

# Welcome to AustraliaCDRhelp.Com

## CAREER EPISODE 1

### Production of Bio-Diesel Fuel

#### A) Introduction

##### [CE 1.1]

Project: Production of Bio-Diesel Fuel

Duration: [Date] – [Date]

Location: Hyderabad, India

Organization: Anurag Group of Institutions

Position: Chemical Engineering Student

#### B) Background

##### [CE 1.2]

The earth was confronting decreasing fossil energy sources at a period when global energy consumption was soaring and pollutants from fossil fuels were wreaking havoc on public health and the ecosystem. As availability declined and costs rose, countries needed an alternative method of environmentally beneficial liquids fuels. Generating fuel from alternative energy sources, such as Bio-diesel, becomes a solution to the issue of fluid fuel (produced from fossil fuels).

##### [CE 1.3]

The work aim was conducting bio-diesel fuel production in which I applied my technical knowledge to get the associated work results. This was a group project and I applied my knowledge to obtain the definite results applying chemical engineering steps in it.

##### [CE 1.4]

The specific work nature relied on bio-diesel fuel production and it was dependent on analyzing<sup>1</sup>

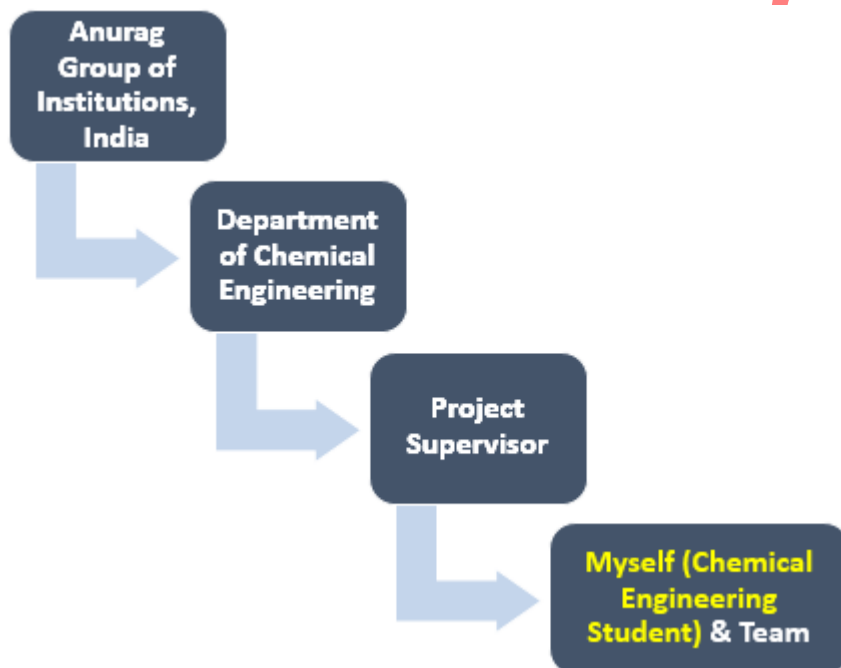
Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR



**AustraliaCDRHelp.Com**  
Competency Report Writing Helper

the defined activities and achieving the results applying chemical engineering practices in the project.

[CE 1.5]



[CE 1.6] Duties:

- I used alcohol that was deprotonated with a base in the trans-esterification process to making it a richer nucleophile and methanol was frequently utilized.
- I observed the process and it has no further input than triglycerides or the alcoholic.
- I utilized distillation in the batches process which was considered to be batch distillation and was done using chemical engineering concepts.
- I worked on the inclusion of the liquid-liquid extract along with the solid-state removal for splitting the solution.

### C) Personal Engineering Activity

[CE 1.7]

2

Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR



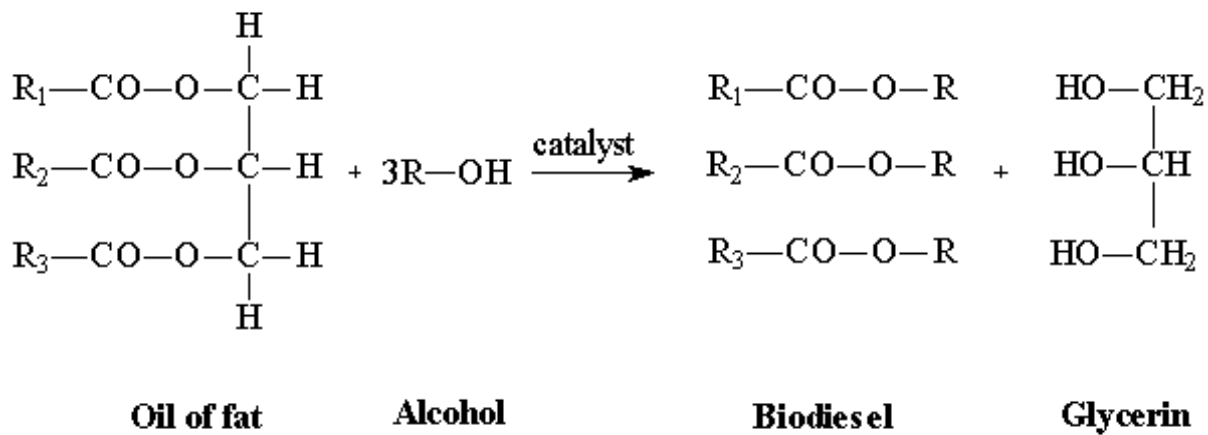
I implemented the steps related to biodiesel production in which the first step was the preparation of feedstock. I worked on the contaminants, waxes, water, gum, and other plants materials that were extracted from oils and animal fats during refinement. I obtained 3 stages that were involved in filtering:

- Degumming
- Bleaching
- Deodorization

I performed it to get rid of the gum (phospholipids) or liquid within animal fats. I used phosphoric acid to extract phospholipids from the tallow, accompanied by centrifugation extraction to separate sticky particles and contaminants. I reduced it by heating to 105° C because the addition of liquid while the process allows triglycerides to hydrolyze and create detergent rather than Bio-diesel.

### [CE 1.8]

I conducted it to remove color and other contaminants from the oil and diminish the oil's susceptibility to rancidity. I heated the degummed oil to 100-110°C below vacuum (760mmHg), then I processed with fuller earth to reduce color and strained through a Pressure Leaf filtration. Fuller earth was a clay substance that may decolorize oil and other fluids without any need for chemicals. I conducted it to get rid of the oil's greasy and distinctive flavors and odors. I found that oil retains its unique qualities, such as flavor and odor, however after degumming or bleached. I heated the oil fat to 260-275°C in that deodorization procedure by flowing lower pressured steaming (1 Kg/cm<sup>2</sup>) through a counter presently under cleared environment. I first included the meal at 3.0% FFA (free fatty acid) however, after deodorization, the FFA content drops to 0.1 percent. That process would normally occur very slowly or just not in normal circumstances, thus heat or catalyst (acid and/or base) were also needed to boost it up. I analyzed that it was crucial to note acid or base was not used during the trans-esterification reactions, hence they were catalysts rather than substituents. I found that sodium hydroxide, potassium hydroxide, and sodium methoxide were major trans-esterification catalysts.



**[CE 1.9]**

I processed oil using methanol in an influence of sodium methoxide catalysts to made bio-Diesel, also known as Methyl-ester. In that method, I connected two reactors in series, each with three compartments and independent agitators for each segment. I injected the processed oil from the holding container into the first compartments of the first reactors, together with 30 percent sodium methoxide in methanol. Then I pumped excess from the first reactor into the second reactor, which would be charged with a 30 percent sodium methoxide and methanol mixture. Both furnaces were kept at a temperature of 55-60°C. I delivered the volume of the reaction from the second reactor to a separating container, where Methyl-ester (Biodiesel) floated and crude glycerol settles. I retained the pH of these solutions constant, methyl-ester from the separating tank that was combined using dilute HCl. I cleaned that methyl-ester using a 10% warm water counter currently during an extracting process, to eliminate methanol, glycerol, catalyst traces, or other contaminants.

**[CE 1.10]**

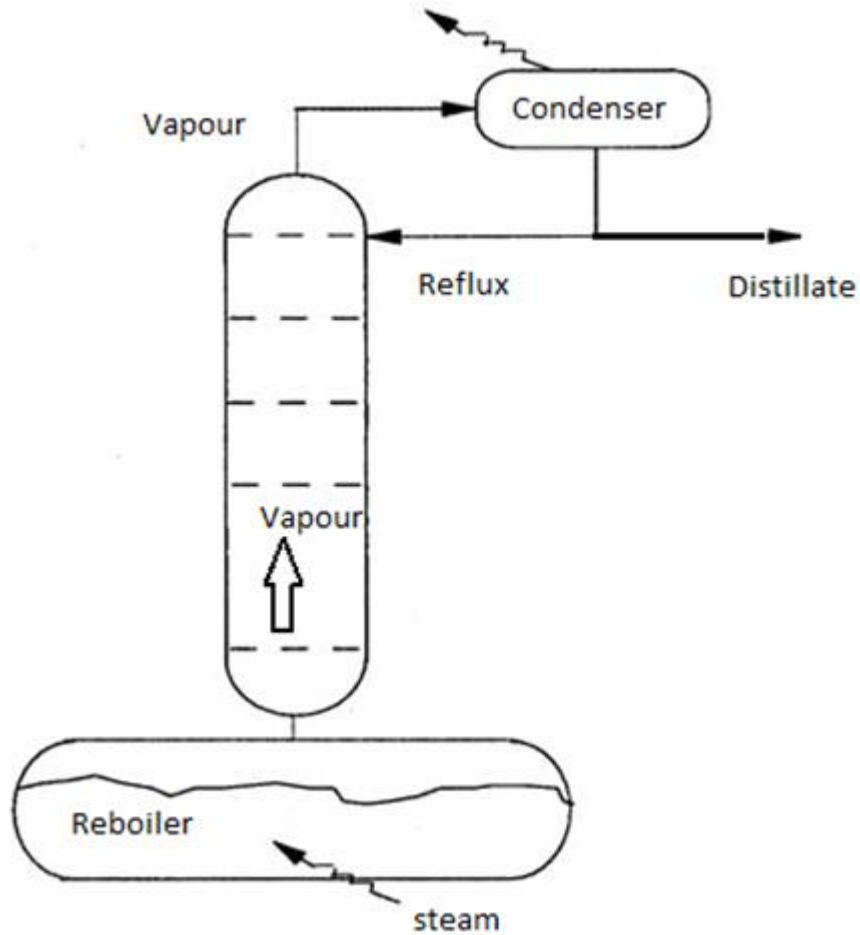
I analyzed the operations involved during the production of bio-diesel and associated by-products and these were:

- Centrifugal separation
- Distillation
- Filtration
- Evaporation
- Extraction

I worked on a centrifuge separation device that uses centrifugation to remove solids from fluids and it usually consists of a rotating cylinder container inside a bigger static tank. I obtained those solids and fluids were parted by centrifuge strength in that apparatus. I used a distillation process that was a procedure of separating component materials from liquid combinations by vaporizing and condensing them depending on their varied volatility (evaporation level). I examined that distillation

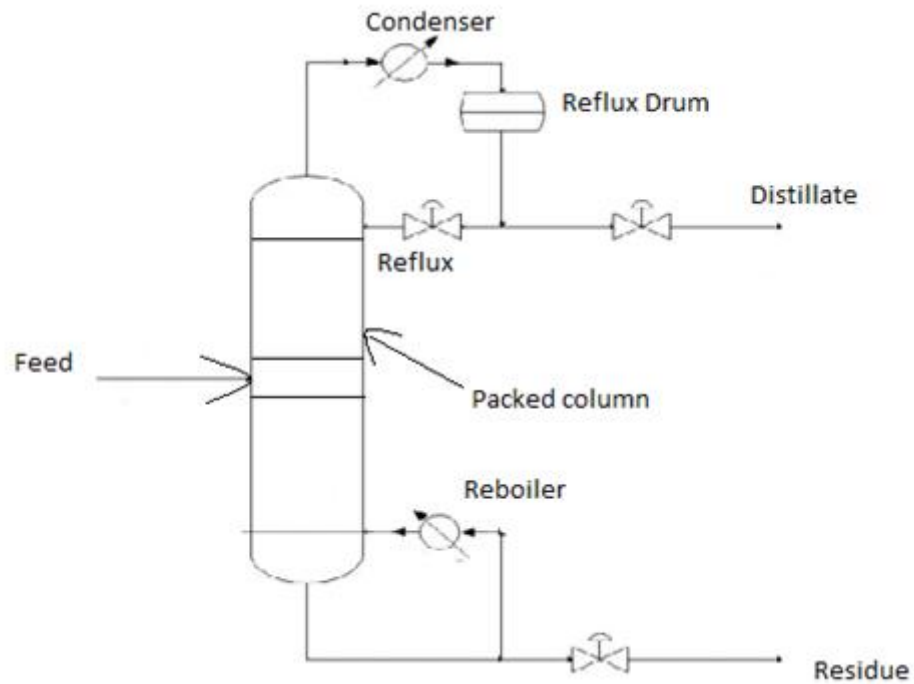
Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR

was not a chemical process, but rather the operations of a unit or physically separating procedure. I used distillation in batches that were referred to as batch distilling. Because it refers to the procedure of distilling a combination to divide it into its constituent parts while charging the distilling always with a new combination and repeating the procedure.



**[CE 1.11]**

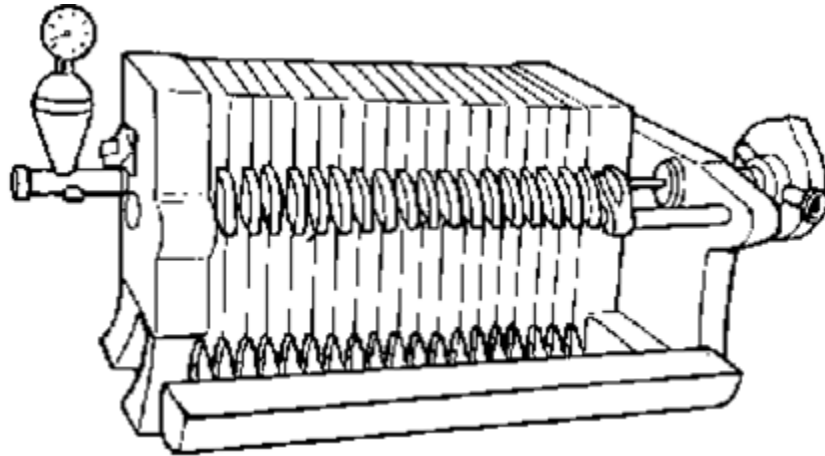
I used distillation indefinitely that was a type of distillation in which a solution was continually supplied into the operation (without interruptions) and divided sections were regularly withdrawn as outputs streamers (i.e., distillate and residue).



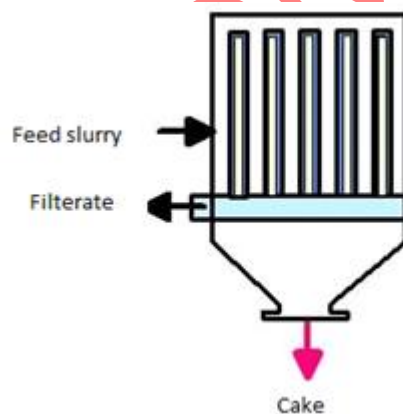
I used a physical or mechanical process of filtering that separates particles from liquids (fluids or gasses) bypassing the liquid across a media that only the liquid could flow over. And filtered represents the fluids that flow through. I obtained the medium that retains oversized objects in the liquid.

- Plate and frame filter
- Leaf filter

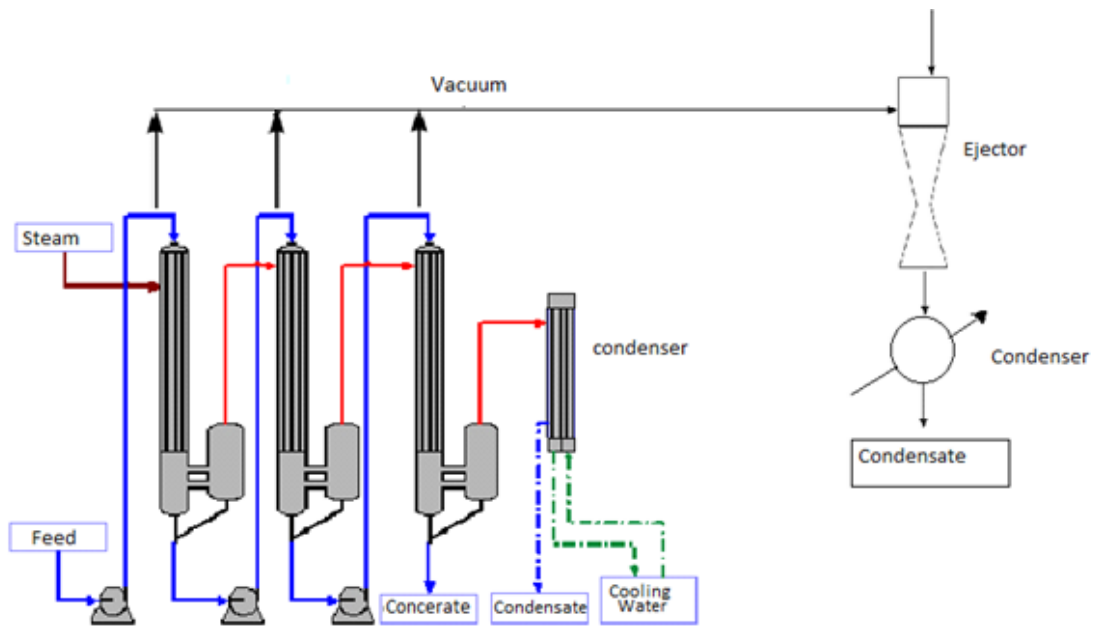
I used the concept of pressure-driven generated by a slurry pump to separate solids from fluids that were separating techniques. I examined that filter press has a limited capacity and batch activity, which implies it should be halted to release the filter cake until the next batches could begin. Then I found that skeleton and filtering package were the two most important parts of a filter press. Although I created the pressure within the filter chambers because the skeleton keeps the filter packed connected and it could only contain a certain amount of solid at a time.



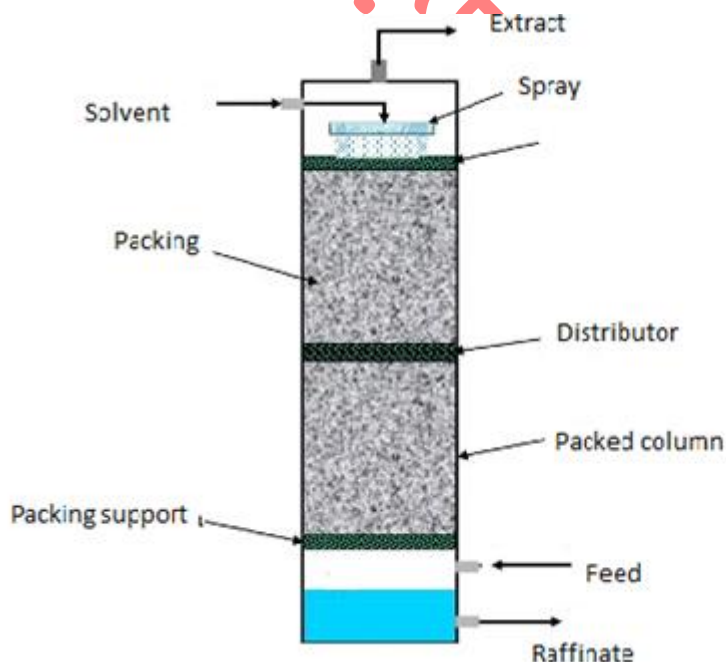
I worked on a leaf Filter that was ideal for solid-liquid separation and operate on the pre-coating and pressures concept. I accomplished pre-coating by mixing 0.5 to 1 percent of appropriate filler material (bleaching earth, supercell, Hyflo, super flo, etc.) with the fluid to be filtering. I installed the leaf vertically on a similar manifold pipeline, which was where the filtered liquid exits and a vibrating shaft holds the petals at the head. I controlled the leafy shaft that was vibrated by a mechanical vibrator by an electric engine vibrator enabling cake discharge. Because the filter releases filter from both sides, a large filtering surface could be attained in a compact vessel.



I used evaporator devices to evaporate liquids mixtures. And I attained that evaporation was the vaporization of a liquid that happens when a liquid evaporates off its surface into a gases stage that was not saturation with the evaporating component. I worked on a multiple-effect evaporation system that was described as a device for successfully evaporating water utilizing steam heating. I boiled water inside a series of vessels, each kept at low pressure than last, in a multiple-effect evaporator. So, because boiled temperatures of liquid drop as pressure loss, the vapor boils off in 1 vessel could be used to warm the next one, only the first vessel (at the maximum pressures) needs an outside source of heat.



I worked on extraction that involves extracting material from a mixture. I included liquid-liquid extract and solid-state removal to divide a solution through one step into another. I extracted organic chemicals from an aqueous solution through an organic phase in a typical lab extracting process. Then I prepared general extractants of ethyl acetate to waters (ethyl acetate < acetone < ethanol < methanol < acetone:water (7:3) < ethanol:water (8:2) < methanol:water (8:2) < water) in rising quantity of action. I found that the transference of just one (or even more) substance from a feeding solution to some other immiscible fluid (solvent) was known as liquid-liquid extraction (LLE) and extraction was a solvent that contains a high concentration of solute(s).



**[CE 1.12]**

Throughout the work, there was consistent discussion executed with the team members as well as with the project supervisor to gain effective work results.

**D) Summary**

**[CE 1.13]**

I examined that biodiesel was non-toxic and renewable, it was safe to manage and it eliminates all emissions. I observed that biodiesel could be used solo or combined with petroleum diesel in every proportion and diesel engine that hasn't been upgraded. Because there were no engine adaptations or "engine conversions" required to use biodiesel.

**[CE 1.14]**

And I discovered that the increasing usage of renewable biofuels has important microeconomic implications for both the urban and rural sectors, and the overall economy.

**[CE 1.15]**

I deduced that biodiesel represents a significant possibility for rapidly resolving energy security issues because it could be created using established manufacturing production capability and utilized with ordinary technologies.

AustraliaCDRhelp.com

# CAREER EPISODE 2

## The Production of Alumina

### A) Introduction

[CE 1.1] The work "The Production of Alumina" was the executed project at Anurag Group of Institutions, Hyderabad, India.

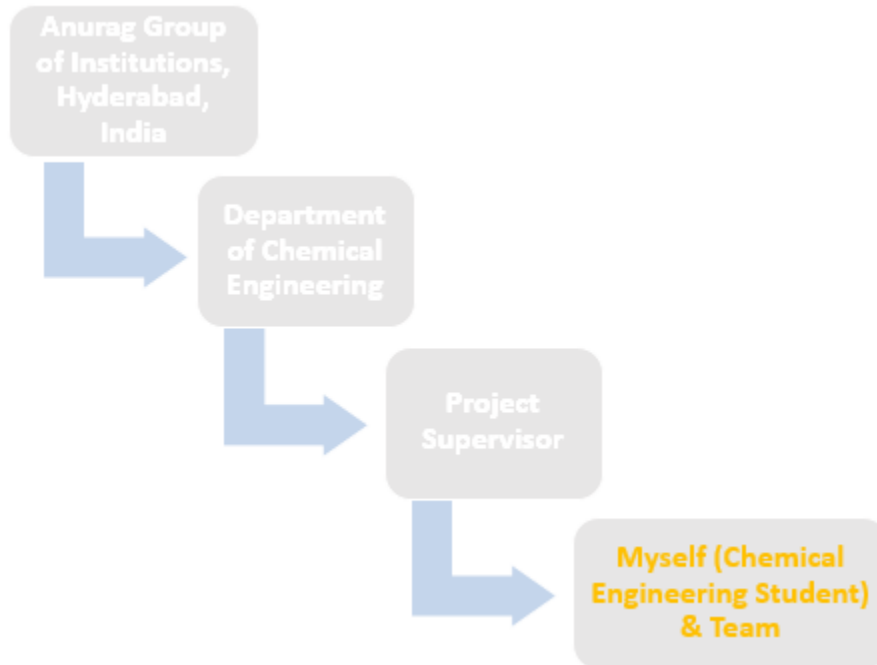
### B) Background

[CE 2.2] A chemical compound of oxygen and aluminum is termed as aluminum oxide. The various occurring of aluminum oxides works with various other chemicals. These are termed as alundum, or alkoxide and aloxide. These mainly depending on the specific forms of applications that commonly occur in the polymorphic phase in which the composition of numerous mineral works with other varieties. Aluminum oxide mainly utilizes for producing aluminum metal with abrasive behavior mainly owing to the defined hardness level. It is linked with the refractory material owing to the higher melting point.

[CE 2.3] The work objective was carrying out the plant designing for producing 10 tons per day of alumina. I assumed the plan which was to be operating for 300 days in a year. There was an in-depth literature review conducted for the available processes for alumina production. There was also the selected process description made for the alumina production thoroughly. I obtained significant benefits with the associated factors for the selected process with chemical engineering skills usage.

[CE 2.4] The project work was executed based on the complete material and energy balances which were on the 10 tons per day basis. I proposed the reactor for the operation and entire design calculations were executed accordingly. I calculated the total investment needed with the plant profitability which was estimated accordingly with the set payout period and rate of return.

[CE 2.5]



[CE 2.6] The assigned work duties were:

- I worked on specifying and setting the factory location which was done after evaluating various factors associated with the site.
- I did economic material selection which overall worked on satisfying the process and mechanical requirements.
- I executed an acceptable plant design using chemical engineering skills which worked within the process specifically for overall effective process operation.
- I carried out the working on setting the fire fighting instructions in which gas fires were not extinguished unless specified.

CE 2.9 Please add more engineering details and evidence of the material selection performed by you, problems faced and solutions found.

CE 2.13 Almost nothing of the listed here has been represented with clear technical details and evidence.

### C) Personal Engineering Activity

[CE 2.7] I started the working with the base plate calculations as shown below:

11

Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR



Australia's Trusted Website | 100% Approval Rate

Page

From table suitable base plate size  $a = 140\text{mm}$  &  $b = 150\text{mm}$

Now  $P_{\text{average}} = P/ab = 447886/140 \times 150 = 21.3 \text{ N/mm}^2$

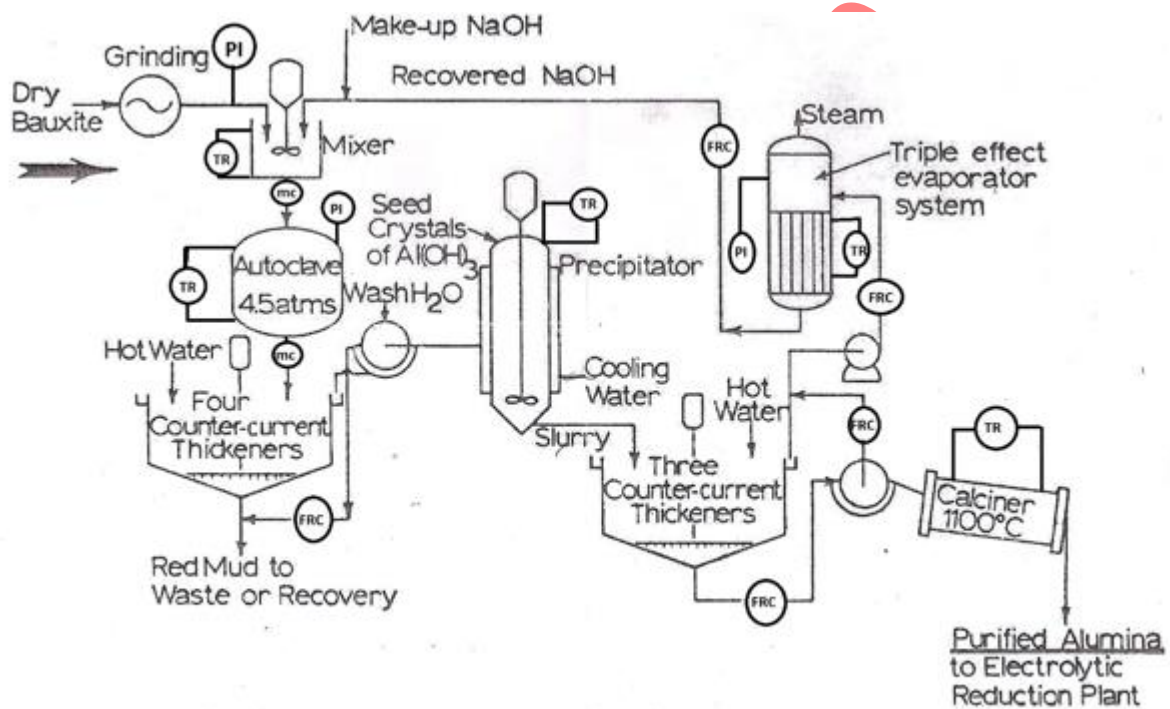
Now, bending stress  $(f) = 0.7 \times P_{\text{avg}} \times b^2 / T^2 \times (a^4 / a^4 + b^4)$

$157.5 = 0.7 \times 21.3 \times 150^2 / T^2 \times (140^4 / 140^4 + 150^4)$

$T^2 = 918$

$T = 30 \text{ mm}$

Furthermore, various other factors evaluated with the appropriate technical skills applied. It included a web plate, bracket support for a column, base plate for a column, and other related calculations. The implemented instrumentation diagram is below:



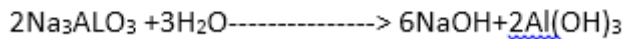
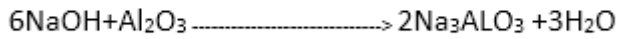
Flowsheet for Purification of Alumina from Bauxite by Bayer Process

The material balance process is shown below:

Basis=10 tons per day

$$=10 \times 1000 / 126$$

$$=79.365 \text{ k moles}$$



(bauxite)                      (alumina)

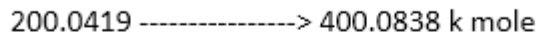
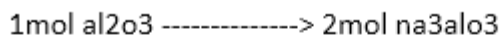
50%

98%

Actual bauxite needed =  $79.365 / 0.98 \times 0.5 = 161.969$  k moles

Excess including losses = 200.0419 kmol

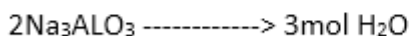
The reactor material balancing process is below:



$$\text{Actual } \text{Na}_3\text{AlO}_3 = 400.0838 \times 0.5 \times 0.98$$

$$= 196.04106 \text{ k mol}$$

For H<sub>2</sub>O:-



$$\text{H}_2\text{O} = 294.06 \text{ k mol}$$

The energy balance process is shown below:

| Component                      | Specific heat values( $C_p$ )<br>J/mol K |
|--------------------------------|--|
| H <sub>2</sub> O               | 33.5597                                  |
| Al <sub>2</sub> O <sub>3</sub> | 18.23                                    |
| Fe <sub>2</sub> O <sub>3</sub> | 24.104                                   |
| TiO <sub>2</sub>               | 13.44                                    |
| SiO <sub>2</sub>               | 10.398                                   |

$T_o=273K$

$T=25C=298K$

$T_{avg}=(298+273)/2=285.5K$

**Reactor: INPUT**

**OUTPUT**

| component                                 | M<br>Kmol | $C_p$<br>J/mol K | Q<br>KJ    | M<br>kmol | $C_p$<br>J/mol K | Q<br>KJ   |
|---|-----------|------------------|------------|-----------|------------------|-----------|
| NaOH                                      | 588.123   | 152.2            | 2237808    | -         | -                | -         |
| Bauxite<br>Al <sub>2</sub> O <sub>3</sub> | 100.02    | 18.23            | 45575      | 2         | 108.23           | 911.5     |
| SiO <sub>2</sub>                          | 18        | 10.39            | 4675.5     | 18        | 10.39            | 4675.5    |
| Fe <sub>2</sub> O <sub>3</sub>            | 80        | 24.104           | 48208      | 80        | 24.104           | 48208     |
| TiO <sub>2</sub>                          | 2         | 13.44            | 672        | 2         | 13.44            | 672       |
| Na <sub>2</sub> AlO <sub>3</sub>          | -         | -                | -          | 196.04    | 33.55            | 164428.55 |
|   |           |                  | 232938.498 |           |                  | 218895.55 |

Required water=product-feed

$Q=218895.55-232938.498$

$=-14042.948$

$mC_p\Delta T=14042.948$

T1=25 T2=50

$\Delta T=25$

$C_p=33.559 \text{ J/molK}$

$M=14042.948/33.559 \times 25$

=16.71 k moles of water required per day

**Precipitator:** INPUT OUTPUT

| Component | M<br>Kmol | $C_p$<br>J/molK | Q<br>KJ     | M<br>Kmol | $C_p$<br>J/molK | Q<br>KJ    |
|-----------|-----------|-----------------|-------------|-----------|-----------------|------------|
| Na3AlO3   | 194.08    | 154.1           | 747693.2    | 15.52     | 154.1           | 59790.8    |
| H2O       | 582.304   | 67.1194         | 977097.3774 | 46.58     | 67.1194         | 78160.54   |
| NaOH      | -         | -               | -           | 535.65    | 152.2           | 2038148.25 |
| Al(OH)3   | -         | -               | -           | 178.55    | 104.78          | 467729.58  |
|           |           |                 | 1724790.577 |           |                 | 2643829.17 |

Q product-feed=-919038.593

steam value=970.3 btu/lb

$mC_p\Delta T=919038.593$

Provide the steam  $\Delta H_r=m'$

=970.3x4.18x18x1000/919038.593

=79.5507kmol

The evaporator process is shown below:

| I/P                              | <u>Kmol</u> |
|----------------------------------|-------------|
| Na <sub>3</sub> AlO <sub>3</sub> | 15.52       |
| H <sub>2</sub> O                 | 46.58       |
| <u>NaOH</u>                      | 535.65      |

Total=597.75

Na<sub>3</sub>AlO<sub>3</sub>+NaOH=551.17

H<sub>2</sub>O=46.58/597.75=0.077

Mole fraction of Na<sub>3</sub>AlO<sub>3</sub>+NaOH;

=551.17/597.75

=0.9220=92.2%

Mole fraction of H<sub>2</sub>O=46.58/597.75

=0.077=7.7%

92.2%----->99.8%

X<sub>1</sub>=0.922      X<sub>2</sub>=0.998

L=597.75x0.922/0.998

=552.22 kmoles

F=V+L

=vapor+liquid

597.75=V+552.22

V=45.53 kmoles

[CE 2.8] I initiated the process by deciding on initialization the suitable site selection. This was not as easy to go place as the site selected was needed to be proper and all the money expended on the equipment, layout and factory building, etc. would go in waste in case of wrong selection. Thus, I selected a site in which consideration was made on the commercial, technical and financial aspects that produced maximum benefits. I split the issue into main major categories and these were the factory general location and the specific site selection. I set the factory general location which included fulfilling various factors and these were from the raw material availability at a comparatively 16

Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR

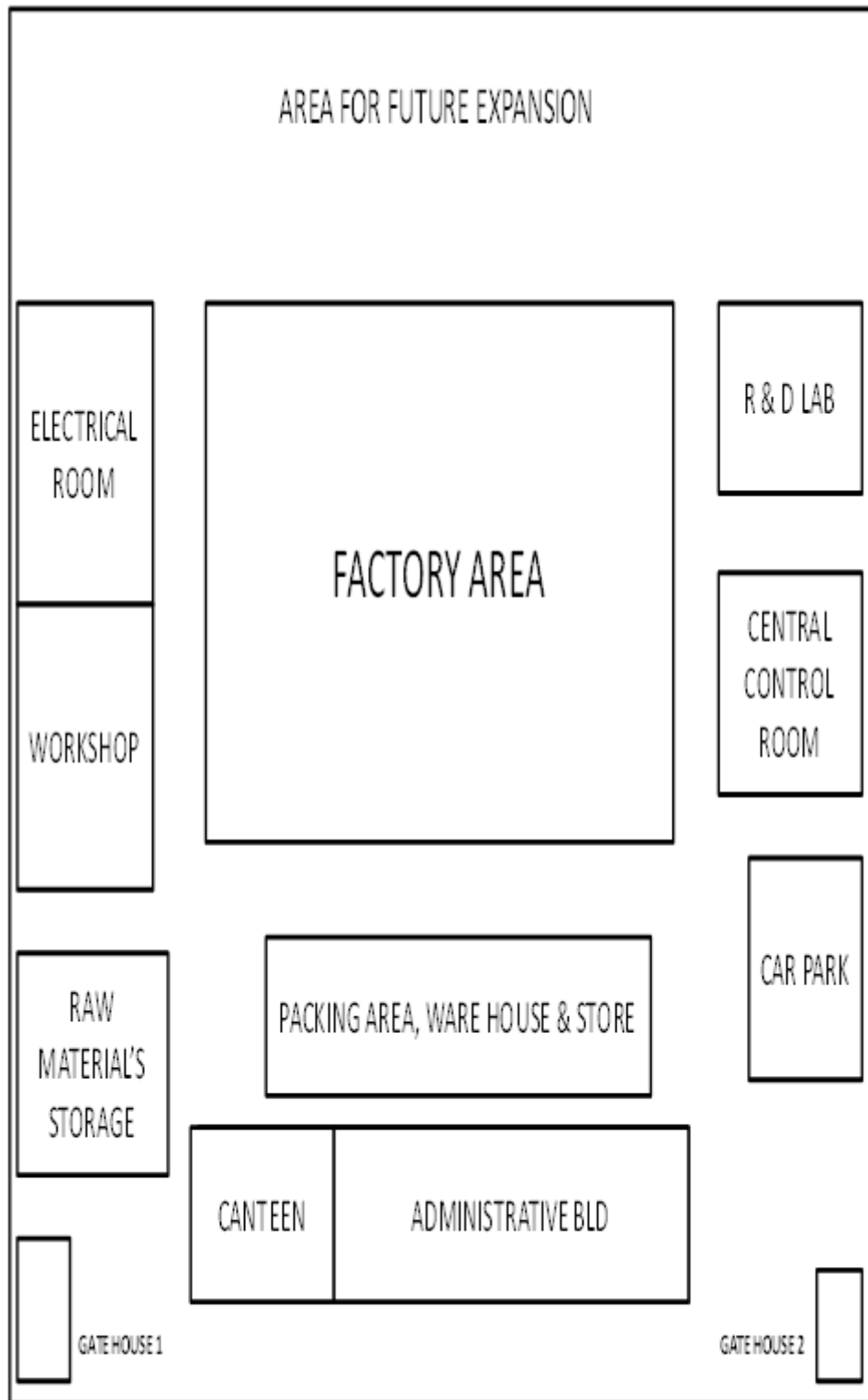


lower cost with lower freight charges. I made sure that the market was closer to the factory for quick service to the customers and easier transportation. There were decent transportation facilities utilized for bringing new material and sending finished goods. Also, I made sure to obtain skilled and cheap laborers which were present near the plant site. Power and fuel availability was influential as it has a direct impact on the plant site. The consideration was also made on the atmospheric and climatic conditions which were based on governing factors for various chemical industries. The detailed plant layout is shown below:

AustraliaCDRhelp.Com

Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR





[CE 2.9] There were numerous factors considered during the engineering materials selection and these were for chemical process plant which led towards different strategies<sup>18</sup>

Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR

with the ability for resisting corrosion. I executed the process for materials recommendation which was suited for the process conditions. I considered the requirements of the defined material and the material selected had adequate strength which worked effectively in the project. I made a selection of the economic material which satisfied the mechanical and process requirements and provided the lowest possible cost over the entire plant life working operation. It allowed replacement and maintenance as well. There were various other factors considered which included process safety and contamination. I did entire process designing which is shown below:

$$\text{NaOH} = 23524.92 \text{ Kg/day}, \quad \text{Density} = 2130 \text{ Kg/m}^3$$

$$\text{Bauxite} = 10202.04 \text{ Kg/day}, \quad \text{Density} = 3100 \text{ Kg/m}^3$$

$$\text{Volume} = m/\rho$$

$$= 23524.92/2130 + 10202.04/3100$$

$$= 14.335 \text{ m}^3 + 30 \% \text{ excess}$$

$$V = 18.6355 \text{ m}^3$$

$$V = \pi/4 D^2 H \text{ \& } H = 1.5D$$

$$74.542 = \pi \times 1.3 D^3$$

$$D^3 = 15.826$$

$$D = 2.510 \text{ m} = 2510 \text{ mm}$$

$$H = 1.5 D$$

$$= 1.5 * 2.510 \text{ m}$$

$$H = 3.765 \text{ m or } = 3765 \text{ mm}$$

$$t_s = PD/2FJ-P$$

$$P = \text{design pressure kg/cm}^2$$

$$D = \text{mean diameter m}$$

$$J = \text{joint efficiency}$$

$$f = \text{permissible stress}$$

$$\text{For Stain steel } f = 0.85$$

$$P = 4.5 \text{ atm. Pressure} = 4.5 * 0.10132 = 0.45594 \text{ N/mm}^2$$

$$t_s = 0.45594 * 2510 / (2 * 67 * 0.85) - 0.45594 = 10.08 \text{ mm}$$

**[CE 2.10]** I carried out an acceptable plant design that worked with the process mainly capable of operation under defined conditions and it yields significant profit. I made sure that the capital was allocated for equipment and direct labor. There were many plant expenses with other indirect

Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR



**AustraliaCDRHelp.Com**  
Competency Report Writing Helper

expenses included and these were mainly linked with the plant total cost analysis. There was the capital investment needed for other industrial processes. I worked on obtaining the capital investment which was needed for the defined industrial process. The capital investment mainly worked with the capital present for paying salaries and keeping raw materials with the product on hand. It also included handling the other special items which needed a direct cash outlay and carrying out costs analysis along with manufacturing costs evaluation with the general expenses including income tax. I also defined the capital investment which worked as the money needed for supplying the necessary plant and manufacturing facilities along with the money needed as working capital for facilities operation.

$$\text{FIXED CAPITAL INVESTMENT} = \text{DIRECT COST} + \text{INDIRECT COST}$$

The cost estimation is provided below:

| S. No | EQUIPMENT                   | Cost in rupees     |
|-------|-----------------------------|--------------------|
| 1)    | Reactor                     | 1,00,00,000        |
| 2)    | <u>Thickeners</u>           | 28,00,000          |
| 3)    | Precipitator                | 6,00,000           |
| 4)    | Evaporator                  | 25,00,000          |
| 5)    | Filter                      | 10,00,000          |
| 6)    | <u>Calciner</u>             | 30,00,000          |
|       | <b>Total equipment cost</b> | <b>1,99,00,000</b> |

**[CE 2.11](i) Problem:** The challenging aspect was recommendation of materials which was suitable for the process conditions.

**Solution:** While doing so, I considered the mechanical design requirements and the material selected had adequate strength and be easily executed.

**(ii) Problem:** Maintaining the project budget was another challenging part in the project.

**Solution:** I made sure to select the most economical material which satisfied both mechanical and process requirements. The material selected had the lowest cost over the plant working life and it allowed for replacement and maintenance. Other factors including process and product contamination was also considered.

**[CE 2.12]** Safety was of utmost priority in the project and I made sure to give off irritating fumes in the fire. There were no sparks, flames, and smoking. I noted that the vapors were explosive and fire risk along with explosion on contact with incompatible substances were also evaluated appropriately. I recommended to not use compressed air for filling, handling, or discharging. I set the fire fighting instructions in which gas fires were not extinguished unless gas flow was immediately<sub>20</sub>

Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR



stopped. The shut-off gas source was pointed with further allowing gas to burn out. There was the usage of water made for cooling equipment, containers, and surfaces mainly exposed to excessive heat and fire. I also noted that the fire-fighting activities could result in exposure towards higher heat, smoke or combustion by-products and thus, I selected NIOSH approved pressure-demand self-contained breathing apparatus with complete piece and protective clothing.

#### **D) Summary**

##### **[CE 2.13]**

Thorough research was conducted in the entire work tenure on various technical factors and each factor was evaluated with appropriate chemical engineering skills execution. The research was associated with other factors and in-depth meetings with team members as well as with the project supervisor were made for getting effective work results.

##### **[CE 2.14]**

I analyzed the defined chemical and physical properties in the project with the manufacturing areas setting the defined environmental conditions. It included numerous alumina production techniques and the elected process worked with the defined material and energy balance for various equipment. I carried out the reactor design which included carrying out calculation of both the mechanical design and process design.

##### **[CE 2.15]**

The plant layout and location of the process were also set with adequate safety and hazard management considered for efficient operation. The entire plant cost estimation was also carried out which included breakeven point and total product cost. I even made the consideration of the capital investment required with the estimation of the plant profitability with the defined payout and rate of return. My understanding was significantly enhanced in the chemical engineering field with the accomplished assigned project tasks.



# CAREER EPISODE 3

## Process Analysis of Silica Extraction

### A) Introduction

[CE 3.1] The work “Process Analysis of Silica Extraction” was done during my engineering degree in chemical engineering at Anurag Group of Institutions, Hyderabad, India.

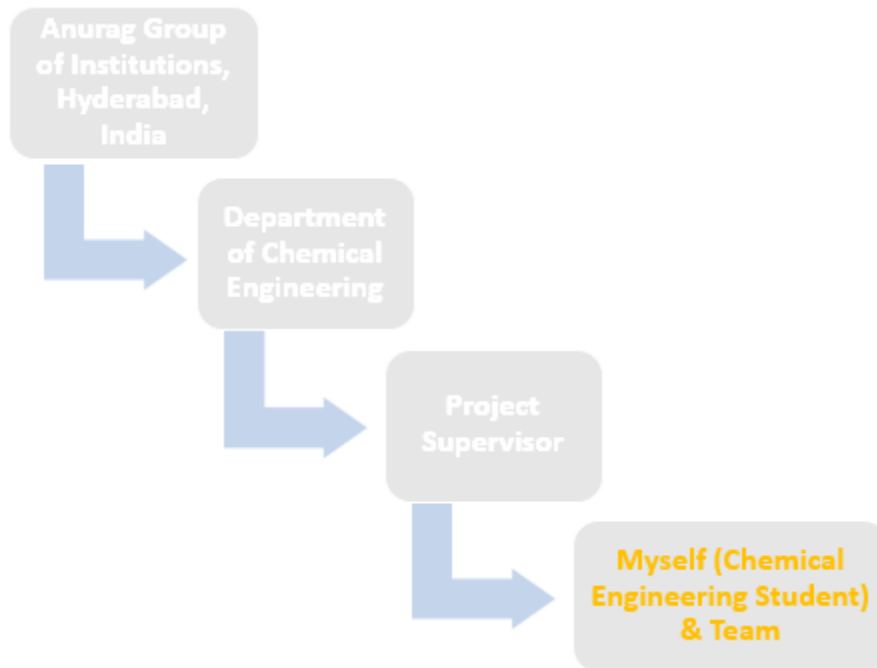
### B) Background

[CE 3.2] The rice husk combustion act as the byproduct for generating energy and rice husk ash was formed from silica and carbon. These are apart from small constituents and various treatments can be utilized for increasing the silica purity obtained. The efficiency is tested of various methods for obtaining silica, characterizing, and comparing the silicas obtained from RHA. The research was conducted and selected methods were utilized for producing silica which was mainly characterized by XRF, specific weight, particle sizing, total carbon, SEM, and surface area.

[CE 3.3] The project aim was executing the process analysis of silica and the results indicated mainly based on producing silica from RHA utilizing simple techniques. These specifically produced silica with 98% purity. I executed the treatment which mainly worked with affording the optimum results regarding the acid leaching and it was specifically followed from the thermal temperature at 800 degrees. I evaluated the alkaline extraction at low temperature with a defined silica purity value of 99 and 99.5%.

[CE 3.4] Each research element in the work was specifically based on analyzing the associated concepts and it assisted well in fetching the definite results. There was an in-depth discussion made with the project supervisor regarding the set work objectives and results were achieved using chemical engineering skills.

[CE 3.5]



[CE 3.6] The assigned work duties were:

- I conducted an analysis of numerous treatments for contaminations reduction and obtained improvements in the RHA properties.
- I carried out RHA potentialities investigation mainly worked as the defined silica source.
- I worked on getting the particle treatment at 700 degrees with the mean values of the set diameters mainly set to 18 and 23 micrometers.
- I attained sodium hydroxide surface area particles mainly executed on comparing with the other treatments specifically executed in the research.

### C) Personal Engineering Activity

[CE 3.7]

The research was conducted on higher purity mainly needed in various silica applications. I considered silica as the basic raw material utilized in the ceramics, polymers, materials industries, and semiconductors. I produced silica from quartz fused at defined temperatures and afforded to obtain ultrapure polycrystalline silicon and silicon hydride. There were simpler techniques applied for obtaining pure silica which created opportunities for the RHA industrial applications development. Numerous techniques were produced higher amounts from rice husk. I analyzed various treatments for reducing contamination and improving the RHA properties. There was continuous silica extraction process performed utilizing conditions dependent on the batch experiments results. I considered rice husk slurry with 0.2M NaOH solution and these were stored in reservoir and continuously supplied for reactor. There was solid content steadily supplied to reactor for stable operation in continuous process. Also, there were experiments conducted for measurement of 23

Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR

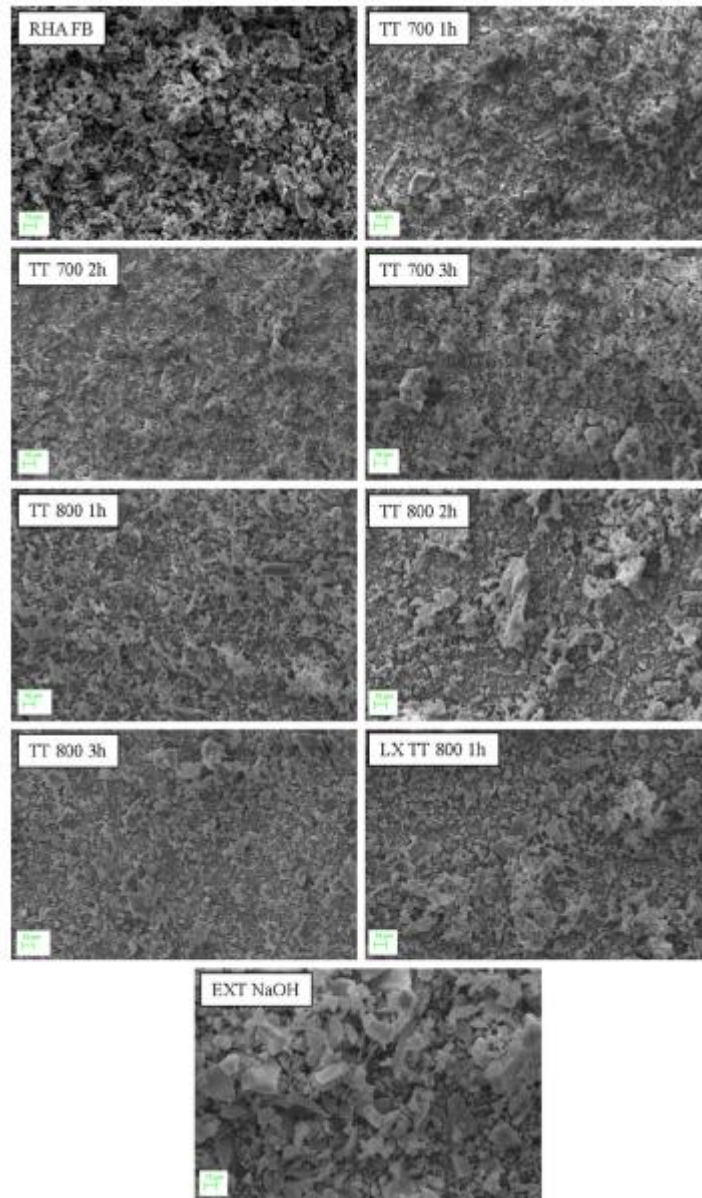


**AustraliaCDRHelp.Com**  
Competency Report Writing Helper

the solid content. The samples were collected from reservoir outlet at every 8 hours and the first sample obtained 8 hours after initial process and it indicated 6% solid content. I did characterization of RHA and silica particle sizing and this was from wet laser diffraction in particle analyzer. This was done utilizing water as solvent and it contained one surfactant drop. I set flow rate which was 25% and ultrasound time was 30 seconds. I considered samples which had 1.6 refractive index and specific weight was obtained utilizing helium pycnometer. At 105 degrees in an oven, there was approximately 5g of RHA type placed in 10cm<sup>3</sup> aluminum sample holder. I evaluated samples specific surface area and these were according to the nitrogen BET absorption method in surface area analyzer. There were samples degassed at 200 degrees under vacuum for 34 hours.

**[CE 3.8]**

I conducted research which was done with the testing at various temperatures among 600 degrees and 1000 degrees for incinerating rice husk. There were used raw samples and leached ones which was linked with obtaining amorphous silica. But, the peak sharpness enhanced with combustion temperature, particularly for non-leached samples and it indicated that crystallization of silica started at 900 degrees. There was also the alkaline species removal during acid leaching which was an obstacle to the silica eutectic reaction. I predicted the behavior which was similar to the sample heated to 800 degrees for 3 hours and had a sharper peak when comparing to the others. I obtained SEM silica microphotographs obtained from RHA samples and these were subjected to various tested treatments. There were silica particles produced from all samples and these were jagged and irregular. These included particles agglomerates under 10 micrometer. Further, there were various pretreatments utilized and affected the silicas obtained chemical composition.



I noted that the particles morphology and structure was not altered.

**[CE 3.9]**

I applied the processing and purification methods which were compared for the amount and silica properties produced depending on the research. I performed various processing and purification treatments. I applied various chemical and thermal treatment methods that worked with acid leaching pretreatment followed from the oxygen-rich incineration and rice husk combustion produced the highest silica content. I worked on the set atmosphere with the highest oxygen partial values induced the carbon chemical reduction and was effective than the atmosphere settings evaluation. Various methods worked for producing and purifying silica. There were RHA virtually not utilized for the project and research was conducted based on the silica production directly from rice husk. I conducted the investigations for checking the RHA potentialities which worked as the silica<sup>25</sup>

Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR

source and the samples utilized were RHA produced under the controlled laboratory conditions. I conducted the research which characterized and compared the silica production. There was another adequate research considered regarding the purification technique which normally affected the end product features. I compared and characterized silicas mainly produced from RHA utilizing various purification methods and extraction. I conducted an analysis of each process on the silicas characterization produced and analyzed with each defined method.

**[CE 3.10]**

I obtained the results with the conducted research which included carrying out treatments specifically led towards the predominantly amorphous silica generation. The demonstration obtained and indicated that the cristobalite phase started at 800 degrees. I obtained the research results which confirmed the findings and these were predominantly amorphous with the treated samples handled at 800 degrees. These were presented at the cristobalite phase as the main peak with the silica obtained from alkaline extraction at low-temperature values. It was particularly because sodium hydroxide solubilized only amorphous silica which was subsequently precipitated. I pretreated the sample with acid leaching and it did not differ from the sample which was incinerated at the set temperature without previous leaching. I also observed that the particle's mean diameter was enhanced with temperature. I obtained the particle treatment at 700 degrees with the diameters mean values which were 18 micrometers and 23 micrometers. There was an increase in the particles' mean diameter which worked with increasing temperature. I obtained the longer diameter which was resulted from the particle surfaces mild pre-fusion and it was possible because of potassium presence. There were sample particles pretreated with acid leaching which were slightly shorter than the other samples treated at 800 degrees. This also with the lower potassium content in the sample and the sampled sodium hydroxide has a set diameter of 200 micrometers. Additionally, I worked on the sodium hydroxide surface area particles which mainly worked on affording the comparison with other treatments carried out in the research.

**[CE 3.11] (i) Problem:** There was testing required to conduct at various defined temperature levels and it was challenging aspect in the work.

**Solution:** I conducted the testing at various temperature levels from 500 degrees and 900 degrees for incinerating rice husk. The raw samples were used and obtained amorphous silica. Also, I obtained the peak sharpness which was enhanced with combustion temperature specifically for non-leached samples. It specifically indicated that silica crystallization started at 900 degrees and that the alkaline species during acid leaching was an obstacle to the silica eutectic reaction.

**(ii) Problem:** There was also behavioral analysis required to conduct during the work and it was linked with applying chemical engineering concepts.

**Solution:** I predicted the behavior which was similar to the sample collected mainly heated to 800 degrees for 3 hours with the sharper peak mainly compared to others. I obtained the silica microphotographs obtained from RHA samples mainly subjected to the various tested 26

Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR



treatments. I obtained the silica particles which were jagged and irregular. These were observed accordingly with the particles under 10 micrometers. Various pretreatments utilized which worked with affecting the obtained silica chemical composition.

**[CE 3.12]** Associated factors were evaluated and analyzed with the consultations made on defined work factors. The consultations were made with the project supervisor and each project activity was analyzed appropriately with the thorough skills implementation in the chemical engineering domain.

#### **D) Summary**

##### **[CE 3.13]**

I obtained the research results which indicated the possible solution regarding the silica from RHA with the simple processes usage. There were numerous production techniques tested and it worked well with obtaining the silica with purity higher than 98%. This was specifically with the acid leaching followed from thermal treatment and sol-gel worked with the alkaline extraction at a lower temperature.

##### **[CE 3.14]**

I carried out the RHA treatment with the high silica content and low TC levels. The thermal treatments utilized did not affect the samples' chemical composition consistently. The potassium was the main contaminant which varied from 0.5 and 0.8. There was also the consideration made of high treatment temperatures mainly produced samples with lower TC. I obtained the sample from alkaline extraction at a lower temperature which had a high silica level with the chlorine acted as a contaminant. The treatment was adopted which included silica precipitation with HCL. I considered the additional washing with water deionization which removed the residual contaminant. It was appropriate at 700 and 800 degrees with the incineration time which did not substantially influence the composition. The thermal treatment was adequate for producing mandatory results.

##### **[CE 3.15]**

The silica contents were in between the values of 99% to 99.5%. These were higher as compared with the data reported particularly with the fact consideration made on the extraction of silica directly from unburnt rice husk. The executed activities in the project significantly boosted my understanding of the chemical engineering field.

## **PROFESSIONAL ENGINEER**

### **Summary Statement**

**These are the competency Units and Elements. These elements must be addressed in the Summary Statement (see Section C). If you are applying for assessment as a Professional Engineer, you will need to download this** 27

Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR



page, complete it and lodge it with your application.

| Competency Element  | A brief summary of how you have applied the element   | Paragraph number in the career episode(s) where the element is addressed |
|---|---|--|
| <b>PE1 KNOWLEDGE AND SKILL BASE</b>   |   |  |
| PE1.1 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline | I undertook three mechanical engineering projects which were: <ul style="list-style-type: none"> <li>• Production of Bio-Diesel at Southern Online Bio Technologies Ltd.</li> <li>• The Production of Alumina.</li> <li>• Process Analysis of Silica Extraction.</li> </ul> | CE 1.1, CE 2.1, CE 3.1   |
| PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics and computer and information sciences which underpin the engineering discipline           | There were theoretical principles analyzed with the definite numerical concepts applied in the project for obtaining the results.   | CE 1.10, CE 2.9, CE 3.8  |
| PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline  | Mandatory technical skills were implemented in the work for getting the definite results with the consistent technical skills.  | CE 1.8, CE 2.10, CE 3.11   |
| PE1.4 Discernment of knowledge development and research directions within the engineering discipline  | Various work factors in the project was thoroughly evaluated and analyzed with applying the mandatory skills in the chemical engineering field.   | CE 1.12, CE 2.11, CE 3.10  |
| PE1.5 Knowledge of contextual factors impacting the engineering discipline  | The research was made on the associated project factors and targets were achieved according to the set timeline.  | CE 1.9, CE 2.8, CE 3.9   |
| PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline                            | Associated research was made with the project supervisor for getting the definite work results.   | CE 1.11, CE 2.11, CE 3.12  |
| <b>PE2 ENGINEERING APPLICATION ABILITY</b>  |   |  |
| PE2.1 Application of established engineering methods to complex engineering problem solving   | Evaluations on the work factors were made appropriately with applying the problem solving techniques for getting the results.   | CE 1.9, CE 2.11, CE 3.10   |
| PE2.2 Fluent application of engineering techniques, tools and resources   | Research was made on the tools and resources applied in the work which resulted to get the targeted results.  | CE 1.10, CE 2.10, CE 3.11  |
| PE2.3 Application of systematic engineering synthesis and design processes  | The systematic approach was carried out with the systematic design processes assisted well in gaining the results.  | CE 1.12, CE 2.12, CE 3.12  |

Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR

|  |   |                           |
|--|---|---------------------------|
| PE2.4 Application of systematic approaches to the conduct and management of engineering projects | An appropriate project conduct was carried out the engineering management principles applied appropriately in the work.                             | CE 1.8, CE 2.10, CE 3.9   |
| <b>PE3 PROFESSIONAL AND PERSONAL ATTRIBUTES</b>  |   |                           |
| PE3.1 Ethical conduct and professional accountability  | A definite ethical conduct in the work was maintained with the professional accountability which worked appropriately within the set work timeline. | CE 1.11, CE 2.9, CE 3.8   |
| PE3.2 Effective oral and written communication in professional and lay domains                   | Definite oral and written communication skills were applied in the project for effectively getting the work results.                                | CE 1.11, CE 2.11, CE 3.10 |
| PE3.3 Creative innovative and proactive demeanour  | An appropriate demeanour in the project was executed with the effective implementation of the technical skills.                                     | CE 1.10, CE 2.11, CE 3.9  |
| PE3.4 Professional use and management of information   | Targeted technical information was managed effectively in the project for getting the desired work results.   | CE 1.8, CE 2.8, CE 3.10   |
| PE3.5 Orderly management of self, and professional conduct                                       | There was professional conduct maintained appropriately in the work for achieving the targeted results.   | CE 1.7, CE 2.9, CE 3.8    |
| PE3.6 Effective team membership and team leadership  | Appropriate improvements under the project supervisor's leadership were made in the project for obtaining the effective work results.               | CE 1.10, CE 2.11, CE 3.12 |

AustraliaCDR

Name: PROFESSIONAL CIVIL ENGINEER - QUANTITY SURVEYOR

