Indonesia International Institute for Life Sciences

ENRICHMENT PROGRAM REPORT

Designing An Online Inventory Database, Bulk Density Validation and Shelf Life Assessment for Partially Processed Raw Materials

STUDY PROGRAM
Food Science & Nutrition

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INDONESIA INTERNATIONAL INSTITUTE FOR LIFE SCIENCES (i3L)
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INTERNSHIP REPORT

Designing An Online Inventory Database, Bulk Density Validation and Shelf Life Assessment for Partially Processed Raw Materials

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Certificate of Approval

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Cohort	: 2021
Title of Enrichment Program project	: Designing an Online Inventory Database, Bulk Density Validation, and Shelf Life Assessment for Partially Processed Raw Materials.

We hereby declare that this EP project is from student's own work. The EP Report has been read and presented to i3L's Examination Committee. The EP has been found to be satisfactory and accepted as part of the requirements needed to obtain an i3L bachelor's degree.

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ABSTRACT

PT Global Vita Nutritech (GVN) is Indonesia's first local premix batching manufacturer specializing in vitamins, minerals, and other functional ingredients to be used by food, beverage, and nutraceutical industries. As a premix manufacturer, PT Global Vita Nutritech intends to help in minimizing raw materials days inventory outstanding, enhancing production control, and simplifying the supply chain process by providing premix to other businesses. The author had done several projects including the development of an online inventory application, shelf life analysis on partially processed materials and premix, bulk density validation, and new or alternative raw materials assessments within the process development department. The development of online inventory applications using AppSheet platform improved the efficiency of inventory management by integrating all inventory data into a single platform that is accessible from anywhere. The improved system accessibility provided by the online inventory system supported the departments by providing a platform for process development teams to monitor inventory updates in real-time, enabling them to plan trials more effectively creating a more robust and efficient workflow. Furthermore, the partially processed materials stability which were zinc sulphate heptahydrate showed no significant degradation in all parameters indicating the materials were still applicable for further process. Lastly, the bulk density validation project needs to be continued by assessing the premix bulk density based on its dominant raw materials contained in the product because the discrepancy value of theoretical and actual premix bulk density were over than the limit.

Keywords

Premix, database system; inventory management; shelf life analysis; zinc sulphate heptahydrate; bulk density

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Jakarta, 20th December 2024

Sheren Tania Josephine

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INTRODUCTION

1.1. Company Description

PT Global Vita Nutritech (GVN) is Indonesia's first local premix batching manufacturer specializing in vitamins, minerals, and other functional ingredients to be used by food, beverage, and nutraceutical industries. PT Global Vita Nutritech (GVN) was established on 14 September 2016 at Indotaisei Industrial Estate in West Java under Kalbe Group specifically PT Sanghiang Perkasa or Kalbe Nutritional together with PT Global Chemindo Megatrading and fully operated to produce its commercial products as an independent company on 1 November 2018. Before being established as an independent business to business (B2B) enterprise, this company was part of Kalbe Nutritionals as one of its departments.

As a premix manufacturer, PT Global Vita Nutritech intends to help in minimizing raw materials days inventory outstanding (DOI), enhancing production control, and simplifying the supply chain process. By providing premix, the company supports food, beverage and nutraceuticals businesses in meeting the government regulation on product fortifications, expanding potential market through special functional ingredients, as well as accelerating road to market their products. Moreover, with the quality certifications including Food Safety System Certification (FSSC) 22000, Halal Indonesia Assurance System, Cara Produksi Pangan Olahan yang Baik (CPPOB), and Kosher obtained, PT Global Vita Nutritech has demonstrated their compliance with food safety and quality standards that is recognized by international standards.

1.2. Vision and Mission

The vision of PT Global Vita Nutritech is to be the preferred partner to enhance premix and minor ingredients supply chain process. By providing high quality premix and minor ingredients solutions for food and nutraceutical business, the company implements its mission which is to simplify life through quality products and creative solutions. The solutions offered by the company are reducing the handling process of raw materials and suppliers into one simple process and also minimizing complex preparation processes. Therefore, customers can focus on their main production process

1.3. Company Main Activity

As a business to business (B2B) company, PT Global Vita Nutritech sells their products to food, beverage, and nutraceutical manufacturers. The company focuses on premix customized batching which is packed premix and/or other ingredients according to the customer's batch size in

reasonable quantities and lead time. This unique system will benefit customers especially in reducing cost of production through eliminating preparation process, reducing premix or ingredient potential loss, reducing days of inventories, as well as controlling production process at toll manufacturing. Furthermore, this manufacturer provides a wide range of vitamins, different salt combinations of minerals, and a wide selection of functional ingredients including amino acids, fatty acids (e.g omega 3, omega 6, and DHA), sweeteners, antioxidants, emulsifiers, and many more. The premix can be used in several product applications such as flour, beverages, cereals, biscuits, confectionaries, dairy products, supplements, and many others.

The main products of PT Global Vita Nutritech are divided into two categories which are IB and IC (item compile) series. IB series (IBMIX) is a mixture of several major and minor ingredients such as food additives, vitamins, minerals, and other functional ingredients which are mostly in dry-blend format (Figure 1). IBMIX products made by the company are vitamin premix, mineral premix vitamin and mineral premix, also non-vitamin mineral premix such as extracts, stabilizer, chocolate, coffee mix, etc. These IB series (vitamin, mineral, combination of both premix) are then divided into two groups which are standard premix and customized premix made from customer requests. These premixes are mainly used in mandatory fortification including wheat flour fortification, supplements for pregnancy and infants according to *Peraturan Menteri Kesehatan* (*Permenkes*), also for pregnancy, breastfeeding, and weaning food or supplements according to *Badan Pengawas Obat dan Makanan* (*BPOM*) regulation. Other than that, the premix can also be used for benefit claims such as rich or source of claims, immune booster, beauty and sport nutrition, mental wellbeing, energy booster, bone and teeth nutrition, weight wellness, and others or also can be used in plant-based products to substitute and fulfill its nutritional content. The second product, IC (item compile) series is a compilation of raw materials, IB series, or a combination of both ingredients weighed and packed in a certain formulation. The purpose of the IC series is to facilitate multi-sequences production processes and separate any materials that can't be blended due to its nature or interaction with other materials.

Figure 1. IB series (IBMIX)

Figure 2. IC (item compile) series

1.4. Organizational Structure and Student's Department

PT Global Vita Nutritech has six departments which are production planning and inventory control (PPIC) and procurement; production, warehouse, and engineering; finance, accounting, tax, and management system; quality assurance, control, and system (QA/QC); process development; and information technology (IT). Other than the production department, process development and QA/QC departments are both directly handling the product. The QA/QC department is responsible for monitoring incoming raw materials and ensuring the product meets all quality standards and is ready to be released while the process development department is in charge of developing formulations and products to fulfill the customer needs. During this internship the author became part of the process development team as an intern with Paulus Advent Satya Nugraha as the supervisor and Viannisa Alifia as the staff.

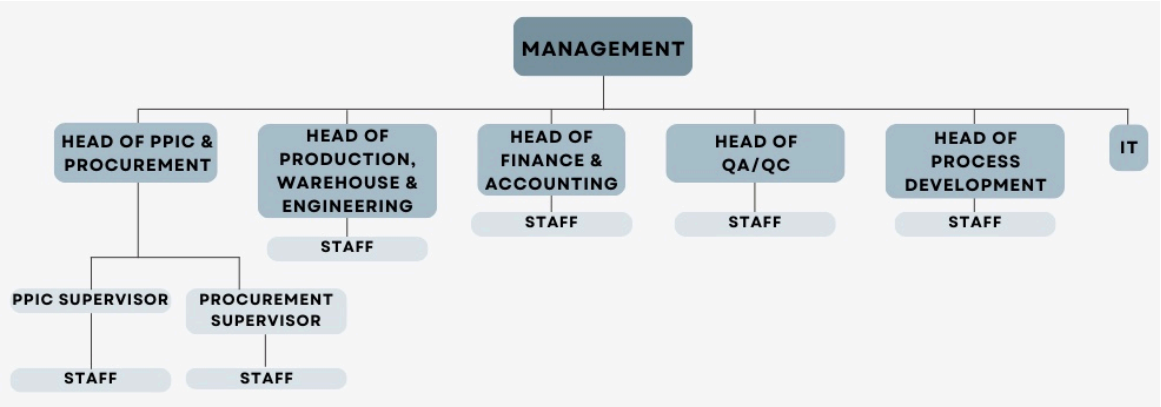

Figure 3. Organizational structure of PT Global Vita Nutritech

INTERNSHIP ACTIVITIES

2.1. Working Conditions

The internship was conducted for 6 months at PT Global Vita Nutritech from 24 July 2024 until 24 January 2025. The working hours are Monday to Friday from 8.00 AM to 4.30 PM. Several projects were done during this six month internship such as designing raw materials inventory application, premix bulk density validation, and shelf life analysis of partially processed raw materials. Other activities include assessment of alternative or new raw materials and packaging materials, analyzing shelf life of premix, along with assisting in premix manual mixing, product application trial, as well as sample preparation during first production approval and trials were also done as the operational works which were done during the internship period incidentally. However, the inventory application project was done in 3 months from August to October 2024, partially processed raw material shelf life project was done for 6 months (August 2024 – January 2025), while the bulk density validation project was carried out from October until December 2024.

2.2. Internship Tasks and Experience

2.2.1. Online Inventory Application

One of the duties performed by the process development department is assessing new or alternative raw materials and packaging materials. After being assessed, those materials were stored in a box or chiller depending on its appropriate storage condition. The storage place and the remaining quantity of each material were not listed. Therefore, it is hard to track down the location of the materials and which materials are still available. Hence, creating an online inventory application for these materials was done as one of the projects during this internship period.

2.2.2. Shelf Life of Partially Processed Raw Material

Partially processed or work in progress material is raw materials which have undergone a grinding or sifting process to reduce its particle size. In the shelf life project of partially processed raw materials, one raw material used was zinc sulfate heptahydrate ($ZnSO_4 \cdot 7[H_2O]$). Each material had different assessment criteria such as chemical and instrumentation based on its critical parameters. This material was packed using double plastic and aluminum foil bags to maintain their quality which were then stored in cold room temperature.

2.2.3. Bulk Density Validation

Most of the raw materials and finished products in the company are in the form of powder. Bulk density determination is a crucial parameter for products in powder form since it determines the amount of powder can fit in a space. The bulk density of each raw material was calculated and combined together to determine which mixer is suitable to be used during the mixing process. The mixing process was done in four different v-mixers which were the 3 kg, 10 kg, 25 kg, and 50 kg v-mixer and an intermediate bulk container for quantities more than 100 kg. However, the bulk density of the permix itself needs to be assessed to ensure that the theoretical bulk density calculated from the raw materials is consistent with the actual bulk density of the finished product (i.e premix). Five premix samples were used in this analysis to validate the bulk density calculation and define its discrepancy value.

2.2.4. New and Alternative Raw Material Assessment

Vitamins and minerals were the raw materials used by the company as the main ingredients in their premix. Some problems such as customer requests, materials' quality reduction, price increasement, limited supply, and others could happen. Thus, these materials should be obtained from different manufacturers or principals and suppliers to ensure the on hand stock is available constantly. The incoming raw materials were checked and compared with existing materials, if it was an alternative material. The parameters checked were varied depending on its certificate of analysis (CoA) and the amount of samples given by the suppliers. Asides from doing laboratory analysis, solubility testing and organoleptic properties assessment of raw material samples in powder and diluted form using descriptive analysis were also conducted. These assessments were required to ensure that the materials satisfy the standards and are suitable to be used for the production process. When the results of the analysis comply with all the specifications from internal and/or external (i.e suppliers), the materials will be used as new materials, replace the existing materials, or used simultaneously with the existing ones. Three new raw materials, and seven alternative raw materials were assessed in this internship period.

2.2.4.1. Alternative Raw Material

Seven raw materials from 5 principals and 4 different suppliers were analyzed including vitamin B3 (nicotinamide/niacinamide), vitamin B5 (pantothenate), vitamin B6 (pyridoxine), vitamin B12 (cyanocobalamin), and vitamin D3 (cholecalciferol). All of these materials were assessed based on the parameters and specifications attached in the certificate of analysis (CoA) from each principle, mostly the moisture content and the purity of the material. The assay analysis which determines the purity of the materials were done

using spectrophotometry while the moisture content was analyzed using an oven-drying method. Along with the laboratory analysis, alternative and existing materials were evaluated for its solubility and organoleptic properties including appearance, odor, and taste in the powder and diluted form. The organoleptic properties were assessed through sensorial analysis using descriptive analysis combined with paired comparison tests.

2.2.4.1.1. Nicotinamide / Niacinamide

Table 1 shows the results of alternative vitamin B3 ($C_6H_6N_2O$) laboratory analysis while **Table 2** shows the sensory analysis results of the alternative materials and compared with two existing materials. As can be seen in the **Table 1** below, the results of moisture content and pH fulfilled the internal and external specification while the assay results which determine material purity didn't comply with both specifications. The moisture content result was in accordance with the Spain Patent which stated that the water content of a dry nicotinamide powder was below 0.5% (w/w) (Gerritzen et al., 2013). All organoleptic properties results assessed by the author were consistent with the results by NCBI (2024), which state that vitamin B3 powder was white, odorless, bitter, very soluble in water, and had 7.4 pH value.

Table 1. Analytical result of vitamin B3 (niacinamide / nicotinamide) powder

	Parameter		
	Assay (%)	Moisture (%)	pH (5% w/v)
Alternative	98.3 ± 1.32	0.215 ± 0.007	7.15 ± 0.03
Supplier specification	99 – 101	<0.5	6.0 - 7.5
Existing specification	99 – 101	<0.5	6.0 - 7.5

Note. Amount of sample (*n*) for assay moisture, and pH (*n=2*)

Table 2. Organoleptic properties of vitamin B3 (niacinamide / nicotinamide)

	Parameter					
	Powder form			Liquid form (5% dilution)		
	Appearance	Aroma	Taste	Appearance	Aroma	Taste
Alternative	White (+3), fine powder (+3), clumps (+2)	Odorless	Bitter (+3)	Clear and colorless	Odorless	Bitter (+3)
Existing A	White (+3), fine powder (+3), clumps (+2)	Odorless	Bitter (+3)	Clear and colorless	Odorless	Bitter (+3)
Existing B	White (+3), fine powder (+3)	Odorless	Bitter (+3)	Clear and colorless	Odorless	Bitter (+3)

Note. Intensity quantification: (+1) = low; (+2) = moderate; (+3) = high intensity

2.2.4.1.2. Calcium D-Pantothenate

The alternative materials of vitamin B5 ($C_{18}H_{32}CaN_2O_{10}$) from two different principals and suppliers were analyzed and compared with the existing material. As can be seen below, **Table 3** shows the results of vitamin B5 analytical assessment, **Table 4** shows the heavy metals result, and **Table 5** shows the results of materials' sensory analysis. As seen in the **Table 3** all parameters such as pH, purity, and moisture content comply with all specifications with sample alternative B has slightly lower moisture content and pH value. Moreover, the assay results of both samples as calcium pantothenate satisfied the specification ranging around 99% with alternative A sample had slightly higher purity content. The results were in accordance with the study by Ministry of Health, Labour, and Welfare (2016), which stated the calcium pantothenate content (assay) not less than 98.0% and no more than 102% on the dried basis while the pH value was in the range of 7.0 to 9.0 while the loss on drying or moisture content was no more than 5.0%. **Table 4** showed the results of heavy metals (e.g arsenic, cadmium, lead, and mercury) within the sample which stated that the arsenic content was slightly higher than the specification while the other heavy metals were below the maximum value. The organoleptic properties attached on **Table 5** were also in accordance with the Ministry of Health, Labour, and Welfare (2016) which state calcium pantothenate is white powder that is freely soluble in water, odorless, and has bitter taste. The sweet taste appeared on the sample in powder form might due to its coating agent (e.g maltodextrin) to mask the bitter taste

Table 3. Analytical result of vitamin B5 (calcium d-pantothenate) powder

	Parameter			
	Assay (%)	Moisture (%)	pH (5% w/v)	Bulk density (g/mL)
Alternative A	99.47 ± 0.33	3.195 ± 0.02	7.09 ± 0.06	—
Alternative B	99.09 ± 0.92	2.45 ± 0.01	7.08 ± 0.02	0.74
Supplier specification	98 – 102	<5	6.8 - 8.0	—
Existing specification	99 – 101	<5	6.8 - 8.0	—

Note. Amount of sample (*n*) for assay, moisture, and pH (*n=2*); bulk density (*n=1*)

Table 4. Heavy metal analytical result of vitamin B5 powder

	Parameter			
	Lead (ppm)	Cadmium (ppm)	Arsenic (ppm)	Mercury (ppm)
Alternative A	0 ± 0	0 ± 0	1.55 ± 1.89	0.02 ± 0
Alternative B	0.03 ± 0	0 ± 0	0 ± 0	0 ± 0
Supplier specification	<0.5	<0.5	<1	<0.1

Note. Amount of sample (*n*) for lead, cadmium, and mercury (*n=2*); arsenic (*n=3*)

Table 5. Organoleptic properties of vitamin B5 (calcium d-pantothenate)

	Parameter					
	Powder form			Liquid form (1% dilution)		
	Appearance	Aroma	Taste	Appearance	Aroma	Taste
Alternative A	White (+3), fine free-flowing powder (+3)	Odorless	Bitter (+1), slightly sweet (+2), slightly sour (+1)	Clear and colorless	Odorless	Tasteless with astringent mouthfeel (+1) and bitter aftertaste (+1)
Alternative B	White (+3), fine free-flowing powder (+3)	Odorless	Bitter (+2), slightly sweet (+2)	Clear and colorless	Odorless	Tasteless
Existing	White (+3), fine free-flowing powder (+3)	Odorless	Bitter (+2), slightly sweet (+2)	Clear and colorless	Odorless	Slightly bitter (+2)

Note. Intensity quantification: (+1) = low; (+2) = moderate; (+3) = high intensity

2.2.4.1.3. Cyanocobalamin

Two samples of vitamin B12 ($C_{63}H_{88}N_{14}O_{14}P$) or cyanocobalamin 0.1% were assessed for its purity and moisture content followed with sensory analysis done by the author. **Table 6** and **Table 7** below showing the results of analytical and sensory analysis. The results for materials' purity content from both samples were 0.1% which were satisfied with specifications whereas the moisture content of Alternative B sample did not meet the specifications as it was far higher than the maximum level

which was 4%. The organoleptic properties of both samples attached in **Table 7** were in accordance with other studies which stated that cyanocobalamin was odorless and had clear color when diluted in the water (Ministry of Health, Labour, and Welfare, 2016; NCBI, 2024). However since the materials assessed were 0.1% cyanocobalamin the appearance and taste were not in accordance with literature which stated that cyanocobalamin was a tasteless dark red powder or crystalline and had clear red liquid color when it was diluted (Ministry of Health, Labour, and Welfare, 2016; NCBI, 2024).

Table 6. Analytical result of vitamin B12 (cyanocobalamin) powder

	Parameter	
	Assay (%)	Moisture (%)
Alternative A	0.1 ± 0	3.4 ± 0.03
Alternative B	0.1 ± 0	9.24 ± 0.08
Supplier specification	> 0.1	< 4
Existing specification	> 0.1	< 5

Note. Amount of sample (*n*) for assay (*n=2*) and moisture (*n=3*)

Table 7. Organoleptic properties of vitamin B12 (cyanocobalamin)

	Parameter					
	Powder form			Liquid form (1% dilution)		
	Appearance	Aroma	Taste	Appearance	Aroma	Taste
Alternative A	Soft pink (+3) fine powder (+3)	Odorless	Slight savory (+2) and slightly sweet (+1)	Clear pink (+2)	Odorless	Tasteless
Alternative B	Soft pink (+1) fine powder (+3)	Odorless	Slightly sweet (+1)	Clear pink (+2)	Odorless	Tasteless
Existing	Soft pink (+2) fine powder (+3)	Odorless	Slightly salty (+1)	Clear pink (+2)	Odorless	Tasteless

Note. Intensity quantification: (+1) = low; (+2) = moderate; (+3) = high intensity

2.2.4.1.4. Pyridoxine Hydrochloride

Table 8 and **Table 9** below shows the results of vitamin B6 ($C_8H_{11}NO_3HCl$) analytical and sensory analysis. All analytical results satisfied both specifications with

the purity content of the sample was 99.89% ± 0.14, moisture content 0.055% ± 0.02, and pH value 2.92 ± 0.04. These results were in accordance with the specs by the Ministry of Health, Labour, and Welfare (2016) which stated that the purity content of pyridoxine hydrochloride is not less than 98% and no more than 101% while the pH is between 2.5 – 3.5 and the moisture content is below 0.30%. Another study by NCBI (2024) stated that pyridoxine hydrochloride is a white crystalline powder with bitter taste and no odor which was consistent with sensory analysis conducted by the author.

Table 8. Analytical result of vitamin B6 (pyridoxine hydrochloride) powder

	Parameter			
	Assay (%)	Moisture (%)	pH (5% w/v)	Lead (ppm)
Alternative	99.89 ± 0.14	0.055 ± 0.02	2.92 ± 0.04	0 ± 0
Supplier specification	99 – 101	<0.5%	2.4 – 3.0	<2
Existing specification	99 – 101	<0.5%	2.4 – 3.0	—

Note. Amount of sample (*n*) for assay, moisture, pH, and lead (*n=2*)

Table 9. Organoleptic properties of vitamin B6 (pyridoxine hydrochloride)

	Parameter					
	Powder form			Liquid form (1% dilution)		
	Appearance	Aroma	Taste	Appearance	Aroma	Taste
Alternative	White (+3) crystalline fine powder (+3)	Odorless	Salty (+3), sour (+3), bitter (+2)	Clear and colorless	Odorless	Sour (+3) with bitter aftertaste (+2)
Existing	White (+3) crystalline fine powder (+3)	Slightly bitter (medicine-like) aroma (+1)	Salty (+3), sour (+3), bitter (+1)	Clear and colorless	Odorless	Sour (+3)

Note. Intensity quantification: (+1) = low; (+2) = moderate; (+3) = high intensity

2.2.4.1.5. Cholecalciferol

Table 10 and **Table 11** showed the comparison results of alternative and existing cholecalciferol or vitamin D3 ($C_{27}H_{44}O$) analysis. The moisture content of the alternative material was 5.19% ± 0.06 which was below the maximum level meaning the value complying with specifications. However the purity content was 95.36% ±

2.17 which was compatible with the specifications. During the solubility testing, both materials were not fully soluble in water resulting in cloudy water appearance since vitamin D3 is a fat-soluble vitamin and it has poor solubility in water as stated in the study by Almarri et al (2017).

Table 10. Analytical result of vitamin D3 (cholecalciferol) powder

	Parameter	
	Assay (%)	Moisture (%)
Alternative	95.36 ± 2.17	5.19 ± 0.06
Supplier specification	> 95	< 6

Note. Amount of sample (*n*) for assay and moisture (*n=2*)

Table 11. Organoleptic properties of vitamin D3 (cholecalciferol)

	Parameter					
	Powder form			Liquid form (1% dilution)		
	Appearance	Aroma	Taste	Appearance	Aroma	Taste
Alternative	White (+2) fine granular powder (+2)	Odorless	Slightly sweet (+2)	White cloudy (+2)	Odorless	Slightly sweet (+1)
Existing	Broken white / yellowish white (+1) fine granular powder (+2)	Odorless	Slightly sweet (+2)	White cloudy (+2)	Odorless	Slightly sweet (+2)

Note. Intensity quantification: (+1) = low; (+2) = moderate; (+3) = high intensity

2.2.4.2. New Raw Material

2.2.4.2.1. Deoiled Sunflower Lecithin

Lecithin is a fatty substance that naturally occurs in various plants and animals such as soybeans, egg yolk, red meat, nuts, green leafy vegetables, sunflower seeds, and whole grains (Kapalka, 2010). This material was widely used as an emulsifier to stabilize fat and improve food texture including chocolate, baked goods, margarine, and salad dressing (Singh & Krishnaswamy, 2022). Currently, sunflower lecithin is widely considered to substitute soybean lecithin because it is a non-GMO product and it doesn't have any allergy potential (Guiotto et al, 2015). Deoiled sunflower lecithin as the new raw material and its peroxide value, moisture and microbial content were assessed followed with sensorial analysis. Results of the moisture content weren't satisfied with the specification with a slightly higher value

which was 1.925% ± 0.02 while the peroxide value complied with the specification (**Table 12**). Peroxide value is closely related to the peroxide development in unsaturated fats which indicates the oxidative level or degree of oxidation in oils (Buthelezi et al, 2019). To avoid rancidity flavor, the peroxide value of a product should not be over 10-20mEq/kg (Kong & Singh, 2011).

Table 12. Analytical result of lecithin powder

	Parameter			
	Peroxide value (mEq/kg)	Moisture (%)	Microbiology (CFU/gr)	
			SPC	YM
	0.825 ± 0.02	1.925 ± 0.02	150	20
Supplier specification	> 5	< 1.5	—	—

Note. Amount of sample (*n*) for peroxide value, moisture (*n=2*); microbiology (*n=1*)

Table 13. Organoleptic properties of lecithin

	Parameter		
	Appearance	Aroma	Taste
Powder	Soft yellow (+2) to brownish (+1) fine powder (+1)	Nutty (+2)	Nutty (+2)
Liquid (1% dilution)	Soft yellow (+2) cloudy (+3)	Nutty (+1), fatty (+1)	Nutty (+1), fatty (+1)

Note. Intensity quantification: (+1) = low; (+2) = moderate; (+3) = high intensity

2.2.4.2.2. Magnesium Citrate

Magnesium citrate nonahydrate was assessed as one of the new raw materials for its magnesium, moisture, and heavy metals content together with bulk density, pH, and particle size measurements as well as sensory analysis. All analytical results except the magnesium content (**Table 14**) were satisfied with the supplier specifications while the magnesium content tested were lower than the specification with the value of 11.83% ± 0.39. Based on **Table 15**, more than 90% particles of the materials passed the 80 mesh while in 200 mesh less than 35% of the particles passed through. Because the materials had poor solubility in water, it only dispersed and resulted in a greyish cloudy diluted solution as stated in **Table 16**. The bitter after-taste in both liquid and powder form materials was in accordance with a study

by a mineral salts manufacturer, Dr. Paul Lohmann GmbH KG (n.d.) which states that magnesium is astringent and bitter.

Table 14. Analytical result of magnesium citrate nonahydrate powder

	Parameter					
	Magnesium Content (%)	Moisture (%)	Bulk Density (g/mL)	pH	Heavy metals (ppm)	
					Arsenic	Lead
	11.83 ± 0.39	0.51	0.87	8.16	0	0.01
Supplier specs	14.5 – 16.4	< 29.0	—	5.0 – 9.0	< 2	< 1

Note. Amount of sample (*n*) for moisture, pH, heavy metals (*n=1*); magnesium (*n=7*)

Table 15. Particle size result of magnesium citrate nonahydrate powder

	Mesh size								
	20	30	40	50	60	80	100	120	200
Amount of particle passing through (%)	99.98	99.8	99.6	99.4	99.2	95.8	87.5	72.6	34.6

Note. Amount of sample (*n*) for all particle size (*n=1*)

Table 16. Organoleptic properties of magnesium citrate nonahydrate powder

	Parameter			
	Appearance	Aroma	Taste	Texture
Powder	White (+2) fine powder (+3)	Odorless	Tasteless with bitter aftertaste (+2)	Sandy (+3)
Liquid (1% dilution)	Greyish white (+2) cloudy (+3)	Odorless	Tasteless with bitter aftertaste (+1)	—

Note. Intensity quantification: (+1) = low; (+2) = moderate; (+3) = high intensity

2.2.4.2.3. Branched Chain Amino Acids

Branched-chain amino acids (BCAAs) is a group of essential amino acids such as leucine, isoleucine, and valine which has been known to have positive effects on reducing muscle damage, improving muscle protein synthesis to fasten muscle recovery, as well as nurturing muscle mass (Stefańska et al. 2024; der Meij et al, 2019). As seen in **Table 17** below, all results complied to the specification from the

suppliers with moisture content 0.09% ± 0.01 which was consistent with study by Xin et al (2018) stating that the water content of BCAA was below 0.2%. As stated by Mukai et al (2007), BCAAs had a bitter taste which led to low palatability that was in accordance with the sensory analysis results done by the author. Morevore, since BCAAs was not fully dissolved in the water, the appearance of its liquid 1% dilution was slightly cloudy (**Table 18**).

Table 17. Analytical result of branched chain amino acids (BCAA) powder

	Parameter				
	L-leucine (%)	L-isoleucine (%)	L-valine (%)	Moisture (%)	Heavy metals (ppm)
Test result	48.75 ± 0.35	23.8 ± 0.14	24.65 ± 0.21	0.09 ± 0.01	0
Supplier spec	46 – 54	22 – 27	22 – 27	< 0.4	< 10

Note. Amount of sample (*n*) for l-leucine, l-isoleucine, l-valine, moisture, and heavy metals (*n=2*)

Table 18. Organoleptic properties of branched chain amino acids (BCAA)

	Parameter		
	Appearance	Aroma	Taste
Powder	White (+2) fine powder (+3)	Savory (+2) with chemical smell (+2)	Bitter (+2), slightly sweet (+1)
Liquid (1% dilution)	Transparent, slightly cloudy (+1)	Odorless	Bitter (+1) with slight savory (+1) and sweet (+1)

Note. Intensity quantification: (+1) = low; (+2) = moderate; (+3) = high intensity

2.2.5. Shelf Life Assessment

The shelf-life of all premixes in the company are one year after the manufacturing date, however each premix might have a different period depending on its raw materials composition. Shelf life assessments were done in six different premixes using real time shelf life testing that is stored in cool room temperature (<25℃, <55% RH) and normal room temperature (>25℃, >55% RH). The application of different storage temperatures was suspected to give quite significant results to the sample, specifically its vitamin or mineral and moisture content. Each premix had different assessment criteria such as chemical, instrumentation, microbiology, and physical properties depending on its critical parameters.

2.2.5.1. Premix Extract for Gummy Candy

Fresh fruits and vegetables are rich in macro- and micronutrients but due to its highly perishable nature, its conversion into powders form helps to preserve its nutritional content and prolong its shelf life by reducing its moisture or water content (Jiang et al, 2013; Ying et al., 2021). These ingredients were added in food and beverage products (e.g bakery products, extruded snacks, beverages, noodles, etc.) not only to alter the nutritional content of the products but also elevate products' organoleptic properties such as texture, color, aroma, and other sensory aspects (Ying et al, 2021). The premix assessed during this period was made from the compilation of carrot, marigold, bilberry, and elderberry extract. The parameters checked for the stability analysis were microbiological parameters (sent to the lab department), moisture content (sent to the lab department), and pH value. The shelf life assessment was done for one year and the data for 8 months were recorded in this report.

The results of each analysis have been attached in **Appendix 1** until **Appendix 3**. During 8 months of the stability test, the moisture content for both storage conditions increased with the premix stored in the ambient temperature room having slightly higher value after the third month (**Appendix 1**). The pH values were assessed on 1% liquid dilution and show the value ranging on 4.3 – 4.7 indicating the premix had acidic pH (**Appendix 2**). Moreover, the microbiological parameters were also checked to ensure the safety and quality of the premix. Standard plate count (SPC) together with yeast and mold (YM) of the premix were found lower than the limit with Yeast and Mold results 0 CFU/gr on each month and the standard plate count was 60 CFU/gr on the eighth month as the highest result (**Appendix 3**).

2.2.5.2. Premix Mineral for Isotonic Ready to Drink Beverage

Isotonic drinks are used for a quick and effective supplementation of mineral deficiencies which are caused by an intensive physical or intellectual activity (Leśniewicz et al, 2016). The study also stated that the highest concentration of minerals found in this type of drink were calcium (Ca), magnesium (Mg), sodium (Na), and phosphor (P). The mineral parameters assessed (sent to the lab department) were magnesium, potassium, sodium, and calcium which were the ingredients used on this premix followed with pH value testing and moisture content determination (sent to the lab department). The shelf life assessment was done for one year and the data for 8 months mineral stability, pH and moisture content were recorded in this report.

The results of minerals stability analysis have been attached in **Appendix 4** until **Appendix 7** while the water content results in **Appendix 8** and pH value in **Appendix 9**. During 8 months of the stability test, the moisture content and pH value for both storage conditions increased with the premix stored in the cool room temperature room having higher value in most of the months. The pH values were assessed on 1% liquid dilution and show the value was increased one point from 8.9 to 9.9 indicating the premix had basic pH. Furthermore, the mineral stability results attached on **Appendix 4** until **Appendix 7** showed the mineral content for one gram of premix (mg/g of premix). The results of each mineral content fluctuating each month might be due to different materials' particle size which leads to a non homogenized sample.

2.2.5.3. Extend Shelf Life

The quality of vitamin and mineral premix is determined by its micronutrient content and organoleptic properties as well as its moisture content. Compared to minerals, vitamins are more prone to be degraded overtime which resulted in the decrease of nutritional quality of the products. Stability of vitamins are closely related to its storage period and condition such as humidity, light, oxygen, and temperature (Yang et al, 2024). The study also stated that losses were found most noticeable in vitamin C, vitamin E, vitamin A, and vitamin B1, if not stored properly or exposed to certain conditions. Four different premixes would be assessed for one and a half years with vitamin A, vitamin B1, vitamin C, vitamin E, and vitamin D3 as several parameters assessed to determine the vitamin stability in the premix. Moreover, the organoleptic properties (appearance, aroma, and taste) of the premix were also assessed under the laboratory department by comparing its characteristics with the unexpired samples.

2.2.6. Other Activities

2.2.6.1 First Production Approval and Trial

Two types of premix production were performed by the author as the operational works in the company which were first production approval (FPA) and trial. First production approval (FPA) is a process in which the products were made using an appropriate mixer for the first time as a new product or when there were any changes in formulations (i.e scale up, scale down) and/or procedures. Whereas, trial is a production process performed by the process development team which is done manually for small quantities. During the

production process, the homogeneity of premix and no presence of clumps and agglomerate products were the most critical aspects that needed to be considered.

2.2.6.2. Product Application Testing

Premix made by the company can be used in various foods and beverages products including rice, ready to drink beverages, gummy, infant porridge and/or snacks, flour, extruded snacks, and many others. Throughout this internship period, the author has made several product applications to be used in events or to check the compatibility of the premix within the products including isotonic drink, infant porridge complementary feeding, milky beverages, and etc.

2.3. Comparison Application of Theory and Practical

Throughout the internship period, the author gained valuable intellectual and practical knowledge in the food industry and manufacturer. As an intern in the Process Development Department, the author got the opportunity into the professional world offering a firsthand experience of practical application in the food industry and manufacturing. Since the company is focusing their product on the premix for vitamin and minerals, the author might implement and learn further about vitamins and mineral interaction which had been learned theoretically throughout the Food Chemistry class. Furthermore, one of the job descriptions in the process development team done by the author was to assess the organoleptic properties of new and alternative raw materials. By doing those duties, the author got to perform a descriptive sensory analysis followed by 3-point intensity quantification that has been learned during the Sensory Evaluation course in i3L.

2.4. Difficulties

The difficulties took place in the first month of internship when the author had to adapt to a new environment and tasks related to the operational work that needed to be done daily. Since the author's internship was done in a premix manufacturer that is not really prevalent products, the author needs to do a lot of research and learn many new things and theories related to the products. Moreover, since one of the projects done by the author was related to inventory application, the authors need to learn and understand deeply on how the system works. Nevertheless, with guidance from the author's field supervisor and mentor, all difficulties can be managed very well. During the internship period, many supportive colleagues not only from the author's department but also from other departments helped the adaptation process become easier and smoother.

PROJECT DESCRIPTION

3.1. Introduction

3.1.1. Online Inventory Application

3.1.1.1. Project Background

The process development department is responsible for evaluating new and alternative raw materials and packaging materials that will be used in the production process. These evaluations were done to ensure that the materials had met the necessary quality and functionality standards to be used in the production process. After analytical analysis which sent the sample to the laboratory department and sensory evaluation was done, these materials were stored in boxes or chillers depending on its appropriate storage requirements to maintain its optimal quality for future use. However, despite the importance of these materials, there was no established system in the department to systematically record the storage locations and track the remaining quantities of the materials. This issue could lead to possible inefficiencies and disruptions in the workflow during everyday operational works.

The absence of this detailed inventory management system posed significant difficulties for the department as the process development staff were struggling to find the required materials to be used on the trial production. Without a clear record, locating specific materials or ensuring which items were still available required excessive time and effort which led to delay the production process. These drawbacks might also increase the risk of either inadvertently duplicating orders or running out of essential material stocks which causes unnecessary costs and waste. To address these issues, developing an online inventory application became one of the projects during this internship period.

3.1.1.2. Scope

The application was designed as a centralized platform to track the storage locations and quantities of all raw materials. This system proposed to simplify the management process by providing real-time data and easy access to essential information which significantly reduces the time spent to look for the materials by providing real-time data.

3.1.1.3. Objectives

The objective of the project was making a system that can record and track raw materials storage location as well as its remaining quantities to reduce any delay during the production process and lower the risk of unnecessary cost and waste due to inaccurate record-keeping. Moreover, the application would not only resolve the existing inefficiencies

problem but also establish a foundation for more effective inventory management in the future.

3.1.1.4. Materials and Methods

3.1.1.4.1. Materials

The application used to make the inventory management system was AppSheet which was an application that provides a no-code development platform for application software that allows users to create mobile and/or web applications using data sources. The data sources used were spreadsheets which had been made prior to the development of the application.

3.1.1.4.2. Method

The methodology done for the online inventory application project can be seen on **Figure 4**. The project was started with the learning process of the AppSheet system from the existing application. After the application was finished, all raw materials existed were compiled, sorted, and discarded (if expired) followed by putting or recording the data (e.g product name, lot or batch number, manufacturer, country of origin, storage location, quantity, and related usage) for each materials in the system

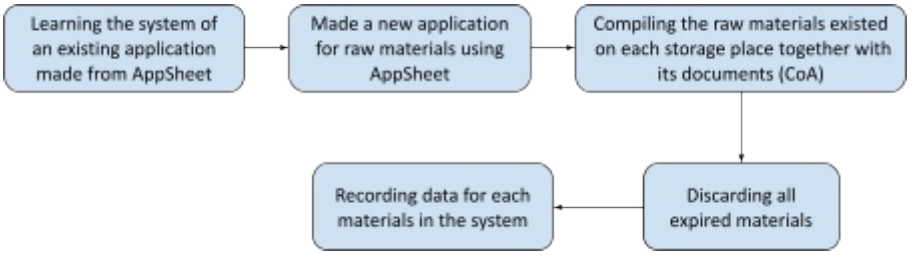

Figure 4. Methods of making an online inventory application

3.1.2. Shelf Life of Partially Processed Raw Materials

3.1.1.1. Project Background

Partially processed raw materials is a term used to describe the raw materials which have undergone initial processing steps in the production process but not yet became a finished product. In the company, the partially processed materials refers to the raw materials that have been through a grinding or sifting process to reduce its particle size. These processes are essential for optimizing the materials for further applications, as a smaller particle size can improve the homogeneity of the premix during the mixing process. However, the reduction of particle size significantly increases the surface area of the material leading to a faster chemical reaction. This phenomenon causing the handling and storage of

the materials more challenging to preserve its quality. One material used in this stability project was zinc sulphate heptahydrate ($ZnSO_4 \cdot 7H_2O$) which had undergone a sifting process.

Zinc sulphate ($ZnSO_4$) is an inorganic colorless crystalline salt that has strong hydrogen bond interactions with water molecules which lead to a capability to form several stable hydrated crystalline states easily including heptahydrate and hexahydrate as the most common form (Carsky et al, 2014; Liu et al, 2022). The study by Liu et al (2022) also stated that the water molecules in the hydrates gave significant impact in the structure, physical and chemical properties which affect the stability, homogeneity, and organoleptic properties of the products to a certain degree. Furthermore, due to its hygroscopic nature, this sulfate tends to form an agglomeration when it is exposed to humidity which not only alters the physical properties of the material but also complicates further processing activities especially during the mixing process (NCBI, 2024). Thus, the company did the sifting process to physically separate the materials using sieve or mesh and achieve a finer particle size. This process results in a smaller particle size of zinc sulphate heptahydrate which makes the material have a larger surface that fastens the rate of reaction (Juarez-Enriquez et al, 2017; Zhang et al, 2022). Due to its high affinity for water molecules, zinc sulphate heptahydrate had a tendency to re-agglomerate overtime as a result of gradual moisture absorption from the environment. This phenomenon causes significant issues on its practical application especially during handling, transportation, and storing periods.

3.1.1.2. Scope

Due to its hygroscopic nature and high moisture content, the sifted zinc sulphate heptahydrate tends to re-agglomerate and forms clumps overtime during the storage period. However this change in physical properties had not yet been confirmed to also change the chemical characteristics of the materials. Thus, the company proposed to implement its shelf life and stability analysis. The stability of the material was analyzed for 15 weeks with 12 weeks data recorded in this report.

3.1.1.3. Objectives

The objective of this analysis is to determine the stability of the partially processed materials by analyzing its chemical composition during 15 weeks of storage.

3.1.1.4. Problem Formulation

1. How is the stability of the raw material after being partially processed?

3.1.1.5. Materials and Methods

3.1.1.5.1. Materials

The raw material needed was zinc sulphate heptahydrate together with a stainless steel spoon, analytical balance, LLDPE plastic bag, and aluminum foil bag for the sample preparation.

3.1.1.5.2. Methods

Figure 5 below shows the workflow of the project which started with parameters determination. The stability of zinc sulphate heptahydrate was assessed by doing moisture and purity content analysis followed by checking the zinc content within the material. Then, a sampling plan was made to determine the amount of sample needed for overall analysis followed by raw material sample preparation. These samples were then stored in cold temperature conditions (<25℃, <55% RH). The assessments were done once in every week for each parameter by taking one bag of samples for each parameter and sending it to the lab department. Throughout the project, any laboratory analysis was done by the laboratorian due to the company regulations with the method of analysis attached in **Appendix 10-12**. The results obtained during this project were then referred as the standard of the other partially processed or work in progress raw materials.

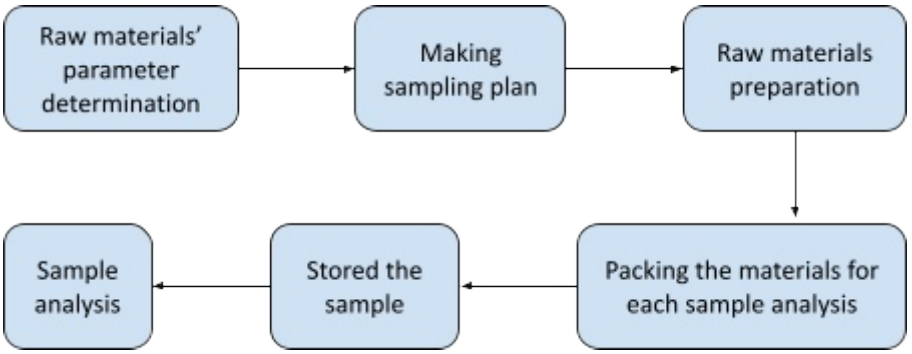

Figure 5. Methods of partially processed material stability project

3.1.3. Bulk Density Validation

3.1.3.1. Project Background

Bulk density that represents the weight of powder divided by its volume (generally stated in kg/m^3 or g/cm^3) is a method to determine the amount of powder that can fit in a space which includes the spaces between the particles and volume of the particles itself (Amidon et al, 2017). Based on the study by Sharma et al (2012), bulk density is classified into 4 categories which are loose bulk density (i.e bulk density value measured when the powder is freely poured into the container), compact density (i.e bulk density measured after

compressing powder with mechanical pressure, vibration, and impact), tapped density (i.e bulk density value measured when volume of the powder has been tapped or vibrated under specific conditions), and aerated bulk density (i.e bulk density measured when particles are separated from each other by a film of air). Raw materials used in the company are mostly in the form of powder in which all the raw materials for premix products are in the form of powder. Thus, checking its bulk density for each raw material must be done to determine which mixer was appropriate for the mixing process on that particular formulation since a small quantity of mass doesn't mean it also has small volume. Previously, in the company the bulk density of a premix was measured by calculating it theoretically using the bulk density and volume of each material. Therefore, doing a validation was necessary to ensure that the bulk density of all premixes could be determined by only doing theoretical calculations of its raw materials.

3.1.3.2. Scope

Bulk density is one of the critical parameters for a product that is in powder form, thus PT Global Vita Nutritech as a premix manufacturer proposed on doing a bulk density validation to find out whether their method of defining each premix bulk density was the most compatible method.

3.1.3.3. Objectives

The objective of the project was to validate the theoretical bulk density calculation of premixes.

3.1.3.4. Hypothesis

The hypothesis in this study is:

The H_0 (null hypothesis) is the theoretical bulk density value will be similar to the actual premix bulk density with the discrepancy less than 10%, while the H_1 (alternative hypothesis) is theoretical bulk density value will be dissimilar to the actual premix bulk density with discrepancy value more than 10%.

3.1.3.5. Problem Formulation

1. Is the theoretical bulk density of premix from calculating each raw material having similar value with the actual premix bulk density?
2. What is the discrepancy value between theoretical and actual bulk density?

3.1.1.6. Materials and Methods

3.1.1.6.1. Materials

The materials needed for the analysis were 5 vitamin and mineral premixes which were premix for infant porridge, premix for beverage products, and premix for wheat flour.

3.1.1.6.2. Methods

Figure 6 shows the workflow of the bulk density validation project which began with sample determination. Bulk density values in this project were determined in two methods which were measured theoretically and actually. The theoretical bulk density was equal to the results of premixes' mass divided by its volume. To calculate the volume of the premix, the volume of each material used was first determined by dividing the mass of the material with its bulk density which then would be added together. However, the actual density was measured using a tapped bulk density method by the laboratorian in the lab department due to the company regulations (**Appendix 13**) . The analysis was done in one period by sending two samples for each premix. After both bulk density values were obtained, the discrepancy value would be calculated with 10% as the maximum limit. Furthermore, the data obtained would be referred as the standard in determining which mixer will be appropriate to be used for each premix.

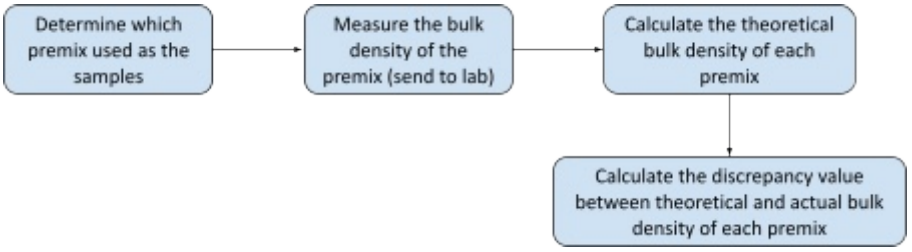

Figure 6. Methods of bulk density validation project

3.2. Results and Discussion

3.2.1. Online Inventory Application

The remaining raw and alternative materials which had been assessed by the process development team were stored in a storage box and chiller. The development of this online inventory system improved the efficiency of inventory management by integrating all inventory data into a single platform that is accessible from anywhere and providing instant updates on stock levels and locations of the materials ensuring its stock availability. The home display of the online inventory application which was made using the AppSheet platform attached in **Figure 7** below along with the

display for each section in **Appendix 14** and **15**. The plus (+) symbol was used to add materials which had a display attached in **Appendix 16**. To record the stock change, the inventory log icon should be chosen then filled in the required section on the usage form as seen in **Appendix 17**.

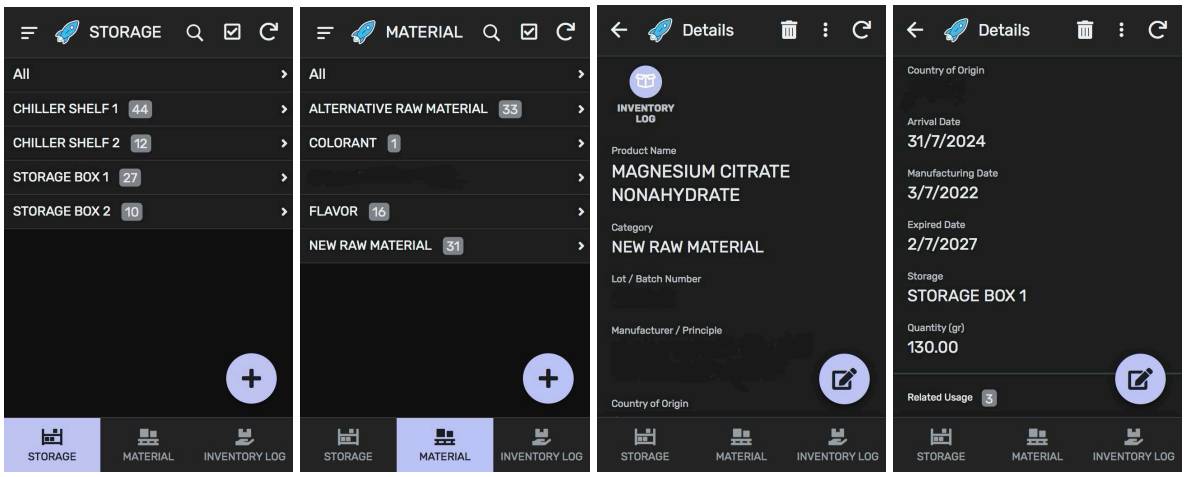

Figure 7. Display of storage section, material section, and material details

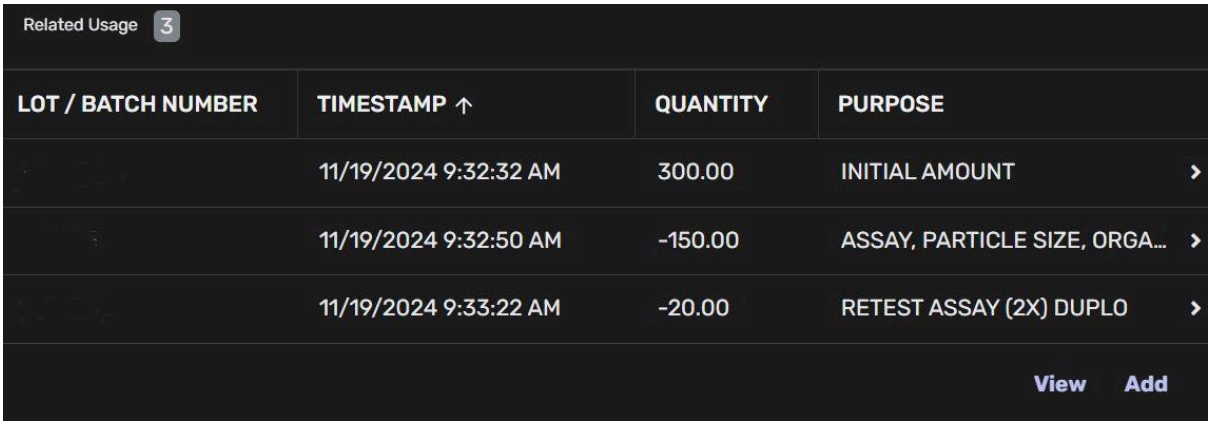

Figure 8. Display of material's related usage section

The development of this online inventory management application was also followed by sorting existing materials and compiling all documents related to the materials (e.g certificate of analysis) (**Appendix 18**). Before having a system gathering all the information related to the materials, inventory tracking was handled manually, leading to inefficiencies and errors which required staff to look for each and every material in the storage box or chiller. By integrating all material related information into this online system, users can now easily access material details including storage locations and quantities with just a few clicks. The amount of raw materials inserted into the database were more than 90 materials. Data recorded in the system for each material include product name, materials category, lot or batch number, manufacturer or principle, country of origin, manufacturing and expiry date, arrival date, storage location, quantity, and materials' related usage. As seen in **Figure 8**, the related usage section consisted of the lot or batch number of the material, timestamp, quantity used, and the purpose of usage. The improved

accessibility provided by the online inventory system supported the departments by providing a platform for process development teams to monitor inventory updates in real-time, enabling them to plan trials more effectively creating a more robust and efficient workflow.

3.2.2. Shelf Life of Partially Processed Raw Materials

The stability of sifted zinc sulphate heptahydrate was determined by assessing its moisture, zinc, and purity content (assay) as the parameters for 12 weeks or 3 months. The moisture content of the material in **Figure 9** shows there were no significant changes as the moisture content using loss on drying method was ranging from 35.93% to 36.12% within those three months. These results were much higher compared to the water content of sifted zinc sulphate monohydrate which was reported to have 0.5-1% moisture (Emfema, n.d). This might be due to zinc sulphate heptahydrate having more water or hydrates attached to its bond per formula unit and its hygroscopic nature meaning that it could interact and retain more water.

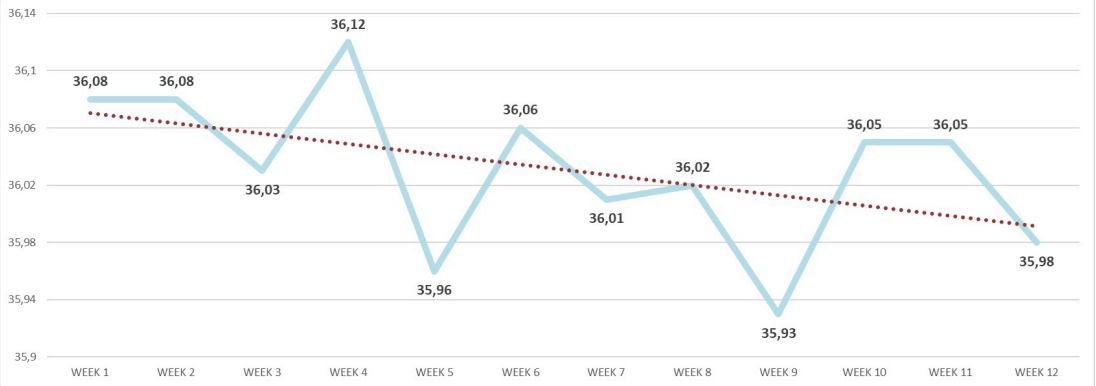

Figure 9. Moisture content results of sifted zinc sulphate heptahydrate (%)

The amount of zinc and the purity of sifted zinc sulphate heptahydrate (%w/w) in the materials was also assessed to define the stability of the materials. **Figure 10** shows the result of zinc content per mg in one gram of sample for three months with the lowest zinc content 138 mg/g sample in week three while week 11 had the highest zinc content value which was 223 mg/g sample. These results were lower than a study conducted by EFSA (2015) which stated that the theoretical zinc content was 22.7% while their measurement in two batches reported to be between 23.9% and 24.2%. Moreover, the results of materials' purity content were shown in **Figure 11** with the value ranging from 100 – 102.5%. The internal purity content specification of normal or unsifted zinc sulphate heptahydrate which had value 99 – 102% were used as the standard specifications during this project. The purity content on week 3, 4, 7, and 10 slightly exceeded the upper limit of the specified range indicating the results were out of specification. However the company still allowed for a minor deviation which made the results were still in the safety margin for operational use.

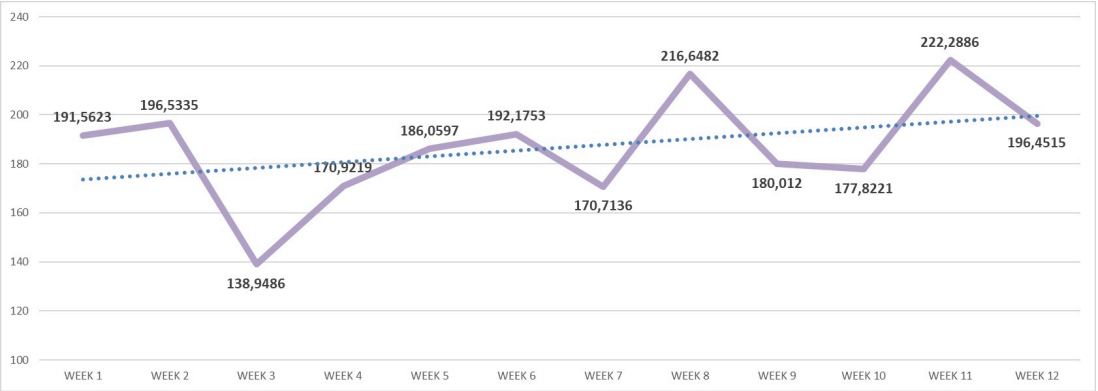

Figure 10. Zinc content of sifted zinc sulphate heptahydrate in mg/gr

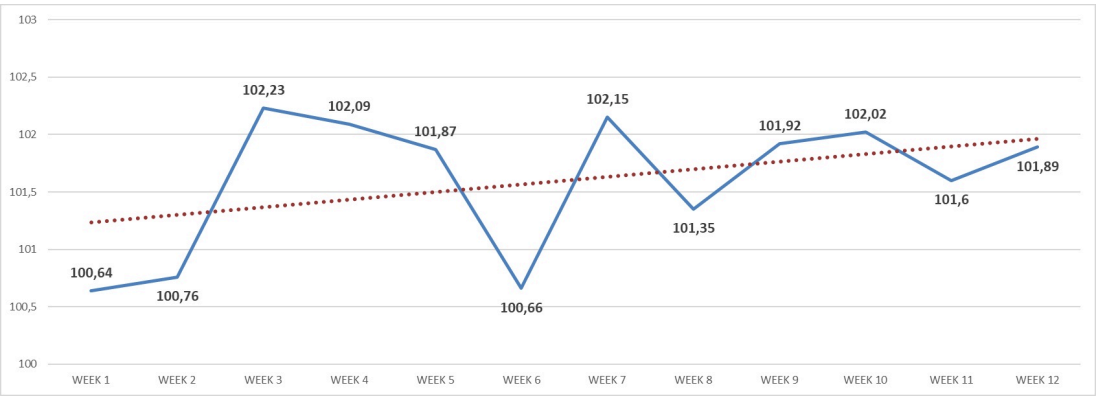

Figure 11. Purity content results of sifted zinc sulphate heptahydrate (%)

3.2.3. Bulk Density Validation

Bulk density results for both theoretical and actual bulk density of five premixes were seen in **Table 19**. Both bulk densities were tapped bulk density with the actual bulk density values were all higher than the theoretical value with the discrepancy values were more than the limit which were 10% except for premix B. Premix D and E which were the premix used in wheat flour had the highest discrepancy value for more than 30% with the value of actual bulk density higher than the theoretical value. Moreover, the discrepancy between theoretical and actual bulk density value of premix A and C were also in the range of 25-30% with the value of actual bulk density higher than its theoretical value. After discussing this matter, it was determined that the actual bulk density of the premix was similar to the bulk density of its dominant raw material. Thus, the project would be continued by sorting the premix based on its dominant raw materials contained in the product.

Table 19. Bulk density result

Premix	Theoretical Bulk Density (g/mL)	Actual Bulk Density (g/mL)	Discrepancy value (%)
A	0.445	0.575 ± 0.007	28.09
B	0.853	0.785 ± 0.007	8.56

C	0.608	0.795 ± 0.007	29.93
D	0.942	1.27 ± 0	34.82
E	0.88	1.215 ± 0.007	37.5

Note. Amount of sample (*n*) for bulk density (*n=2*)

3.3. Conclusion and Recommendations

The development of the online inventory system improved the efficiency of inventory management by integrating all material related information into this online system which allows users to easily access material details including storage locations and quantities with just a few clicks. This improved accessibility supported the team to work effectively and efficiently by providing a platform to monitor any inventory updates in real-time. Furthermore, The stability of sifted zinc sulphate heptahydrate was not changed or altered during 3 months of storage meaning the null hypothesis was accepted. All parameters including moisture content, zinc sulphate heptahydrate purity, and zinc content were all shown a constant and stable value within each week. Thus, the stability test needs to be done in a longer time period to know the maximum storage period of the partially processed materials. Moreover, the null hypothesis of the bulk density validation project which stated that discrepancy value between theoretical and actual value were less than 10% was rejected indicating that the previous method to determine the bulk density of the premix which was done theoretically was not the most appropriate method. These results were then led to other work which were checking the bulk density of the premix based on each dominant composing materials and comparing the value (followed by the determined discrepancy value) with the bulk density of that dominant materials.

SELF REFLECTION

Throughout the internship period, the author developed a lot of valuable skills both in hard and soft skills. Key competencies such as time management were honed while working on multiple projects simultaneously requiring effective planning, communication and proactive problem solving. Over six months, the company actively supported and engaged the intern's growth and development through hands-on involvement in the manufacturing process and participation in internal training sessions. These experiences exposed the author to a real-word application of theoretical knowledge, bridging the gap between academic learning and industry practices. Guided by the supervisor, the author improved critical thinking skills and problem solving abilities as well as gained practical experience and knowledge such as conducting shelf-life testing, evaluating raw materials, and addressing some issues related to the operational works in the company including the bulk density validation project. Each task done by the author throughout the internship period required analytical thinking, attention to detail, and adaptability to overcome unexpected obstacles. Despite encountering challenges and making mistakes throughout the internship period, this program offered invaluable learning experiences for the author. Mistakes made along the way provided valuable lessons helping the author develop resilience and a growth-oriented mindset. The lessons learned during this period will undoubtedly serve as foundation for the author's future career endeavors equipping the author to handle complex projects and responsibilities in the related field.

CONCLUSION & RECOMMENDATION

The internship activities were conducted for 6 months at PT Global Vita Nutritech gave invaluable insight and experience for the author, offering chances to observe the real professional career world conditions including workplace culture, workflow, and responsibilities. This experience allowed the author to transition her academic knowledge into practical applications, thereby bridging the gap between theory and practice. The author has achieved her goal by successfully implementing her knowledge in every practical job desks given such as shelf-life testing, evaluating raw materials, developing inventory application, as well as reporting throughout the internship period which also enhanced her both technical expertise and problem-solving skills. The exposure to such dynamic workflows also encourages the author to reflect on her self development encompassing both hard and soft skills as well as embrace challenges as learning opportunities which are essential in order to succeed in her future careers. In addition to that, the author is also blessed for the opportunity to expand her connections with the seniors and other colleagues from other departments who gave a lot of encouragement and valuable insight during this internship, enriching the author's understanding of teamwork and effective communication.

Looking ahead, the author recognizes the need to further develop initiative and proactiveness to quickly adapt to the workplace. Having a curious mindset and willingness to learn are also fundamental to allow a continuous personal and professional development. These attributes will not only facilitate acquiring new knowledge but also help in overcoming future challenges with confidence and competence. Reflecting on the experience, the author acknowledges the importance of seeking feedback and embracing opportunities to improve her performance and skills.

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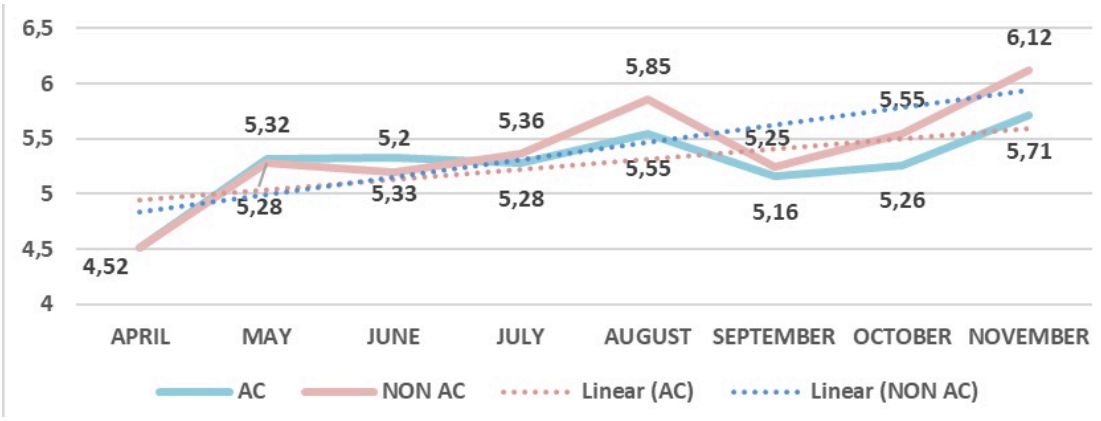
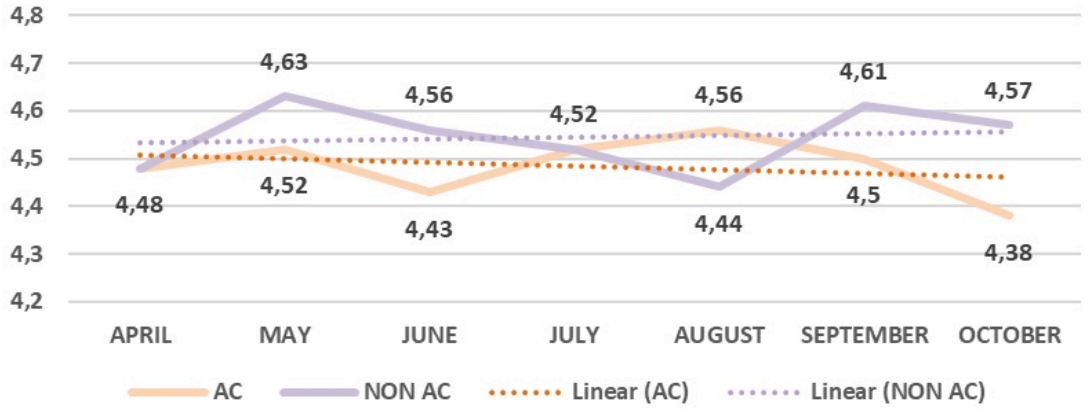
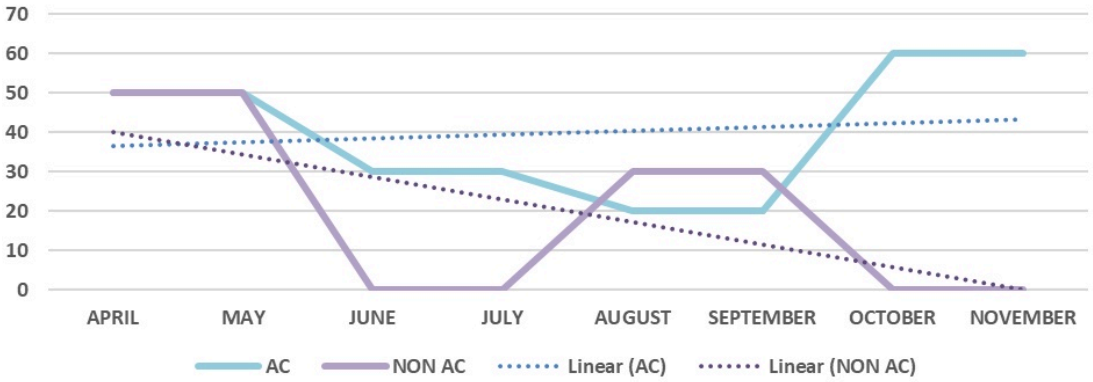
APPENDICES



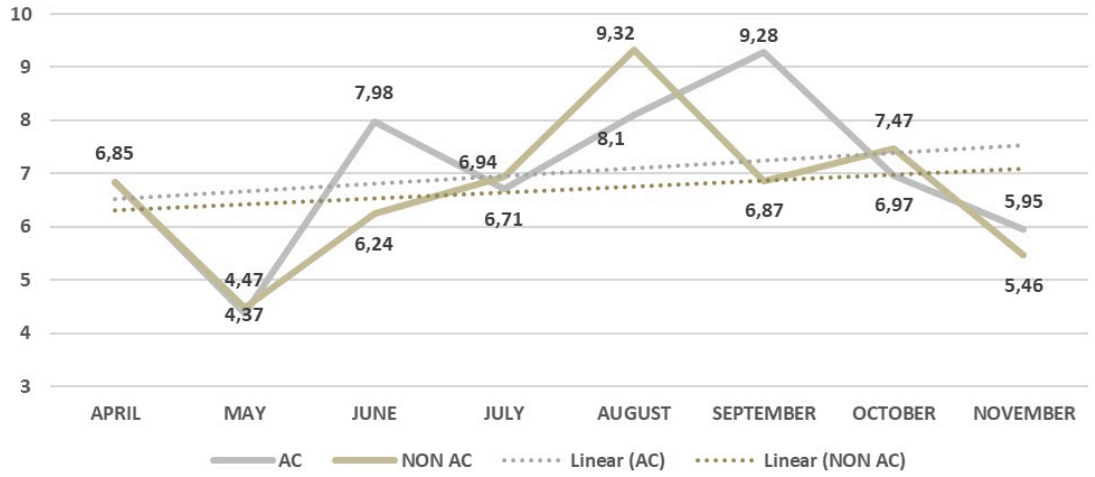
Appendix 1. Moisture content results of extract premix stored in cool and ambient conditions



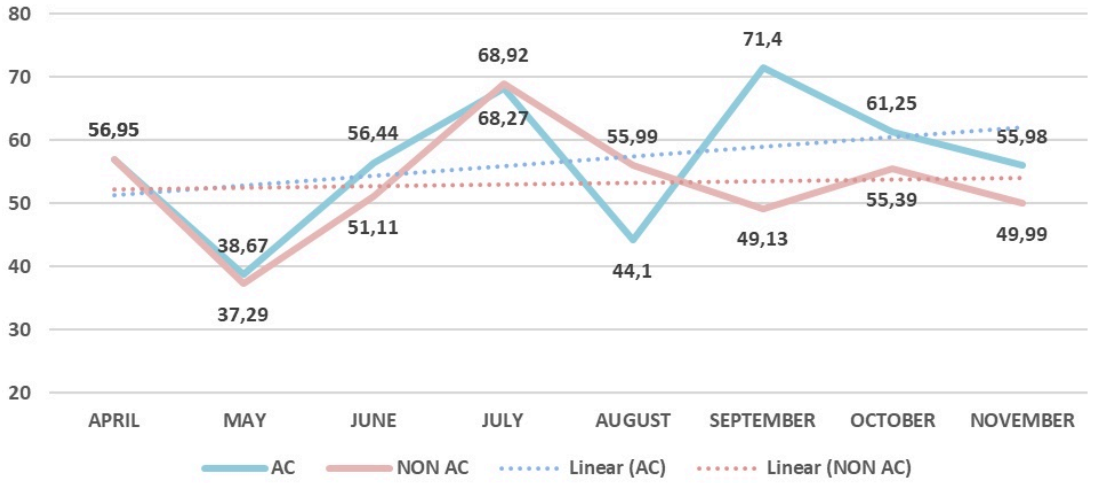
Appendix 2. pH results of extract premix stored in cool and ambient conditions



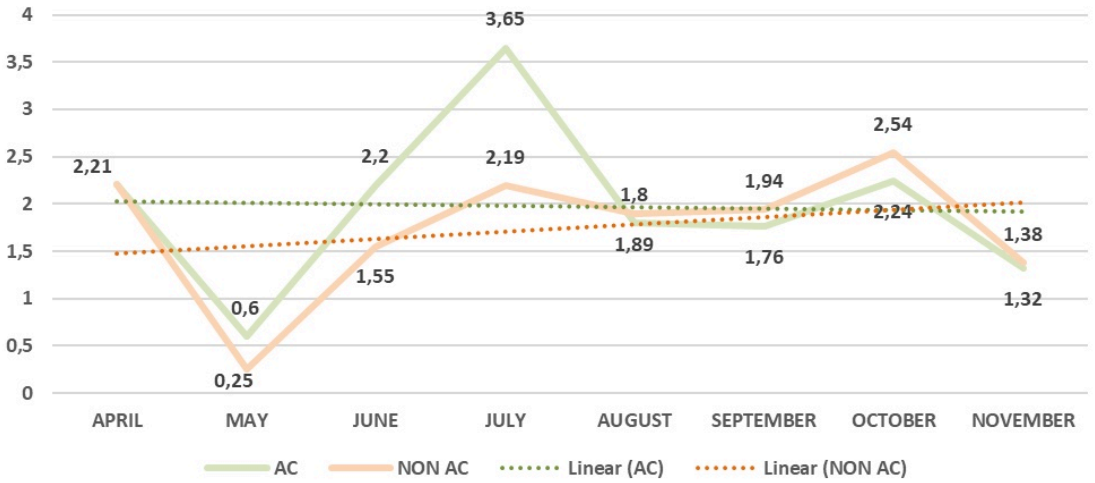
Appendix 3. Standard plate count results of extract premix stored in cool and ambient condition



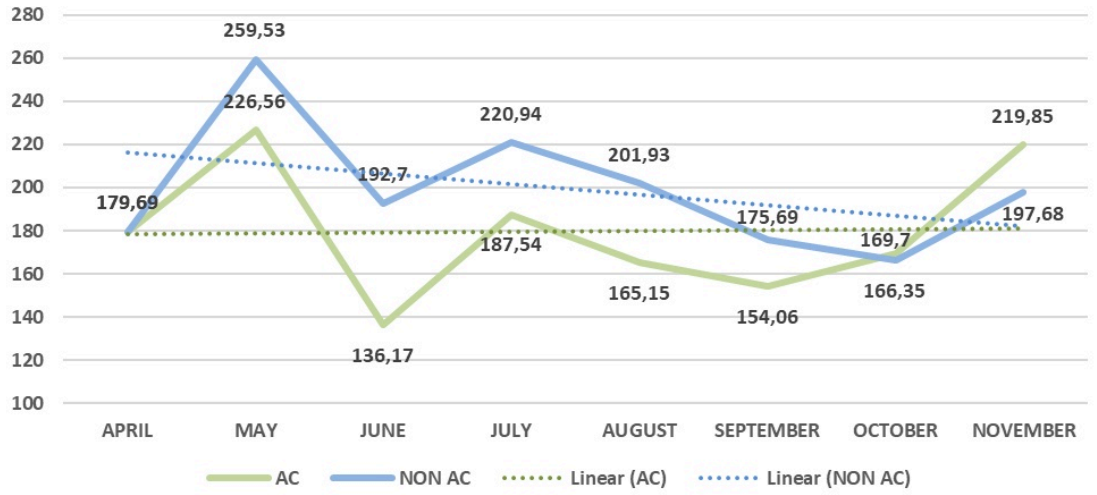
Appendix 4. Calcium content of isotonic mineral premix stored in cool and ambient condition



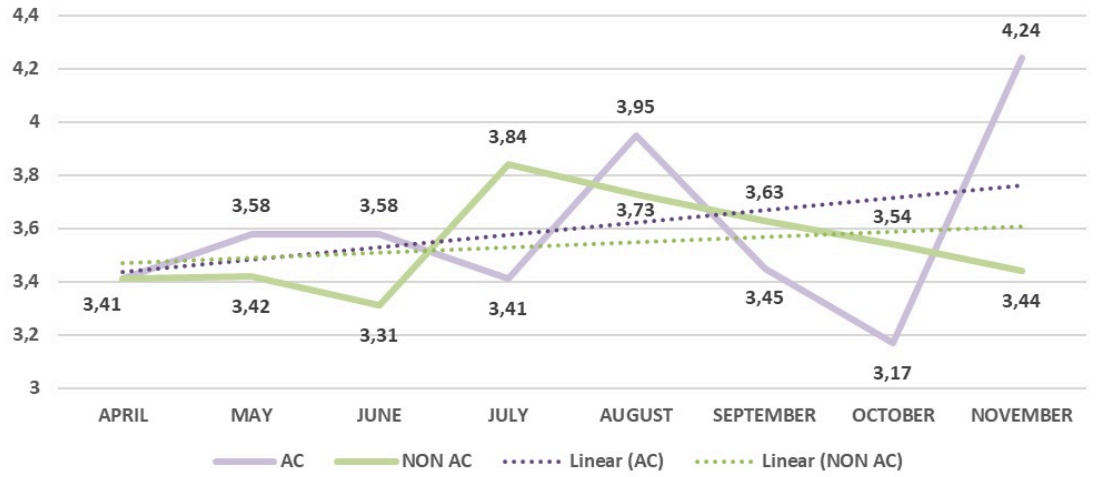
Appendix 5. Potassium content of isotonic mineral premix stored in cool and ambient condition



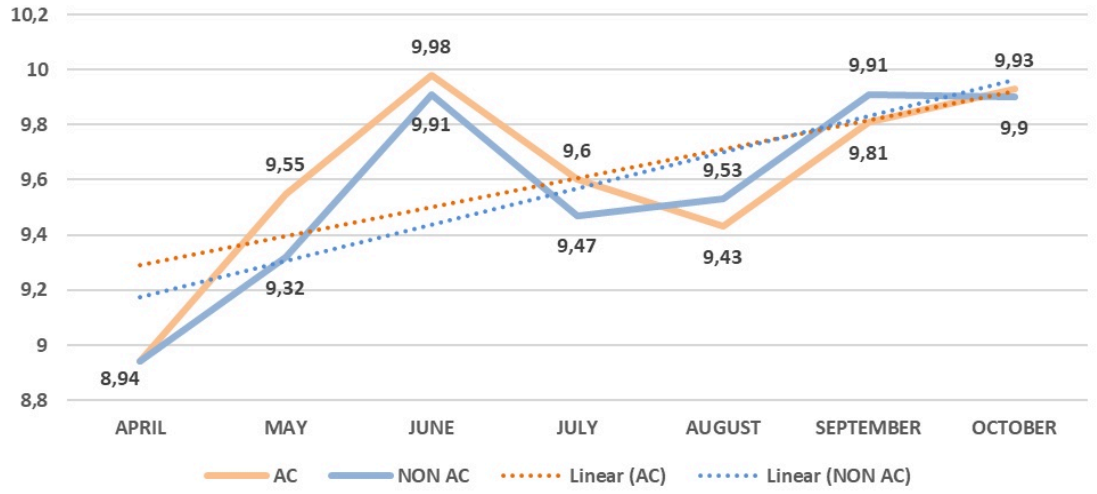
Appendix 6. Magnesium content of isotonic mineral premix stored in cool and ambient condition



Appendix 7. Sodium content of isotonic mineral premix stored in cool and ambient condition



Appendix 8. Moisture content of isotonic mineral premix stored in cool and ambient condition



Appendix 9. pH value of isotonic mineral premix stored in cool and ambient condition

Appendix 10. Method in determining moisture content according to company laboratory regulation

Preparation:

1. Heat weighing container in an oven at 102°C for 30 minutes. If the weighing container is wet, heat it at 102°C for 6 hours.
2. Remove and cool the container in a desiccator for 30-45 minutes until it reaches room temperature.
3. Weigh the container as W2.

Analysis:

1. Homogenize the sample then weigh 2.00 ± 0.01 gram of sample into the container prepared on the preparation section.
2. Put the sample and its container into the oven at 102°C for 2 hours.
3. Remove and cool it in the desiccator for 30-45 minutes until it reaches room temperature.
4. Weigh the sample and its container

Calculation:

Moisture content (%) = $\frac{W1 + W2}{W1} - W3 \times 100$

W1 = initial sample weight (gram)

W2 = container weight (gram)

W3 = weight of both sample + container after drying process (gram)

Appendix 11. Method in determining zinc content (ICP-OES) according to company laboratory regulation

Sample preparation for premix:

1. Weigh ± 0.02 gram sample into 50 mL volumetric flask.
2. Add 20 mL aquadest milli-Q
3. Sonicate for ± 10 minutes.
4. Add ± 5 mL 65% concentrated HNO_3.
5. Boundary mark with aquadest milli-Q then homogenized.
6. Carry out dilutions of necessary.

Blank solution preparation:

1. Add 5 mL of 65% HNO_3 into the vessel.
2. Close and fasten the vessel and insert it into the rotor.
3. Perform digestion process in a microwave digester.
4. Put the digestion into a 50 mL polypropylene volumetric flask.
5. Boundary mark with aquadest milli-Q then homogenized.

Analysis:

1. Perform ICP-OES in accordance with the standard operating procedure (SOP) for operating instruments.
2. Conditioning of the instrument for ± 30 minutes.
3. Take measurements at a wavelength according to the Working Instruction of each parameter

Result interpretation

Zinc content (mg/g) = $\frac{(Sample\ Conc - Blank\ Conc) \times V \times DF \times 100}{W}$

Sample Conc = sample measurement result (mg/L)

Blank Conc = blank measurement result (mg/L)

V = volume of final dissolution (L)
DF = dilution factor
W = sample weight (g)

Appendix 12. Method in determining zinc sulphate heptahydrate purity

Analysis:

1. Weigh ± 0.2 gram sample and put it into a 250 mL Erlenmeyer flask.
2. Dilute the sample in 50 mL aquadest.
3. Add 2 mL Buffer pH 10.
4. Add ± 3 mg EBT indicator.
5. Titrate with EDTA solution 0.05 M until the endpoint color is blue that is stable for 1 minute.
6. Calculate the result.

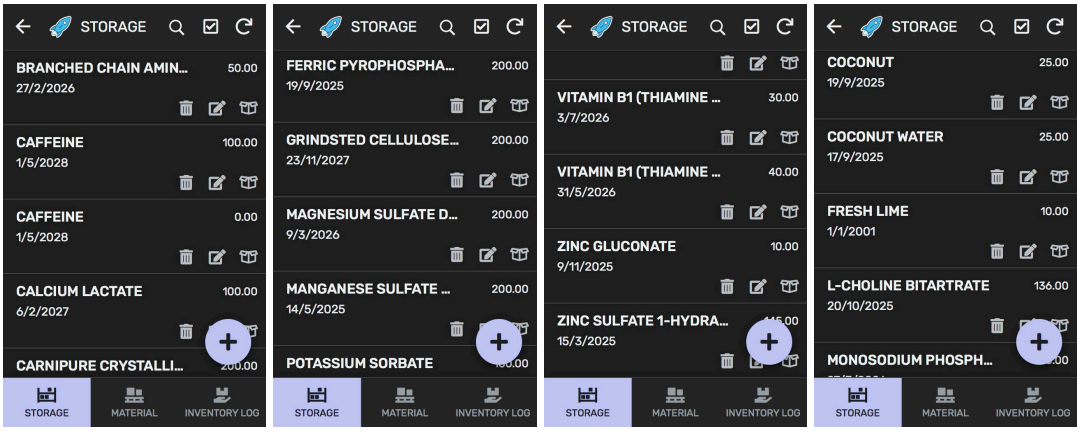
Calculation:

Zinc Sulphate Heptahydrate ($ZnSO_4 \cdot 7H_2O$) content (%) = $\frac{V \times M \times 14.38 \times 100\%}{Sample\ weigh\ (mg) \times 0.05}$

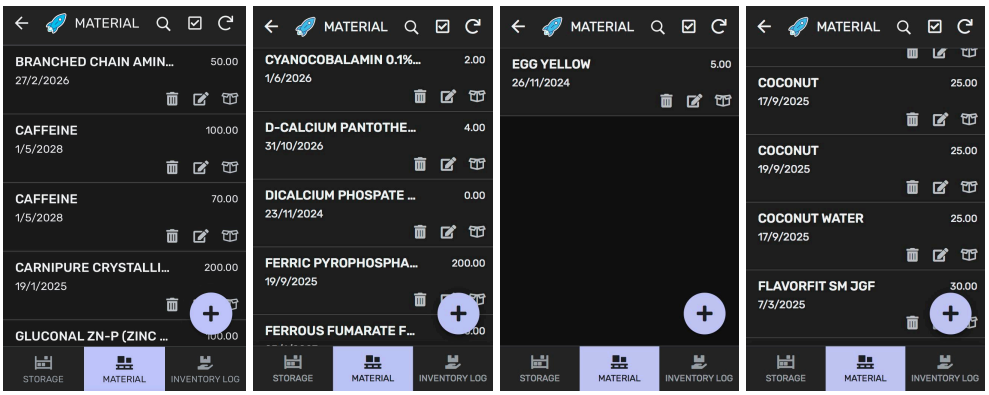
Appendix 13. Method in determining the bulk density

Analysis:

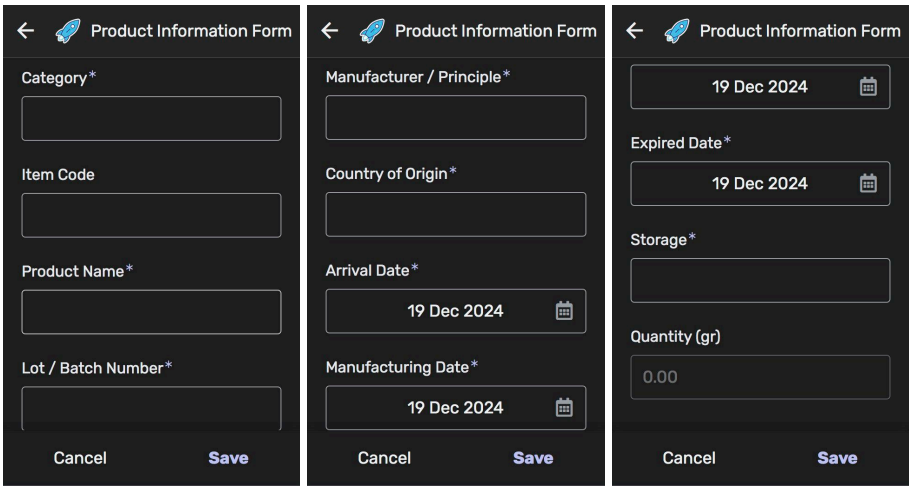
1. Make sure the tools and equipment are clean and dry.
2. Place the measuring cylinder in the analytical balance, adjust the scale into 0 gram by pressing 'tare'.
3. Put the sample into the measuring cylinder until the volume reaches 100 mL and record the sample weight (g).
4. Get down the cylinder from the analytical balance and tap it repeatedly for 70 times.
5. Read and record the volume (mL)
6. Calculate the bulk density (gr/mL) = $\frac{sample\ weight\ (gr)}{sample\ volume\ (mL)}$



Appendix 14. Display of storage section (storage box 1, storage box 2, chiller shelf 1, and chiller shelf 2 respectively)



Appendix 15. Display of material section (new raw materials, alternative raw materials, colorant, flavor respectively)



Appendix 16. Display after pressing plus (+) symbol which aims to add materials.

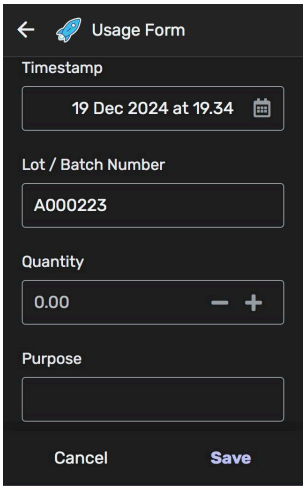


Figure 17. Usage form display on the inventory log change option.

(a) (b)

Figure 18. Before (a) and after (b) sorting raw materials in the chiller followed with recording the data in the inventory system

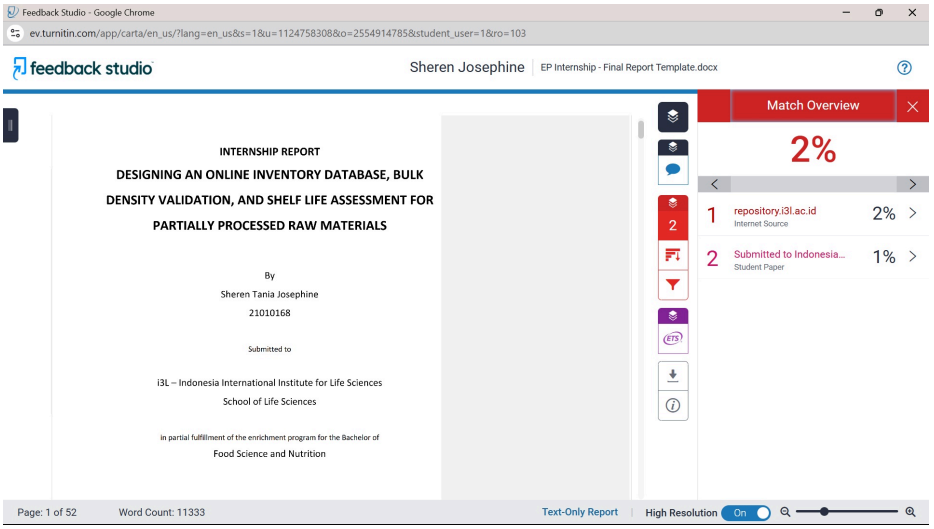


Figure 19. Turnitin result