of the paint film to become brittle and crack. Limited paint flexibility. Prevention: Improve the formulation of the product.
 *Figure 20: The cracking of one coat*	Defects: Cracking. Probable Causes: It is usually a stress-related failure and can be attributed to surface movement, aging, absorption and desorption of moisture. Prevention: Perform the correct of application techniques.

 *Figure 21: Peeling defect*	Defects: Peeling. Probable Causes: It is the reduction in bond strength of the paint film due to contamination or incompatibility of coats. Prevention: Perform a correct coating system.
 *Figure 22: The sedimentation of the solid constituents comprising pigments and extenders*	Defects: Settlement. Probable Causes: It is a problem due to the old stock, heavily pigmented paint and incorrect product formulation. Prevention: Use products within shelf life.

As shown as the above, the quality control measurement is not only performing one of the requirements in producing paints, but it helps to provide the customers with the correct information and knowledge about the paints they are interested in. The correct and improved formulation of the products tend to give a good finishing coatings, indeed. Fortunately, the right application techniques is required too. Thus, quality control measurements can be considered as the initial testing before selling it to customers. Therefore, the weakness and defects of the products can be detected prior to the marketing.

4.0 CONCLUSION

In a nutshell, the student had gained a tremendously experiences and knowledge during performing their industrial training at KCC Paints Sdn Bhd. The moral support and guidance shown by the supervisor and colleagues were helping the trainee in order to execute the daily tasks. The industrial training course program is not only to help the student to apply the chemical engineering knowledge at the workplace, it does help the student with both communication and critical thinking skills development. For instance, the student needs to have a proper conversation with their supervisor and colleagues, the student also needs to give an immediate solution and a prompt action in solving problem at the workplace. Furthermore, the industrial training course program helps the student to show their commitment and responsibility through the 17 weeks of the internship. During the industrial training, KCC Paints Sdn Bhd has the shortage of manpower at both quality control and production departments. Thus, KCC Paints Sdn Bhd can add more manpower in order to increase the production rate and faster quality control measurement.