Internship report on:
"Production and quality management of carbonated beverage in AST Beverage ltd. (sub-company of Globe Pharmaceuticals Group of Companies)"

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Date of submission: 22 January 2023

Letter of Transmittal

Date:22.1.23

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Subject: Submission of Internship report

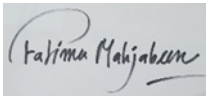
Sir,

I, Fatima Mahjabeen (183-34-814) am very excited and honored to state that I am submitting this internship report as a summary part of the curriculum of the Nutrition and food engineering (NFE) program.

I have arranged all of the information and data centered on my one-and-a-half-month learning experience while interning at "AST Beverage ltd, Shimrail, Shiddhirgonj, Narayanganj. (sub-company of Globe Pharmaceuticals Group of Companies). This report is written with an in-depth explanation of the Internship Training in Product Development & production as well as formulation Activities in AST beverage. I have tried to absorb as many new and important pieces of information as possible to get myself introduced to the actual process of running a beverage production company. This internship was a golden opportunity that helped flourish my knowledge of handling and maintaining tasks related to beverage production and manufacturing. This internship period gave me a taste of how the corporate world operates and how much work and energy are put to run a business.

Hence, I would like to present to you my internship report. Your suggestions and comments will inspire me to be the best version of myself in my career.

Sincerely Yours,



……

Fatima Mahjabeen

Student ID: 183-34-814

Department of Nutrition and Food Engineering, Faculty of Allied Health Sciences, Daffodil International University

Certification of Approval

I'm pleased to declare that the presentation and defense/viva-voice of Fatima Mahjabeen's internship report on **"Production and quality management of carbonated beverage in AST Beverage ltd. (sub-company of Globe Pharmaceuticals Group of Companies)"** have been accepted. The ID for the project report is 183-34-814.

I confirm that the research and findings in the paper are authentic. Regarding future academic guidance and defense/viva-voice, I thoroughly agree with her findings. Fatima is a great individual with strong moral values. It has been a delight to work with her. I wish her the best for the future.

Effat

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Acknowledgments

First and foremost, I would like to thank Allah for blessing me with endless mercy and grace to experience great things in life. And one of those great things happens to be this internship program.

I would like to start this paper summary by expressing gratitude toward every single person that paved the way to create the opportunity I was fortunate enough to experience.

I am extremely grateful to Daffodil international university as well as the Nutrition and Food Engineering department for a great opportunity to have a taste of a potential career in the food manufacturing industry.

This opportunity would not have been accessible to me without the help of my respected professors and supervisors of the NFE department. I would like to express my appreciation to Ms. Fouzia Akter ma'am, the Head of the Department of Nutrition and Food Engineering, for her kind suggestions and encouragement.

To my lovely teacher and supervisor, Ms. Effat Ara Jahan ma'am, I am immensely thankful to you for guiding me through this experience and making me believe that I am skilled enough to complete the tasks related to food production.

I am eternally grateful to Md. Munjurul Azam sir, QC Head and lab manager of AST Beverage Ltd, for having the patience to teach us everything thoroughly. This internship would not have been possible without your encouragement, support, and positive outlook.

I would like to sum up by thanking the whole AST beverage team for making my internship days enjoyable, informational and encouraging. I am more grateful than you will ever know.

Executive summery

I had the golden opportunity to spend 1.5 months at AST beverages Ltd located at Shimrail, Shiddhirgonj, Narayanganj, Bangladesh. I had the opportunity to experience different unit operations, machinery functions, and production cycles related to drinking water production, beverages manufacturing (carbonated soft drink, juice), Water Treatment Plant, PET bottle production Plant, quality control cycles, Microbiological laboratory tests, Reverse Osmosis plant, carbon dioxide production plant. The Globe is a household name for different food products in Bangladesh. On the scale of most popular food production industries, the globe foods and beverage will be on the top 10 list. And because of the popularity of their different beverages globe has created the AST beverage company just to produce the selected most consumed beverages based on popular demand. The globe group of industries initially started os globe pharmaceuticals but as the business flourished new opportunities to branch out. and with that luck and confidence, in 1986 the Globe group joined the domestic foods and beverage market and has been successfully producing numerous food products since and also exporting various kinds of food and beverage articles all over the world. 2002 was the exact year globe launched its official beverage companies and the people of Bangladesh started to see the different interesting, good quality, and affordable beverages on the local markets. And as the popularity of beverage products from the company increased, in 2006 they established AST beverage company to keep up with the demand and production of their most popular beverages. This company currently produces the most popular energy drinks in Bangladesh yet. It was delightful to be able to observe every step of the production line from purifying the water to packing the final bottles of refreshing drinks.

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Chapter 1

Introduction

Globe Soft Drinks Limited

In 2002, with a vision and a strong plan, Globe created the beverage branch. The market at that point in time was competitive, but the future for succeeding was bright.

One of the first launched products was the "URO" line, introducing URO lemon to the market which then expanded into more flavors like URO cola and URO orange. These products were up on the popularity lists for their unique flavor and taste, eye-catching advertisements, and affordable price. To keep the grab on the local market, Globe started to create new beverage products to the market such as Fizz up, Tiger energy drink, and Black horse to the market.

Initially, the black horse beverage was not a first-line product. But, after the company introduced the royal tiger energy drink to the local market, everyone loved this product soon making it one of the most consumed beverages among the younger demographics of customers. By following the steps of the Royal tiger, they created black horse energy drinks with a new flavor. Although the popularity of royal tiger energy drinks is not comparable or replaceable by any others yet, Black horse did well for themselves on the market creating a place in the aisles of the supermarket.

As of right now, AST beverages have a variety of drinking products available all over the domestic and international markets. Some of the popular products are orange, lycheena, mangolee, mango king, and many others.

While introducing the beverage sector of Globe to the market, the capacity of GSDL (GLOBE SOFT DRINKS & BEVERAGE LTD) plant was 10,000 liter per hour. But in just a few years, in 2006 they had to expand it to 25,000 liters per hour given the popularity of their beverages. To keep up with the production demand of the beverages, the Noakhali production plant was not enough, therefore they established a new branch of the beverage production factory and named it AST beverage at Narayanganj. it is said that the name originated from combining the first letters of the chairmen's children's names.

Both of these factory plants are set and prepared with high-quality automated machinery imported from Europe for smooth and hazardless continuous production of great beverages. From the water preparations and carbon dioxide production to making the packaging and bottles from scratch, every single steps are self-made by the company.

All of the production line management is done according to ISO guidelines and especially by following the ISO 9001 guideline protocol. The company manages and regulates the production of products based on international safety guidelines and suggestions made by WHO and GMP as well as HACCAP standards.

The GSDL and AST work hand in hand to produce the best quality beverages for consumers inside and outside of the country, even though AST prepare most of the domestic products, they also produce export products from time to time as well.

With determination and a strong workforce, Globe Soft Drinks Ltd. started exporting their beverages and drinks like “Uro Cola, Uro Lemon, FizzUp, Lychena, Royal Tiger Energy Drinks” etc. different countries like India, Bhutan, Nepal, Maldives, Ghana, South Africa, Nigeria, Somalia, Somaliland, Kenya, Liberia, Burkina Faso, Italy, Canada, Poland, China, Sri Lanka & Myanmar, UAE, Kuwait, Qatar, Saudi Arabia, Bahrain, Oman, Singapore, Malaysia, Brunei, Mauritania from 2007 to present days.

Chapter 2

Relevance of the learning

As the rise of consumerism is at its peak thanks to social media and evolving trends, the beverage sectors all over the world are working day and night to innovate interesting and eye-catching products to meet the consumer's demand.

To diversify the range of options, every company is working to its best capacity. And if we compare the progress, the Globe has been able to keep its reputation for different flavors and varieties when it comes to the beverage options in the market. Consumers and customers can choose drinks from different flavors and tastes based on their liking.

As a nutrition and food engineering major, I had a new door of learning opened for developing new beverages with not only focusing on the flavor but also the nutritive value and how to increase a drink's health benefits while simultaneously keeping up the good taste.

What caught my attention was, that they focused on quality very precisely and opened a scope so that Good drinks can taste good to the mouth and also feel good to the body.

This internship report will let you see the GLOBE beverage company and AST beverage through my eyes. I have written down every little detail I soaked up from my stay at the company.

This opportunity not only gave me a taste of beverage production but just how precisely and with care every member of a food and beverage manufacturing company works to obtain the best version of food article.

Chapter3

Carbonated soft drinks or, CSD

3(1) PET plant for the drink bottle production

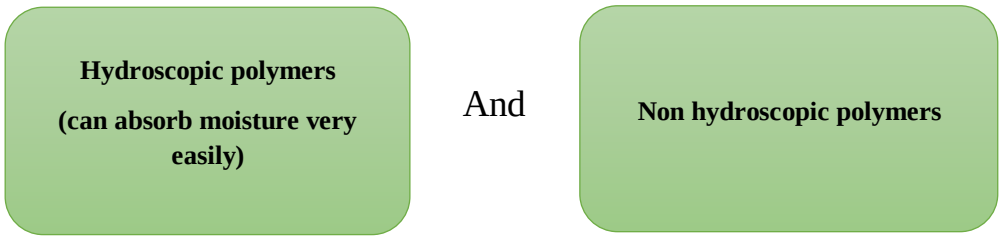
To begin the production, we need to talk about the bottles for the drinks as they will hold the drinks in and keep them safe for consumption. Therefore, I will begin with the PET plant.

Pet is the short form for polyethylene terephthalate. The pet bottles are made by melting resins and shaping the molten liquid into molds.

Plastic Resins are actually by-products of mineral oils primarily. It is a by-product of petroleum oil. But, the PET resins that are used specifically for food-grade product containers, do not contain any scattered harmful mineral substances that come into contact with the food or drink and affect the quality of the food article it is holding.

PET resin is used to make the drink bottles. AST buys its pet resins from a brand called "ASPET".

To understand the resin materials, understanding different polymers is very important. There are two types of polymers.



The PET resins then are also of two kinds,

1. Bottle-grade resins.
2. Synthetic resins.

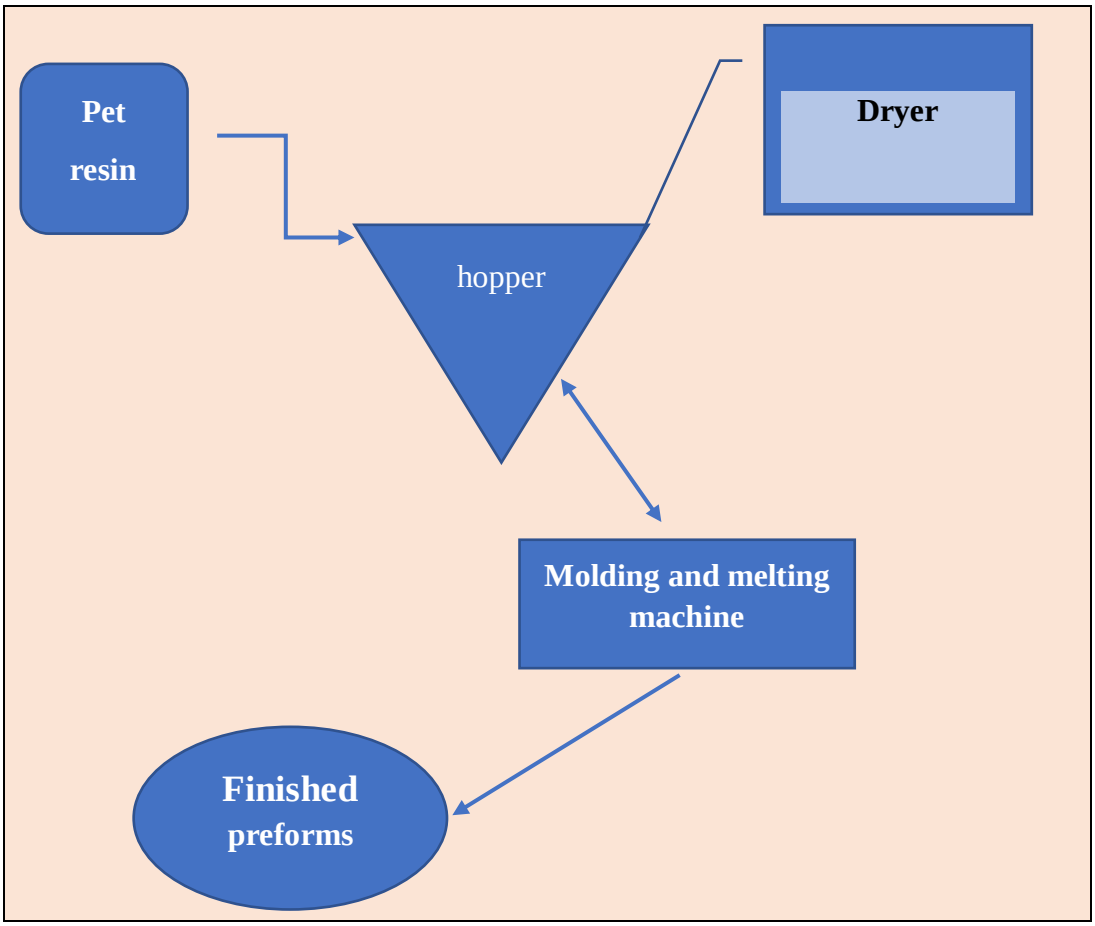
1. The bottle-grade resins are usually white resins that turn colorless or transparent once come in contact with heat. And that is why they are very useful for drink bottle production. The transparency of the resin makes it easier to tint and color according to the design necessary so it is easy to be used.
2. As for the synthetic resins, it is transparent, to begin with, but turns white while heated. It is not commonly used for general food-grade bottle production but is used for some packaging and synthetic clothing.

The PET resins are hygroscopic. The batch of resins needs to be heated and dried before using for bottle making to avoid spotting and other defects.
There are some key reasons why PET resins are the best choice for food-grade bottle making. They are;

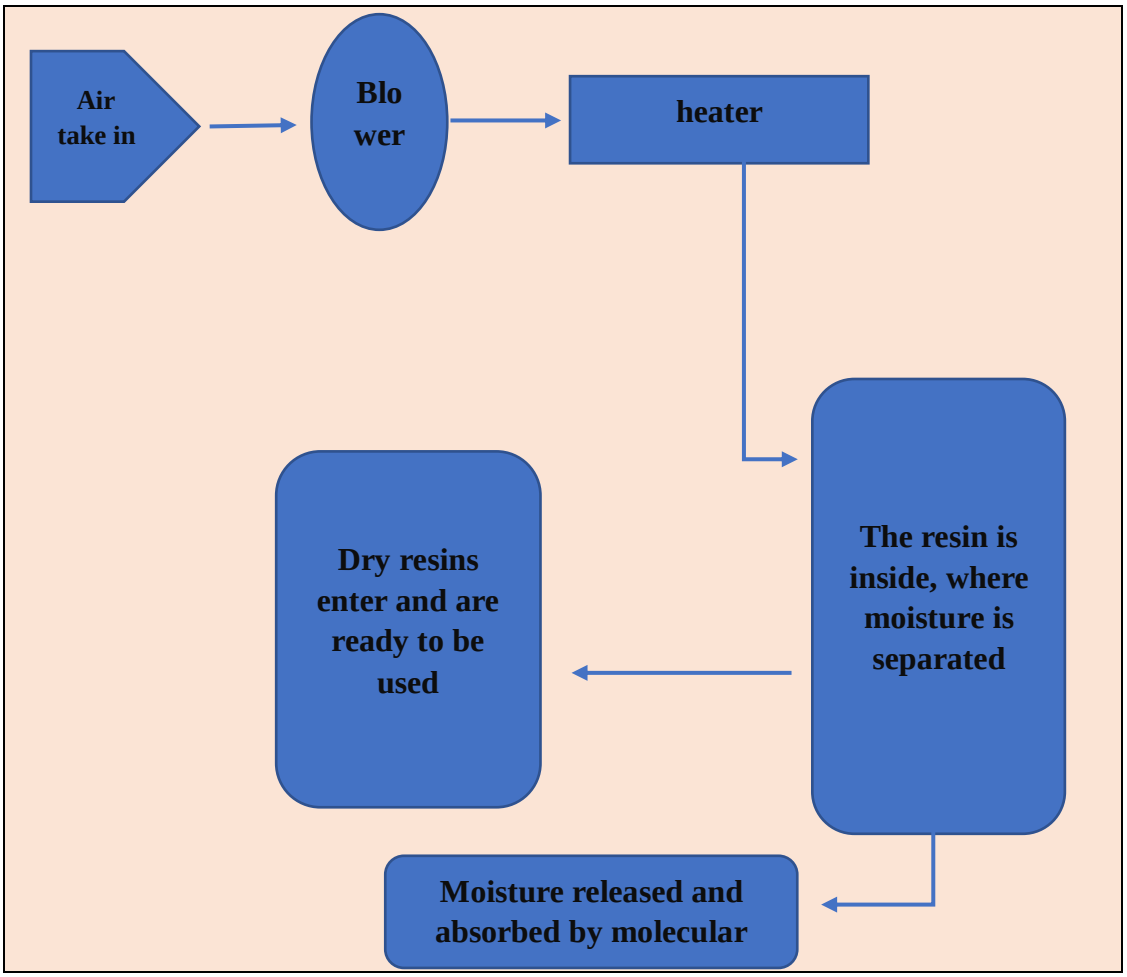
- The PET resins have a crystal-clear appearance by themselves while easily colorable to tint the bottle with any shade necessary. Even after the coloring, the bottle gives off a sheer tinted glass look that is very attractive.
- The availability of this material is vast as most of the resin manufacturers carry them and on top of that it is really inexpensive.
- It can withhold the carbon dioxide gas pressure in it without cracking and bursting. Durability is one of the most important factors for the drink bottle.

As the PET resins require them to be dried before using, a structured drying process is set to dry them before molding.

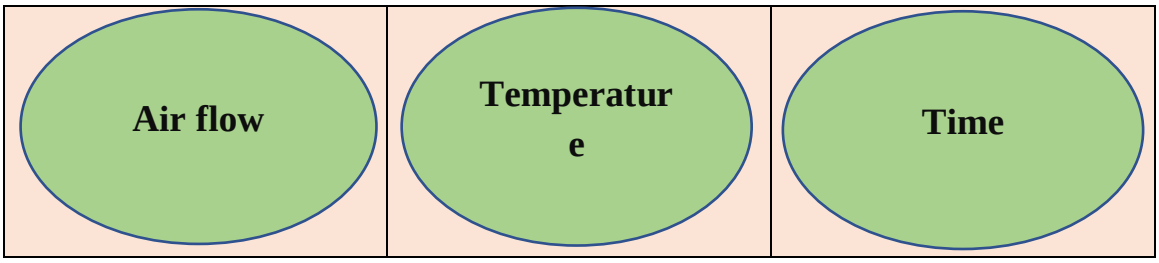
The overall preform making process flow chart is given below:



Now, if we only focus on the dryer part,



There are some factors that must be followed in order to achieve a great result in preform preparation. The drying factors are as important as the quality of the product as the drying of resin will affect how great and sturdy the preforms are.
They are,



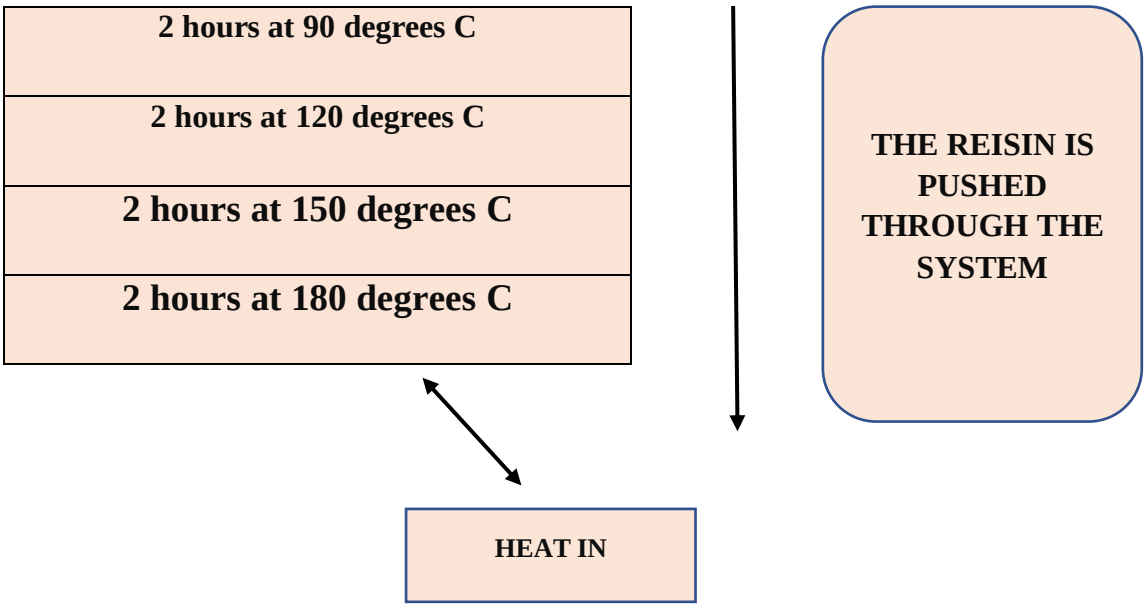
- **Airflow:** the airflow will transport the heated air to dry out the moisture. If we do not have the perfect and calculated airflow in the right pressure and directions, we cannot achieve the right drying process.
- **Temperature:** the right temperature is crucial to the drying process of the resin. If we do not set the right temperature, the air will not be heated enough, therefore, causing an unbalanced drying where some moisture might be left over.
- **Time:** the time for a successful drying process is set and assigned for successful drying. Without proper timing, there will be a lack of drying and moisture leftover problem will occur.

We can say that the right time, proper airflow pressure, and correct temperature will work hand in hand with a successful drying cycle.

As for the drying process,

The PET resins are dried for about 8 hours in 4 steps. They are:

1. 1st Step → 2 hours at 90degree C.
2. 2nd Step→2 hours at 120degree C.
3. 3rd Step → 2 hours at 150degree C.
4. 4th Step → 2 hours at 180degree C.



The heat insertion is done from the bottom part of the system raising upward. And on the other end, the resin is pushed through in a downward motion. The heat at first will be given at a very high temperature but the temperature gradually drops as it flows up. And the resin starts to heat up and eventually dry as it goes down and the temperature increases.

And to maintain a gradual and proper heat distribution, the resin is held for two hours in each step.

The PET resin usually starts to melt at the temperature of 280 degrees C. that's why if the temperature of the dryer exceeds 220 C the alarm system of the drying machine will go off and the machine will be set for a cooling system for about two hours to stop any melting incident from happening.

- Different resins and their uses: (according to AST beverage requirements)

PET	Used for bottles (Hydroscopic)
HDPE	Used for the cap. (non-hygroscopic)
LDPE	Used for case wrapping paper. (Non- hydroscopic)
LLDPE	Used for case wrapping paper. (Non- hydroscopic)
PE	Used for case wrapping paper. (Non- hydroscopic)

From the time of the resin filling to the mold to prepare the perform, this duration of time is called 1 cycle time. There are 3 preform making machines available in AST, and they are:

Machine number, name	**The capacity of each hopper**	**Performs produced per cycle**	**Cycle time**
AST06	4300 kg	72	14.5 seconds
AST07	3500 kg	72	28 seconds(50g each perform)
AST08	6500 kg	144	14.5 seconds

For each different product bottle, the preforms are custom made. There are three main parts to a preform. They are; Gate area, wall thickness, and neck.

Each preform is made to fit the exact amount of product in some of the size prepared at AST beverages and the market range for the sizes are given below.

- For fizz up (CSD)

Bottle size	**Preform size**	**Market range**
250 ml	16.76 gm	13-18 gm
500 ml	20,76 gm	18-22 gm
1000 ml	35 gm	28-38 gm
2000 ml	50 gm	46-52 m

- Lemonjee, orangee, lychena

Bottle size	Preform size	Market (basic range)
175	13 gram	12-15 gm

- Uro orange, Uro cola, Uro lemon

Bottle size	Preform size	Market (basic range)
250 gm	16.76 gm	13-18 gm

- Tiger energy drink, black horse energy drink

Bottle size	Preform size	Market (basic stage)
250 gm	16.76 gm	13-18 gm

- Mangolee (juice in hot fill)

Bottle size	Preform size	Market (basic range)
250 ml	20.76 gm	16-22 gm
500 ml	35 gm	26-36 gm
1000 ml	42 gm	38-46 gm

- Mineral water (H2O)

Bottle size	Preform size	Market (basic range)
300 ml	13 gm	10-15 gm

- Mineral water (Alma)

Bottle size	Preform size	Market (basic range)
500 ml	20.76 gm	16-20 gm
1500 ml	35 gm	28-36 gm

To make the best quality preforms and bottles there are some general parameters available to follow. They are:

1. Evaluating the molecular weight of the polymer
2. Crystallinity
3. Strength of tensils.
4. Checking the IV reflections. (IV is a parameter that is set to check the quality control specifications related to PET. It usually depends on the chain length of the polymers. The oil/water bottle (no hot fill + no gas product) has PET resin containing IV (0.70-0.78). On

the other hand, the CSD bottle has PET resin containing IV (0.80-0.86). if the required iv value is not found the preforms and the finished bottles will have defects.)

5. The melting point.
6. The color checking by the V and L values.
7. The temperature categories: machine temperatures should be at 270 to 290 C, and the temperature of the dryer is required to be 180 degrees C. as for the cooling temperature it should be around20 -30 degrees centigrade.

The color dosing for preforms:

There are two types of coloring available to be used for food-grade bottles.

They are:

- Liquid colors.
- 2. Palletized (Granular colors). At AST beverages, palletized colors are used.

The working system for color dosing is:

The Colors/ tints + PET resin → palletized colors + PET resin

And the colorful preforms for each master batch will be ready. (masterbatch is the primary batch of tinted resins that are prepared as it is easier to dilute the colors in large amounts later on.)

The faults in a preform:

There are some fault types available to identify severity or the exact level of defaults seen in a preform. Some of them are given down below.

Less critical (may affect the quality and performance of preform)	**Critical** (will affect the quality and performance of preform)	**Very critical**(will affect quality and performance at an unacceptable level; the preforms should be rejected)
Sink marks and stringing	Long gate nubs	Bubbles
Excess and uneven wall thickness	Flash	Un-melted particles
Intended parting line and gate dimpling	Moisture marks	Short shots

Occasionally, bubbles un-melted particles, and short shot problems are seen at the AST beverages.

Importance of glycol adding: while preform is in the preparation stage, a heat exchanger is used to regulate the temperature and heat. Now, at the cooling end of the exchanger extremely cool water is required to keep up the system (about 0 degrees C) to keep the water from turning into

ice and freezing the system, “Glycol dosing” is used to prevent icing. The glycol additions are also regulated and dosed according to the needs.

3(2) Caps production at PET plant

The bottle caps are produced separately from the preforms. Even though both bottle preforms and the caps are of PET plant’s production item, they go through different processes and molding steps to be made.

HDPE (High-density polyethylene) resins are the main ingredient used to make Caps at AST beverage Ltd. The brand name is INNOPLUS (grade number-3502C). The international standard cap-making style is followed to produce the caps.

There are different types of neck thread models available. The neck thread model used at AST is PC01881.The bottle opening diameter is 28mm.

The cap production machine used here is called SFM which means Slitting Folding Machine.

Currently per hour cap production is 75000. Though the machine has the capacity to make 120000 caps per hour.

The production of two different caps are made with the machines named below:

1. SACMI machine – CCM type.
HUSKY machine – IM type. (It has the capacity to make 45000 caps per hour)

The caps are made using two different types of molds. They are,

Type of molds	**Description**
IM or, (Injection molding.)	The soft resin material is pushed into the mold to create the desired shape.
CCM or, (Continuous Compression Molding.)	The soft resins are continuously pressed into the molds to make a large batch of caps in a short time.

the characteristics of Injection Molding are:

- It has an injection spot.
- The caps weigh about 2.20 grams
- Needs more energy and electricity
- Low production high cost.

The characteristics of Continuous Compression Moldings are:

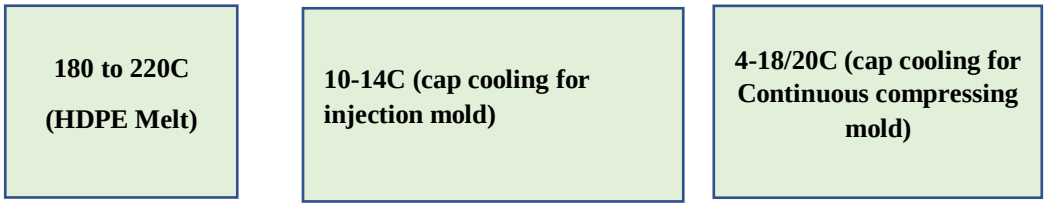
- Has no injection spots, the putty resins are pressed into the mold
- Caps weight about 2.35 gram

- Less power and electricity needed.
- more economically favorable because of high production at a low cost

Temperature:

There are different types of temperatures required for cap makings depending on the process.

They are:



complications and errors

1. liner problems: there is a narrow yet sturdy lining on the inside of the cap that Grable onto the bottle top while the caps are screwed. If the lining has problems, the bottle will not hold the pressure in as the cap will not be tight enough resulting in gas leakage.
2. Improper cooling: if the caps are not cooled down immediately after preparation, the shapes will deform resulting in rejected caps.

3(3) Plastic Case Wrapping Paper

The composition of about 40 kg shrink wrapping used for the packing of the beverage are:(end output 47 kg and proper wraps of 40 kg, 7 kg are considered faulty)

*MAINTAINING 130-160 DEGREES CENTIGRADE TEMPERATURE.

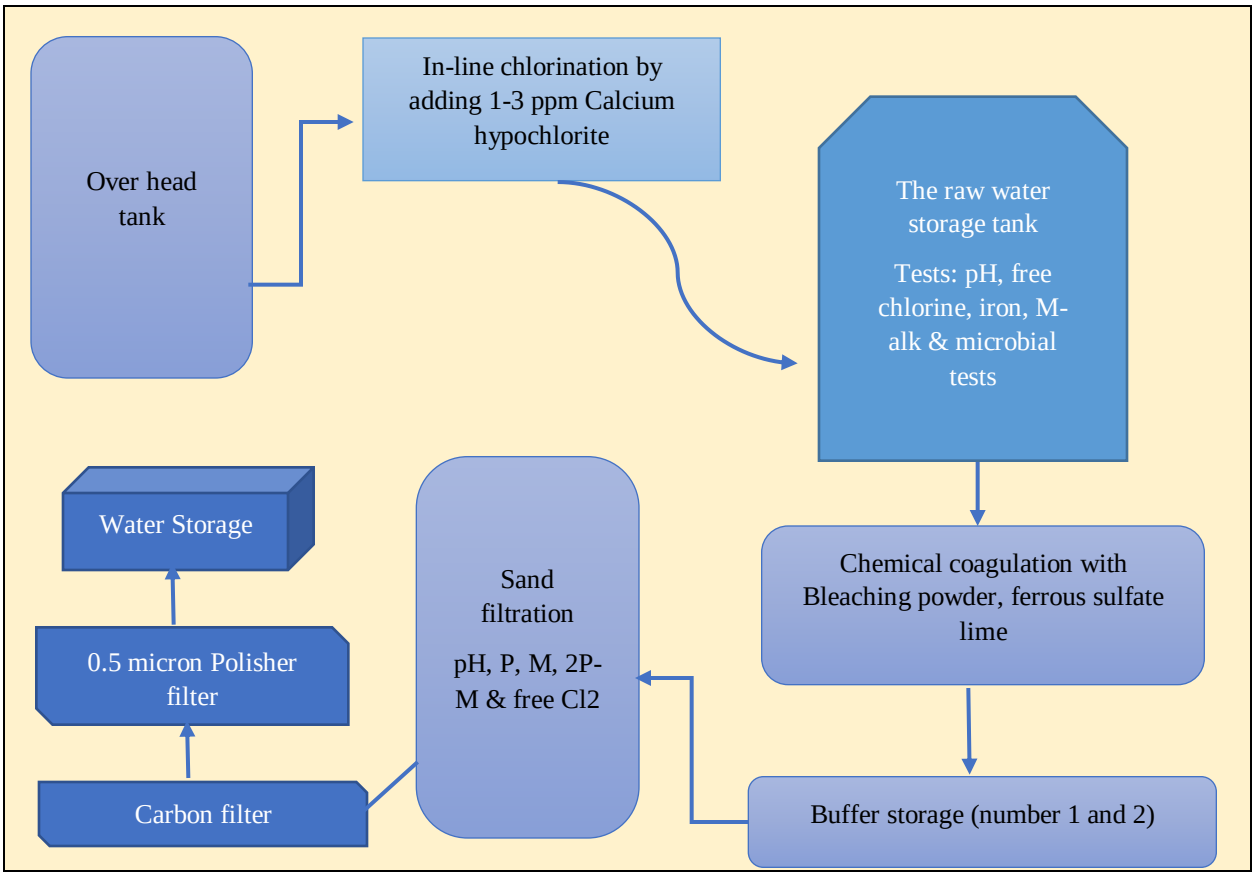
The shrink wraps are made of resembling and rounded tunnel-like plastic paper that has both of the ends stuck together. To prepare a thin, smooth, flat paper they cut down the edges and the jointing of the papers. Which also builds up plenty of wasted material. The wastes are then re-melted and turned into tiny particles that are sold to retailers for different purposes.

3(4) water treatment plants for beverages

A water treatment plant is the most important system for the beverage production industry. If the water is not properly treated, the beverage will have severe faulty and undesired finished products as water is the main component of any beverage.

At AST beverage, they run up to 37 different tests on the water depending on the needs.

The tests are done for raw water as well as the treated water to be used for CSD products right before using them.



The basic water treatment processes are:

1. Firstly, the water is in the deep which is collected by a deep tube well into an overhead tank where bleaching powder is added.
2. The water is then passed through a multimedia filter with layers of gravel set all throughout the system. The holding capacity of this filter is about 15000 L.
3. The water is flown through a carbon filter with a granular carbon filtration medium.
4. The water is sent to a coagulation tank where lime, ferrous sulfate, and bleaching powder are used to coagulate impurities. The holding capacity of this tank is 35000 L of water.
5. Now the water is sent to the buffer tank. There are two buffer tanks available at AST beverage with a 32000L holding capacity (each).

6. The water is pushed through the sand filter with 15000 L holding capacity for further purification
7. The water is pushed through another carbon filter like before, to scrub out and absorb residual smells or unwanted odors.
8. The water is polished with a polishing filter. It contains 18 cartridges with 0.5 microns.
9. Now the water is treated and kept in a treated water tank.

The treated water has some key tests as well. Some of them are:

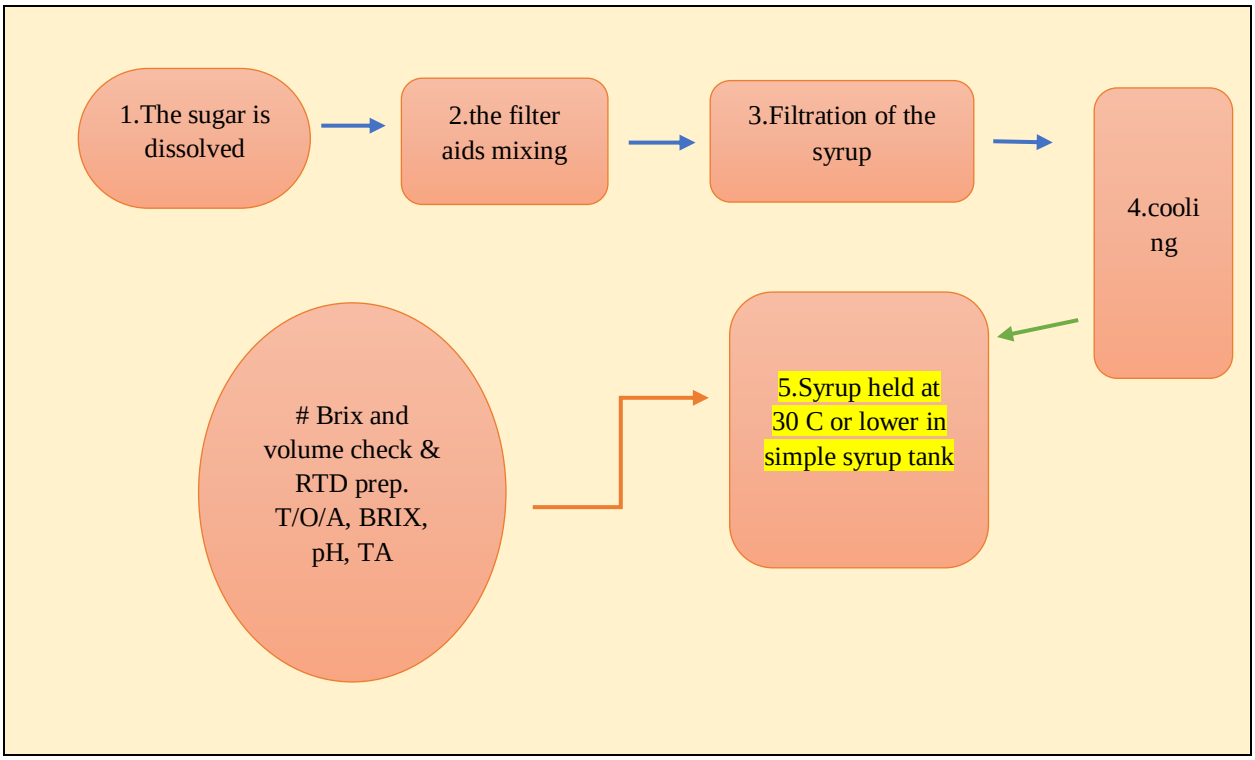
Test name	range
Hardness test	
P alkalinity	
OT	
M alkalinity	50
pH	7.2
Turbidity test	0.10
Iron test	0.2%
Chlorine test	2ppm dosing

3(5) the syrup making

Syrups are key ingredients in beverages. Syrups in terms of beverages refer to the primary mixture of concentrated ingredients that will be used to make the final products.

The syrups are made by following a set recipe which is different depending on the beverage type and company. The syrup rooms are therefore a very private area where only employees with passes and the syrup mixing officers and the general management people are allowed.

I was not allowed to enter the room as I was an intern, but I have the general process of syrup making. That is:



The syrup then is prepared into the diluted mixture depending on the need by adding treated water to prepare the beverages by filling in the bottle and CO2 addition.

Even though the proportions and serials of adding each ingredient are different, there are some common ingredients needed for each type of beverage.

Some of them are:

	Name of the product	**Key ingredient**
1	URO cola	Cola A and Cola B flavor.
2	URO lemon	Sodium benzoate, citric acid, and lemon flavor
3	URO orange	Sodium benzoate, citric acid, and orange flavoring
4.	Fizz Up	Sodium benzoate, citric acid, sodium citrate and lime lemon flavor
5	Royal Tiger	Sodium benzoate, citric acid, sodium citrate, citrus powder, caffeine, tartrazine yellow, mixed fruit flavor.
6	Black Horse	Sodium benzoate, citric acid, sodium citrate, citrus powder, caffeine, caramel powder, sunset yellow, mixed fruit flavor.
7	Konia	Sodium benzoate, citric acid, sodium citrate, citrus mineral powder, citrus vitamin powder, grapefruit emulsion

		flavor.
8	Oranjee	Sodium benzoate, citric acid, sodium citrate, orange compound and sacs, flavor.
9	lycheena	Sodium benzoate, citric acid, and lychee flavor.

3(6) carbon dioxide production for carbonated beverages (co2 plant)

Carbon dioxide is the key ingredient responsible for the fizzy sensory characteristic of sparkling beverages. CO2 can be produced following two methods. By Burning natural gas or by burning diesel or petroleum oils. At AST beverages, they use natural gas to produce carbon dioxides. They have two different types of plants. They are:

- Union plant (500kg)
- Asco plant (285 kg)

Key ingredients for CO2 production are:

- Water
- Soda ash
- MEA
- Natural gas

The MEA solution is used to capture the CO2 from the system. The MEA solution is continuously needed throughout the whole process. After each 2 years, the MEA solution is changed as they can produce odor and low co2 capturing if kept for too long. For a 500 kg capacity plant, MEA solution needed is about 12000 L.

The recipe for this solution preparation is:

MEA = 1080Kg (9%)

Soda ash = 360kg (3%)

Water = Rest of the amount to make up 12000L solution. (88%)

The total distribution of the MEA solution is:

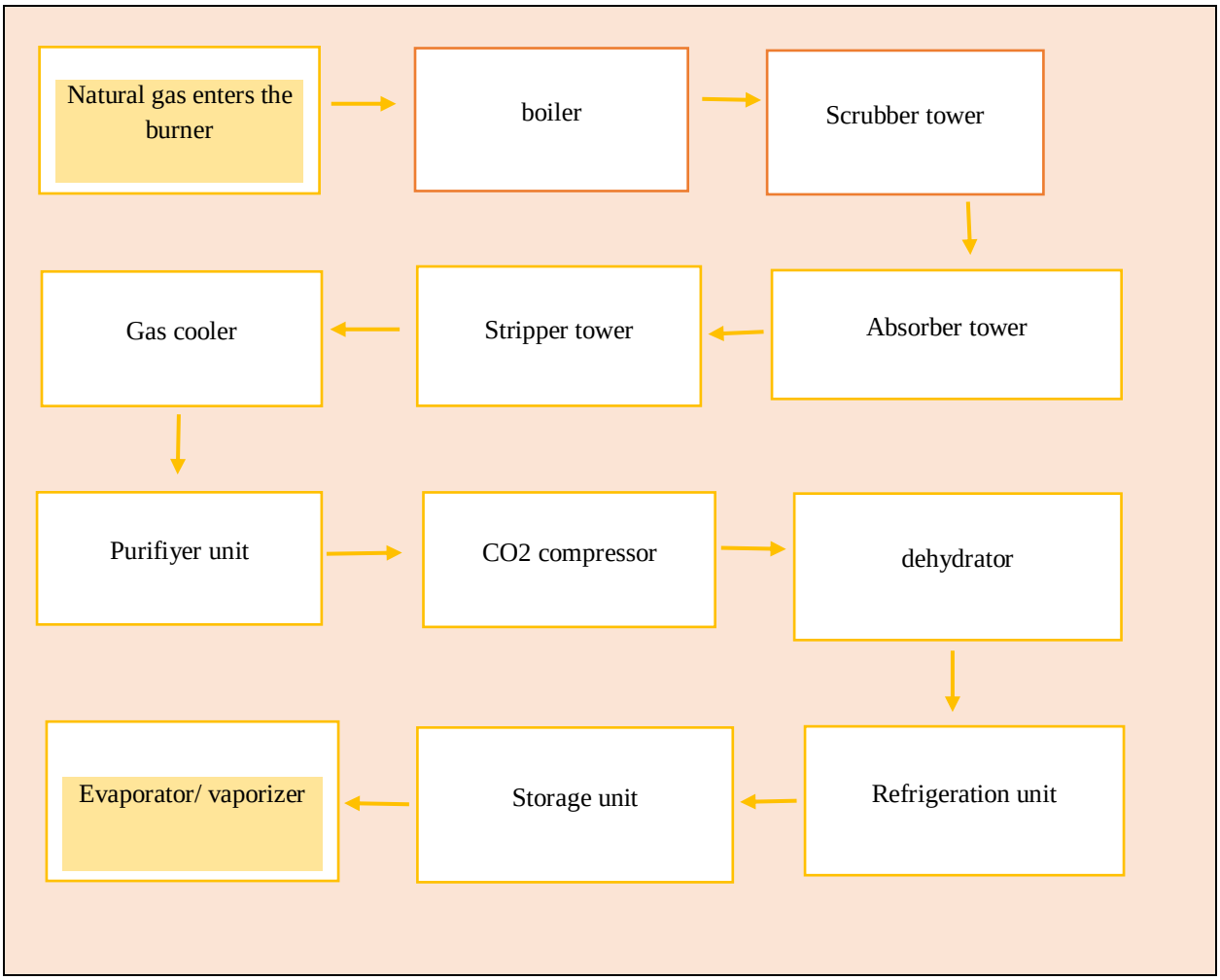
- 5500L at the boiler
- 3000L at MEA tank
- 2100L at stripper tower
- 1200L in absorber

- 200L in pipelines

The brief process of carbon dioxide production:

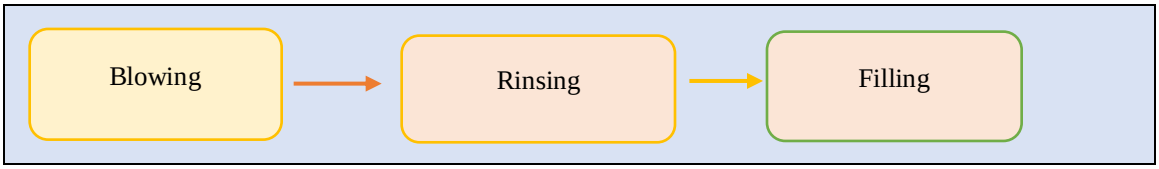
1. First the natural gas is burned inside the burner and sent to the reboiler.
2. The gas enters the scrubber tower at (240-248) C, and the temperature is cooled down to (150-180) C.
3. The gas is then taken into the absorber tower by a blower where the carbon dioxide will be absorbed. The tower has an open top so that the unnecessary gas can be flown out of the system and only the carbon dioxide gas is left behind. The absorber tower holds a mixture of soda ash (3%), MEA (9%) with the normality of (1.9-2.1), and water (88%).
4. The strength of the MEA must be well maintained to ensure purity, as the acceptable purity limit of the CO2 is (99.98-100%). While the other unimportant gases leave the tower, they take away some amount of CO2.
5. The MEA containing CO2 will enter the stripper tower.
6. The mixture is sent to previous boiler from stripper tower where carbon dioxide is taken out of MEA. The lean MEA or just MEA without any carbon dioxide will be returned to the absorber tower.
7. The CO2 is sent into a gas cooler where the temperature of the gas is lowered from (150-180) C to (80-100) C.
8. Now the gas is purified in a purifier unit using either softened water in 2 bar pressure or potassium permanganate. AST has both of these processes available.
9. The gas is sent to the dryer/ dehydrator unit. In this unit the purity test of co2 is done under relatively low temperature (around 30 to 40 degrees C). here two chambers are placed for the purpose of removal of bad smells and moisture absorption. (carbon filter and molecular chips).
10. At the refrigeration / refrigerant unit the CO2 are prepared into liquids.
11. This liquid gas is stored in storage unit at very cold temperature around -27 to -30 C.

The CO2 production process are:

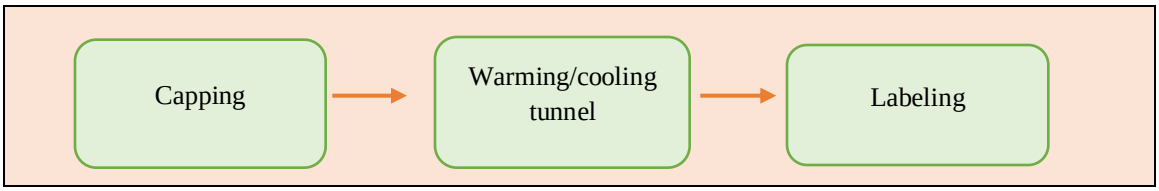


3(7) filling the bottle

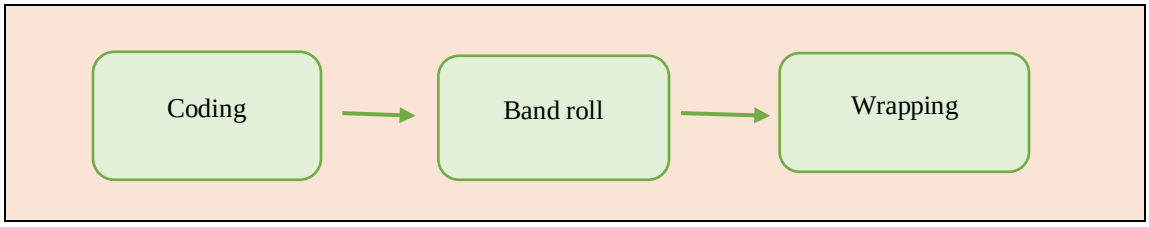
The steps of filling the bottles will be explained below:



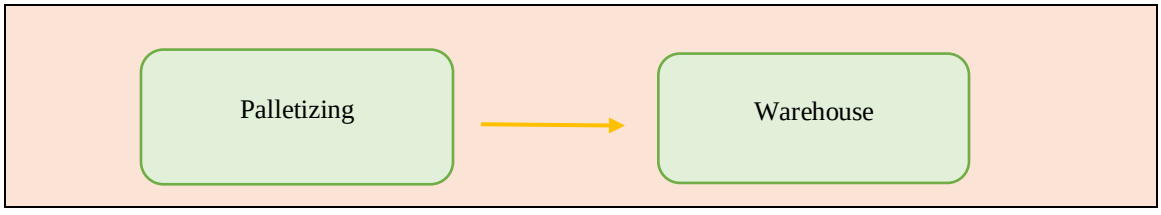
- The bottles enter the system after they are blown in the air and prepared as bottles from pre-forms.
- The bottles then go through the rinsing phase to ensure they are clean and sterile.
- The bottles are filled with final beverage liquids that by dilution of syrup.



- Now, before putting the caps on the bottles, we need to run some final tests, such as T/O/A, Brix, GV, Torque, net content (for CSD), T/O/A, Brix, Torque (hot fill juice), pH, TDS, turbidity, net cont., T/O/A, TORQUE (for drinking water)
- The caps are screwed on the top of the bottles. After that, if the bottles are too cool they are warmed to room temperature and if they are too warm they are chilled down. Without this step, the bottles will fog and the labels will not set well.
- Now the bottles enter the labeling tunnel where the information label is stuck to the bottles.



- The codes are one of the crucial parts of the packaging as they are required mandatory by law. Ink is shot to the bottles with exact code information and number to be printed on the bottles. The coding conditions are checked properly to ensure no number or info is missing.
- The band rolls are used to dry and roll in an exact number of bottles for each casing for wrapping.
- The bottles are wrapped together with clear shrink wraps in the proper set.



- The packs are palletized and sent to the warehouse for storage and sent out to distributors.

3(8). different tests for beverages.

There are mandatory tests available that are done for beverages to ensure quality. The common tests are separated into two sets for easy and proper system maintenance. They are:

- Online tests were done while the beverage is still on the processing line:

1. Gas volume
2. Brix
3. Taste , odor, appearance
4. Torque test
5. Stress cracking
6. Batch code and label

- Tests done in processing lab

1. pH
2. % TA

1. **Gas volume test:**

The gas volume tests are done to evaluate the amount of carbon dioxide present inside a bottle of drink. This test is done for carbonated drinks preparation. The testing process is conducted by taking the temperatures and pressure gauge of the bottle.

- Firstly, a bottle is taken as a sample from the production line by random evaluation.
- The bottle is shaken intensely to pressurize the carbon dioxide gas present inside the bottle.
- The bottle is now placed on the pressure gauge piercing machine. The bottle should be set right below the piercing pin so that the cap can be pierced.
- Now as the piercing pin enters the cap, the gas pressure will overflow the bottle and we can see the pressure measured on the meter.
- By taking a thermometer, we will see if the temperatures are below 20 degrees or not, and the exact temperature measure. Noting that, the temperature should be measured in Fahrenheit.
- The gas volume is calculated by putting the value against each other on the gas volume chart provided by the company with the required values. The intersected value is considered to be the gas volume of the drink. This test is done every 30 minutes by selecting a random sample from each production line.

The products name and permitted gas volume range by AST beverages are given below:

Product name	**Gas volume level given by AST**
Fizz up	3.5-4.0
Royal tiger	3.5-4.0
Black horse	3.4-3.8
URO lemon	3.5-4.0

URO orange	3.2-3.6
URO cola	3.5-4.0
URO jal jeera	3.5-4.0
Lycheena	3.2-3.6
Konia	3.5-4.0
Oranjee	3.0-3.4
Lemonjee	3.0-3.4

2. Brix

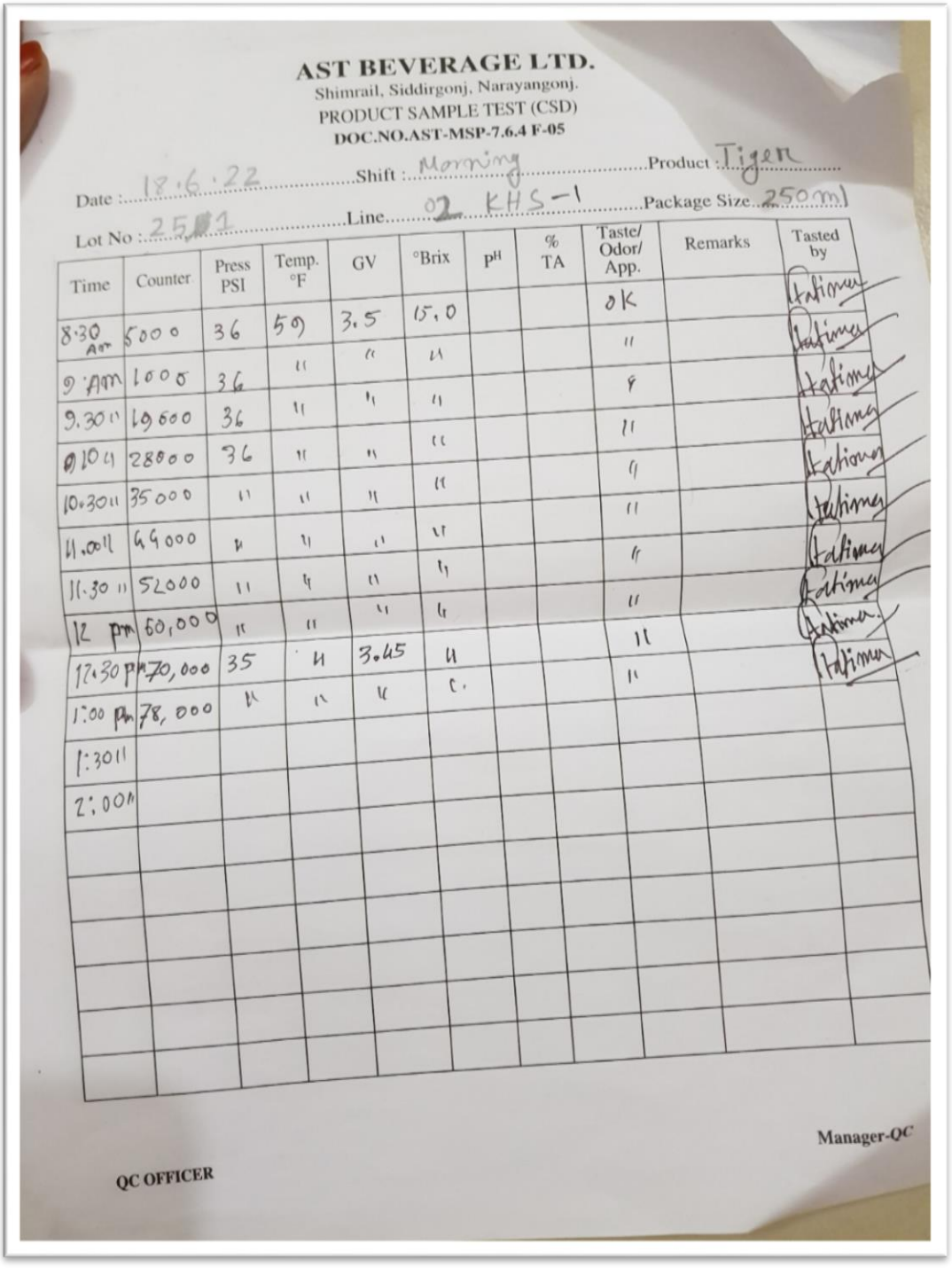
Brix is checked to know about the sugar content of the product. The brix reading will indicate the amount of sugar added in the drink. The brix measuring helps the proper evaluation process of the sugar addition easier. The sugar content is changed depending on many reasons such as to follow new recipe, making the product economically favorable, or simple product improvements. This test is done by a handheld refractometer.

- Firstly, a refractometer is taken and the prism is cleaned with distilled water. Also, checked if the value is at zero.
- Now, we will add about 2 to 3 drops of product on the prism and let the liquid cover the prism properly.
- There is a shutter or cover part present over the prism and we will lower that to ensure the liquids are trapped properly.
- While pointing towards a bright light; we can see the brix scale properly.
- Being careful that we do not tilt the refractometer. The refractometer should be held at a straight position.
- The brix should be checked at 20 degrees C as it is the best result giving temperature.
- This test is also done every 30 minutes, usually at the same time as the gas volume checking.

- The results are noted down in a required paper to be kept as a record to the quality control officer, so that just in case if any problem arises, they can identify which batch had the issue.
- If the required Brix is not found, the line is stopped immediately and a thorough evaluation is done to fix that issue by measuring the water to syrup ratio of the drinks. After correction the line is re-started for production.

Products name	**Brix range for AST**
Fizz up	11.5±0.2
Royal Tiger	17.5±0.2
Royal Tiger Diet	0.8±0.2
Black Horse	18±0.2
URO Lemon	13±0.2
URO Cola	10.7±0.2
URO orange	13.5±0.2
URO jal-jeera	11.5±0.2
Lycheena	13±0.2
Konia	6±0.2
URO oranjee	16±0.2
URO lemonjee	15.3±0.2
URO Lychena	13.8±0.2

Product sample test chart for CSD



AST BEVERAGE LTD.
Shimrail, Siddirgonj, Narayangonj.
PRODUCT SAMPLE TEST (CSD)
DOC.NO.AST-MSP-7.6.4 F-05

Date : 18.6.22 Shift : Morning Product : Tiger
Lot No : 2581 Line : 02 KHS-1 Package Size : 250ml

Time	Counter	Press PSI	Temp. °F	GV	°Brix	pH	% TA	Taste/ Odor/ App.	Remarks	Tasted by
8:30 AM	5000	36	59	3.5	15.0			OK		Tahmina
9 AM	10000	36	〃	〃	〃			〃		Tahmina
9.30 〃	19600	36	〃	〃	〃			〃		Tahmina
10 〃	28000	36	〃	〃	〃			〃		Tahmina
10.30 〃	35000	〃	〃	〃	〃			〃		Tahmina
11.00 〃	44000	〃	〃	〃	〃			〃		Tahmina
11.30 〃	52000	〃	〃	〃	〃			〃		Tahmina
12 pm	60,000	〃	〃	〃	〃			〃		Tahmina
12.30 pm	70,000	35	〃	3.45	〃			〃		Tahmina
1:00 pm	78,000	〃	〃	〃	〃					
1:30 〃										
2:00 〃										

QC OFFICER

Manager-QC

3. Taste, odor, appearance

The taste odor and appearance tests are for the sensory evaluation of the products. The beverages prepared need to be tasted and smelled to make sure they are of the required result. the consumer will notice the tastes and the odor as the first sensory experience. If they are not taken into serious consideration the sales of the products will go down.

To do this test,

- A random bottle is selected from the product line by the production officer.
- The bottle is opened and the smell test is done firstly by smelling the drink.
- Then a few sips of the drink is taken in the mouth to see if the flavor and taste are in the correct order.
- The drink's appearance is carefully evaluated to see if the drink looks exactly like the criteria.
- These tests are done every 30 minutes.

4. Torque test:

Torque is the rotational force with which the cap is applied to the beverage bottle. This test will ensure that the bottles are securely sealed and there will not be any risk of gas leaking by closure cracks or gaps. This test is done once every 6-hour shift. The CO2 pressure is a very important characteristic of the CSD and to ensure that the carbon dioxide is going to be held in the bottle properly this test should be done with care and concentration. The torque must be of a

The value indicates that the cap will not burst due to the gas pressure and at the same time it is easy for the consumers to open the bottle caps.

- firstly, 20 bottles from the batch are collected.
- Then, they are marked based on every different batch.
- Now we will use the torque tester machine to test each of the bottles, one by one. And the torque values are noted down in a record.
- The torque value range in AST is in between (18-22/23). If the torque is found to be less than 18 for any bottle, then it is informed to the production line officers by the QC officers. Then, they correct the problem by checking if the capping machine is the problem or if the pre forms are not being made properly.

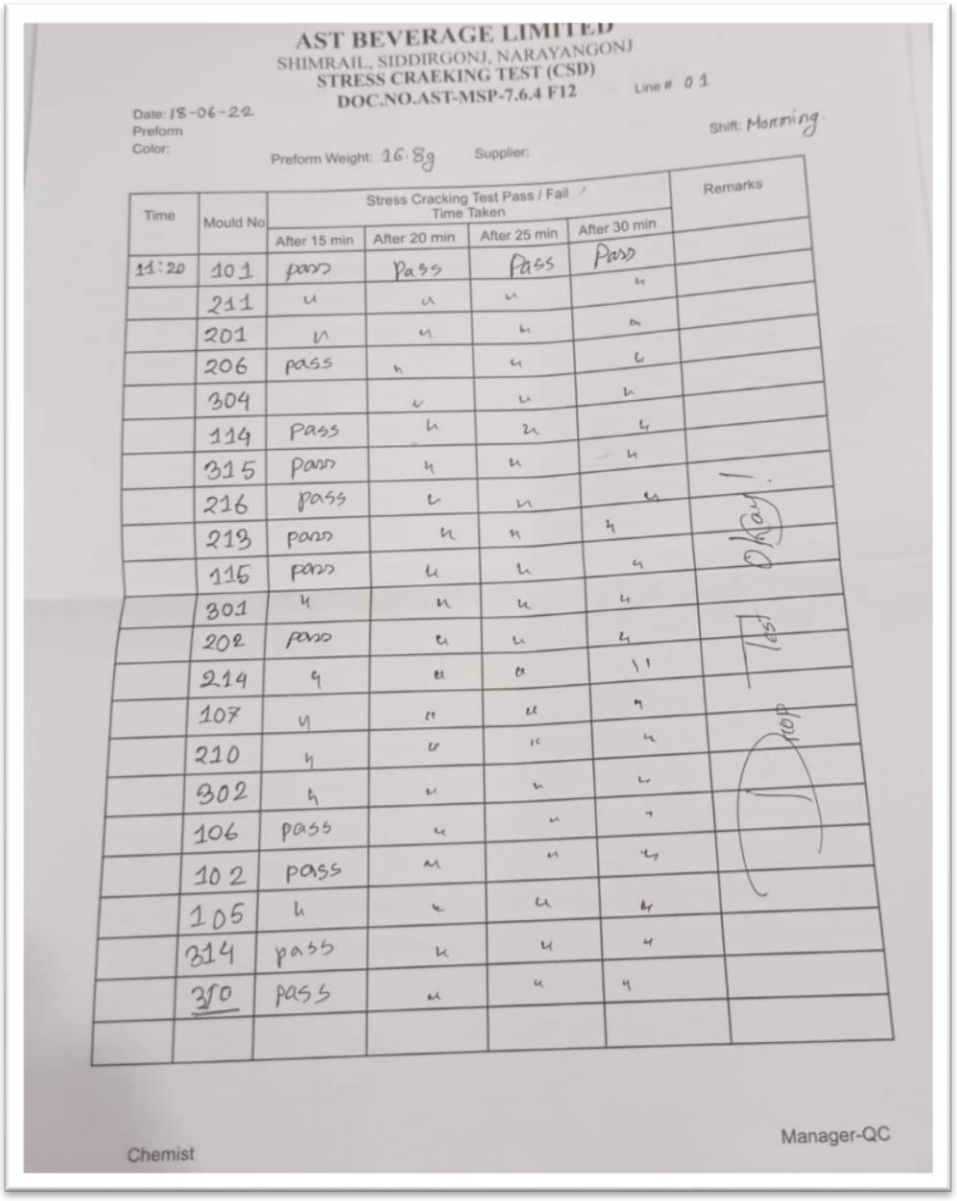
Stress cracking test:

Stress cracking tests are done to have an idea of how durable the bottles will be. After the beverage bottles are dispatched, there is not enough control over them on how they are handled by the transportation companies. And sometimes accidental situations can cause the bottles to

crack which causes product loss. To reduce this type of problem, torque tests are done for the beverage bottles once every 8-hour shift.

- First about 26 bottles are collected from each bottle mold. and they are marked with the numbers to make sure they are recognizable.
- The stress cracking solution is prepared which usually consists of 0.2% NaOH solution in 1000 ml water measure, and 5000 ml water solution is prepared.
- The NaOH used at AST beverage had 89% purity so they added 11.23 gm NaOH for the 5000ml solution preparation.
- After preparing the solution in a bowl or sturdy bucket, the bottles are placed inside them and observed carefully for 30 minutes. If the bottles crack during that time period, the bottles are not sturdy enough. And the bottles from that mold will be re-evaluated.
- And if the bottles pass that test it indicated that they will most probably hold up to small accidental drops while handling.

stress cracking record sheet.



AST BEVERAGE LIMITED
SHIMRAIL, SIDDIRGONJ, NARAYANGONJ
STRESS CRAEKING TEST (CSD)
DOC.NO.AST-MSP-7.6.4 F12

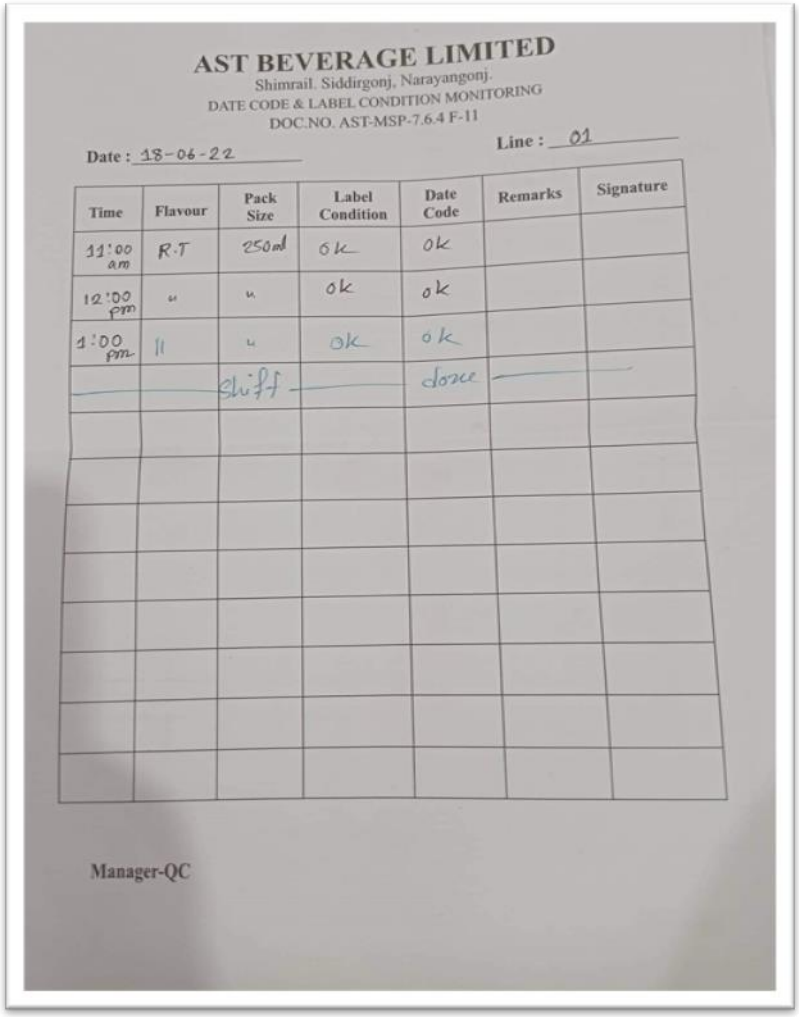
Date: 18-06-22 Line # 01
Preform
Color: Shift: Morning
Preform Weight: 16.8g Supplier:

Time	Mould No	Stress Cracking Test Pass / Fail / Time Taken				Remarks
		After 15 min	After 20 min	After 25 min	After 30 min	
11:20	101	pass	Pass	Pass	Pass	
	211	"	"	"	"	
	201	"	"	"	"	
	206	pass	"	"	"	
	304		"	"	"	
	114	Pass	"	"	"	
	315	pass	"	"	"	
	216	pass	"	"	"	Okay!
	213	pass	"	"	"	
	115	pass	"	"	"	
	301	"	"	"	"	
	202	pass	"	"	"	last
	214	"	"	"	"	
	107	"	"	"	"	
	210	"	"	"	"	
	302	"	"	"	"	
	106	pass	"	"	"	
	102	pass	"	"	"	
	105	"	"	"	"	
	314	pass	"	"	"	
	350	pass	"	"	"	

Chemist Manager-QC

5. Date-code-Label test

The labels and date codes need to be checked properly as they are required to be sealed on the bottle to ensure easy identification. Any problems regarding to the batch code and label can cause legal trouble for the company.



AST BEVERAGE LIMITED

Shimrail. Siddirgonj, Narayangonj.

DATE CODE & LABEL CONDITION MONITORING

DOC.NO. AST-MSP-7.6.4 F-11

Date : 18-06-22 Line : 01

Time	Flavour	Pack Size	Label Condition	Date Code	Remarks	Signature
11:00 am	R.T	250ml	Ok	Ok		
12:00 pm	"	"	Ok	Ok		
1:00 pm	"	"	Ok	Ok		
		Shift		doze		

Manager-QC

6. pH Test-

the pH tests are one of the most important parameters of carbonated beverages. The pH of CSD needs to be slightly lower to give an acidic flavor to the drink. And if the pH is not at the required parameter the drink will taste unpleasant.

- This testing is done once for each batch during a production cycle.

- There are a few types of pH machines available at AST to find the most accurate and precise result.
- The digital pH meter is used to conduct this test.
- The beverage is first transferred from the bottle to a beaker in an adequate amount and stirred using a stirring magnet until the carbon dioxide bubbles disappear completely.
- The CO2 needs to be removed completely for an accurate result.
- Now the pH meter probe is dipped in the beverage and kept till the machine gives a result.
- After the measurement, the pH is noted down in record-keeping sheets.

Product name	Ph range
Fizz up	3.0-3.5
Royal Tiger	2.8-3.10
Royal Tiger Diet	3.0-3.5
Black Horse	2.70-3.40
URO Lemon	2.40-2.90
URO Cola	2.20-2.70
URO orange	2.60-3.10
URO jal-jeera	2.20-2.70
Lycheena	3.20-3.80
Konia	3.50-4.0
URO oranjee	3.10-3.50
URO lemonjee	2.80-3.30
URO Lychena	3.20-3.80

7. %TA (Total acid)-

The total acid content or total titrable acid testing is done once every batch before production. This test is done in the lab with the sample.

- The beverage is taken in the beaker as a sample.
- The stirring magnet is put in the beaker and the sample is stirred for five minutes to reduce carbon dioxide content.
- Now,1oml of the sample is taken in a conical flask.
- 3-4 drops of Phenolphthalein indicator are put into the conical flask.
- By taking 0.1N NaOH in the burette we can start titration drop by drop.
- The titration is stopped once the pink color is appear, the end point is recorded.

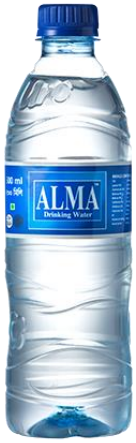
- Then by calculating, %TA is figured out. (formula: %TA= (Burette end point*strength of NaOH* molecular wt. of NaOH*100)/sample vol.)

Product Name	%TA range
Fizz up	0.17-0.22
Royal Tiger	0.48-0.52
Royal Tiger Diet	0.34-0.70
Black Horse	0.56-0.60
URO Lemon	0.21-0.25
URO Cola	0.10-0.15
URO orange	0.13-0.18
URO jal-jeera	0.16-0.20
Lycheena	0.22-0.25
Konia	0.13-0.16
URO oranjee	0.32-0.37
URO lemonjee	0.48-0.54
URO Lychena	0.185-0.205

Chapter 4

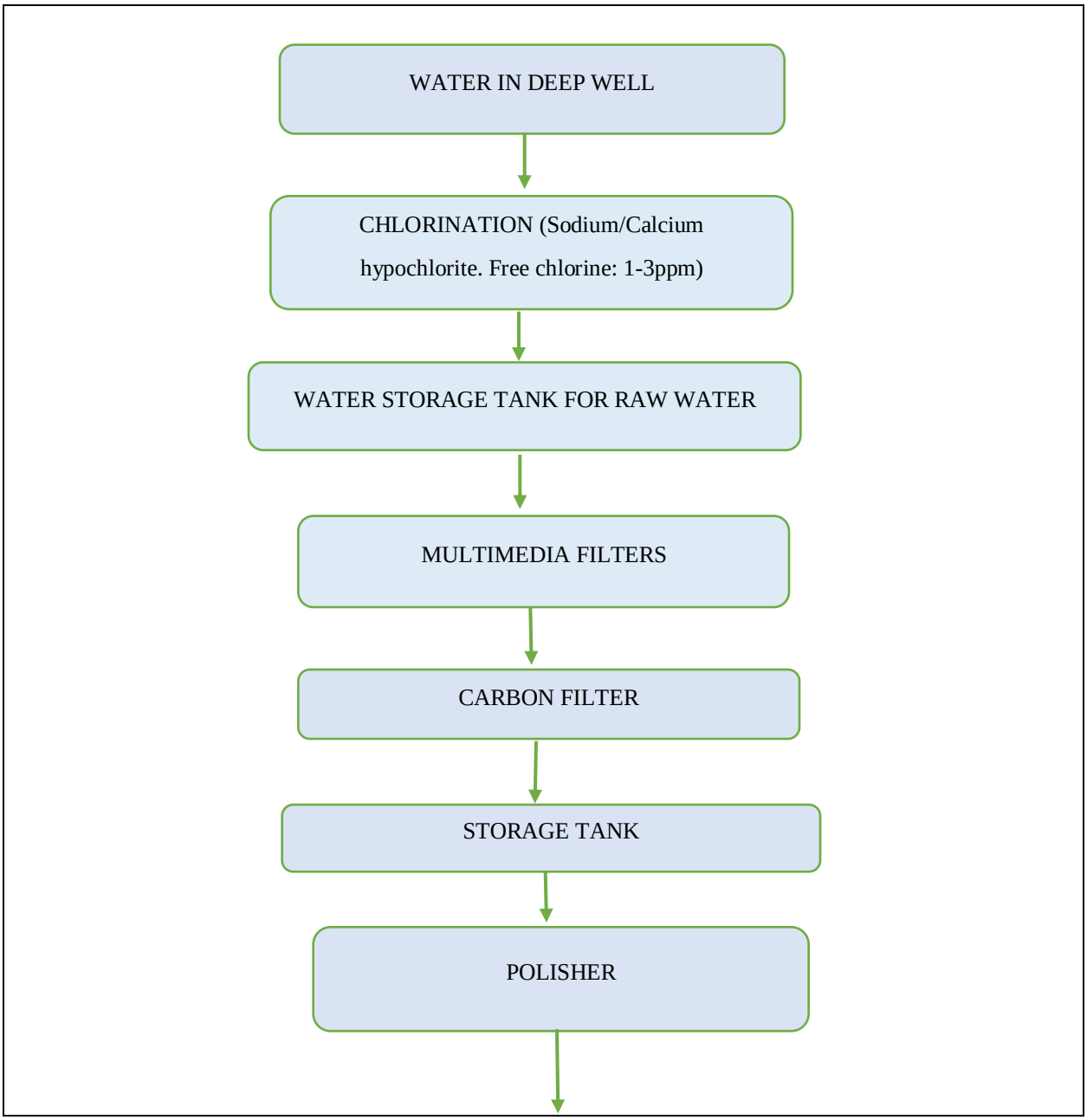
Reverse osmosis for drinking water

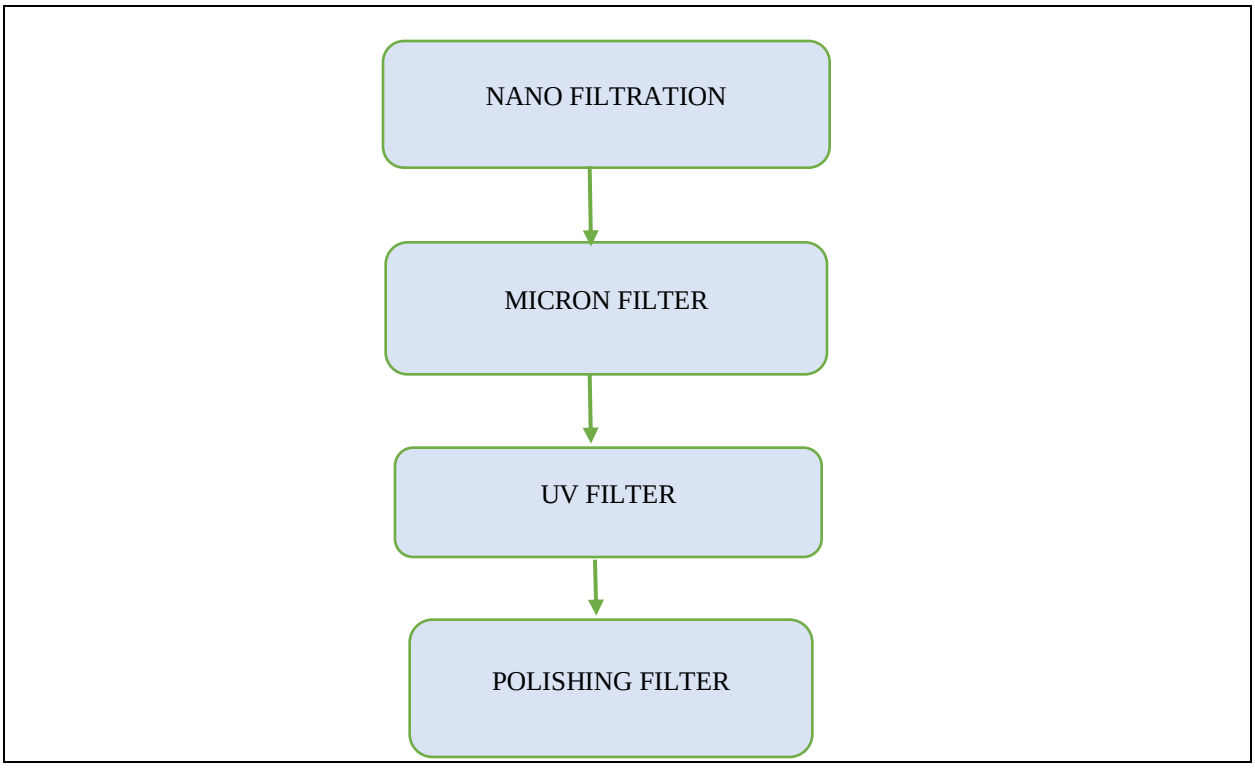
Brand: H2O
Category: Packaged Drinking Water
SKU: 300 ml
Packing Mode: PET
EAN 13: 8941128008320
Manufacturer: GSD & AST Beverage Ltd
Country of Origin: Bangladesh



The water treatment plant and drinking water plants have different style of working process. The reverse osmosis or RO treatment is used for the drinking water production in conjunction to a ultra violet filter.

The RO system for drinking water is described below:





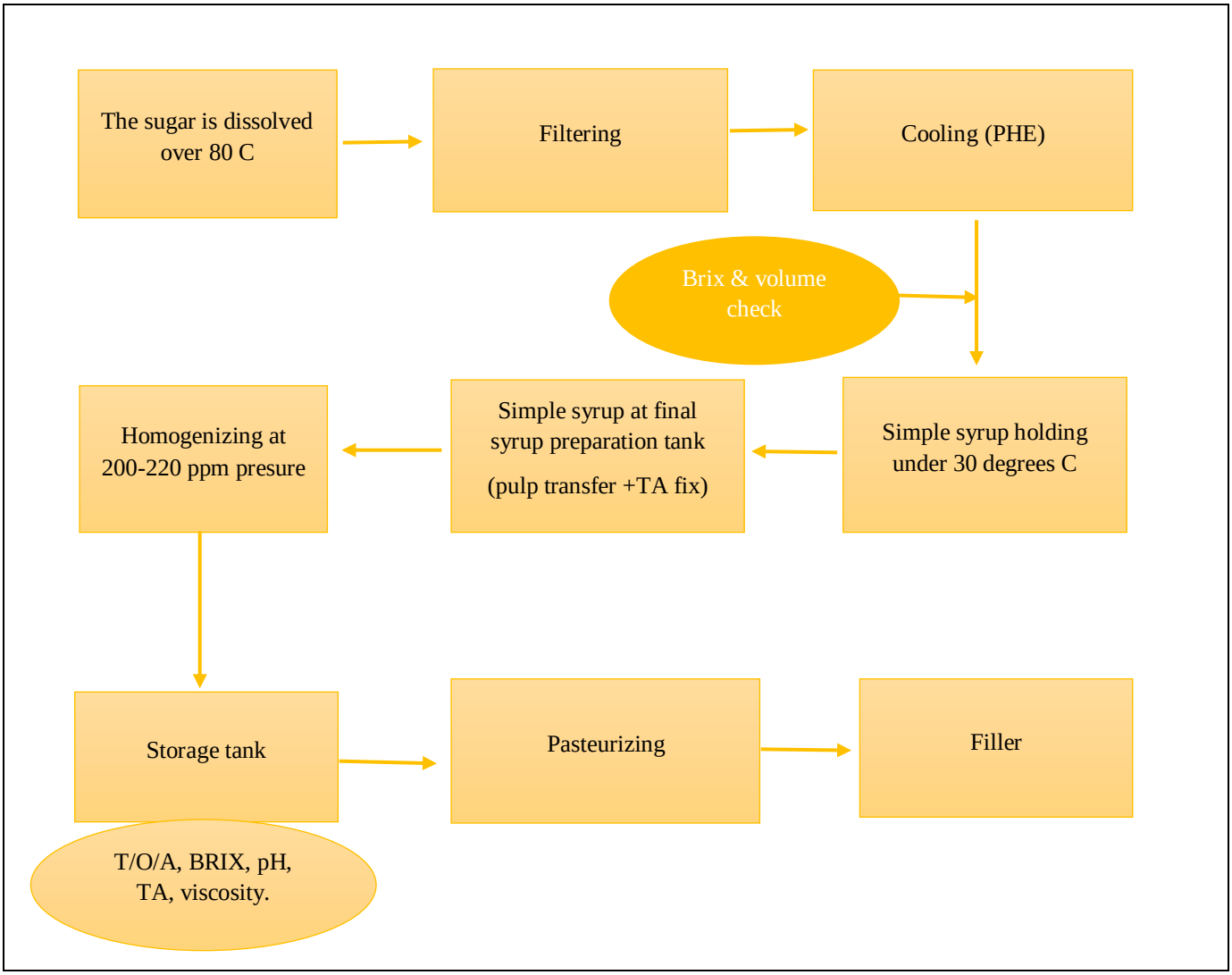
Chapter 5

Juice products

The juice products are processed and made differently from carbonated beverages. Here are some facts about them:

- The juice bottles are actually made with more sturdy materials to withhold the heat.
- The juices are filled in a technique called “hot filling”
- The juices are thicker than CSD products hence why handling them will need caution to avoid lumping or clumping.
- At AST they have separate production lines for the hot beverage filling.
- Juice products of AST are one of the most loved products that have great export demand.
- The export and import labels for juice bottles are designed a little differently depending on the popularity of design and economical points.
- There are separate lines available at AST just for juice box fillings.

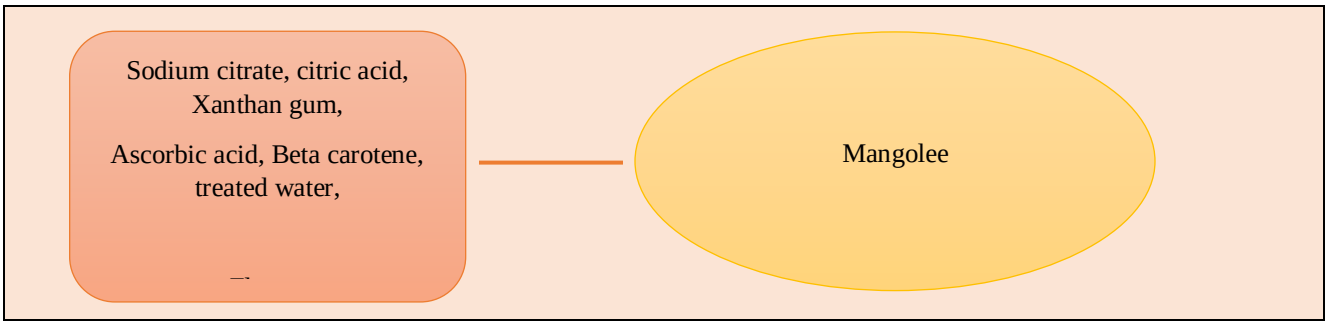
Now, the juice syrup preparation flow chart is given below:

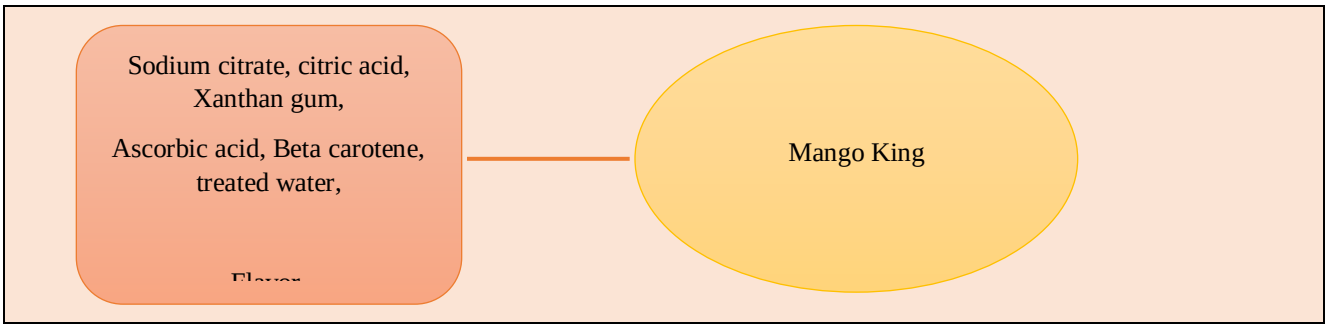


The parameters for juice production:

Product	% TA	BRIX	pH
MANGOLEE	0.20±0.025	14.6±0.2	3.5-4.0
MANGO KING	0.225±0.025	15.8±0.2	3.3-3.5

The ingredients for the juices :





Different tests done for juice products:

On line	• Brix • Tase, odor & appearance • Torque test • Date code Label test
Lab	pH • %TA • Viscosity • Vacuum • Sulfur dioxide

Chapter 6

Microbiology laboratory tests

The microbiological tests are very important as they can make or break a beverage and its safety. This test is done once per batch of products. The tests are done with special care to make sure there is no cross-contamination. The results are noted down very carefully on a record notebook.

The different types of microbiological tests done for the reasons are given below:

Tests	Media	Method	Incubation period	Incubation Temperature	Acceptable Range
TPC (Total Plate Count) or TBC (Total Bacterial Count)	Plate Count Agar/Nutrient Agar	Pour plate method/Filtration Method	48-72 hours	35±2°C	Juice-50 CSD-50 Drinking water- 100

Tests	Media	Method	Incubation period	Incubation temperature	Acceptable range
Yeast/Mold Test	Potato Dextrose Agar	Pour plate method/Filtration Method	5-7 days	25±2°C	0

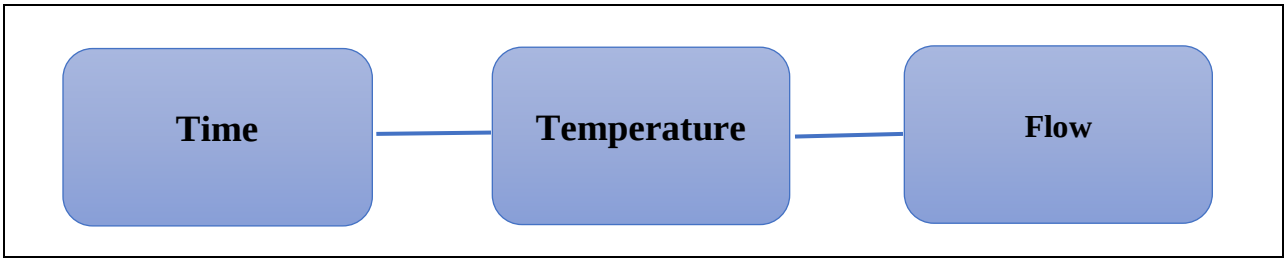
Tests	Media	Method	Incubation period	Incubation temperature	Acceptable range
Coliform Test	McConkey Agar/m-Endo growth media	Pour plate method/Filtration Method	24-48 hour	35±2°C	0

Chapter 7

The CIP system

CIP or cleaning-in-place is a system by which the heavy and important machinery of the factory are cleaned. It takes 4 hours to conduct CIP in SYMPACK machine and 2 hours for KMS machine. At AST beverages 5 step CIP is followed before every product line change. But, here instead of caustic soda, nitric acid is used. And if any product line has not been in use for quite a time or if the microbial load of any product line is increased than the acceptable limit, then 7 step CIP routine is done.

The most important factors to a successful CIP system. They are:



There are three types of CIP systems available that are mostly used. They are:

3 step CIP	5 step CIP	7 step CIP

- The 3 step CIP:

1. Normal water (10-15) min.
2. Hot water run for 30 min, at 85°C.
3. 3. Normal water run for (10-15) min.

- 5 Step CIP- (Done every 72 hours) (Schedule CIP)
    1. Normal/Rinse water flow for (10-15) min.
    2. Caustic soda (1.0-1.75) % for 25 min, temperature at (65-77) ° C.
    3. Normal water (10-15) min.
    4. Hot water run for 30 min, at 85°C.
    5. Normal water (10-15) min.

- 7 Step CIP-

1. Normal water (10-15) min.
2. Caustic soda (1.0-1.75) % for 25 min, temperature at (65-77) °C.
3. Normal water (10-15) min.

4. Nitric Acid (0.6-0.8) % for 30 min.
5. Normal water (10-15) min.
6. Hot water run for 30 min, at 85°C.
7. Normal water (10-15) min.

Chapter 8

The effluent treatment plants

Effluent treatment plants:

- The effluent treatment plants consist of different boxes with pores that are made of metals such as iron or steel. The pores are of different sizes and in each layer of the pores, there are stones or tiny gravel particles placed in which the water flows.
- While the wastewater is flown through this system the different size pores and different layers of granules capture and trap the impurity depending on their sizes.
- This process will take away most of the solid wastes.
- Now, with the help of an inlet pump, a set weighted amount of waste water enters a homogenization system tank. An aeration pump takes the homogenized water to another tank which is relatively smaller.
- Here, calculated percentages of Aqua-Lung (6-7 kg in 120L of water), K-alum(6-7 kg in 120L of water), and Polymer (70gm in 120L of water) are added.
- Once the added chemicals mix with the water completely, they will be sent to an aerobic biodegradation chamber. And after the degradation, the water is filtered.
- The filtered water will stay in the main tank for sedimentation and sludging. The sludges are separated and dumped while the water is kept in a settling tank where some leftover wastes are sedimented.
- The water will be now filtered with carbon and sand filters. After these filtration processes, the water will be taken to the reserve tank when the air will be incorporated again in order to increase the DO (dissolved oxygen) level of the water.
- Now the water will be taken to a chamber for aeration. And with this step, the treatment of the water is done and the water becomes safe to be discharged to the environment.

The ISO standard for ETP plants:

Quality parameters	**Unit**	**Standards**
Electro chemicals	Micro siemens/cm	Max.1200
Color	-	Non-objectionable
Suspended solids	Mg/l	Max .150
pH	-	6.0-9.0
TDS	Mg/l	Max. 21000
DO	Mg/l	14.5-8.0
BOD	Mg/l	Max .10
Oil and grease	Mg/l	Max.10
Toxicity	-	Non toxic

Chapter 9

Conclusion

Conclusion

This internship program gave me an insight into the real world of beverage production. The time of my internship happened to be during the summer production season. This is the time they produce the most amount of carbonated cold beverages as it holds most of the demands. The machines were working 24 hours straight to meet the target of supplies every day.

Even in this busy atmosphere, everyone in the factory was kind and eager to give us their time so that we can learn. I had the chance to see beverage productions from start to finish. to give some final touch of information summary, the company is built on a land of about 6 acres, and the factory has 7 different production lines ranging with 4 production lines (CSD), 2 tetra pack lines, and 1 drinking water line, which also is used for carbonated beverages when needed. The summer season is their most busy season of the year as cold beverages have high demand. The juice lines and CSD lines are set in a schedule where they can fulfill the target production without compromising one or another. But the summer is basically for tiger energy drinks and fizz-up production as they are the most popular during this time. The drinking water is produced during the winter as the lines are not as busy as in summer times making it easier to use the lines for varieties of products. Some beverage productions fully depend on the availability of the ingredients so if the flavor and raw material are not exported on time that beverage is kept on hold of production. Every officer works eight to twelve-hour shifts depending on the schedule and they carefully manage the production lines to avoid any accidents and ensure the quality and availability of products. Every single raw material is individually tested to ensure purity. From production to putting them on the shelves of the supermarket, a lot of careful thought and management is involved and I would have never thought of how deep a product formulation and production is without seeing it first-hand. This internship program has let me experience the insightful taste of production strategy of food articles and I am forever thankful for this opportunity.