



**Internship Report on**

“Product Manufacturing in AST Beverage Ltd. (Concern of Globe Pharmaceuticals Group of Companies)”

**Submitted to**

**Dr. Nizam Uddin**

Associate Professor and Head

Department of Nutrition & Food Engineering

Faculty of Allied Health Sciences

**Supervised by**

**MD. Harun-Ar-Rashid**

Lecturer (Senior Scale)

Department of Nutrition & Food Engineering

Faculty of Allied Health Sciences

Daffodil International University

**Submitted By**

**Israt Jahan Emu**

ID: 183-34-810

Department of Nutrition & Food Engineering

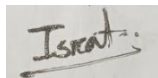
Faculty of Allied Health Sciences

Daffodil International University

**Date of Submission:**

### Declaration

By submitting this internship report “Product Manufacturing in AST Beverage ltd. (Concern of Globe Pharmaceuticals Group of Companies)”, I declare that the entirety of the work contained therein is my own, original work, and I am the sole author of it. It also declares that it has not been submitted elsewhere for any conferment.



.....  
Israt Jahan Emu

Student, B.Sc. (Hon’s), Nutrition and Food Engineering (NFE)

Student ID: 183-34-810

E-mail: israt34-810@diu.edu.bd

Department of Nutrition and Food Engineering

Faculty of Allied Health Sciences

Daffodil International University

Dhaka, Bangladesh

## LETTER OF TRANSMITTAL

Date:

Dr. Nizam Uddin

Associate Professor and Head

Department of Nutrition and Food Engineering,

Faculty of Allied Health Science

Daffodil International University Dhaka, Bangladesh.

Subject: Submission of Internship report

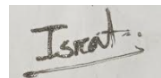
Sir,

I, Israt Jahan Emu (ID 183-34-810) would beg to state that, it is a matter of honor and pleasure for me to have this momentum to submit this Internship report as a part of the curriculum of Nutrition and Food Engineering (NFE) program.

I have prepared this report based on the knowledge as well as information I have gathered throughout the one and half month period of my internship in “AST Beverage Ltd, Shimrail, Shiddhirgonj, Narayanganj. (Concern of Globe Pharmaceuticals Group of Companies)” This report contains the detailed information of Internship Training on Product Developments & Analyzing Product Activities in AST beverage”. Since this was the first time, I was given the chance to experience the practical process of how a beverage industry works, I tried my level best to learn as much as I can within this period of time. This internship provided me the opportunity to not only learn how one of the leading beverage industries functions from within but also how it feels to develop a network and survive in the corporate world.

I therefore, would like to present this internship report to you. Your kind advice and suggestion will guide as well as encourage me to do well in the near future.

Sincerely Yours,



Israt Jahan Emu

Student ID: 183-34-810

Department of Nutrition and Food Engineering

Faculty of Allied Health Sciences

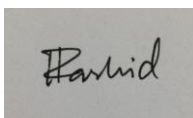
Daffodil International University

**Letter of approval**

I am pleased to certify that the internship report on “Product Manufacturing in AST Beverage ltd. (Concern of Globe Pharmaceuticals Group of Companies)”conducted by Israt Jahan Emu (ID 183-34-810) student of department of Nutrition and Food Engineering has been approved for defense\ viva voice. Under my supervision Israt completed her one and a half month of internship period.

I am pleased to certify that Israt Jahan Emu has completed her internship based on our instructions. I strongly recommended the report presented by Israt for further academic endorsement & defense\ viva voice.

Israt bears a strong moral character & a very amiable personality. It is indeed a great pleasure working with her. I wish her all success in life.



.....  
**Md. Harun-Ar Rashid**  
Lecturer (Senior Scale)  
Department of Nutrition & Food Engineering  
Daffodil international university

.....  
**Dr. Nizam Uddin**  
Associate prof. and Head  
Department of NFE  
Daffodil International university

## **Acknowledgement**

Firstly, I want to thank almighty Allah for providing me with the soundness and opportunity from the very beginning to the end of my internship period so that I could learn as an intern and complete the internship report on time.

I would like to express deepest gratitude to my supervisor, Md. Harun-Ar-Rashid, Lecturer (senior scale), Daffodil International University, for his kind advice, support and guidance. I choose this moment to acknowledge his contribution gratefully.

I would also like to thank Md. Munjurul Azam, QC Head and lab manager of AST Beverage Ltd of GLOBE group, for making my internship days easier and providing me enough time and scope to learn.

I'd like to express my gratitude to Ms. Fouzia Akter, Head, Department of Nutrition and Food Engineering, for her kind advice and support. My deepest gratitude goes to Daffodil International University's entire NFE Department for arranging an Internship Program that helped me not only with theoretical knowledge but also with proper practical implications

At last, but not the least, I'd like to thank the entire AST beverage team (from managers, officers to factory workers), for helping me from moral to material needs as well as enlightening me with their knowledge to improve mine. I must mention this organization's amazing working balance in resolving problems, maintaining the harmony within the factory and fulfilling the flow of product delivery which has helped me to get acquainted with the factory life throughout this internship period.

## **Executive Summery**

I have prepared this report on the basis of my one and a half month period of practical experience at AST Beverage Ltd, Shimrail, Shiddhirgonj, Narayanganj, Bangladesh. (Concern of Globe Pharmaceuticals Group of Companies)". This internship program enriched me with the practical knowledge & experiences about drinking water, beverages (carbonated soft drink, juice), Water Treatment Plant, PET Plant, quality control, Microbiological tests, RO plant, CO2 plant, different laboratory tests, CIP etc. GLOBE is one of the most renowned and top food industries in Bangladesh. More than 25 years ago, Mr. Harunur Rashid dreamt of Globe Pharmaceutical Group of Companies Ltd. With determination, will and his uncompromising belief he built an empire so that it could nourish the common people. It was dedicated to deliver well-being of numerous of people of our country. In 1986, when Globe became successful in the pharmaceuticals business it started its journey with foods and beverage market to introduce people with good quality foods and drinks with affordable price. In 2002 it started its journey in beverage sector which is situated in Noakhali and in 2006 it started AST beverage Ltd producing the same line of beverages. It is one of the top brands in energy drinks, holding a very strong position in soft drinks, natural juice and mineral water industry. It has the ability and capacity to meet with the demands domestic as well Global market. It plays an essential role in the country's economy by using countries man-power hence reducing the unemployment problem of this developing country and merging as one of the most flourished organizations of Bangladesh. AST beverage Ltd. Accepted my internship proposal which was grateful of them as I have observed and learnt about a beverage company from so close. Finally, I could use my book-based knowledge into practical use during the total period of my internship program.

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## Chapter 1- Introduction

With a vision to be the first choice in beverages among the existing companies, GLOBE started its journey in beverage industry in 2002 promising to deliver high quality and different varieties of beverages.

Starting with URO lemon they introduced different flavors like URO cola, URO orange which made history. As Bangladeshi consumers showered their love towards these products, the company introduced new soft drink products like Fizz up, energy drink Royal Tiger (emerging as the number one energy drink in the country). After this amazing success of royal tiger, they introduced another energy drink “Black Horse” into the market. These energy drinks were very popular among the young generation. They are also producing mineral waters like Alma and H2O.mThey have other popular products like “Mangolee”, “Oranje”, “Lychena”, “Lemonjee” etc.

At the very beginning, the production capacity at GSDL (GLOBE SOFT DRINKS & BEVERAGE LTD) plant was 10,000 liter per hour. In 2003, the capacity was expanded to 25,000 liter per hour. Due to huge consumer demand not only in domestic but also global market, GLOBE set up another factory plant in Narayanganj named AST Beverage Ltd in 2006. This plant is also equipped with hi-tech automated production line from European origin. From PET bottles, CO2 gas to finished products they produce everything in their own plant which provides more convenience during production. After, this the company was able to produce 80000 liter of beverages per hour.

GLOBE believes in research, product development, experiments and introducing new products in the market to keep up with the pace of consumer’s changes in taste. GSDL is fully dedicated to meet the demands of export as well as local demand while AST is fully devoted to feed the domestic market. They ensure that all the products they are producing are meeting with the local and global standards like WHO, GMP standards and local regulatory norms in every step of sourcing & buying raw ingredients with best quality, product manufacturing, quality assurance and delivery of products.

They also make sure that all the activities are in line with the documented Quality Management System (QMS), following International Standard requirements of ISO 9001 and continuously developing Human Resources by regular training, workshop and participation.

With their amazing products and marketing tactics GLOBE is emerging as one of the most demanding beverage brands of the country. In 2007, Globe Soft Drinks Ltd. started to export their products like “Uro Cola, Uro Lemon, FizzUp, Lychena, Royal Tiger Energy Drinks” etc. to 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.

## Chapter 2: Significance of the Study

In the market of beverages, the manufacturers continue to do research, study, experiment and develop new products to keep up with the consumer's need, want and demand. In Bangladesh, there are many beverage making companies but among them, Globe is one such brand which has more diversity in products. It has more products in the market than any other brand.

Innovation has been the main key of this company from the very beginning. They have a diverse line of beverage products with amazing new flavors which sets them apart from the most the brands of the country.

As a food engineer, I saw greater scopes here to learn as they are so keen to do different types of research and product development. This, internship report contains detailed information about their beverage production overview and many more things. Due to this study scope, I was able to see and learn how a beverage industry works from production to Distribution.

## Chapter 3- Carbonated Soft Drink (CSD)

### 3.1.1 PET (Polyethylene Terephthalate) Plant (Bottles)-

Resin is a by-product of oil. Countries which have more oil, produces resin as a by-product and supplies to other countries. There are different types of resins available in the market. PET resin is used to make bottles. The brand which is used in AST is called ASPET.

There are two types of polymers-

1. Hydroscopic (absorbs moisture)
2. Non- Hydroscopic

PET resins are usually of two types-

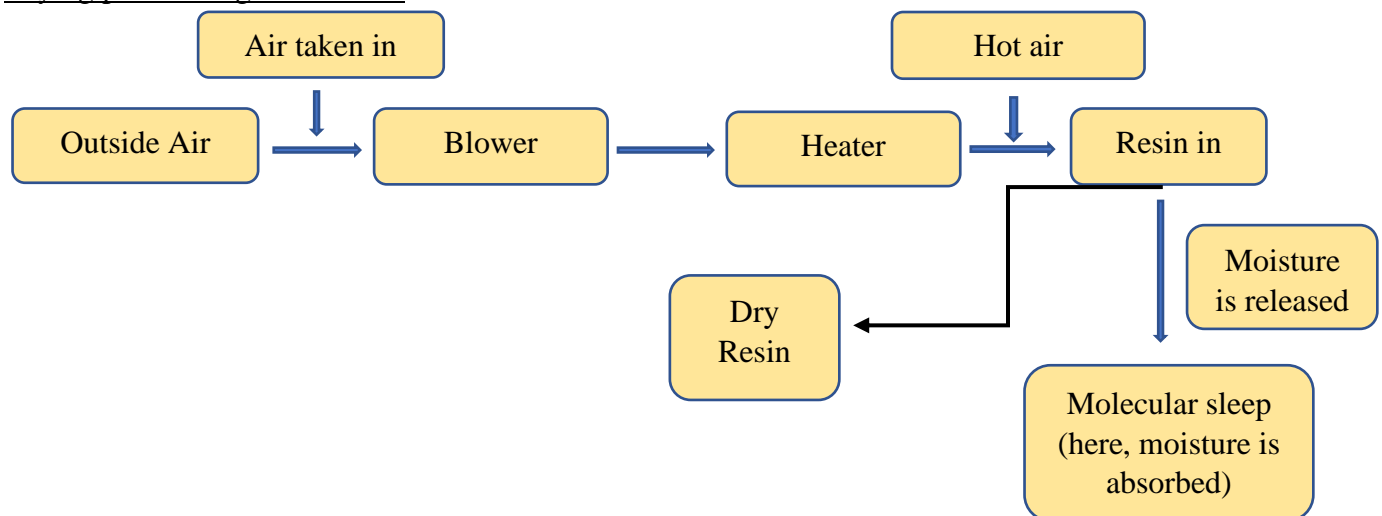
1. Bottle grade. (Color is usually white. While heated it becomes transparent)
2. Synthetic Resins. (Color is usually transparent. While heated it becomes white. Its percentage is usually used in making of polyester clothes.)

PET resins are used in bottle making because-

- High transparency.
- Light weight.
- Easily available in market.
- Low price.
- Its more efficient in holding the pressure of CO<sub>2</sub> than other resins.
- Not in risk for breaking.

If hydroscopic resin is used then moisture should be removed first before making bottles out of them. Usually, dryer is used to dry the PET resin.

Drying process is given below-



**Figure-1: (PET resin Drying process)**

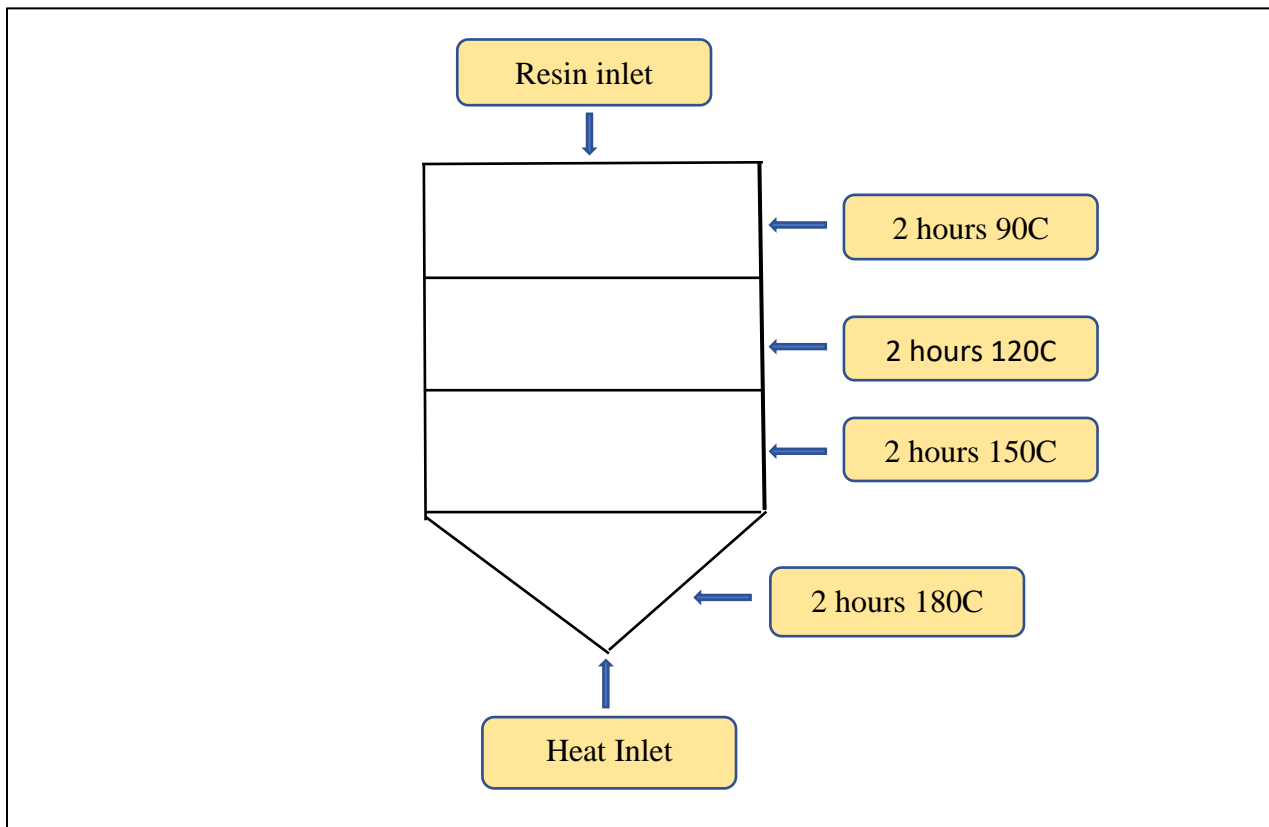
The PET resins are dried for 8 hours which includes 4 steps-

1. 1<sup>st</sup> Step → 2 hours at 90degree C.
  2. 2<sup>nd</sup> Step→2 hours at 120degree C.
  3. 3<sup>rd</sup> Step → 2 hours at 150degree C.
  4. 4<sup>th</sup> Step → 2 hours at 180degree C.
- } Total 8 hours

Key factors of dryer-

- Air flow.
- Temperature
- Time.

If there is problem in maintaining any of these three factors, the preform will retain moisture and the bottle will be faulty. If there's any problem in the dryer then, it is put at cool for 2 hours.



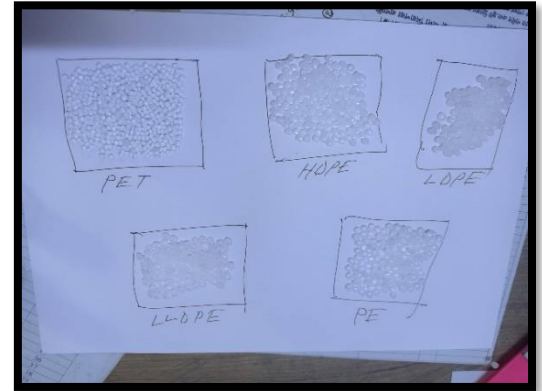
**Figure-2: Hopper**

Here, heat is inserted from the bottom at 180C and resin is inserted from the top into the hopper. At the top step, the temperature is 90C. As the resin falls from the top at each step it stays for 2 hours, absorbs heat and moisture is released. In this way, different temperatures are maintained at different steps of the hopper. The melting point of PET resin is 280C. That's why, if the temperature of the dryer exceeds 220C, an alarm starts to ring. Then the situation is controlled by putting the dryer at cool stop for 2 hours. Dew point for PET resin is -45C. It helps us to know

the drying quality. It is the ratio of cooling line and heating line. It is used so that the temperature of the dryer does not exceed 180C. The dew point should always be in negative (-). Once, the resins are dried, it goes for next step (preform preparation).

In AST beverage Ltd., different types of resins are used for different purposes-

- PET → For bottles (Hydroscopic)
- HDPE (High Density polyethylene) → For cap. (non-hydroscopic)
- LDPE (Low density Polyethylene) → For case wrapping paper. (Non- hydroscopic)
- LLDPE (Linear Low-Density Polyethylene) → For case wrapping paper. (Non- hydroscopic)
- PE (Polyethylene) → For case wrapping paper. (Non- hydroscopic)



### 3.1.2 (Preform preparation)

Figure-3: Different types of resins

Preform making process is given below-

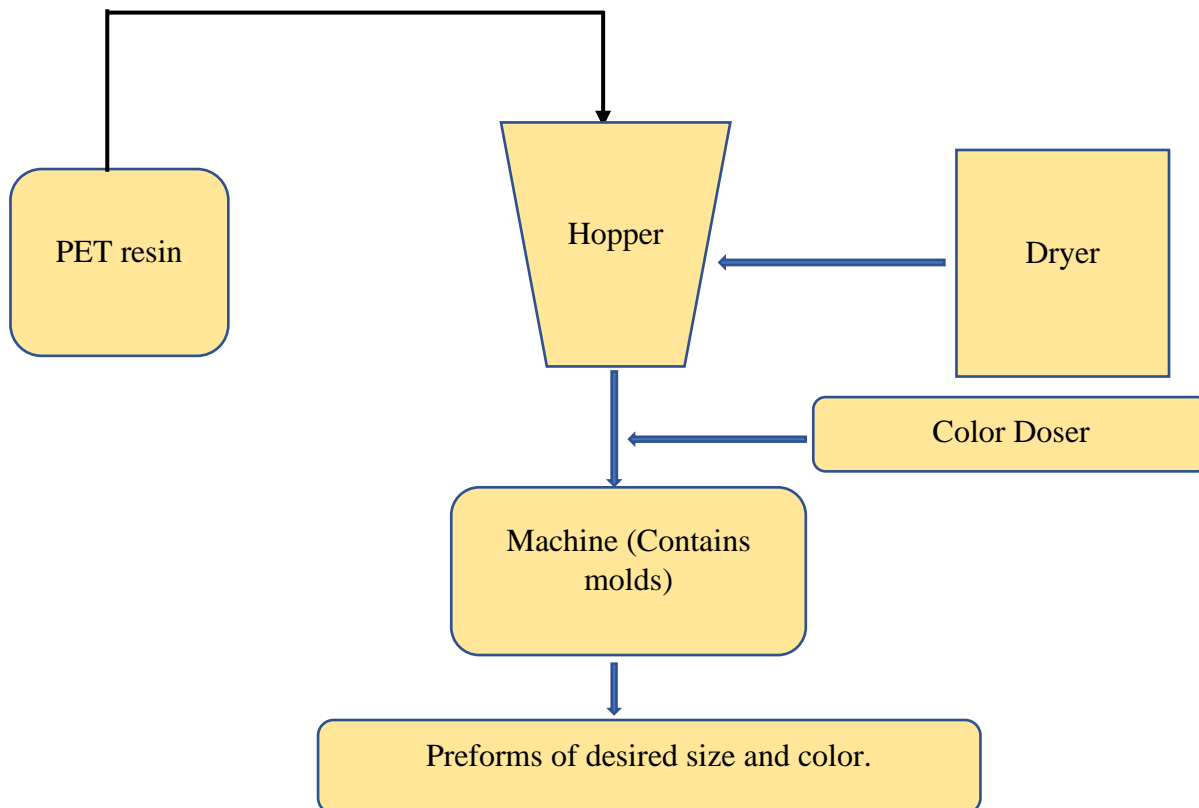


Figure-4: Preform preparation flowchart.



**Figure-5: Picture of 250 ml bottle preform.**

From the time of filling the resin into the mold to preparing preform, this duration of time is called 1 cycle time. There are 3 preform making machines in AST.

**Table 1: No. of preforms produced by each machine in 1 cycle time along with their hopper capacity.**

Machine Name	Hopper capacity	No. of preforms produced per 1 cycle time	Cycle Time
AST06	4300 kg	72	14.5 seconds
AST07	3500 kg	72	28 seconds (For 50g size of preforms)
AST08	6500 kg	144	14.5 seconds

Different preform weights for different types of products and sizes are mentioned below along with the market range levels-

**Table 2: Preform weight for different products and sizes of bottles.**

Product Type	Product Name	Bottle sizes	Preform sizes	Market range
CSD	Fizz up	250 ml	16.76 gm	13-18 gm
		500 ml	20.76 gm	18-22 gm
		1000 ml	35 gm	28-36 gm
		2000 ml	50 gm	46-52 gm
	Lemonjee	175 ml	13 gm	12-15 gm
	Oranje	175 ml	13 gm	12-15 gm
	Lychena	175 ml	13 gm	12-15 gm

	Uro lemon	250 ml	16.76 gm	13-18 gm
	Uro Orange	250 ml	16.76 gm	13-18 gm
	Uro cola	250 ml	16.76 gm	13-18 gm
Energy Drinks	Tiger	250 ml	16.76 gm	13-18 gm
	Black Horse	250 ml	16.76 gm	13-18 gm
Juice (Hot fill)	Mangolee	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	300 ml	13 gm	10-15 gm
	Alma	500 ml	20.76 gm	16-20 gm
		1500 ml	35 gm	28-36 gm

The weight of the preforms depend on the product type, amount etc. For example, for 250 ml CSD, the preform weight is 16.76 gm but for 250 ml juice, the preform weight is 20.76 gm. It is because juice is filled hot. That's why the bottle should be strong enough so that its shape does not change after filling the juice due to heat. The most important parameter of PET is IV (Intensive viscosity). It is an index of polymer molecular weight as determined by measuring the viscosity of a polymer solution.

PET Parameters can be-

- Measure of the polymer's molecular weight.
- IV reflects the materials melting point.
- Crystallinity.
- Tensile strength
- IV (a key QC specification and perhaps the most important characteristic of PET. The IV is dependent on the length of the polymer chain. Oil/water bottle (no hot fill + no gas product) has PET resin containing IV (0.70-0.78). On the other hand, CSD bottle has PET resin containing IV (0.80-0.86). In case of CSD bottles, if IV is less than 0.80, then the bottle will swell up due to CO<sub>2</sub> gas. Here in AST, they use resins for water and oil bottles with IV 0.70. And for, CSD and hot fill juice, they use resins with IV 0.84. High IV value indicates high acetaldehyde value. Acetaldehyde value should always be below 1. Otherwise, the product will get spoiled. That's why, whenever high IV value containing resin is used, before using it, acetaldehyde value is tested.
- Melting point. (245C)
- L value and V value to check colors.



During preform making-

- Temperature of machine → 270-290C
- Temperature of dryer → 180C (cooling tower temperature is 26-30C to lower the temperature of the hydraulic oil in dryer)
- Temperature of mold → 270-290C

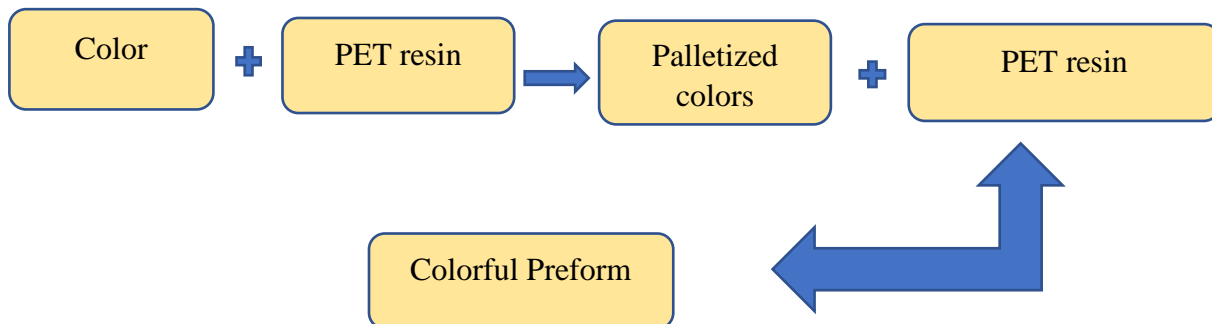
In the mold, there is chiller water which is used to cool down the hot preforms. The temperature of the chiller water is (9-11C) and the pressure is (5-7) bar.

Those preforms in which, color is used is called master batch. AST beverage uses colors supplied by local supplier.

There are two main types of colors-

1. Liquid colors.
2. Palletized (Granular colors). In AST beverage, they use palletized colors.

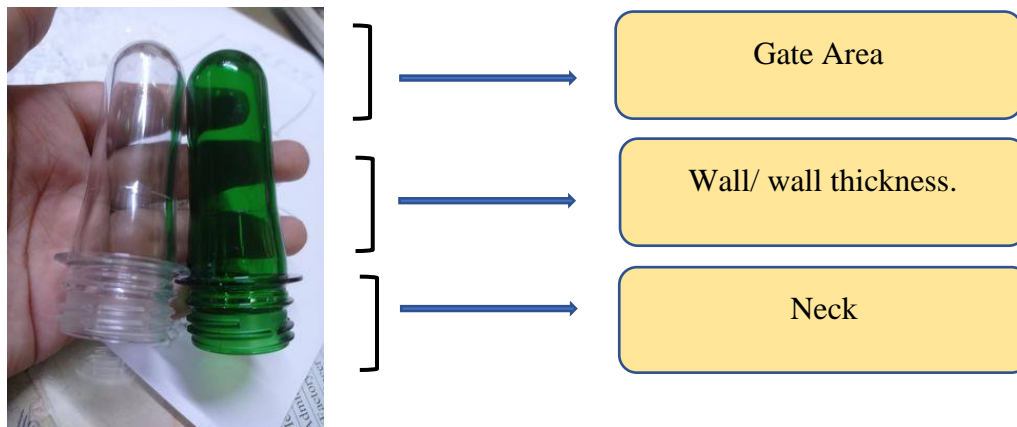
Master batch is usually liquid when it is produced. Then it is mixed with resins at (0.6-0.8) %. Usually 600-800gms with 100kg of resins. It is done so that the mixing of colors with resins to make preform becomes easier.



**Figure-6: How Palletized Colors are made.**

From 1gm of master batch, 10kg kg of palletized color is made. Then, it is added with 1000kg of PET resins. After that, it is sold to different industries as it is now more convenient to mix.

Preforms are usually divided into 3 parts-



**Figure-7: Names of different parts of a preform.**

The gate area is called the gate area because from this side the material is filled into the mold. The neck design is different for CSD products. Because it contains CO<sub>2</sub> gas.

Three types of faults are found in preforms-

1. Less Critical (may affect quality and performance)
  - Sink marks.
  - Stringing.
  - Excess wall thickness variation.
  - Intended parting line.
  - Gate dimpling.
2. Critical (Will affect quality and performance)
  - Long gate nub.
  - Flash.
  - Moisture Mark.
  - Gate crystallinity.
3. Very critical (will affect quality and performance to an unacceptable level)
  - Bubbles.
  - Unmelts.
  - Short shot.



**Figure-8: Faulty Preform**

In AST beverage, they usually face bubbles, unmelts and short shot problems (if fault is ever happened).

During preform making, there is heat exchanger connected to it. In the cooling line, water is used at below 0C. But it does not turn into ice. Because glycol is added to it. Glycol prevents the water flowing in the cooling line from turning into ice.

**Table 3: % glycol according to different temperatures.**

Temp	%Glycol additive										
Degree C	0	10	20	30	40	50	60	70	80	90	100
80			0.991	1.003	1.017	1.026	1.036	1.046	1.054	1.062	1.068
70		0.990	1.000	1.010	1.023	1.034	1.042	1.053	1.062	1.069	1.075
60		0.995	1.007	1.017	1.030	1.041	1.050	1.060	1.070	1.076	1.083
50		1.000	1.013	1.023	1.035	1.048	1.057	1.067	1.077	1.084	1.090
40	0.990	1.004	1.018	1.029	1.042	1.054	1.064	1.074	1.085	1.091	1.098
30	0.996	1.007	1.022	1.034	1.047	1.059	1.070	1.080	1.092	1.099	1.105
20	0.999	1.010	1.026	1.038	1.052	1.065	1.076	1.088	1.099	1.106	1.114
10	1.000	1.013	1.028	1.042	1.056	1.070	1.082	1.094	1.105	1.113	1.120
0	1.000	1.015	1.029	1.045	1.061	1.075	1.088	1.100	1.112	1.120	1.128
-10				1.048	1.065	1.079	1.092	1.107	1.118	1.127	1.135
-20					1.068	1.083	1.097	1.113	1.124	1.133	1.136
-30						1.087	1.100	1.118	1.128	1.137	1.137
-40							1.102	1.122	1.133	1.138	1.138

### 3.1.3 CAPS-

HDPE (High density polyethylene) resins are used to make Caps in AST beverage Ltd. The brand which is used here is called INNOPLUS (grade number-3502C). Here international standard cap making style is followed. The neck thread model which is used here is PC01881. The bottle opening diameter is 28mm. Single piece type of caps are produced and used here.

**Figure-9: Caps**

The main characteristics which are seen here are-

1. Density
2. MFI (Melt flow index) (The higher the MFI, the product will be softer).
3. ESCR (Environmental Stress Cracking Resistance)

Density and MFI for different product holding caps-

**Table 4: Density and MFI for different product holding caps**

Product type	Density	MFI
CSD	0.982 cm/kg	1g/10 mins.
Water	0.982 cm/kg	6.5-8.50g/10 mins
Oil	0.982 cm/kg	6.5-8.50g/10 mins

Caps are made in two different molds-

1. IM (Injection molding.)
  - Here the material (resin) is pushed into the mold.)
2. CCM (Continuous Compression Molding.)
  - Here the material (resin) is continuously pressed in the mold.

In AST, the Cap producing machine 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.

AST has two different machines with two different molds-

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

**Table 5: Difference between IM and CCM caps.**

CCM caps	IM caps
No injection spot	Injection spot
Weight – 2.35gm.	Weight – 2.20gm.
Less electricity is required.	Relatively more electricity is required.
High amount of production at low cost.	Low amount of production at high cost.

Different temperature in cap making-

- HDPE melting temperature is →180-220C
- Cap cooling temperature →10-14C (for injection mold)
- Cap cooling temperature →14-18/20C (for Continuous compressing mold)

Types of defects in caps-

- Liner problem. (CO<sub>2</sub> gas will fly away after filling)
- Cooling problem.

**3.1.4 Case Wrapping Paper/Shrink film-**

Shrink film is used to wrap the cases of beverages. It is made up with three different types of resins. The three different resins are mixed together at a counted proportion. The temperature maintained to make this film is around 130-160C.

Composition of shrink film-

- LDPE→25kg
- LLDPE→1.5kg

Output is almost 47kg of wrap. In this, 7kg is considered as wastage and 40kg is final

- PE → 4kg.

Brands for these resins used in AST-

- PE → Marlex.
- LLDPE → SABIC
- LDPE → SABIC

MFI for this resins-

**Table 6: MFI value for the three resins used in making the shrink film.**

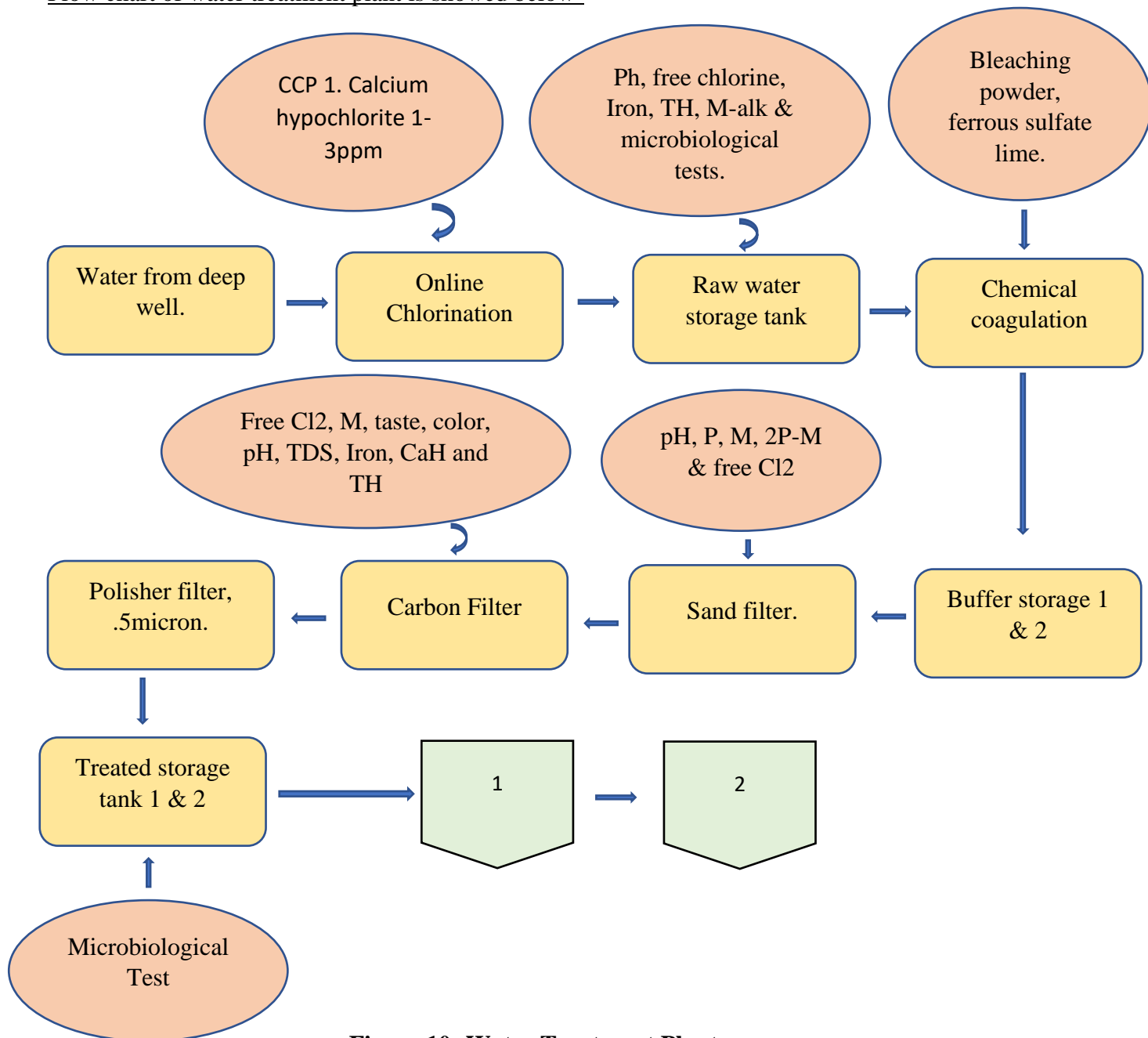
Name of the Resin	MFI
PE	0.039gm/10min (grade No. BN5502)
LLDPE	2gm/10min (grade No. 218W)
LDPE	20gm/10min

To get the perfect size of the wrapping paper, they cut the edges of the films. After cutting the sides or edges of the wrapping paper, AST produces a lot of wastes. They shred down the edges, packs them and sells them to other industries which can be used for many other purposes. This process lowers down the waste production of the factory.

### **3.1.5 (WTP) Water Treatment Plant-**

Water is the first and foremost component of any type of industry. In food industries, the importance of water is impeccable. Specially in beverage industries. AST beverage produces their own water within the factory to meet the daily requirement for the production and other uses. They have total two water treatment plants. Water is collected by motor from deep and then brought to overhead water storage tank. That's how first step of water treatment is started.

Flow chart of water treatment plant is showed below-



**Figure 10: Water Treatment Plant.**

- In the overhead tank, bleaching powder is added.
- The capacity of multimedia filter is 15,000L. It contains gravel as well as sand filters.
- The capacity of coagulation tank is 35,000L. Here flock is formed due to the addition of lime, ferrous sulphate and bleaching powder.
- There are two buffer tanks in AST beverage Ltd. The capacity of each of the tanks are 32000L. Here sludge is formed.

- Then the water goes to sand filter. The capacity of this tank is 15,000L. It is cleaned after every three months.
- Then comes the carbon filter. It contains granular carbons. It absorbs chlorine from the water. Capacity of this tank is 15,000L.
- After that, water goes to polisher filter. It contains 18 cartridges with 0.5 microns. The capacity of the cartridges can be reduced with time.
- After that, treated water is produced and goes to the treated water tanks. It is cleaned after one month.

Different tests for treated water-

- Turbidity test (AST range is 0.10)
- pH (AST range is 7.2)
- M alkalinity (AST range is 50)
- Iron test (AST range is 0.2%)
- Chlorine test.(2ppm dosing)
- Hardness test.
- P alkalinity.
- OT test.

CCP verification plan for carbonated beverage, fruit juice and drinking water-

**Table 7: CCP verification plan for carbonated beverage, fruit juice and drinking water-**

SI No.	Process step	CCP	Critical limit	Verification				Record doc. reference
				What	How	When	Who	
1	Raw water chlorination	Raw water chlorination	1.0-3.0 ppm of free chlorine.	Amount of free Cl <sub>2</sub> at the outlet of the storage tank.	Testing records.	After every 24 hours.	Quality manager	AST-MSP-8.5.1-06.F01
2	Pasteurization	Pasteurization temperature	(89-92) C at min 30s	Temperature	Monitoring record	After every 24 hours	Quality manager	AST-MSP-7.6.4F-08

3.1.5 (RO) Drinking Water Plant-

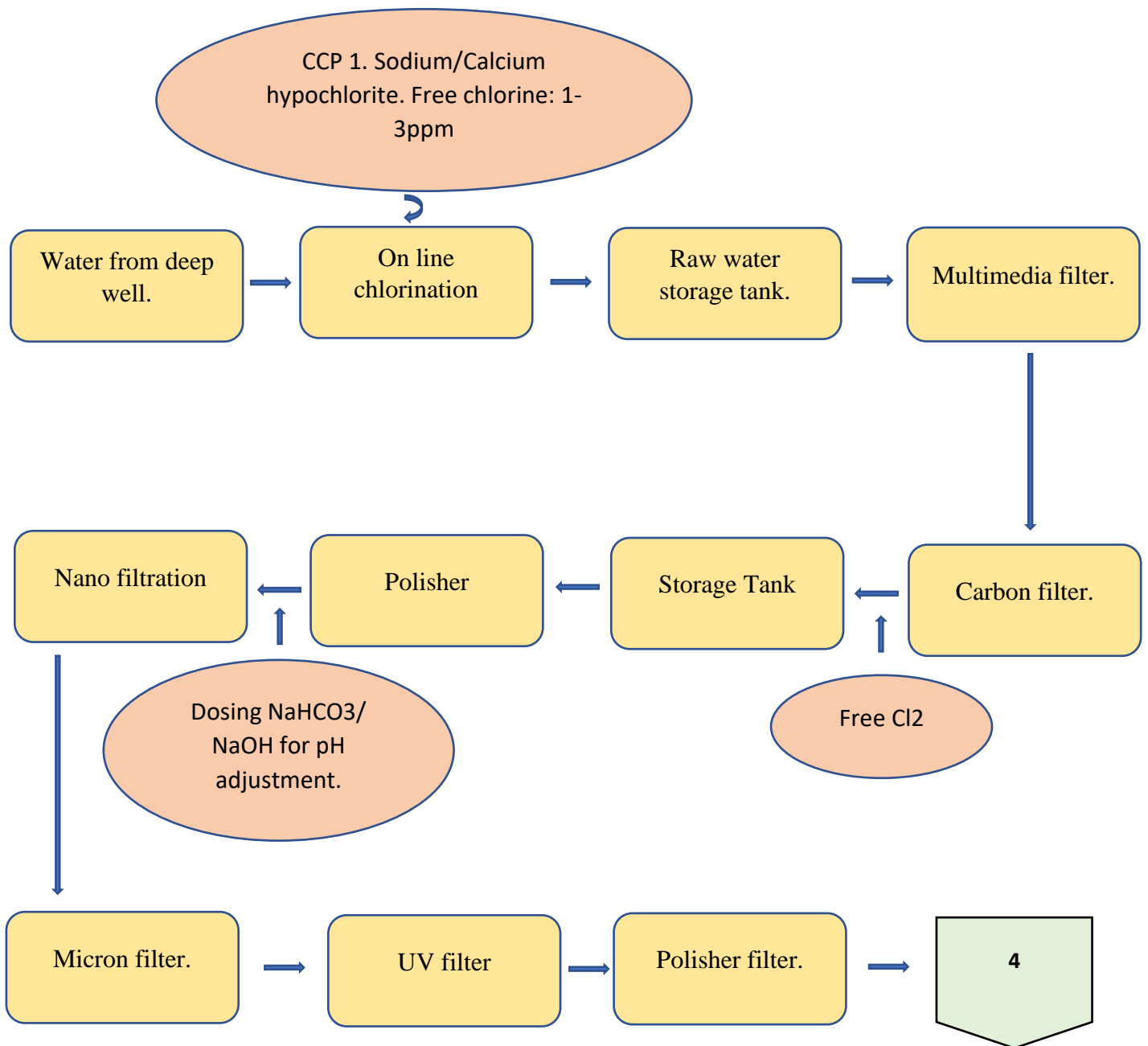


Figure-11: Drinking Water Plant.



### 3.1.6 CO2 Plant-

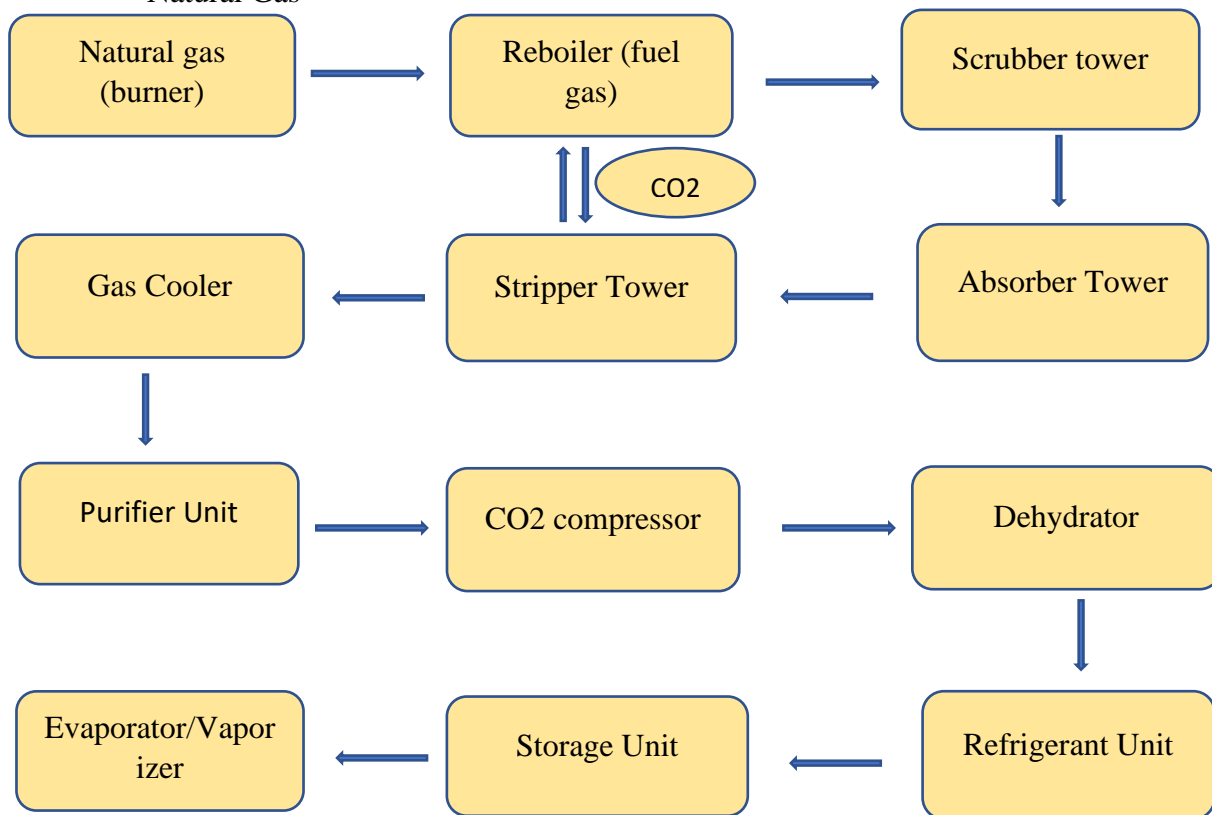
CO<sub>2</sub> is one of the most important ingredients in carbonated beverage making. CO<sub>2</sub> can be produced by two methods. One is by burning natural gas and other one by burning diesel. When natural gas is burnt other gases are also produced other than CO<sub>2</sub>. AST beverage limited produces their CO<sub>2</sub> within their own plant through burning natural gas. They have two CO<sub>2</sub> plants.

**Table 8: Hourly CO<sub>2</sub> gas production of the plants.**

Name of CO <sub>2</sub> plants	Production per hour
Union Plant	500Kg
Asco Plant	285 Kg

#### Ingredients required to produce CO<sub>2</sub>-

- Water
- Soda Ash
- MEA
- Soda Ash
- Natural Gas



**Figure-12: CO<sub>2</sub> production flow chart**

Broad specification-

- At first, natural gas is burnt in burner then it enters to reboiler.
- After that, it enters scrubber tower. The temperature of the gas here at first is (240-248) C. Here, softened water is used through flushing to reduce the temperature to (150-180) C.
- Then the gas comes to absorber tower through a blower. The top of the absorber tower is kept open always. In absorber tower, a mixture of soda ash (3%), MEA (9%) with the normality of (1.9-2.1) and water (88%) is present. If the strength of the MEA is not well maintained, then the purity of the CO<sub>2</sub> will not be acceptable. The acceptable purity limit of the CO<sub>2</sub> is (99.98-100) %. The mixture is kept at the bottom of the tower. Here, MEA absorbs CO<sub>2</sub> and let the other unimportant gas to go up in the environment. In the absorber tower, CO<sub>2</sub> test is also done. While the other unimportant gases leave the tower, they take away some amount of CO<sub>2</sub> with them. That's why CO<sub>2</sub> test is done. Because, the amount of CO<sub>2</sub> leaving cannot exceed 0.5.
- Then, through a reach pump the mixture of MEA and CO<sub>2</sub> goes to stripper tower.
- From, stripper tower the mixture goes to boiler again. There, the MEA is separated from the CO<sub>2</sub>. The lean ME (without CO<sub>2</sub>), goes back to the absorber tower. And the CO<sub>2</sub> comes back to the stripper tower.
- Then, the CO<sub>2</sub> goes to the gas cooler. The temperature of the gas is lowered from (150-180) C to (80-100) C.
- Then the CO<sub>2</sub> goes to purifier unit which is also known as after scrubber unit. As AST has two different CO<sub>2</sub> plants, these plants have two different ways of purifying the CO<sub>2</sub>. In union plant, it is done by using softened water. Here, using 2 bar pressure, the gas is weakened. In, ASCO plant it is done by using potassium permanganate.
- After purifier, the CO<sub>2</sub> gas goes to the CO<sub>2</sub> compressor.
- Then it goes to the dryer/dehydrator. In the dehydrator unit, the purity test of CO<sub>2</sub> is done at 35C. The temperature of the gas here is in between (30-40) C. There are two chambers at the dehydrator unit. One is called "Carbon filter-it is used to remove the bad smell from CO<sub>2</sub>". The other chamber is "molecular chips- it absorbs the moisture from the CO<sub>2</sub> gas".
- Then it goes to the refrigerant unit. The extra amount of produced CO<sub>2</sub> gas is converted into liquid here.
- Then this liquid gas goes to the storage unit. Here the temperature of the liquid gas is in between (-27C → -30C). Here, this liquid gas is risky to handle because it can cause cold burn to the skin from direct contact.
- When the CO<sub>2</sub> gas is needed, the gas is supplied from the storage unit through an evaporator where it is converted into gas again.
- After that, the gas is supplied to the production floor through pipes.

Extra information-

- After every 2 years, new MEA solution is to be prepared again and the old solution is changed.
- For a 500kg Co<sub>2</sub> production plant, the MEA solution (12000L) recipe would be-  
MEA → 1080Kg (9%)  
Soda ash → 360kg (3%)  
Water → Rest of the amount up to meet total 12000L solution. (88%)
- Total distribution of the 12000L MEA solution is distributed at different sections as following-

**Table 9: Distribution of MEA solution at different sections.**

Section name	Amount
Boiler	5500L
MEA Tank	3000L
Stripper	2100L
Pipeline	200L
Absorber tower	1200L

Due to continuous use of the MEA solution, its strength can become low. When this type of situation occurs, for example, if the strength of the MEA solution is reduced 0.1, then 60kg of MEA is added to the mixture. Water and soda ash are also added accordingly to correct the strength of the solution.

Smoke Test-

Smoke test is done to check whether the color of the fuel is ok or not. If it exceeds 11%, then the boiler is washed or cleaned.

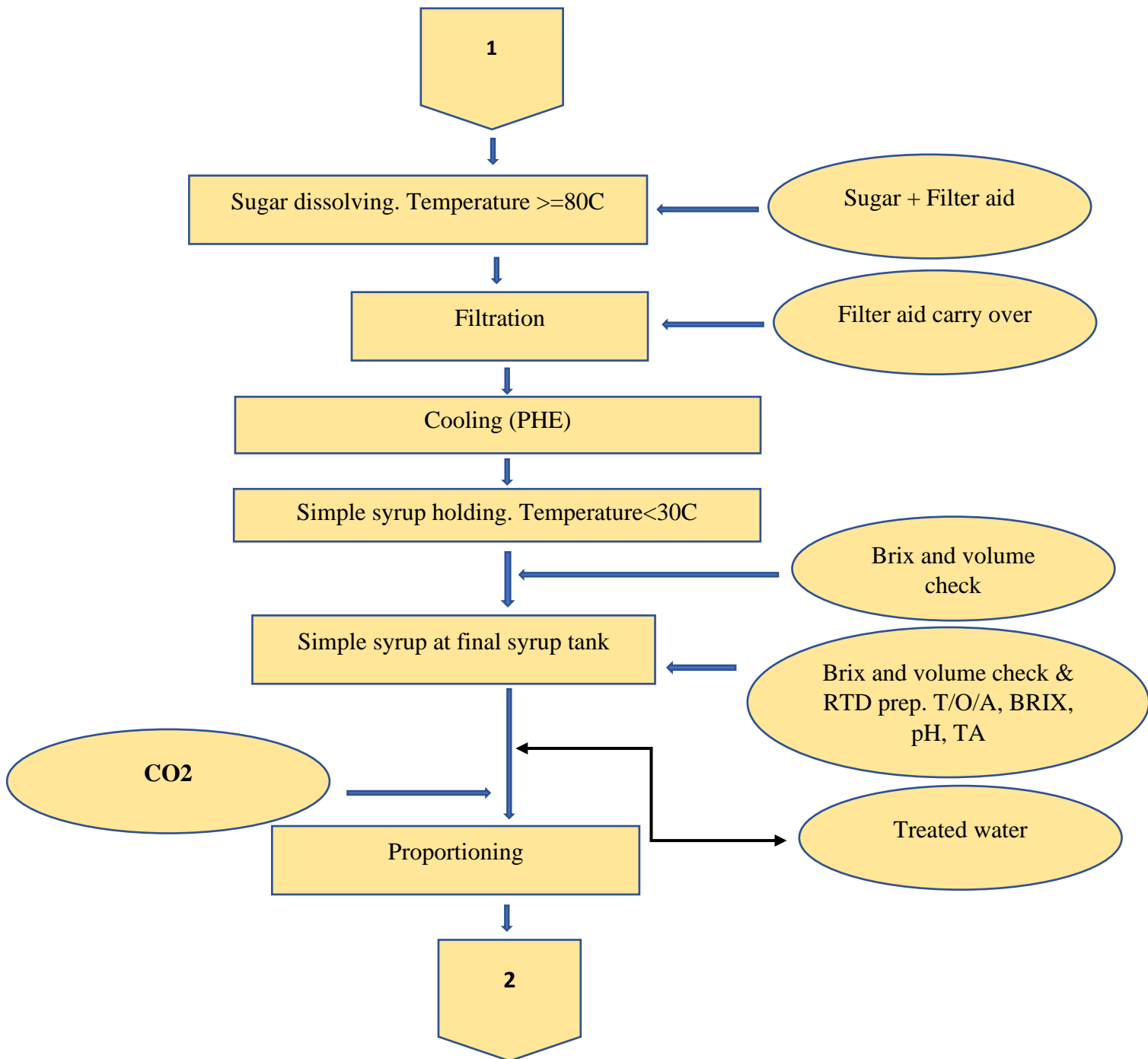
Precautions-

- CO<sub>2</sub> plant is a plant, where the heat is really high. People with heart condition should not work here.
- The workers of the plant should be hydrated.
- Direct contact with the liquid gas can cause cold burn.
- 

**3.1.7 (Syrup Making)-**

Syrup making is the first step in making any beverage product. RTD (ready to deal) test is done for syrups. It was not allowed for interns in the AST beverage to enter into the syrup

making room. But I got the following information from the Lab SOP (Standard operating procedure) book.



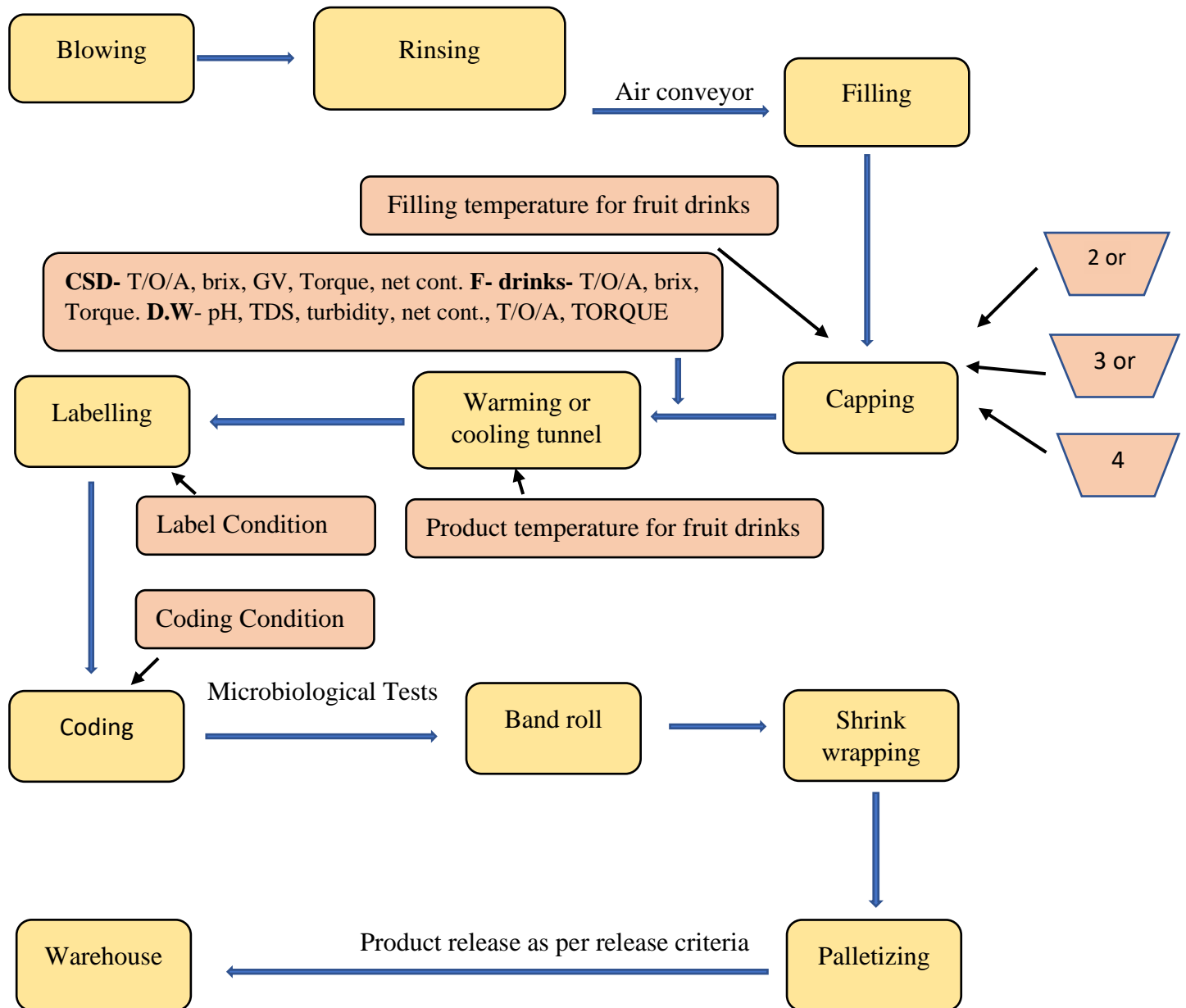
**Figure-13: Syrup making flow chart.**

Different Ingredients for different beverages are mentioned below-

**Table 10: Ingredient list for different beverages.**

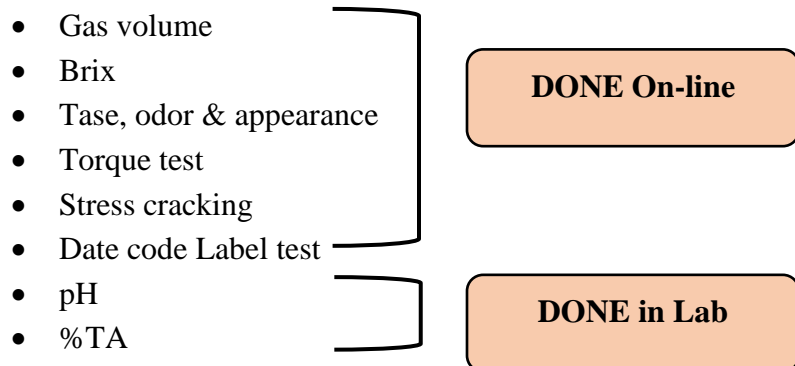
SI	Product Name	Ingredients
1	URO cola	Cola A and Cola B flavor.
2	URO lemon	Sodium benzoate, citric acid and lemon flavor
3	URO orange	Sodium benzoate, citric acid and orange flavor
4	Fizz Up	Sodium benzoate, citric acid, sodium citrate and lime lemon flavor
5	Royal Tiger	Sodium benzoate, citric acid, 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	URO Oranje	Sodium benzoate, citric acid, sodium citrate, orange compound and sacs, flavor.
9	Lycheena	Sodium benzoate, citric acid and lychee flavor.
10	URO lemonjee	Sodium benzoate, citric acid, sodium citrate, lemon compound and sacs, flavor.

**3.1.8 (PET filling to finished product)-**



**Figure-14: PET filling flowchart**

### 3.1.9 Different on-line quality tests for different CSD products-



#### Gas volume-

- Gas volume is usually checked for CSD products. It is checked using pressure gauge and thermometer. While checking, the temperature should be 20C.
- At first, the bottle is shaken several times. Then, placed inside the pressure gauge machine right beneath the piercing pin. Then, by putting pressure on top the pressure of the gas is checked. After that, using a thermometer, the temperature of the drink is checked in fahrenheit.
- Then, the gas volume is calculated by putting the value against each other on the gas volume chart. The intersected value is considered to be the gas volume of the drink.
- This test is done in every 30 minutes.

**Table 11: Gas Volume for different products**

Product Name	AST Gas volume range
Fizz up	3.5-4.0
Royal Tiger	3.5-4.0
Royal Tiger Diet	3.5-4.0
Black Horse	3.4-3.8
URO Lemon	3.5-4.0
URO Cola	3.5-4.0
URO orange	3.2-3.6
URO jal-jeera	3.5-4.0
Lycheena	3.2-3.6
Konia	3.5-4.0
URO oranjee	3.0-3.4
URO lemonjee	3.0-3.4
URO Lychena	1.2-1.5

**Brix-**

- Brix is checked to know about the sugar content of the product.
- It is done by using hand held refractometer.
- After cleaning the prism of the meter with distil water and wiping with tissue paper, place 2-3 drops of the drink on the prism. Then, lower the shutter and check the brix with eye without tilting the refractometer.
- Brix should always be checked at 20C.
- This test is done in every 30 minutes.
- The results are noted in a record file by the on duty QC officer.
- If any type of problem is found, like low brix, then the line is stopped. The syrup and water mixing ratio is checked, corrected and then the line starts again.

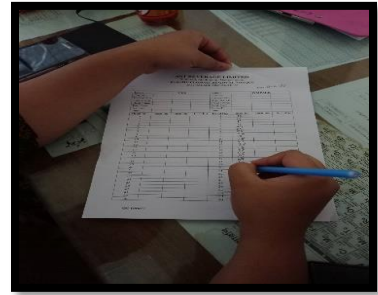
**Table 12: Brix range for different products**

Product Name	AST Brix range
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



### Torque Test-

- Torque test is done once in every 6 hours shift.
- It is done to see whether the caps are capable of holding on to the pressure of the CO<sub>2</sub> test. The torque should be of a value which indicates that, the cap will not be burst due to the gas pressure as well as it will not be very hard for the consumers to open it.
- At first, 20 bottles from the batch are collected. Then, they are marked. After that, using the torque tester machine, the torque is tested one by one. And the torque values are recorded



**Figure-15: Torque Test.**

- 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 ASAP.

### Stress Cracking Test-

- This test is done once in every shift.
- Total 26 bottles are collected (one from each mold) to perform this test. After collecting, they are marked on the cap with a marker.
- Stress cracking is done using 0.2% NaOH solution. In order to prepare 0.2%, 1000ml solution, 2g of NaOH is mixed with 1000ml water. So, 10gm for 5000ml. Since, in AST the NaOH they are using has 89% purity, so they add 11.23gm of NaOH in 5000ml.
- After preparing the solution in a bowl the bottles are placed inside the solution and observed for 30mins. If the bottles pass this test, they will not be hampered. But if any of them fail the test it will be burst. First check is done at 15mins, second is done at 20min, third is done at 25 mins and the last check is done at 30 mins and recorded in the record book.
- Direct contact to NaOH can hamper the skin. That's why gloves are worn during performing this test.



**Figure-16: Stress Cracking Test**

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

Date: 18-06-22  
 Preform: \_\_\_\_\_  
 Color: \_\_\_\_\_

Line # 01  
 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	u	u	u	u	
	201	u	u	u	u	
	206	pass	u	u	u	
	304		u	u	u	
	114	pass	u	u	u	
	315	pass	u	u	u	
	216	pass	u	u	u	
	213	pass	u	u	u	Okay!
	115	pass	u	u	u	
	301	u	u	u	u	
	202	pass	u	u	u	Test
	214	u	u	u	u	
	107	u	u	u	u	
	210	u	u	u	u	stop
	302	u	u	u	u	
	106	pass	u	u	u	
	102	pass	u	u	u	
	105	u	u	u	u	
	314	pass	u	u	u	
	310	pass	u	u	u	

Chemist \_\_\_\_\_      Manager-QC \_\_\_\_\_

Figure-17: Stress Cracking Test record



### Odor-Taste-Appearance Test-

- These are the sensory tests which are also done in every half an hour by the QC officer.
- If any type of problem is found in any of the parameters, then the production line stopped and the situation is taken under control ASAP.

### pH Test-

- pH test is done once for each batch during production.
- There are different types of pH machines available in AST.
- They usually do this test using digital pH meter.
- At first, the beverage is taken into a beaker and then it is de-aerated so that no CO<sub>2</sub> is present into the beverage.
- If there is CO<sub>2</sub> left into the beverage while testing the pH, the pH meter might not show the actual pH of the sample.
- After the pH is measured and recorded.



**Figure-19: Digital pH machine**

**Table 13: pH range for different beverage.**

<b>Product Name</b>	<b>AST pH range</b>
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

**%TA (Total acid)-**

- As like pH, it is also checked once per batch during production.
- This test is done in lab.
- Sample is taken in a beaker.
- For this test, the beverage sample is de-aerated at first.
- After that, take 10ml of the sample in a conical flask.
- Then, add 3-4 drops of Phenolphthalein indicator into the conical flask.
- Add 0.1N NaOH in the burette and start titration drop by drop.
- The titration is stopped once pink color is appeared and end point is recorded.
- Then by calculating, %TA is got.

**%TA= (Burette end point\*strength of NaOH\* molecular wt. of NaOH\*100)/sample vol.**





Figure-20: %TA testing in lab.

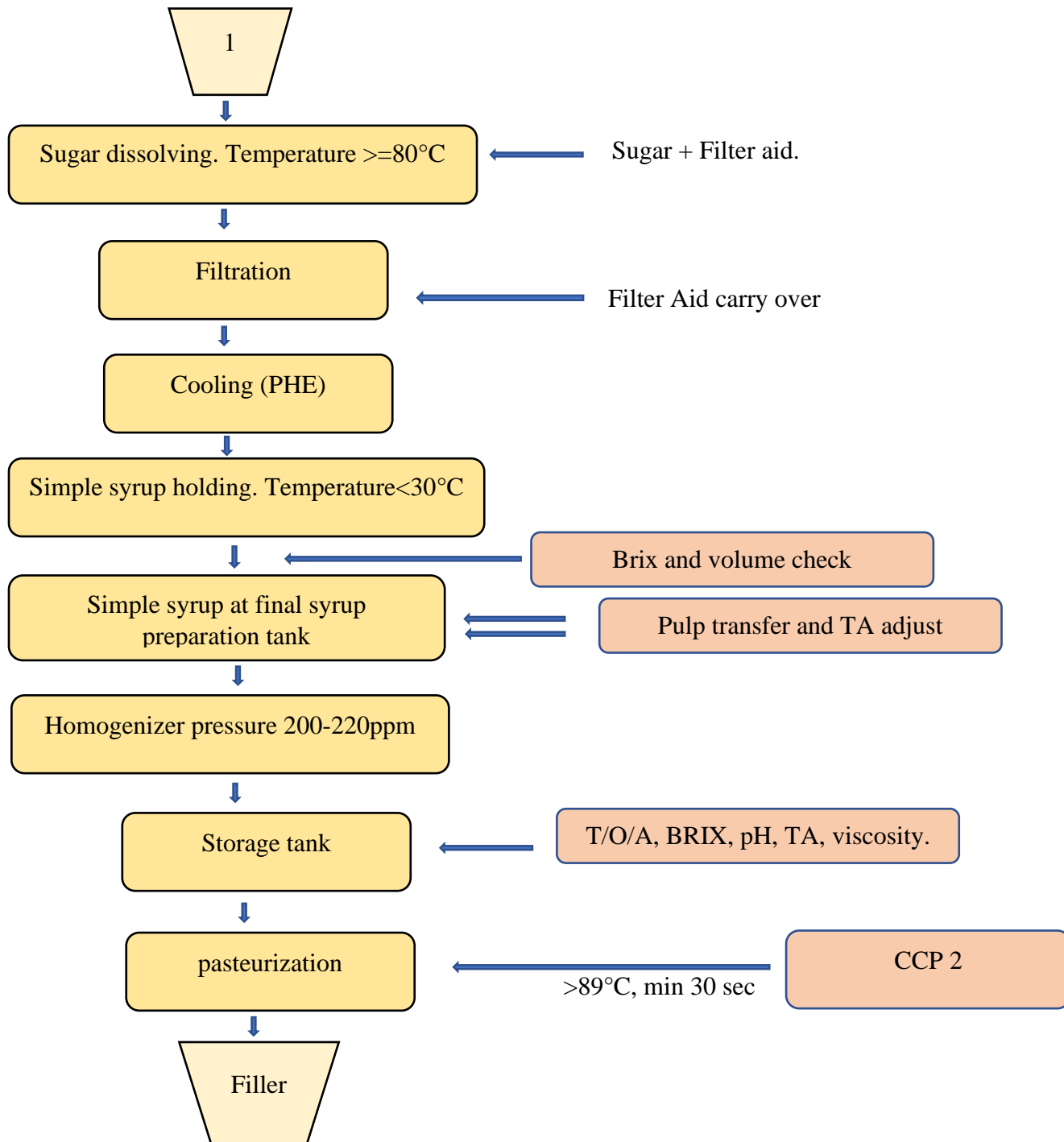
Table 14: %TA range for different beverages

Product Name	AST %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 (Juice- Hot Fill)**

**4.1.1 Process Flowchart for syrup preparation for Fruit drinks-**



**Figure-22: Syrup making flowchart for fruit juice**



#### 4.1.2 Fruit Juice parameter and ingredient

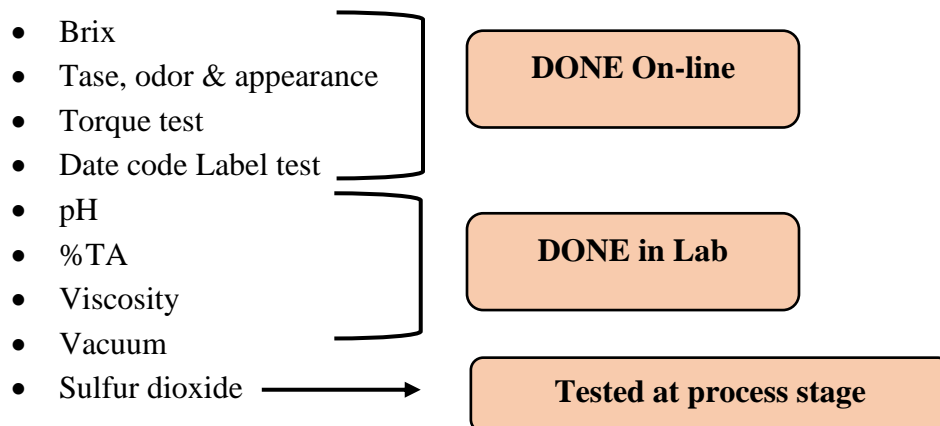
**Table 15: Parameter for fruit juice.**

Parameter	AST Range	
	Mangolee	Mango king
<b>pH</b>	3.5-4.0	3.3-3.5
<b>%TA</b>	0.20±0.025	0.225±0.025
<b>Brix</b>	14.6±0.2	15.8±0.2

**Table 16: Ingredients for fruit juice.**

Product Name	Ingredients
<b>Mangolee</b>	Sodium citrate, citric acid, Xanthan gum, Ascorbic acid, Beta carotene, treated water, Flavor.
<b>Mango King</b>	Sodium citrate, citric acid, Xanthan gum, Ascorbic acid, Beta carotene, treated water, Flavor.

#### 4.1.3 Different on-line quality tests for Fruit products-



- Pasteurization temperature for mangolee is 90±5°C (CCP). Filler temperature is 78±2° or 4° C. Total 12% of pulp is used to make this juice, where the BSTI range is within 25%. The pulp is procured from both local or global suppliers. After filling, the temperature is lowered to 28°C or 30°C. The shelf life is around 10 months for fruit juices.

## Chapter-5 (Microbiological Tests)

### 5.1.1 Different microbiological tests for different category of products-

**Table 17: AST microbiological Tests, methods & parameters**

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
Yeast/Mold Test	Potato Dextrose Agar	Pour plate method/Filtration Method	5-7 days	25±2°C	0
Coliform Test	McConkey Agar/m-Endo growth media	Pour plate method/Filtration Method	24-48 hour	35±2°C	0

- Microbiological tests are done once per batch of products.
- During microbiological tests, one should be very careful.
- Gloves should always be worn during performing the tests.
- Proper observation should be done after completing each test.
- A record book must be maintained which will include all the test results.
- If any noticeable change falls before eyes, situation should be controlled as soon as possible.

## Chapter -6 (CIP system)

### 6.1.1 Types of CIP-

- CIP is elaborated as Clean-in-Place.
- Time, temperature and flow, these 3 are the factors that should be monitored while CIP is carried out. It takes 4 hours to conduct CIP in SYMPACK machine and 2 hours in KMS machine.
- There are 3 types of CIPs, that are followed in AST beverage-
  1. 3 Step CIP
  2. 5 Step CIP
  3. 7 Step CIP

#### 3 Step CIP-

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

#### 5 Step CIP- (Done in every 72 hours) (Schedule CIP)

- Normal/Rinse water flow for (10-15) min.
- Caustic soda (1.0-1.75) % for 25 min, temperature at (65-77) ° C.
- Normal water (10-15) min.
- Hot water run for 30 min, at 85°C.
- Normal water (10-15) min.

**[Before product change in any line, 5 step CIP is followed in AST beverage. But, here instead of caustic soda, nitric acid is used.]**

#### 7 Step CIP-

- Normal water (10-15) min.
- Caustic soda (1.0-1.75) % for 25 min, temperature at (65-77) °C.
- Normal water (10-15) min.
- Nitric Acid (0.6-0.8) % for 30 min.
- Normal water (10-15) min.
- Hot water run for 30 min, at 85°C.
- Normal water (10-15) min.

**[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 acceptable limit, only then 7 step CIP routine is followed and conducted.]**

## Chapter -7 (ETP Plant)

### 7.1.1 Processing steps of ETP plant-

- The elaboration of ETP is Effluent Treatment Plant.
- Effluent comes from different types of industrial waste water, water used to conduct CIP, WTP sludge, flock water etc.
- At the effluent inflow, Boxes made up of iron or steel are situated. These boxes contain pores or holes of different sizes. It also contains stones of different sizes. While the waste water flows through it, different solid wastes are stuck and retained. As a result, the solids are removed.
- By an inlet flow pump, exact amount of waste water will be placed inside the homogenization tank.
- After that, an aeration pump takes the water from the homogenization tank to a small tank.
- In that small tank, the 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 chemicals are mixed properly, the mixture will be taken to another tank. In that tank, air will be flowed again as it contains oxygen. The oxygen will react with the organic substances which will lead to aerobic biodegradation.
- The filtered water stays at main tank where filtration occurs. Through sedimentation, the sludge is sedimented at the bottom of the tank. From there the sludge is taken and dumped into the sludge are through a pump.
- After that, the waste water is placed into the settle tank where some amounts of wastes are sedimented.
- Then, with a pump this water will pass through carbon and sand filter.
- After all these filtration processes, the water will be taken to the reserve tank when air will be incorporated again in order to increase the DO (dissolved oxygen) level of the water.
- With a pump, the treated water will flow to the outlet chamber. Then it will again flow to another chamber for final aeration.
- Once all these steps are done, the treated water becomes free to be discharged to the environment like field/river/outside.

### 7.1.2 (ISO Standard for ETP)-

**Table 18: ISO standard list for ETP**

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

## Chapter-8 (Approval & Certification)

At Globe and AST beverage, they try their level best to make sure that their working style, methods and standards conform with the global as well as local standards. They comply with both WHO (World Health Organization) and GMP (Good manufacturing practice) standards. They also comply with the local regulatory rules so that they can guaranty the use of best quality of raw ingredients to finished products to the consumers. They ensure hygiene in every phase of product development.

They make sure that all kind of activities are taking place according to the documented Quality Management System (QMS), International Standard requirements of ISO 9001 and HR (Human Resource Management) by regular training of the employees so that they are well updated about the newly invented technologies.

Globe is an umbrella company, which is committed to get genuine review, measurement of the performances of the processes, regular activities of the business and QMS for constant improvement so that they can ensure that the products with highest standards are delivered to the consumers. As a result, they satisfy the customers, manages the human resources, takes part in the country's development. At last, the keeps growing.



### Chapter-9 (Conclusion)

This one and half months of internship program has helped me to observe and learn about a beverage industry from up close. I got to know from raw materials to finished products, every single step, tests associated with soft drinks. Since, it was summer season. We know that, during this season, the soft drinks demand in the market always stays at peak. That's why the factory workers, officers, managers were way too busy. Instead of being this much busy, they still tried to teach us how much they could. The factory is built on total 6 acres of land. It has 1 juice line, 4 CSD lines (among them, 1 line can be used for both CSD and drinking water production) and 2 tetra pack lines. They do not usually produce water on summer because of the load of CSD products. They manufacture drinking water mostly during winter when the demand for CSD products is little less. Each of the production lines has separate production area & different CIP protocols. I learnt how the on-line tests are done as well as lab tests such as pH test, hardness test, %TA, Brix test, RTD test, G/V test, Torque test, etc. iron test, chlorine test & TDS test, turbidity test, viscosity test etc. During our internship period, there were mostly production of two products (Royal Tiger & Fizz up). I also learnt how to check the purity of raw materials before they are procured such as purity of MEA, Maltodextrin, sodium benzoate etc. All types of activities which assures product quality are properly followed within the industry. From production of different products to packaging, storing, transportation- all these things are closely monitored here within the industry. In future, if I ever get to work in a beverage industry, I will try to use the knowledge I gathered from this internship period with AST beverage Ltd.