INTERNSHIP REPORT ON

"Product Manufacturing in Transcom Beverage Limited"

Supervised By-

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Submitted By-

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LETTER OF TRANSMITTAL

28 September, 2022

Dr. Nizam Uddin

Associate Professor and Head

Department of Nutrition and Food Engineering

Daffodil International University.

Subject: **Submission of the Report on "Product Manufacturing in Transcom Beverage".**

Dear Sir,

I would like to thank you for assigning me this subject to prepare the report. This task has been given us the opportunity to explore one of the most important aspects of the Production and operations management, which is very important in our practical life.

The report contains a comprehensive study on the Production and Operations management practices of "Transcom Beverage". It was a great pleasure for me to have such type of opportunity to work on this topic. I have endeavored our best to come out with a good one and also if I do any mistake (involuntary), then please try to see it in the eyes of forgiven.

This report is based on ''Product Manufacturing" by Transcom Beverage Limited for 30days from 2nd February, 2022 to 4th March, 2022 under the supervision of Mr. Baloram Paul (Head of Quality Control, Baghabari Plant). This internship give me academic and practical exposure.

Finally, I would like to thank you for valuable guidance & support in preparing this report. I will be grateful for any clarification when required. I will be highly obliged if you are kind enough to approve this report and provide your valuable judgment on it.

Sincerely Yours,

Mst. Afsana Khatun

ID: 182-34-793

Department of Nutrition & Food Engineering

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CERTIFICATE OF APPROVAL

On the behalf of the university, this is to certify that Mst. Afsana Khatun ID: 182-34-793, Program B.Sc. in Nutrition & Food Engineering is a regular student, department of Nutrition & food Engineering, Faculty of Allied health Sciences, Daffodil International University. She has successfully completed her internship program of one month in Transcom Beverage Limited on "Product Manufacturing in Transcom Beverage Limited" Then she completed this report on 05 September, 2022, under my direction. We were aware that Mst. Afsana Khatun completed her internship report by observing our instructions. In addition, I ensure that her report is worthy of fulfilling the partial requirements of the NFE program.

Harun-Ar-Rashid

Senior lecturer

Department of Nutrition & Food Engineering.

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Dr. Nizam Uddin

Associate Professor and Head

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OBJECTIVE OF THE REPORT

Several approaches can be taken to understanding the report's objective:

- General Objective
- Specific Objective

General Objective:

An Internship at Transcom Beverage Ltd. focusing on Beverage manufacturing and quality control.

Specific Objectives:

More notably, this study entails the following aspects:

• The purpose of the course is to learn about the processing, packaging, storage and hygiene of Beverage.

• To assess the QA system according to HACCP in QC Hygiene, safety and sanitation

• To achieve a practical experience on Quality Control Analysis of raw materials, in process food and finish products of different beverage.

ACKNOWLEDGEMENT

First of all, I would like to express my heartiest gratitude to almighty God for his mercy extended to completing my internship report on “Product Manufacturing in Transcom Beverage Limited”. Practical experiences are also needed in parallel with the academic knowledge to fill the gap of theoretical knowledge.

I am deeply indebted to my Supervisor Mr. Harun-Ar-Rashid, Senior Lecturer, Department of Nutrition & Food Engineering, Faculty of Allied Health Science, Daffodil International University, for his whole-hearted supervision during my organizational attachment period.

My Deep gratitude and sincere thanks to the honorable Dean, Faculty of Allied Health Science, Professor Dr. Md. Bellal Hossain for this kind cooperation and to accept this, degree. I am encouraged to take this privilege to deliver my gratitude to each people who are involved with me in every phase of my lives. I am very grateful to, Dr. Nizam Uddin, Associate Professor and Head, Department of Nutrition and Food Engineering, Daffodil International University.

During my student life, I would like to express my warmest thanks to NFE faculty members for their countless inspiration and encouragement.

I am expressing my deep gratitude to Mr. Baloram Paul, Head of Quality control at Transcom Beverage Limited (Bagher Bazar Plant) also expressing to Mr. Bipul Biswas, Senior QA Executive (Laboratory) who managed for me an internship opportunity at Transcom Beverage Ltd as well as All Factory department of “Transcom Beverage Limited’’ because they give me great opportunity for Practical Learning about Industry.

ABSTRACT

This internship program has enriched me with practical knowledge and experience in drinking water, beverage (carbonated soft drink), PET plant, blow molding, quality control of soft drink, microbiology, filling section, water treatment plant, RO plant, ETP plant, CO2 plant & others.

This report is prepared by the practical knowledge during the internship period at "Transcom Beverage Ltd.". It is a great achievement and experience for me to work in Industry. The objective of this internship is to review the principles of manufacturing process which is to selection of ingredients, preparation, processing steps and to maintain quality standards also microbiological lab testing along with product development.

My report is mainly over all section. In my report I include manufacturing procedure, quality control parameter, QC inspection, QC lab testing, and also microbiological testing. In this report also include Raw material and Packaging material testing and storage.

In this report I applied my academic and practical knowledge that I aquaria in my university life and internship period.

TABLES OF CONTENTS

List of Abbreviations

- MGF = Multi Grade Filter
- SF = Softener Filter
- ACF = Activated Carbon Filter
- UGT = Under Ground Tank
- TDS = Total Dissolved Solid
- EBT = Eriochrom Black T
- EDTA = Ethylene Di-Amine Tetra Acetic Acid
- PRP = Prerequisite Program
- GSP = Good Storage Practice
- GMP = Good Manufacturing Practice
- CCP = Critical Control Point
- HACCP = Hazard Analysis Critical Control Point
- FDA = Food & Drug Administration
- CIP = Cleaning In Place
- COP = Cleaning Outer Place
- SOP = Standard Operating Procedure
- BSTI = Bangladesh Standards & Testing Institute
- ISO = International Organization for Standardization
- PP = Polypropylene
- LDPE = Low Density Polyethylene
- FIFO = First in first Out
- FEFO = First Expiry first Out
- GLP = Good Laboratory Practice

INTRODUCTION

Transcom Group is a Bangladeshi business conglomerate. The businesses under this group include beverages, pharmaceuticals, newspaper, radio channel, electronics, foods, etc. This group employs more than 10,000 people. Transcom Group is one of the oldest and biggest companies in Bangladesh.

Transcom Group started its journey in 1885 through tea plantations. This diversified business house now has interests in many segments in the industrial and service sectors in Bangladesh.

Transcom is the local business partner of international brands like Pizza Hut, KFC, Pepsi and Philips. Leading Danish insulin manufacturer Novo Nordisk has also chosen Transcom pharmaceutical company Eskayef as the sole manufacturer of its products after China and India in Asia.

The early industrial ventures have moved over to business involved in high tech manufacturing, international trading and distribution, forming strong ties with a host of blue chip multinational companies.

Transcom Beverages Limited (TBL) is a concern of Transcom Group, which is one of the leading & fast growing business conglomerates in Bangladesh as well as a leading organization in the beverages industry of the country.

Transcom Beverages Limited incorporated as a private limited company in 2000 and started its journey as the **"Exclusive PepsiCo franchisee for Bangladesh"** since its inception. In nationwide, more than 2500 efficient and highly dedicated peoples are directly working for the company.

TBL owns and operates modern plants in Dhaka, Gazipur and Chattogram for bottling & carrying the renowned soft drinks brand: Pepsi, 7 UP, Mirinda Orange, Mountain Dew, Slice, Pepsi Diet, 7 UP Lite, Aquafina (Drinking Water), Pepsi Black and Evervess Club Soda.

SIGNIFICANT OF THE STUDY

Internship Program of Daffodil International University is a BSC requirement for the Nutrition and Food Engineering students. This study is a partial requirement of the Internship program of Nutrition and Food Engineering curriculum at the Daffodil International University.

The main purpose of internship is to get the student exposed to the practical knowledge and successful job world. Being an intern, the main challenge was to translate the theoretical notion into real life experience.

The internship program and the study have following to the point:

- To know the working environment of factory.
- To have a practical experience on Beverage Processing, Packaging and Storage
- It is an objective to observe and assess the implementation of a HACCP-based

Quality Assurance System:

- Assessing different food products for total quality management (TQM).
- NFE Program Requirement of comparing real scenario with lessons learned from DIU.

This report is the result of 1-month long internship program conducted in Transcom Beverage Limited and is prepared as a requirement for the completion of the NFE program of Daffodil International University.

As a result, I need to submit this report based on the "Internship Report on Transcom Beverage Ltd". This report also includes information on the products and services of Transcom Beverage Ltd.

■ PLANTS & PRODUCTS OF TBL

The company is the exclusive PepsiCo Franchisee for Bangladesh. TBL owns and operates three modern plants in Konabari, Mawna and Chittagong for bottling the renowned soft drink brands: Pepsi, 7Up, Mirinda, Slice, Mountain Dew, Pepsi Diet, 7Up Light and Aquafina water and market leader by far.

To deliver sustained growth in Bangladesh and move towards dominant Beverage Company, delighting & nourishing every Bangladeshi, by best meeting their everyday beverages needs & stakeholders by delivering performance with purpose, through talented people.

Product Mix

Transcom Beverages Limited, as the only franchisee of PepsiCo, Inc. in Bangladesh, provides the subsidiaries of PepsiCo. The products that are currently being manufactured by them in Bangladesh fall under the categories of CSD, club soda, water and fruit drinks.

Under CSD, there are four flavors: Cola (includes Pepsi, Diet Pepsi & Pepsi Black), lemon (the favor for 7up & 7up lite) lime (Mountain Dew) and orange (the flavor for Mirinda). 'Evervess' by PepsiCo is a club soda and Aquafina is the only mineral water under PepsiCo that TBL manufactures, Non-carbonated soft drinks or fruit beverages include Tropicana Ftrutz which is currently sold in flavors: mango, orange and apple. Slice is a mango juice which has new launched in Bangladesh since August 2020. Pepsi, 7up (except 7up lite), Mountain Dew and Mirinda are available in stores in GRBs, CANs and PET bottles, Evervess soda, Tropicana fruit drinks, Slice and Aquafina are available in bottles.

Figure: Product (Brand) logos used by TBL

Figure: CSD (CANs) manufactured by TBL

Figure: PET (Bottles) manufactured by TBL

TABLE 1: TBL'S PRODUCT LIST & ATTRIBUTES

PRODUCT	Carbonated beverages/Soft drinks & Water
PRODUCT TYPE	Convenience product (Consumer product that the customer usually buys frequently, immediately and within a minimum comparison and buying effort.)

Product Name	Logo	Flavour	SKU
PEPSI	pepsi	Cola	➔ 200 ml GRB ➔ 250 ml GRB ➔ 250 ml can ➔ 250 ml (go pack) ➔ 500 ml pet ➔ 1000 ml pet ➔ 2000 ml pet

7UP		Clear	➔ 200 ml GRB ➔ 250 ml GRB ➔ 250 ml can ➔ 250 ml (go pack) ➔ 500 ml pet ➔ 1000 ml pet ➔ 2000 ml pet
MIRINDA		Orange	➔ 200 ml GRB ➔ 250 ml can ➔ 250 ml (go pack) ➔ 500 ml pet ➔ 1000 ml pet
MOUNTAIN DEW		Citrus	➔ 200 ml GRB ➔ 250 ml can ➔ 250 ml (go pack) ➔ 500 ml pet ➔ 1000 ml pet
PEPSI DIET		Cola	➔ 250 ml can ➔ 500 ml pet
7UP LITE		Clear	➔ 250 ml can ➔ 500 ml pet
SLICE		Water	➔ 250 ml GRB

AQUAFINA		Water	➔ 500 ml pet ➔ 1500 ml pet
EVERVESS		Club Soda	➔ 500 ml pet

■ CARBONATED SOFT DRINKS & ACTIVITIES

On this day session I learnt about the Production Lines. In the Bagher Bazar Plant there are 4 different Production lines:

1. Line 1: Can Line.
2. Line 2: PET (Poly Ethylene Terephthalate)
3. Line 3: PET (Poly Ethylene Terephthalate)
4. Line 4: Hot Fill PET (Poly Ethylene Terephthalate)

The whole production process can be shown as below (for PET Line):

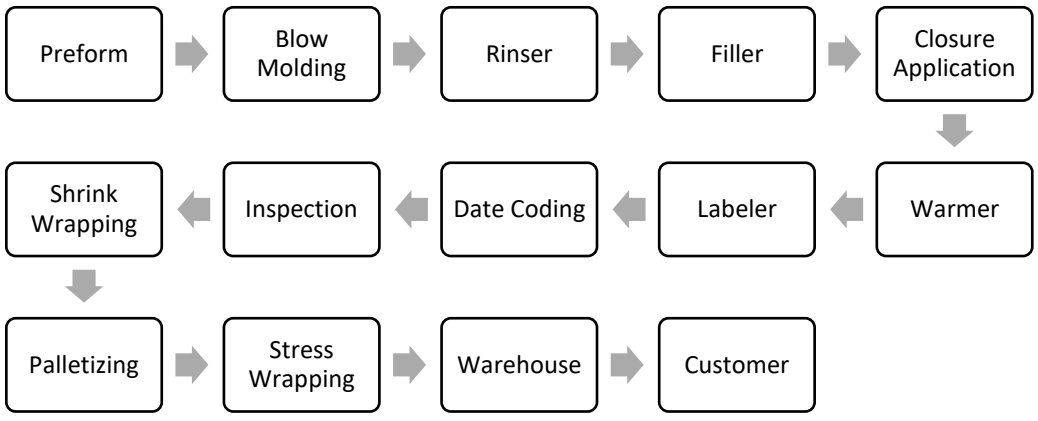
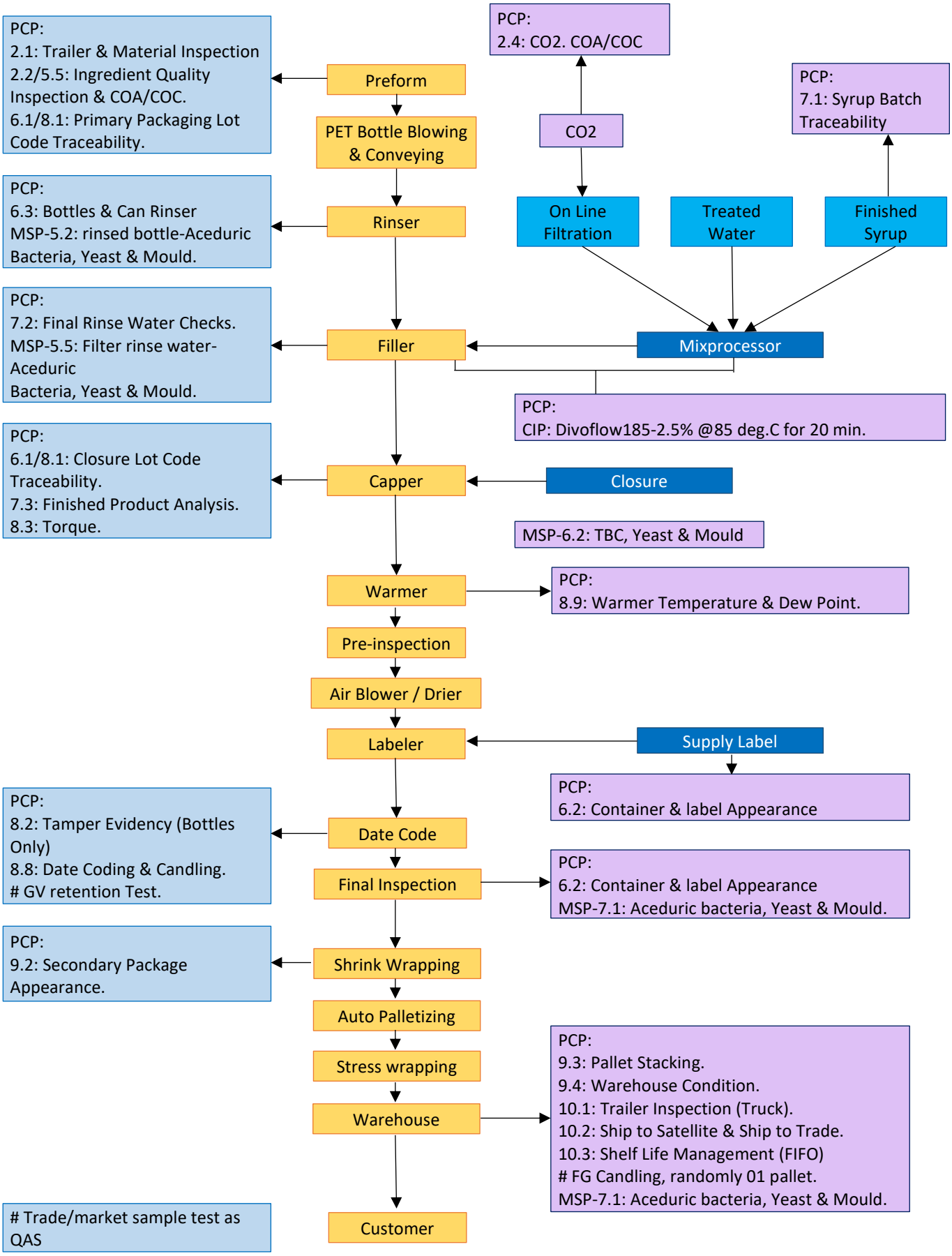
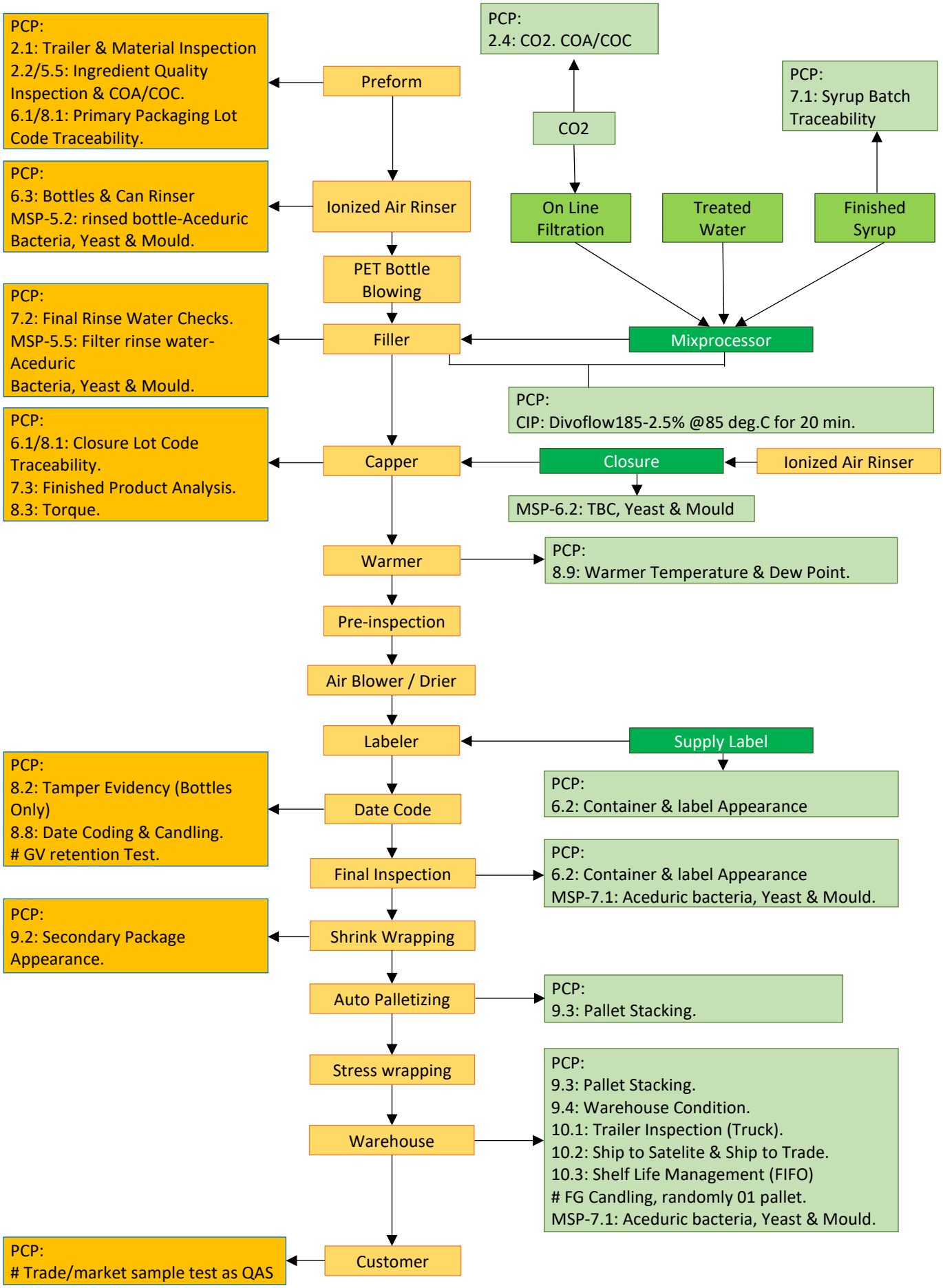


Fig: Flow Diagram of Production Process

Flow Diagram for Line #02 (PET)



Flow Diagram for Line #03 (PET)



Here is a brief description of the main components of the production lines.

Preform

A perform is an intermediate product that is subsequently blown into a PET container. Preforms vary in neck finish, weight, color and shape and are specially designed to meet the needs of customers in different market segments.

Preforms are manufactured from resin, so they are called PET performs.

Preform weight depends on the end container's desired volume. In this plant weight according to their pack size are as follows:

Pack Size (mL)	Weight (g)
2000	46.70
1000	31.93
750	31.93
500	21.40
400	21.00
250	15.17

Blow Molding

This machine used to manufacture the PET bottles from the Performs. In Line 2, the blow molding machine used is KHS Blow Max 12, made by German. It can produce a maximum of 12 PET bottles in a single cycle. It can produce up to 400 bottles per minute.

Rinser

Here, the new PET bottles are washed by treated water circulated from the top of the bottles, so that they can be free from unwanted particles. Any form of impurity present at the bottle before filling will definitely harm the quality of the drink.

Filler

After all the bottles are rinsed they are sent to the filler to be filled up by the desired beverage. The filler can handle up to approximately 72 bottles on a single cycle in line 2. The whole system is PLC controlled. The filling process is also quite interesting. First, carbon dioxide is poured into the bottle to kick out present Oxygen. Then the beverage is sprinkled from the top of the bottle.

Warmer

After the bottle is filled it needs to be warmed up to at least 26-30 °C. To warm the bottles, they are passed through a chamber of steam and hot water. This makes the bottles free from water droplets outside them. It also increases the hardness of the bottles, so that they can stand even larger pressure.

Labeler

It glues the label on the bottles. Main parts of it are-

1. Glue Drum, 140 °C
2. Glue Roller, 146 °C
3. Cutter Drum, 30 °C

The glue is primarily kept in the glue drum. The glue roller rolls the glue to the bottles. The cutter drum finally cuts the label up to the desired limit.

Date Coding

This machine marks the date code on the shoulder of the bottle.

Shrink Wrapper

It finally wraps the PET bottles. This is done in SMI machines which are imported from Italy. The wrapping is done by the dint of heat. Through heating coils form both sides heat is created inside the SMI chamber. The temperature set inside the chamber is about 182 °C. After the shrink wrapping is done the package is ready for shipping.

Important Note:

a. Every type of Size of bottle have to change molding (250ml, 500ml, 1lit, & 2lit)

b. For Reduce Over heat use Chiller (Cold Water) to makeup the bottle former cold. Water inlet → Outlet (Overall Heat Exchange)

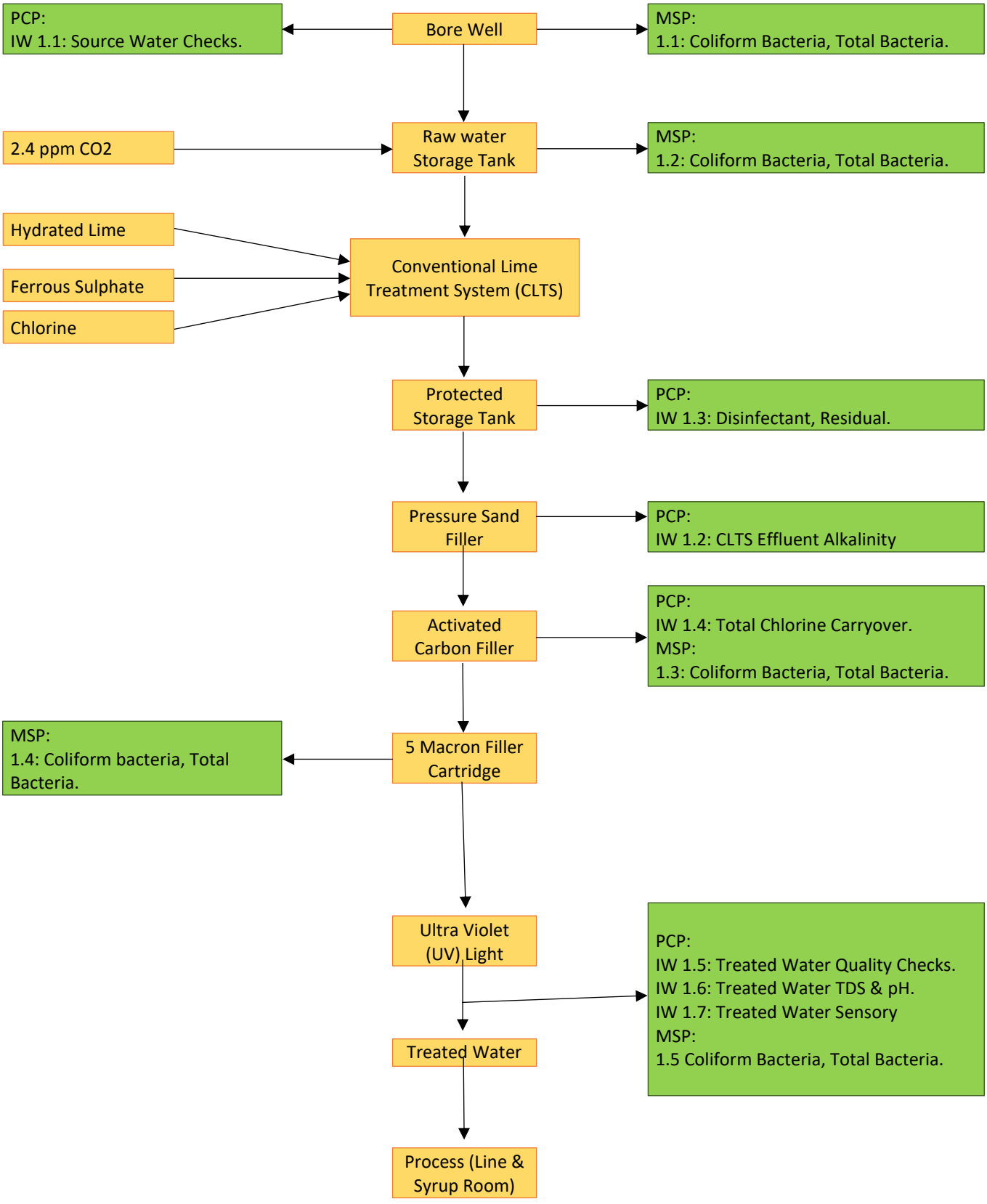
- Transfer Station 3. (Automated Bottle Inspection Section)
- Loading – Unloading Section. (Bottle will unload here from molding section)
- Bottle Discharging Unit. (Final Bottles are discharge from here)
  - Then finally the bottle will Journey to Filling Section through Griper of Air Conveyer Belt.

Some Quality Tests of Bottle

- Bottle Check
- Leg Check
- Bottom Center
- Transparent Check. (Sometimes blemish / cloudy seen show due to the poor quality of Resins)
- Colour Tests. (Test from Reference Colour – Deep/lite color preferable)

WATER TREATMENT PLANT PROCESS

Flow Diagram for Water Treatment Plant



PH Adjustment:

NORMALY TREATED WATER PH HIGH IT ADJUST BY ACID DOSSING (BY H3PO4). (DRINKING WATER PH LIMIT 6.4 TO 7.4).

Ozonation:

Ozone is a molecule that consists of three oxygen atoms (O3), with a negative and a positive electric charge. The ozone molecule is very unstable and has a short half-life. Therefore, it will decay after some time into its original form: oxygen (O2, according reaction presented below)

$$\Delta\ (1300^{\circ}c)$$

$$O2 = O3$$

$$2O3=3O2$$

$$O3=O2+[O]$$

In essence ozone is nothing more than oxygen (O2), with an extra oxygen atom, formed by an electric high charge an extra oxygen atom. In nature ozone is produced by some chemical reactions.

THEN WATER PASS THROUGH THE OZONE TANK TO KILL PATHOZENIC MICRO-ORGANISM

UV Radiation:

WATER PASS THROUGH THE VU LIGHT TO KILL RESIDUAL MICROORGANISM AND RESIDUAL ODOR OF OZONE.

Reverse Osmosis + Softener Plant Process

1. Deep Well Water through pump
2. Reserve Tank, 1-3ppm of CL [CCP_1]
3. Iron Removal Chamber / Plant
    a. [Mn, Stone, Mn (sand) = It used for iron collect (as media)]
4. Hardness Removal Plant
    a. Resin Cation (+) & Anion (-)
    b. Regeneration process also done in this section (NaCl)
5. Sand Filter
    a. Different Size sand are settle down for secondary level of filtrations.
6. Carbon Filter

a. Carbon granular mainly used for tertiary filtration, Remove Chlorine, which uses in the reserve tank for the removal of iron. Moreover, others uses like bad smell remove, different ion remove.

7. Polisher Filter

    a. 5 micron = 24 pieces of membranes.

8. Dosing pump

    a. [NaOH = 4%] For the purpose of pH control to maintain it in 6.5 ≅ 7. [Antiscalant dosing = 6ppm] For the purpose of descaling, known as descalant.

9. UV Filtration (water passes through UV-light)

10. Membrane filter (RO plant) 0.0001 micron

    a. In total 5 membranes = 3 membrane uses for the main filtration, after this filtration waste water will go to another 2 filter to the final level of filtration, after that waste water will wash out by pipe.

11. Through flow meter, pump the treated water store in reserve tank/storage tank. [In the storage tank or water reserve tank there also have a filter which filter the air which is enter this tank for ensure to free from air microbes' contaminations]

12. From the Storage tank, the water will journey to syrup making plant, CIP section, Biscuit dough mixing units and other industrial uses sections.

13. **[N.B:** After treatment, the water through Reverse Osmosis Processes Final water can get 60-70% depending on the performance on the membrane, and others are wastewater 30-40% that will not release in nature, by this water expert use it for clear/washing the surface of the production area and washrooms works.]

CO_2 Plant Process

Introduction to CO_2 manufacturing plant & Cooling Plant. In this plant, CO_2 produced 500 kg/hr. and the CO_2 tank capacity is 50,000 kg. The whole CO_2 plant process is given as follows:

Flow Diagram for CO2 Plant

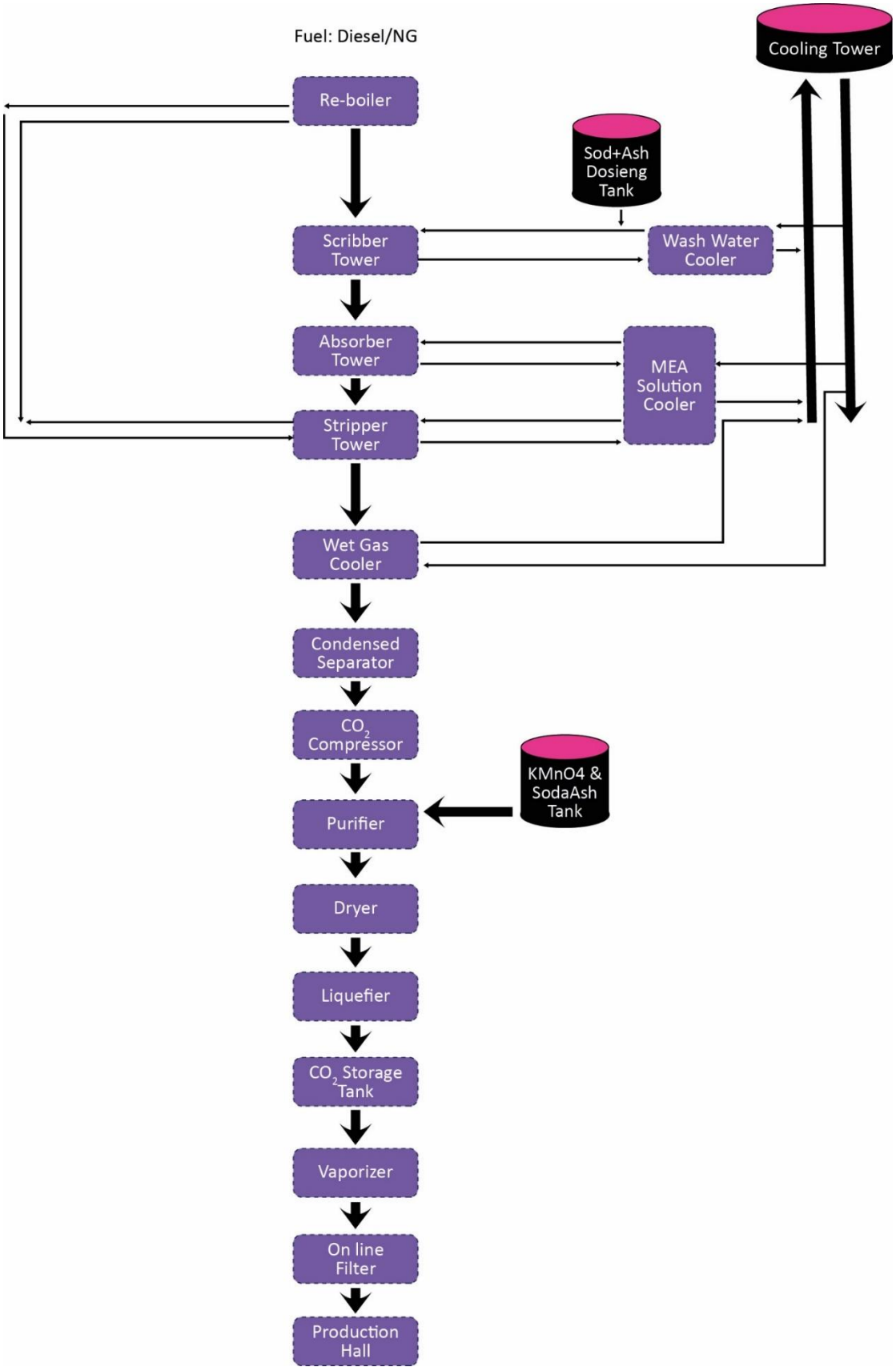


Fig: Flow Diagram of CO_2 Plant

Components of CO_2 Plant

1. Reactivator
2. Scrubber
3. Absorber 1, 2
4. Heat Exchanger
5. Stripper
6. Gas Cooler
7. Condensate Separator
8. Purifier
9. Compressor - Condensate Separator
10. Drier
11. Carbon Filter
12. Liquefier
13. Storage Tank + Re Liquefier
14. Vaporizer
15. Pressure Reducer
16. Silica Gel + Carbon Filter

Operation

In the Reactivator MEA (Monoethenol Amine) solution is burnt. Due to the burn a flue gas is produced where 12-15% is Carbon dioxide. If we use diesel as the fuel then the yield is 15%, if we use gas then the yield is 12%. To burn the MEA solution in the Reactivator we have to take

1) MEA Solution
2) Copper Carbonate
3) Anti-Foam
4) Soda Ash
5) Water

The flue gas from reactivator is passed to the Scrubber where it is washed by water. The water cools the flue gas also. The flue gas then goes to Absorber 1 & 2 and becomes rich in Carbon dioxide. From Absorber 2, the rich solution goes to PHE where it gains heat from the weak solution. Then it goes to Stripper and Carbon dioxide is released from the solution. The weak solution then goes to Cooler 1 & 2 through PHE to become cooled. From the Cooler, the weak solution is driven to Absorber 1 & 2 to become rich. The Carbon dioxide gas produced is passed through Gas Cooler, Carbon Filter, and Purifier. In the purifier, the gas is purified by $KMnO_4$ and Soda Ash. Then it passes through Condensate Separator. It is compressed in 3 different steps. Then it is dried, Carbon filtered and liquefied and stored in the storage tank. Before use of Carbon dioxide gas, the stored liquid is vaporized, pressure reduced and passed through Silica Gel and Carbon Filter. Then we can use the fresh Carbon dioxide gas for drinks production.

Function:

1) Air Blower (Collect O2 from the environments) + CH4 will add (collect from cooking fuel line gas)
2) Then Burn in Boiler. i.g. Burner (temp. 250°c).
3) Flue gas: CO_2 + H_2O, these are produce after boiled. It'll go then Scrubber tower where the temperature will be 200-220^{O}C.
4) Exhauster: Now, The flue gas (CO_2 + H_2O) will transfer into a tower (exhauster) for wash the flue gas through RO water. Purposes; - a) H_2O Separation, b) Decrease of temperature into 50 -60^{O}C.
5) Absorber tower 1: Valve open and the separated flue gas (CO_2) will transfer this tower, here MEA Solution will Absorb CO_2. One more thing is that some other gases present with flue gas (CO_2) will be eliminated and free to the environment. The MEA Sol^{n} then absorb CO_2 is called as RICH MEA, which temp. Stay 55 - 60^{O}C.
    a. [N.B] MEA Sol^{n} come from another tank where this Sol^{n} made =(MEA + Soda Ash + Antifoam oil + RO water will makes and made a sol^{n})
6) Absorber tower 2: (Lean MEA turns to Rich MEA) Lean MEA comes from Boiler (114^{O}C) to this tower through Regenerator (48^{O}C) by Rich pump.
7) Regenerator: Rich MEA will go to NOX Flash Tower.

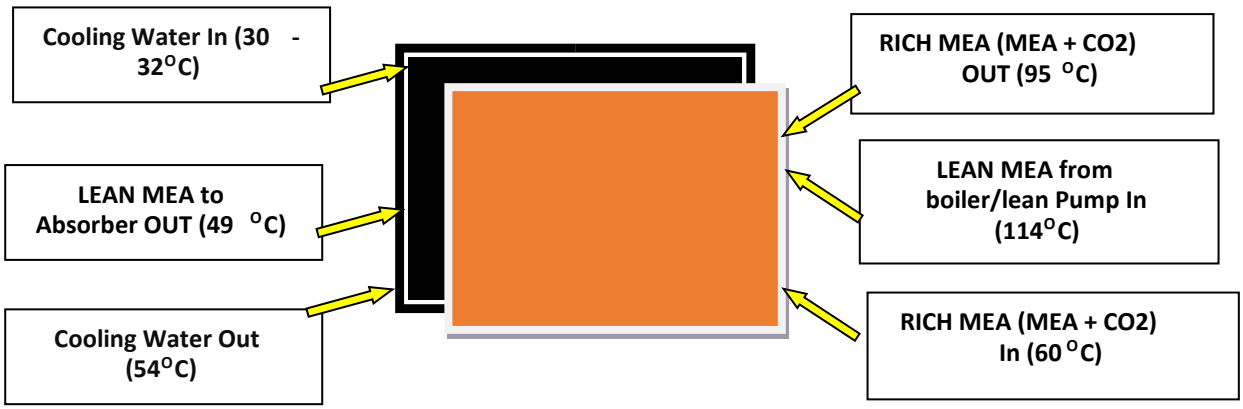


Figure 2 Plate Heat Exchanger

8) NOX flask tower /column: Through Regenerator Rich MEA in the absorber come to this tower. Functions: NO, N2, O2 □ Preheated Elimination. Then Rich MEA will transfer to Stripper tower through Pump (NOX flask pump).
9) Stripper tower: This tower works for breaking RICH MEA means through the steam/heat of boiler CO2 separate from MEA Soln. The Separation of CO2 from RICH MEA is called as LEAN MEA. LEAN MEA will go to boiler again from the Stripper Tower.

10) [N.B] (CO2 separate from MEA) – Heat from burner/boiler. Because MEA tolerate/ready to absorb CO2 in low temperature, in case of High temperature MEA will separate CO2 from its bonding.

The Main Cycle of LEAN MEA to RICH MEA making is:

Boiler (LEAN MEA) Regenerator → Absorber (RICH MEA) → Regenerator → NOX Flash Tower → Stipper Tower → Boiler.

11) Gas Cooler: CO2 from stripper tower transfer to Gas Cooler and here cools the gas by RO Water.

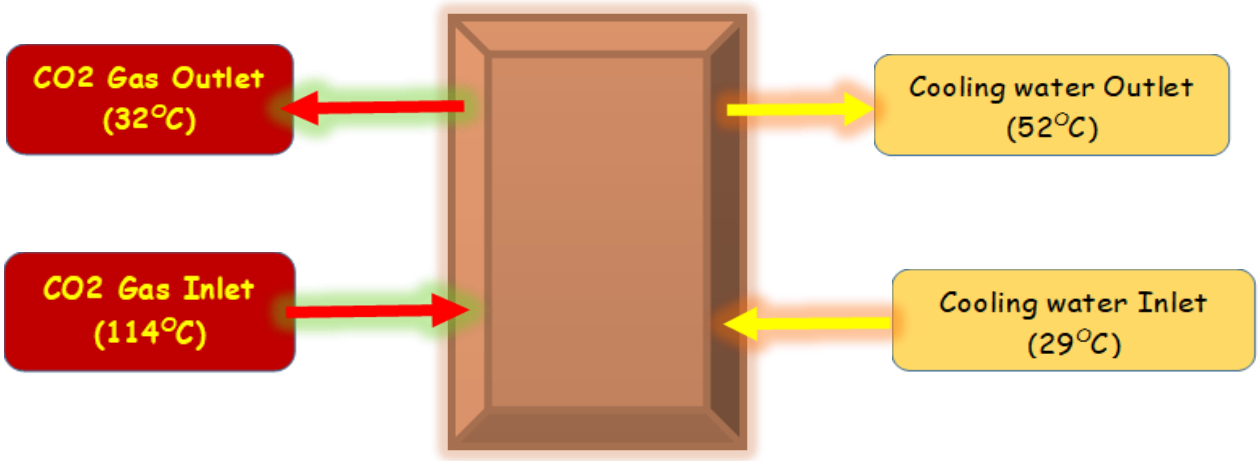
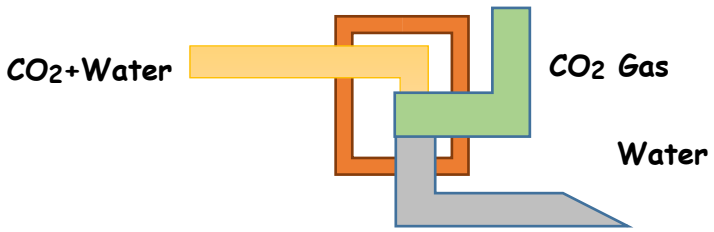


Figure 3 Plate Heat Exchanger

12) Gas Separator: Here Gas Separator works for separate exiting H_2O water from CO_2 gas.



13) After Scrubber: Here wash the CO_2 gas by RO water so that the smell of MEA gas can remove. After that the CO_2 gas will go to Gas Compressor.

14) CO_2 gas Compressor: Here high pressure use to access water remove present in the gas. Pressure:

40m bar 1st stage 3.0 bar

3bar 2nd stage 16.0 bar

15) Dehydrator/dryer: After compressor gas will travel into a section named CO_2 dehydrator/dryer for proper remove of moisture from the gas. Here the temperature is use at 45°c to 46°c. This sections have two working strategy;- One is Operation(which is work as for dehydration for 8 hours), another is Regeneration(which is ready for next 8 hours after operation).

16) Carbon Filter: After the removal of moisture. In this section QC officer/checker will check the Purity of CO_2. Purposes: A) Bad Smell, B) Purity control.

17) Reboiler: Reboiler mainly act as exchanging of heat which works to **generate the vapor supplied to the bottom tray of a distillation column**. In this section, Normal temperature of CO2 will transfer into extremely low temperature. (Here temp. will 46^{O}C gas convert into -16^{O}C) (This -16^{O}C will placed into CO_2 condenser)

18) CO2 Condenser: Here Cooling the CO2 gas for converting Liquid CO2. (Freon + Oil) = Freon Gas use for CO_2 Condenser. CO_2 Condenser working Cycle: Freon Gas Compressor Oil Separator (94^{O}C) Condenser (6^{O}C – 20^{O}C) by cooling water Receiver (Store here) Filter (Freon gas Filter) CO2 Condenser / evaporator Freon gas Compressor.

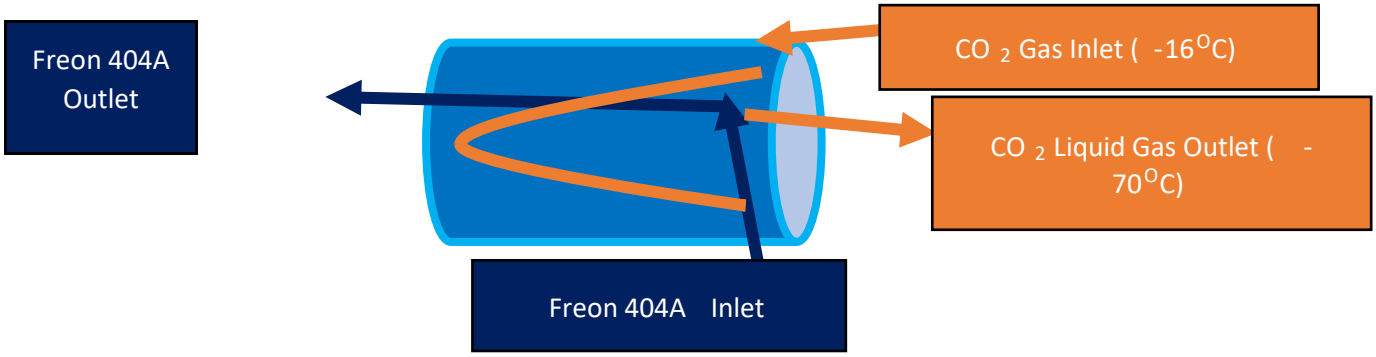


Figure 4 CO2 Condenser

19) Distillation column/distribution gas CO_2: Completing Condensing Liquid CO2 will come this section to stay for some time stay and then transfer to Thermal Transfer Tank.

20) Thermal Transfer tank: From this section $CO_{2(L)}$ will go to Storage Tank.

21) Storage tank: Here $CO_{2(L)}$ will Stock. (30 ton stock)

22) CO2 vaporizer: For Demand of the production of beverages the demanded amount of $CO_{2(L)}$ will be converted to gas and supply.

Finally Distributed for Beverage Production & Other sections (fermentation room etc.)

■ QUALITY CONTROL DEPARTMENT

The whole QC Department is monetarized by a term called **3D Quality**.

1. **Food Safety**
2. **Plant Quality**
3. **Trade Quality**

Food Safety

There are six components under food safety.

1. Bottled Water
2. Ingredient Water
3. Foreign Matter
4. RGB Bottle Washer Program
5. Critical Packaging Defects
6. AIBI Audit

Key points of personnel hygiene

1. Avoid cleanrooms when ill
2. Frequent bathing and shampooing
3. Avoid getting sunburned
4. Avoid cosmetics such as face powder, hair sprays, perfumes and aftershave
5. Clothing should be clean, no frayed and nonbinding
6. Avoid smoking & drinking

Plant Quality

There are four components under plant quality.

1. Physio
2. Micro
3. Ingredient Water
4. Quality Audit System

Trade Quality

There are four components under trade quality.

1. Sensory
2. Package Appearance
3. Torque
4. Technical Self Life

3D Quality is measured by some scores and colors

Plant Quality & Trade Quality		Food Safety	
Blue	97.5 – 100	Blue	≥ 900
Green	89.5 – 97.4	Green	700 – 899
Yellow	79.4 – 89.4	Red	< 700
Red	< 79.5		

Effluent Treatment Plant

Daily Quality Test Log

Location	Test Parameter	Test Result	Operation Limit
Aeration Tank	Temperature (°C)	29.9°	Max. (35°C)
	PH	7.60	7.0 to 8.0
	DO (ppm)	3.2	Min. 0.5 (ppm)
	MLSS (ppm)	1320	1200-1800 (ppm)
	MLSS (%)	50%	40% -60%
	Food to Microorganism (F/M) Ratio	0.10%	Max. 0.15
	Sludge Volume Index (SVI) L	109	80-120
Location	Test Parameter	Test Result	DOE Limit
Untreated Effluent (Inlet)	Temperature (°C)	31.7°	NA
	pH	8.68	NA
	DO (ppm)	2.2	NA
	COD (ppm)	592	NA
	BOD (ppm)	144	NA
	TDS (ppm)	710	NA
Treated Effluent (Outlet)	Temperature (°C)	30.8°	Max. (35°C)
	pH	7.65	06 to 09
	DO (ppm)	6.5	Min. 4.5 (ppm)

	COD (ppm)	72	Max. 200 (ppm)
	BOD (ppm)		Max. 50 (ppm)
	TDS (ppm)	387	Max. 2100 (ppm)
	TSS (ppm)	29	Max. 100 (ppm)
	Water Clarity	ok	Almost Clear

■ QUALITY CONTROL & ACTIVITIES

Quality development quality maintenance and quality improvement in the various departments of design and manufacturing, for achieving the twin objectives of: Economical production and customer satisfaction.

Quality Assurance

- Critical control point identification/sampling program.
- In-process analysis, records and reporting packaging specifications.
- Label specifications.
- Cleaning and sanitizing program.
- Good manufacturing practices (GMP) requirements.
- Recall program.
- Warehousing, shipping and receiving program.
- Laboratory analysis.
- Gross level inspection Farm to Fork like Field / land visiting,
- Third party production area visiting

➔ As part of quality control, a four-stage process is followed-

RM (Raw Material); PM (Packaging Material); In Process Product; Finished product

■ RAW MATERIALS DEPARTMENT

Some color codes are used for several equipment's according to different departments.

There are two kind of Delivery System:

1. **FIFO** (First in First Out)
2. **FEFO** (First Expire First Out)

Consumers under this department are:

1. QC Department &
2. Production Department

Storage Capacity:

Sugar: 140 Tons

Beverages: Approximately 5580 Unit

Preforms: 40.5 lacks

Critical Raw Materials: Sulphuric Acid (H_2SO_4), Hydrochloric Acid (HCl), Caustic Soda (NaOH).

Soft Drinks Raw Materials

- ✓ Sugar
- ✓ Orange Flavour
- ✓ Lemon Flavour (Clear)
- ✓ Mixed Fruit Flavour (T)
- ✓ Citrus Powder Mix Flavour
- ✓ Citrus Powder Dubai
- ✓ Citrus Powder Qatar
- ✓ Cola Acid Flavour
- ✓ Cola – F- Flavour
- ✓ Sodium Benzoate
- ✓ Citric acid (Anhydrous)
- ✓ Sodium Citrate
- ✓ Caffeine Anhydrous
- ✓ Filter Aid
- ✓ Lisapol (Conveyer Lubricant)
- ✓ Common Salt.
- ✓ Inositol
- ✓ Maltodextrin
- ✓ Tartaric Acid
- ✓ Malic Acid
- ✓ Potassium Permanganate

■ SYRUP MAKING

➔ Agitations (Mixing)

Pasteurization (80-82oC for 10 minutes) →CCP-2

➔ Filter Press / bed→CCP-3

Filter Aid make filter bed. <5 bar (range 1-5 bar) [1bar = 14.5 psi]. Activated Carbon (Optional)

➔ Cooling Section

Called Cooling Tower, water come from Chiller.

Inlet Temp. of Syrup 80-82OC

Inlet Temp. of Chiller Water 5OC Outlet Temp. of Syrup 55-60OC Outlet Temp. of Chiller Water 20OC

➔ Syrup Holding Tank

Wait for temperature falling (<25OC), Beverages Bases (The Final All Chemicals Mixing & Agitate here)

➔ Final Syrup Tank

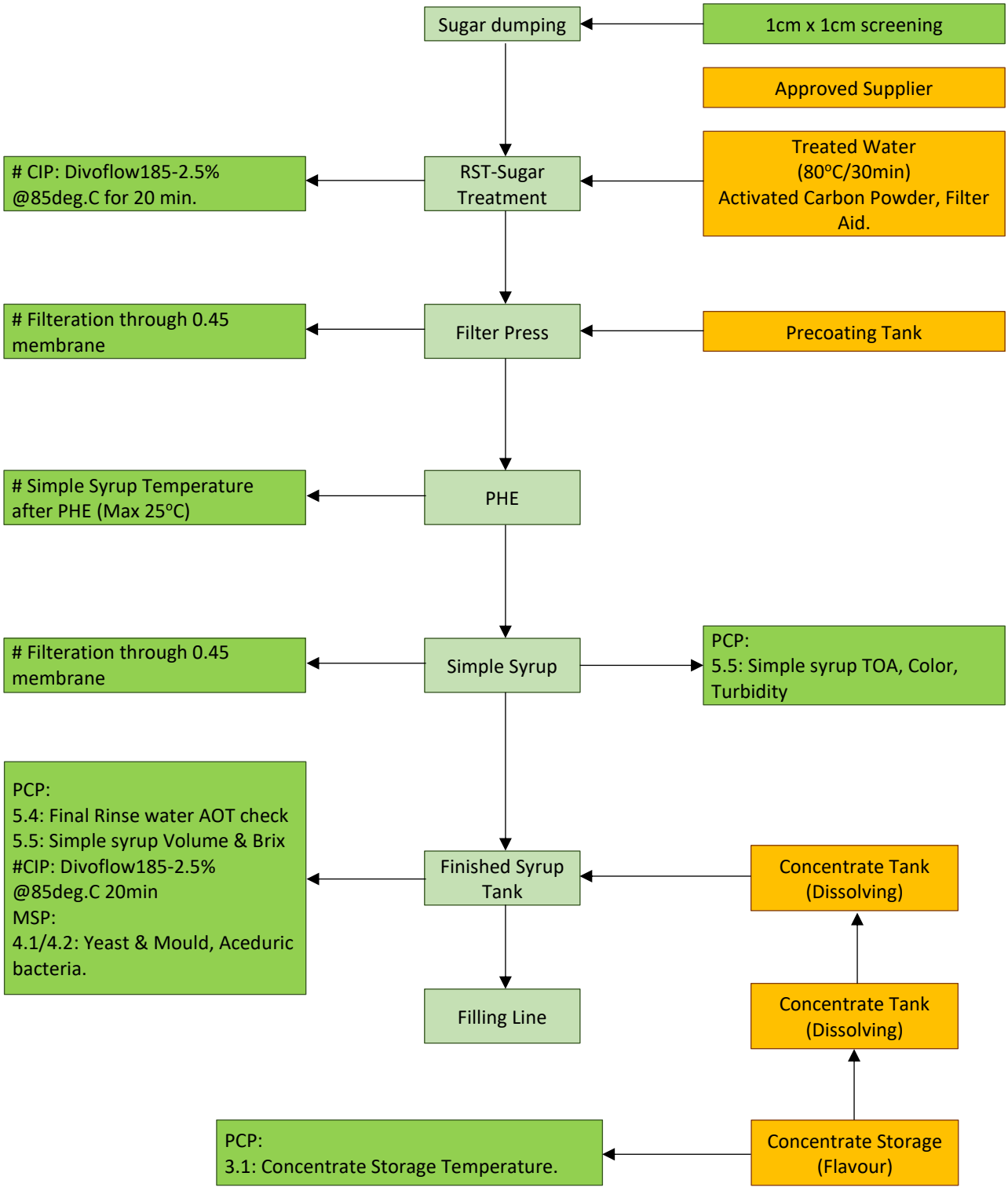
Syrups + Treated Water (if need) + CO2

➔ Proportioning

KMH Paramix Machine doses of Chemical Syrup & CO2 in proportionate rate by the set of QC Manager / operators.

➔ Filling Section

Flow Diagram for Syrup Preparation (CSD)



Equipment List of Syrup Room (CSD)

Sl. No.	Name of Equipment	Capacity	Origin
1	CIP Treated Water Tank	5 KL	Tech Long, China
2	CIP DF-185 Tank	5 KL	Tech Long, China
3	CIP Hot Water Tank	5 KL	Tech Long, China
4	Raw Syrup Tank-01	12 KL	Tech Long, China
5	Raw Syrup Tank-02	12 KL	Tech Long, China
6	Hot Water Storage Tank	15 KL	Tech Long, China
7	Finished Syrup Tank-01	15 KL	Tech Long, China
8	Finished Syrup Tank-02	15 KL	Tech Long, China
9	Finished Syrup Tank-03	15 KL	Tech Long, China
10	Finished Syrup Tank-04	15 KL	Tech Long, China
11	Finished Syrup Tank-05	15 KL	Tech Long, China
12	Finished Syrup Tank-06	15 KL	Tech Long, China
13	Finished Syrup Tank-07	15 KL	Tech Long, China
14	Finished Syrup Tank-08	15 KL	Tech Long, China
15	Flavour Tank-01	500 L	Tech Long, China
16	Flavour Tank-02	50 L	Tech Long, China
17	Precoat Tank	400 L	Tech Long, China.
18	Filter Press-01	54 Plate, adjustable	Unipac Machines Pvt. Ltd. India
19	Filter Press-02	45 Plate	Tech Long, China

■ PRODUCTION

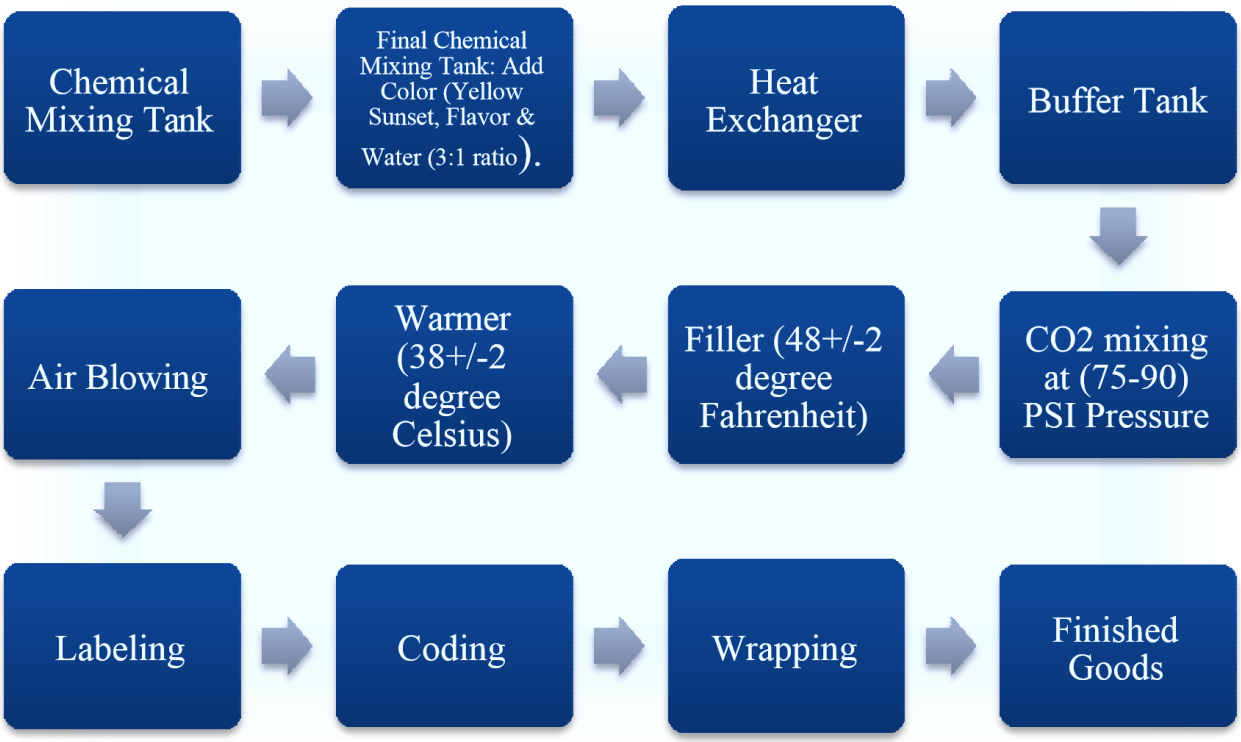
Production Deals with everything in the related to industry. Like:

- ✓ Packaging Materials.
- ✓ Raw Materials
- ✓ Man Power
- ✓ Delivery / Shipping
- ✓ Store
- ✓ Machinery, Power Distribution.
- ✓ Daily Wastage information
- ✓ All Materials Information
- ✓ Market Complaints Handling (Inspection, Controlling measure)
- ✓ Recall (Batch, date and time of Production)

Others related issues + Quality Control

- Manually make base volume
- Manually weighting
- Store
- Production department control.
- Market demand analysis
- Process Control
- Accounts the demand of materials need, Found, how much use etc.
- Net Count – Net Demand balance – Waste management.
- Recycling
- Non-conforming.

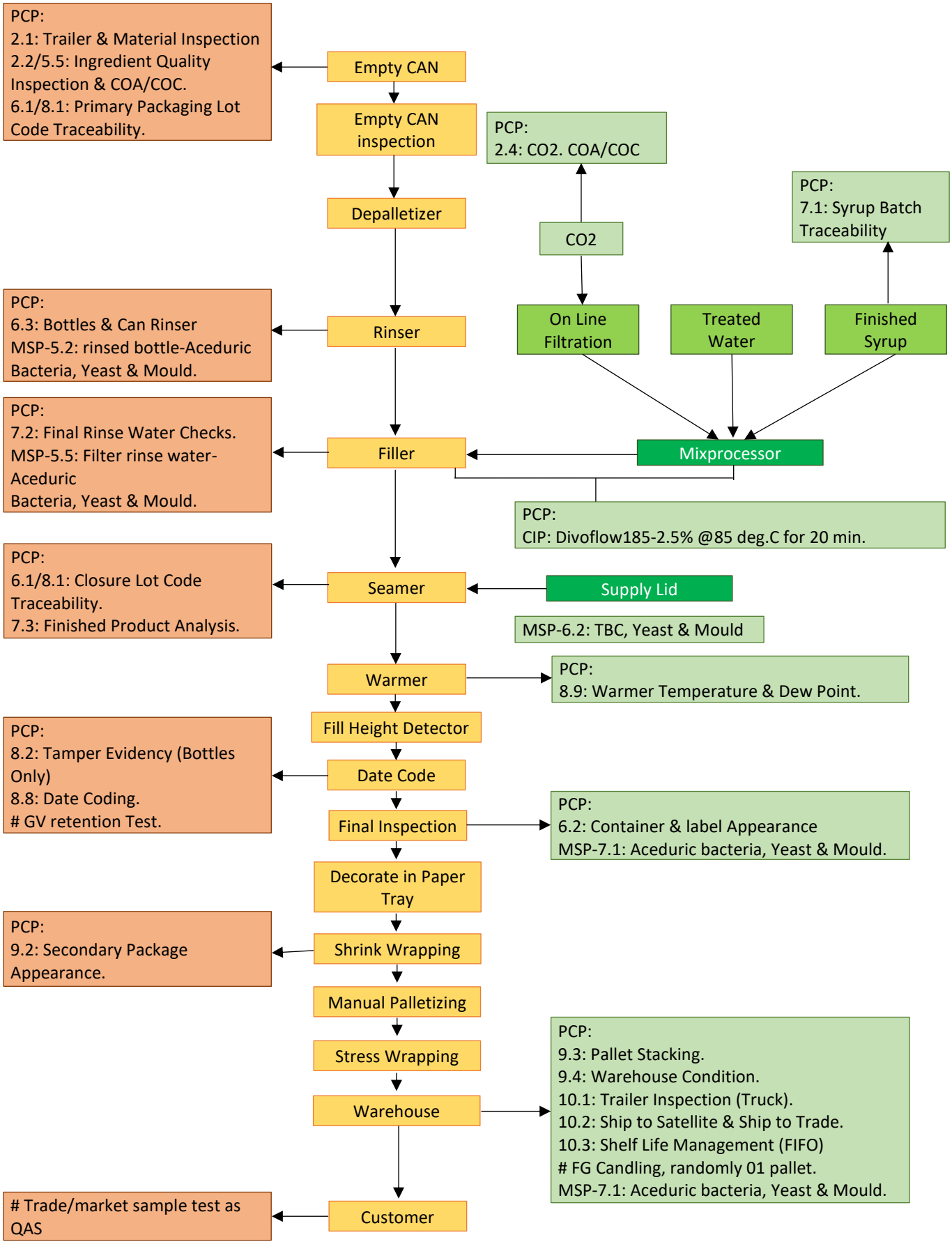
MANUFACTURING PROCESS OF CARBONATED SOFT DRINKS



1. **Chemical Mixing Tank**: All the ingredients except Food Color, Flavor are mixes before stored in Final dissolve tank.
2. **Final Chemical Mixing Tank**: Add Food color (256 gram) & Energy flavor (22 liter) along with sugar syrup 61 degree brix of sugar syrup & water to produces 8000 liter batches of Power Energy drink.
3. **Heat Exchanger:** When product is ready for the further process it passes the heat exchanger at 85+/-2 degree Celsius.
4. **Buffer Tank:** Buffer Tank removes the temperature of the products which passes the heat exchanger & helps stabilize the return water temperature.
5. **Carbon Dioxide Mixing:** Carbon dioxide mixes with product before filling process of the product, Carbon dioxide mixes at (75-90) PSI pressure to maintain gas volume of 4.4 PSI.
6. **Filler:** Filling of Carbonated drinks is done at 48+/-2 degree Fahrenheit, temperature of the products decreases due carbonation process.
7. **Warmer:** Products are warmed at 38+/-2 degree Celsius to retain the room temperature of the products.

8. **Air blower:** Air blowing is done for the purpose of remove the moisture from outside of the product.
9. **Labeling:** Labeling is done with brand name, company names details, nutrients content of the products & other specification.
10. **Coding:** Coding is done according to its date of manufactured & date of expired with product code.
11. **Wrapping:** Wrapping is done with products that are ready to store or distribute. 12 pieces or 24 pieces of Beverages are wrapped together. 12. **Finished Goods:** Products are ready to stored & distributed in the market.

Flow Diagram for Line #01 (CAN)



■ PACKAGING PROCESS

Product in the Wrapping machine:

- ➔ Separator
- ➔ Top-tray (paper/cartoon)
- ➔ Liberator
- ➔ Glue (4 side 4 times) – (Glue from glue pump)
- ➔ Folding
- ➔ Simpling
- ➔ Oven
- ➔ Cylinder (Folding)
- ➔ Blower (cold Air Fan)
- ➔ Collect & Store

■ STORE & SHIPPING (DELIVERY)

For Store:

- ➔ FIFO
- ➔ Temperature
- ➔ Relative Humidity
- ➔ Store Materials
- ➔ Delivery Store
- ➔ Product Store
- ➔ Maintenance Store
- ➔ Machinery
- ➔ Electric/automated
- ➔ Other's part.
- ➔ ISO Standard.
- ➔ Audit Info/copy/directions.

For Delivery:

➔ Production Flow (Market requisition to handover)

➔ Packaging

➔ Delivery Section

➔ Register Maintain (Batch wise)

➔ Transfer Corporate Office (head office)

➔ Delivery transfer

➔ Stock Register Maintain

➔ Floor Stock

Figure: Storage of finished goods.

■ CLEAN IN PLACE (C.I.P)

The Cleaning process follow to wash the tanks, machine online/instant/inline by selected chemical and water is called as CIP.

➔ Different Tanks store usually chemical, hot & cold water in another room.

➔ CIP can be 3, 5 & 7 steps. Usually, they are mainly following 3 or 5 steps with vary with their product and machinery systems.

If we focus on 5 steps, it will;-

1. Fresh water flow (room temp. for 5 – 10 minutes)
2. Hot water flow (65-70OC for 5 – 10 minutes)
3. Caustic Soda 1.5% + Hot Water 80 – 85OC for 30 minutes flow through pump and alert all the sections (pipe) are flashed through it.
4. Hot Water flow 65 – 70OC for 5 – 10 minutes.
5. Fresh water for 25OC for 5 – 10 minutes.

■ STANDARD OPERATION PROCESS

BEVERAGE PREPARATION

- Set SIPART Ratio Controller in Automatic Operating condition.
- Bypass CO2 pressure for doing Preparation, in service menu.
- Open 1st Regulating valve by 3/ 4 turns.
- Close 2nd Regulating valve such as you get flow below 11.0 kl flow.
- When water overflow is seen from CO2 drain line, press OVER FLOW button on touch panel.
- Machine will stop, hooter will trigger.
- Don't touch any button until you get READY lamp on touch panel.
- Open CO2 line.
- Drain complete water, then you will get READY lamp on touch panel.
- If you stop in between the preparation, or power fails, you need to drain Buffer tank half and re-start preparation process.
- A main reason for doing this preparation correctly is to ensure that all air available in Buffer tank and lines are removed and replaced with water and CO2. So that foaming can be eliminated.

PRODUCTION START UP

Cross check SIPART Ratio Controller in Automatic Operating condition.

- Set Brix set point value on SIPART Controller.
- Keep set point 15-25 points higher initially and then reduce to normal factor after 5-10 minutes operation and flushing.
- Remove CO2 Bypass / select Monitoring from Service page.
- Ensure that Syrup Pump is in AUTO mode.
- Ensure that Syrup line manual valve is about 30-35% open. Such a way that during normal production, Syrup valve opening percentage shown on SIPART controller is around 25-35%.
- 2nd valve: This valve is for adjusting Product flow only. If product flow is less than required, open the valve. If high, close the valve. Valve must be operated slowly.
- 3rd valve: This valve is for adjusting CO2 Flow only. Normally this valve is kept fully open.
- 1st valve: This valve is for adjusting Product Pressure. Product pressure is required to keep 0.1 to 0.5 bar less than CO2 Pressure. All these pressures are shown on touch panel. If you see foaming below this valve, need to slowly close this valve. CO2 Flow is also controlled by this

valve. If CO2 flow is less, open this valve. If CO2 flow is high, close this valve. If pressure difference is too high, you get foaming and if too low, you do not get desired gas volume.

- If there is no foaming and still CO2 flow is high, then CO2 flow can be reduced by 3rd valve.
- During Regular production, vacuum should be above 500mBar.

END OF PRODUCTION

- At the end of production, when syrup is finished in Syrup supply tank in syrup room, when all syrup is transferred to machine, observe the level of syrup tank in mixing machine.
- When Maximum light goes off, pause the machine by pressing Stop button once.
- Press PRODUCTION END button. Keep it pressed.
- During this, even if syrup tank gets empty, hooter will blow, machine will not stop. It will keep on consuming all syrup even after tank is empty.
- You can see on SIPART controller that syrup flow is now zero. Thereafter also, keep running for 20-30 seconds. So that, all product available in the pipes are being pushed in to buffer tank by water.

Standard Operating Practices For Co-agulation Tank

Operating Flow Rate	50 m^2/hr
CHEMICAL PREPARATION & DOSING	• Ensure Purity (COA) • Prepare solution by accurate weighing & volume measurements. • Check dosage every 2 hours. • Flush system every 2 hours or whenever system is stopped.
CHEMICAL CONTROL	• Check at Tap-2 every 4 hours for P, M & free chlorine. Maintain 2 P-M>7, free chlorine 6-8 ppm. • Check at Tap-3 every 4 hours for P, M & free chlorine. Maintain 2 P-M-+ 4 to +10. • Check at Tap-4 every 4 hours for P, M & free chlorine. Maintain 2 P-M-+ 4 to +10 & free chlorine 6-8 ppm. Turbidity < 15 NTU.

FLOC CONTROL (T be done with system in operation)	• Check at Tap-1 every 8 hours. • Allow tap to drain for 1 minute. • Collect 500 ml from Tap-1 in a mixing cylinder & mix thoroughly. ID. • Allow settling & observe floc texture & settling characteristics. • After 30 minutes measure floc percentage. • Floc % should be maintained 12-20%. • When more than 20% drain. Sludge for 1 minute.
MECHANICAL	• Check & maintain oil levels in gear boxes once in 8 hours. • Check for unusual sounds.

CLEANING & PAINTING	• Once in 3 years drain the tank, clean & repaint the inside of the tank. • At this time inspect the scraper mechanism & other internals. Repair if necessary.

Standard Operating Practices For Pressure Sand Filter

Water Treatment Plant – Line: 01 (CAN)

BACKWASH	• **Procedure** **8.** Stop backwash, close backwash valves. **9.** Rinse for 10 minutes. **10.** Check Turbidity.
SANITATION	• Once in a month shock chlorinate to 100 ppm free chlorine & hold over night.

	• After overnight holding backwash & rinse as usual.
PAINTING & SAND REPLACEMENT	• Once in 3 years empty the vessel. • Redo the internal painting. • Check strainers. Replace if necessary. • Under media may be washed & reused. • Replace sand (16-32 mesh) media.

SOP for Shrink Wrapper Machine – Line: 01 (CAN)

Start:

1. Keep Air Pressure 6 Bar.
2. Electric supply (Main power) "ON".
3. Oven Tunnel "ON"
4. Heater "ON"
5. Keep Oven Temperature (185-190) "C.
6. Cutting Bar 70 micro-sec.
7. Selector Auto.
8. Pusher "ON".
9. Operation "ON".
10. Outside fan "ON".

Stop /Close:

1. Air Pressure "OFF"
2. Selector "OFF"
3. Heater "OFF"
4. When Oven Temperature down to 100°C, "OFF" Oven Breaker.
5. Main breaker "OFF".

Standard Operating Practices for Raw Water Tank

CHLORINATION	• Maintain free chlorine level 3-4 ppm. • Check every 8 hours.
OPERATING LEVEL	• Operate at higher levels of storage to prevent contamination & provide higher contact time.
RAW WATER ANALYSIS	• Frequency-8 Hours • Check & record. Total alkalinity, total hardness, total dissolved solids, pH & free chlorine.
CLEANING & SHOCK CHLORINATION	• Frequency-6 Months • Empty the tank & clean manually. • Swab walls & roof with 50 ppm chlorine. • Fill tank with 100 ppm chlorinated water & hold over night. • Drain & fill with 3-4 ppm chlorination.

SOP: RAPID MIXER (L-1)

SANITATION

- Set SIPART Ratio Controller in Manual 100% Opening condition. By this, you are opening Syrup Control Valve 100% for better cleaning.
- Release Vacuum from Touch Panel. (About 15 seconds)
- Close CO2 supply line main valve. (Manual Valve)
- Fully Open 3rd Regulating valve below operating panel. (CO2 flow control valve)
- Fully Close 1st Regulating valve below operating panel and then open ½ thread only. (Pressure difference control valve)
- Half Open (Open so as to get desired flow) 2nd Regulating valve below operating panel. (Flow control valve).
- Press CIP button.
- When P3 and P4 starts, CIP flow will start. This time, set CIP flow by 2nd Regulating valve only. Don't touch any other valves.
- During CIP, CO2 rota-meter must fluctuate up-down. This is normal.

- During every 30 seconds, CIP liquid should drain from CO2 drain line for about 10 seconds. It will happen automatically. You must see and ensure this initially.

■ QUALITY CONTROL (LAB)

1. **Brix Test:** The brix range of value is between 10 to 12.

Figure: brix test

2. **pH Test:** pH test is done by pH meter (HI2211PH/ORP Meter)

Figure: pH test

3. **TDS Test:** TDS (Total Dissolved Solid) test is done by TDS meter (CON700)

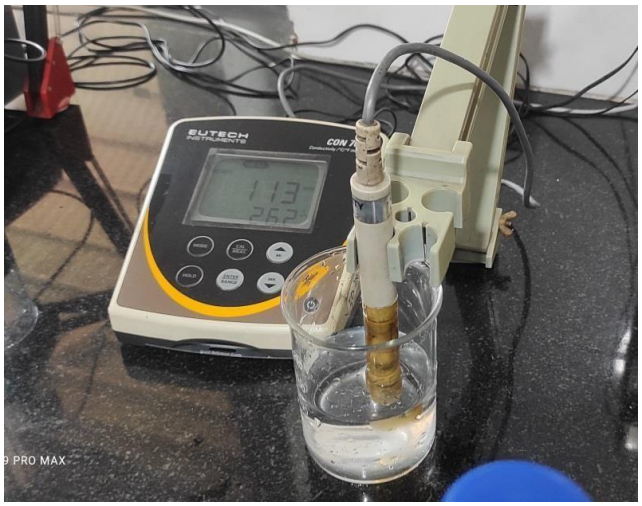


Figure: TDS Test

4. **Hardness Test:** Hardness test is done with Ammonium Buffer, EBT & EDTA solution.

PROCEDURE ARE GIVEN BELOW:

I. Take 2-3 drops of ammonium buffer with 100 ml of sample it.

II. Add 1-2 drop of EBT solution with it.

III. Titrate the solution with EDTA solution until sample being changes color to pink.

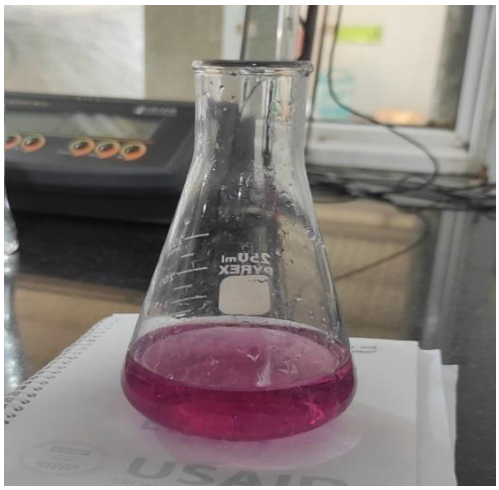


Figure: Hardness Test

5. **Chlorine Test:** Iron test is done by mixing Orthotolidine with the sample, a color change (oily or yellow) indicates the presence of Chlorine, No changes in color indicates absence of Chlorine.

Figure: Chlorine Test

6. Iron Test: Iron test is done Spectrophotometer by mixing iron ferrover with the sample in the cuvette & the results shows in the display as MM.

Figure: Iron Test

■ MICROBIOLOGY

9 Safe Practices for Microbiological Lab are:

1. Treat all microorganisms as potential pathogens.
2. Sterilize equipment's and materials. [Autoclave (121^{O}C) for 30 min]
3. Disinfect work areas before and after use.
4. Wash your hands.(IPA, Ethanol)
5. Never pipette by mouth.
6. Do not smoke, drink, eat or store food in the lab.
7. Label everything clearly.
8. Autoclave or disinfect all waste materials.
9. Clean up spills with care.

SOFT DRINKS MEDIA TEST PROCEDURE

Media (Can be solid, semi-solid, browth) Media Preparations

- NA (Nutrient Agar) - 1 ml
- BPW (Buffer Peptone Water) - 1 ml
- TSB (Tryptic Soy broth) - 1 ml
- SDA (Sabouraud dextrose agar) - 1 ml
- MCB (Mac. Conkey Broth) - 1 ml
- EMB (Eosin methylene Blue) - 1 ml

Required Apparatuses:

- ✓ Measuring balance
- ✓ Beaker
- ✓ Conical flask
- ✓ Test tube
- ✓ Hot-water bath
- ✓ Measuring flask
- ✓ Pincers
- ✓ Spatula
- ✓ Inoculation loop
- ✓ Petri dish
- ✓ Autoclave
- ✓ Spreader
- ✓ Micro pipette
- ✓ Laminar air flow
- ✓ Incubator

Reagent used in Gram Staining tests:

- Crystal Violet, the primary stain.
- Iodine, the mordant
- A decolorizer made of acetone and alcohol (95%)
- Safranin, the counterstain.

Procedure of Gram Staining:

1. Take a clean, grease free slide.
2. Prepare the smear of suspension on the clean slide with a loopful of sample.
3. Air dry and heat fix.
4. Crystal violet was poured and kept door about 30 seconds to 1 minutes and rinse with water.

5. Flood the gram's iodine for 1 minute and wash with water.
6. Then, wash with 95% alcohol or acetone for about 10-20 seconds and rinse with water.
7. Add safranin for about 1 minutes and wash with water.
8. Air dry, Blot dry and observe under microscope.

INTERPRETATION

Gram Positive:	**Blue/Purple**
Gram Negative:	**Red color/Pink**

Effluent Treatment Plant Processing Steps

1. Effluent Come from industry waste water, C.I.P water, WTP water and other sources of waste water.
2. In the way of coming water, there have some boxes made by steel/iron with different holes, where the boxes of iron are full of several sizes of stones which mainly applied to remove the solid waste particles.
3. Through an inlet flow meter/pump the exact amount of effluent ($135cm^3$) water will place in the equalization or homogenization tank. Here the aeration (air blow add with this waste water).
4. Pump will bring the water from Equalization tank and place a small tank, where the percentages of (Aqua-Lung + K-alum + Polymer) will add good and proper proportionately.

Aqua-Lung	K-alum	Polymer
120-liter water	120-liter water	120-liter water
6-7kg (Al)	6-7kg	70gm

5. After mixing the Chemicals Shifted to other tank where again air will add by pump because oxygen will react with the organic materials (allow aerobic biodegradation) (remove CO2) dissolved gases. After all ensure proper mixing of chemical dosing.
6. Tube settles tank or main tank where filtered water stay and some filtration also happen there. Here the sludge (effluent) will sedimented and through the pump will dumped into sludge area.

   Filtration=Plastic filter.

7. Then placed into settle tank (Pretreated + coagulated water and some effluent will sedimented here).
8. Through the pump this water will run to the sand filter and carbon filter for last filtration (where systems wise right wash and backwash will happen for efficiency of the tank and treatment).
9. Then the water will journey from filter to reserve tank (here also air will add for increase DO level).
10. From the reserve tank flow meter / pump will flow the water to discharge / outlet chamber. Moreover, go to another chamber to again / last aeration. Then discharge into the field /river/outside.

ETP ISO Standard

Water Quality Parameters	**Unit**	**Standards**
Electro Chemicals	Micro Siemens/cm	Max. 1200
Colour	---	Non objectionable
Suspended Solids	mg/l	Max. 150
pH	--	6.0 – 9.0
TDS	mg/l	Max. 2100
DO	mg/l	4.5 -8.0
BOD	mg/l	Max. 50
COD	mg/l	Max. 200
Oil and grease	mg/l	Max. 10
Toxicity	--	Non-Toxic

CONCLUSION

The beverage market of Bangladesh holds a very big share among all the FMCGs. For many years, Transcom Beverages Ltd (PepsiCo BD) have been exerting their efforts into creating value and a strong position for PepsiCo's beverages in the market of Bangladesh competing with the strongest global brand 'Cola Coal' and other local beverages companies. In 2014, Global company, PepsiCo was the major market share holder like a true competitor to other brands holding 35% market share, following Coca Cola 25%। It is a pleasure for me to work with them. This internship gave me both academic and practical exposure. In this time, I have gained knowledge about the organizational culture and behavior of a prominent consumer product producing organization of the country. This internship also gave me the opportunity to develop a network with the corporate environment.

From now on, I will try to work in a dynamic, modern and target intensive challenging environment where interest and expertise can be found to develop my skill and creativity to build up a successful career in the area of production, quality and relevant fields.