**A**

**Project report**

**On**

# "Improvement in Yield of Carbonated Soft Drinks on Polyethylene Terephthalate (PET) and Returnable Glass Bottles (RGB) Line"

At Narmada Drinks Pvt.Ltd Bilaspur

**-a methodology of Six Sigma**

**Submitted to**

Institute of Technology
Guru Ghasidas Vishwavidyalaya
(A Central University)
Bilaspur (Chhattisgarh)

**In partial fulfillment of requirement for the award of degree**

Of

**Bachelor of Technology**
**In**
**Industrial and Production Engineering**


**Supervisor:**
Mr. C.P. Dewangan
Associate Professor
Department of Industrial and Production Engineering

**Submitted By**:
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**Bilaspur (Chhattisgarh)**
**Session 2018-2022**

# INSTITUTE OF TECHNOLOGY
# GURU GHASIDAS VISHWAVIDYALAYA
**(A CENTRAL UNIVERSITY)**

## CERTIFICATE OF SUPERVISOR

This is to certify that the work incorporated in the project.

**"Improvement in Yield of Carbonated Soft Drinks on Polyethylene Terephthalate (PET) And Returnable Glass Bottles (RGB) Line"**

Is the Record of research work carried out by Mr. Ritesh gupta bearing Enrollment No. GGV/18/1259. Under my guidance and supervision for the award of degree of Bachelor of Technology in the Institute of Technology, Guru Ghasidas Vishwavidyalaya(A Central University), bilaspur, Chhattisgarh, India. To the bestof my knowledge and belief the project.

- Embodies the work off candidate himself.
- Has duly been completed.
- Fulfills the requirement of the ordinance relating to the Bachelor of Technology of theUniversity
- Is up to the desired standard both in respect of content and language for being refereed to examiner.

……

**Mr. C.P. Dewangan**
Associate professor
Department of Industrial and Production Engineering.

……..

**Head of the department**
**Mr. Sharad Srivastava**
professor
Department of Industrial and Production Engineering.

# DECLARATION BY THE STUDENT

I, the undersigned, declare that the project work entitled "**Improvement in Yield of Carbonated Soft Drinks on Polyethylene Terephthalate (PET) And Returnable Glass Bottles (RGB) Line**'' is based on the work carried out during course of study under the guidance and supervision of **Mr. C.P.Dewangan**, **Associate Professor, Department of Industrial and Production Engineering, Institute of engineering Technology, Guru Ghasidas Vishwavidyalaya, (A Central University), Bilaspur(Chhattisgarh)**

We assert that the statements made and conclusions drawn are the outcome of our study.

**Mr. Ritesh gupta**

Date……

# ACKNOWLEDGEMENT

Completing this project, although was a challenge for me, would not have achieved without support,inspiration, encouragement and contribution of many people. First of all, we would like to express our deep Sense of gratitude towards our supervisor **Mr. C.P.Dewangan (Associate professor) Department of Industrial and Production Engineering, School of Engineering and technology, Guru Ghasidas Vishwavidyalaya (A Central University),** for his valuable guidance, constant encouragement and kind help at different stages for the execution of this dissertation work.

.

**Mr. Ritesh gupta**

# CERTIFICATE BY THE EXAMINERS

This is to certify that project work entitled:

"**Improvement in Yield of Carbonated Soft Drinks on Polyethylene Terephthalate (PET) And Returnable Glass Bottles (RGB) Line**''

**Submitted By:**

Mr. Ritesh gupta **Roll No**: 18105018 **Enrolment No:** GGV /18/1259

Has been examined by the undersigned as a part of examination for the award of Bachelor of Technology degree in industrial and production engineering of institute of technology Guru Ghasidas Vishwavidyalaya (A central university) Bilaspur, (Chhattisgarh)

……. …….

Internal Examiner External Examiner

Date: Date:

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# 1. Introduction

## 1.1. The Coca-Cola Company

Coca-Cola, the product that has given the world its best-known taste was born in Atlanta, Georgia, on May 8, 1886. Coca-Cola Company is the world's leading manufacturer, marketer and distributor of non-alcoholic beverage concentrates and syrups, used to produce nearly 400 beverage brands. It sells beverage concentrates and syrups to bottling and canning operators, distributors, fountain retailers and fountain wholesalers. The Company's beverage products comprises of bottled and canned soft drinks as well as concentrates, syrups and not-ready-to-drink powder products. In addition to this, it also produces and markets sports drinks, tea and coffee.

The Coca- Cola Company began building its global network in the 1920s. Now operating in more than 200 countries and producing nearly 400 brands, the Coca-Cola system has successfully applied a simple formula on a global scale: "Provide a moment of refreshment for a small amount of money- a billion times a day."

The Coca-Cola Company and its network of bottlers comprise the most sophisticated and pervasive production and distribution system in the world. More than anything, that system is dedicated to people working long and hard to sell the products manufactured by the Company. This unique worldwide system has made The Coca-Cola Company the world's premier soft-drink enterprise. From Boston to Beijing, from Montreal to Moscow, Coca-Cola, more than any other consumer product, has brought pleasure to thirsty consumers around the globe. For more than 115 years, Coca-Cola has created a special moment of pleasure for hundreds of millions of people every day.

The Company aims at increasing shareowner value over time. It accomplishes this by working with its business partners to deliver satisfaction and value to consumers through a worldwide system of superior brands and services, thus increasing brand equity on a global basis. They aim at managing their business well with people who are strongly committed to the Company values and culture and providing an appropriately controlled environment, to meet business goals and objectives. The associates of this Company jointly take responsibility to ensure compliance with the framework of policies and protect the Company's assets and resources whilst limiting business risks.

As demand for Coca-Cola increased, the Company quickly outgrew its facilities. A new building erected in 1898 was the first headquarters building devoted exclusively to the production of syrup and the management of the business. In the year 1919, the Coca-Cola Company was sold to a group of investors for $25 million. Robert W. Woodruff became the President of the Company in the year 1923 and his more than sixty years of leadership took the business to unsurpassed heights of commercial success, making Coca-Cola one of the most recognized and valued brands around the world.

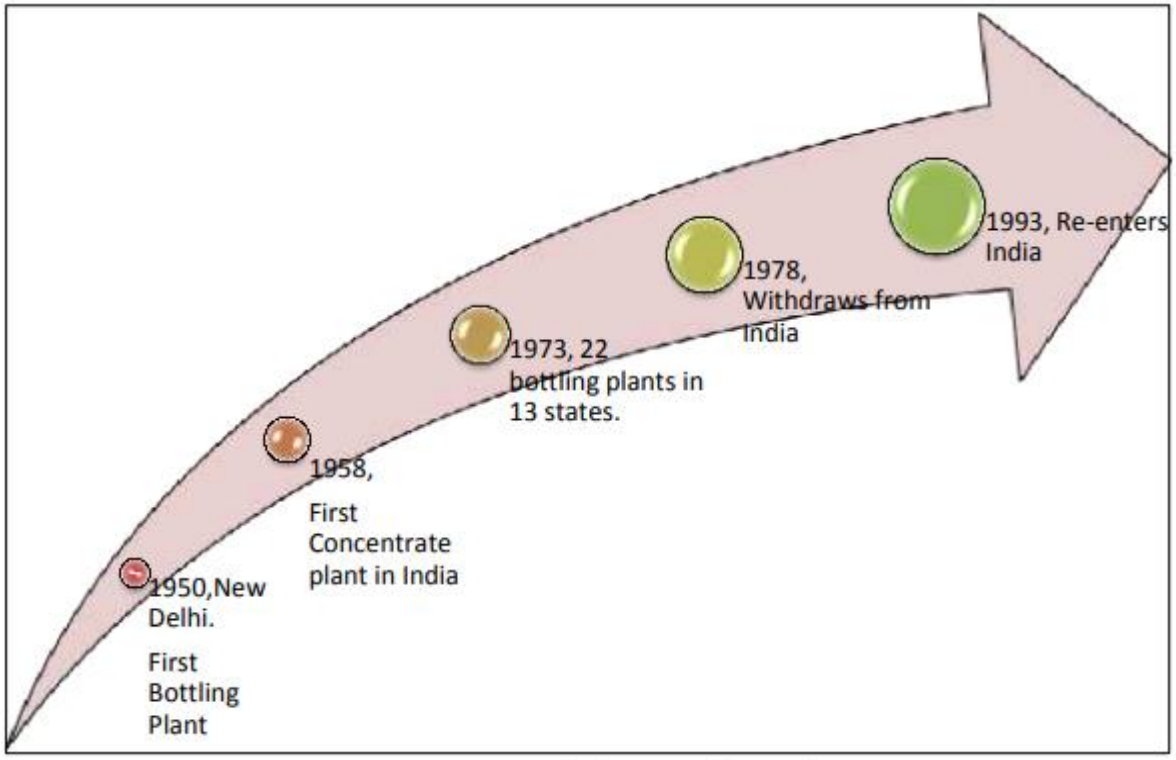


Figure 1: Growth of Coca-Cola in India

### 1.1.1. Narmada Drinks Pvt.Ltd (NDPL)

"NARMADA DRINKS PVT. LTD."(NDPL) is a Franchisee of the COCA COLA Company. It is a fairly new unit & was renovated in the year 2000. After renovation it was started in the month of Feb. 2001. The Plant covers an area of 7.5 acres and is situated in the lush green SIRGITTI INDUSTRIAL AREA OF BILASPUR (CHHATTISGARH).

NDPL follows The Coca-Cola Management System (KORE) and applicable ISO Standards such as ISO 9001 : 2015 for (QMS), FSSC 2018 Version -5.1 as on date for Food Safety , ISO 14001 :2015 for Environ Management System and Safety Management System ISO 45001 :2018 for the Health and Safety to demonstrate Its Strength . We possess valid certificate for all the above ISO standards as on date.

The Manufacturing facility is capable of producing 200ml, 300ml returnable glass bottle packs ,PET bottles of 250ml,300ml,500ml, 600 ml,1.0 LT , 1250ml,1500ml ,2.0Lt 2.25Ltr. packs of all the flavors – Thums Up, Coca-Cola, Fanta Orange, Sprite and Limca. Kinley Soda in the Pack of 500 ml, 600ml & 750ML Pack, Kinley Packaged Drinking Water in 1.0 Ltr & 500 ml Package. The Product portfolio varies depending upon the market requirement.

The Plant has 3 manufacturing lines, 750 BPM for 200ml RGB, 550 BPM for 300 ml RGB packages, 160 BPM for PET CSD & 50 BPM Packaged Drinking Water Kinley One Ltr. We distribute the products both produced here & outsourced from other Franchisees / Co packers across the country to entire CHHATTISHGARH through our distributor's network.


Narmada drinks, sirgitti bilaspur

## 1.2. Strategic Aspects

**Mission**

Our Roadmap starts with our mission, which is enduring. It declares our purpose as a companyand serves as the standard against which we weigh our actions and decisions.

- To refresh the world...
- To inspire moments of optimism and happiness…
- To create value and make a difference…

**Vision**

Our vision serves as the framework for our Roadmap and guides every aspect of our business by describing what we need to accomplish in order to continue achieving sustainable, quality growth.

- **People:** Be a great place to work where people are inspired to be the best they can be.
- **Portfolio:** Bring to the world a portfolio of quality beverage brands that anticipate and satisfy people's desires and needs.
- **Partners:** Nurture a winning network of customers and suppliers, together we create mutual, enduring value.
- **Planet:** Be a responsible citizen that makes a difference by helping build and support sustainable communities.
- **Profit:** Maximize long-term return to shareowners while being mindful of our overall responsibilities.
- **Productivity:** Be a highly effective, lean and fast-moving organization

## Quality Policy

To ensure customer delight, we commit to quality in our thoughts, deeds and actions by Continually our processes…Every time

**Our Winning Culture**

Our Winning Culture defines the attitudes and behaviors that will be required of us to make our 2020 Vision a reality.

**Live Our Values**

Our values serve as a compass for our actions and describe how we behave in the world.

- **Leadership:** The courage to shape a better future
- **Collaboration:** Leverage collective genius
- **Integrity:** Be real
- **Accountability:** If it is to be, it's up to me
- **Passion:** Committed in heart and mind
- **Diversity:** As inclusive as our brands
- **Quality:** What we do, we do well

**Focus on the Market**

- Focus on needs of our consumers, customers and franchise partners
- Get out into the market and listen, observe and learn
- Possess a world view
- Focus on execution in the marketplace every day
- Be insatiably curious

**Work Smart**

- Act with urgency
- Remain responsive to change
- Have the courage to change course when needed
- Remain constructively discontent
- Work efficiently

**Act like Owners**

- Be accountable for our actions and inactions
- Steward system assets and focus on building value
- Reward our people for taking risks and finding better ways to solve problems
- Learn from our outcomes, what worked and what didn't

**Be the Brand**

- Inspire creativity, passion, optimism and fun

## Coca-Cola's six strategic priorities:

*1. Accelerate carbonated soft-drinks growth led by coca cola*

- Coca Cola leads with their strengths. Carbonated soft drinks remain their most profitable business and Coca Cola is the most popular brand in the world. This strategy paves the way for growth.

*2. Selectively broaden our family of beverage brands to drive profitable growth*

- Enormous opportunity exists in categories such as juice and juice drinks, bottled water, teas, energy drinks, coffee and more.

*3. Grow system profitability and capability together with our bottling partners*

- Coca Cola is a company of relationships, and one of our most important relationships is the one we share with our bottling partners. In 2003, those relationships became more profitable and productive.

*4. Serve customers with creativity and consistency to generate growth across all channels*

- We will continually strive to increase growth for the customer happiness, helping create a context for the company's growth.

*5. Direct investments to highest-potential areas across markets*

- Coca Cola tailor their business approach to the individual marketplace based on its stage of development. In this way, we direct our investments in a way that makes the most business sense.

*6. Drive efficiency and cost-effectiveness everywhere*

- By leveraging technology, creating alignment across business units and achieving economies of scale, we are able to operate with more efficiency.

## 1.3. Six Sigma Methodology

To ensure sustainable profitable growth in a highly price-sensitive appliance market Cost reduction through operational excellence is the key imperative. Elin Appliances upgrades can often be justified in terms of savings due to increased productivity. However, in a Six Sigma organization, the DMAIC Method & host of tools can be used to improve productivity throughprocess improvements.

Six Sigma is a statistical concept that measures a process in terms of defects. Achieving "Six Sigma" means your processes are delivering only 3.4 defects per million opportunities (DPMO) - in other words, they are working nearly perfectly. Sigma (the Greek letter σ) is a term in statistics that measures standard deviation. In its business use, it indicates defects in the outputs of a process, and helps us to understand how far the process deviates from perfection.

A sigma represents 691462.5 defects per million opportunities, which translates to only 30.854% of non-defective outputs. That is obviously a poor performing process. If you have a process functioning at a three sigma level that means you're allowing 66807.2 errors per million opportunities, or delivering 93.319% non-defective outputs. That's much better, but we are still wasting money and disappointing our customers. The central idea of Six Sigma management is that if you can measure the defects in a process, you can systematically figure out ways to eliminate them to approach a quality level of zero defects.

In short, Six Sigma is several things:

- A statistical basis of measurement: 3.4 defects per million opportunities
- A philosophy and a goal: as perfect as practically possible
- A methodology
- A symbol of quality

### What is Six Sigma

First, what it is not. It is not a secret society, a slogan or a cliché. Six Sigma is a highly disciplined process that helps us focus on developing and delivering near-perfect products and services. Why "Sigma"? The word is a statistical term that measures how far a given process deviates from perfection. The central idea behind Six Sigma is that if you can measure how many "defects" you have in a process, you can systematically figure out how to eliminate them and get as close to "zero defects" as possible

To achieve Six Sigma quality, a process must produce no more than 3.4 defects per million opportunities. An "opportunity" is defined as a chance for nonconformance, or not meeting the required specifications. This means businesses need to be nearly flawless in executing our key processes.

The Six Sigma can be defined in several ways. It is a "highly technical method used by engineers and statistician to fine tune product and process". It's a way of measuring processes; a goal of near perfection, represented by 3.4 defects per million opportunities (DPMO); an approach to changing the culture of an organization. Most accurately, though, Six Sigma is defined as a broad and comprehensive system for building and sustaining business performance, success, and leadership. In other words, Six Sigma is a context within which you will be able to integrate many valuable but often disconnected management "best practices" and concepts, including systems thinking, continuous improvement, knowledge management, mass customization, and activity based management.

Another definition of Six Sigma is that it's a goal of near perfection in meeting customer requirement. This is also accurate, in fact, the term "Six Sigma" itself to statistically derived performance target of operating with only 3.4 defects for every million activities or "opportunities". It's goal few companies or processes can claim to have achievement.

Still another way to define Six Sigma is as a sweeping "culture changes" effort to position a company for greater customer satisfaction, profitability and competitiveness. Considering the company wide commitment to Six Sigma at place like General Electric or Motorola, 8/70 "culture change" is certainly a valid way to describe Six Sigma. But it's also possible to "Do" Six Sigma without making a frontal assault on your company culture.

If all these definition measure, goal or culture change at least partly but not totally accurate, what's the best way to define Six Sigma? Based on our experience or examples set by the growing number of companies seeking Six Sigma improvement we have developed a definition that captures the breadth and flexibility of Six Sigma as a way to boost performance.

## Six Sigma DMAIC

Six Sigma is a quality improvement program that looks at processes with aview to analyzing process steps, determining what process elements need improvement, developing alternatives for improvement, then selecting and implementing one. It relies on a variety of qualitative and quantitative tools,emphasizing the use of data and statistical analysis with in a method called DMAIC, an acronym for the names of its five phases (Define, Measure, Analyze, Improve, and Control). Six Sigma projects are typically selected for their potential savings in improving any process, whether it is in production,administration, engineering, or services. A Six Sigma project typically begins with a high level definition of a process, using a diagram to specify the processboundaries, inputs, outputs, customers, andrequirement. In the measure phase, a process metric is selected and used to baseline the current performance of theprocess.

In the analysis phase, the process is analyzed, usually with a process map and a failure modes and effects analysis (FMEA), but may include othertypes of analysis. The process map shows each process step with its inputs andoutputs and provides the basis for either a FMEA or a quantitative, usuallystatistical, analysis.

Areas for improvement are pinpointed and alternatives are generated and evaluated. Once an improvement option is selected andimplemented, the project enters the control phase. In this phase, a plan is established for monitoring and controlling the process to ensure that gains aremaintained.

The use of the DMAIC method may vary between projects. For example, the Measure and Analyze phases of this project ran concurrently rather than sequentially. Also, a proposed solution may emerge early in the Measure and Analysis phase, leading to an emphasis on planning and implementation in the Improve phase. Such was the case in the Productivity Improvement project. Consequently, this paper focuses on the Measure and Analyze phases in which a simulation based on a process map provided the justification for Productivity Improvement.

The project is a green belt six sigma project and is based upon the DMAIC methodology.


- Various stages involved are:

**Define**

As per "Voice of the Customer( VOC )",customer products should have price stability & products should be competitive in pricing. To meet customer requirement cost reduction is the key driver for profitable growth.

**Measure**

key aspects of the current process and collect relevant data.

1. The Flow through M-Phase-
2. Develop process measures
3. Collect Process data

4. Check data quality
5. Understand Process behavior
6. Baseline Process Capability

**Analyze**

The data to investigate and verify cause-and-effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered. Seek out root cause of the defect under investigation.

1. Determine potential root cause to measure
2. Analyze data using process stratification
3. Verify root causes with test data

**Improve**

Improve or optimize the current process based upon data analysis using techniques such as design of experiments, poka yoke or mistake proofing, and standard work to create a new, future state process. Set up pilot runs to establish process capability.

- Assess risk using FMEA
- Design implementation plan
- Communicate to People
- Pilot solution and track improved performance

**Control** the future state process to ensure that any deviations from target are corrected before they result in defects. Implement control systems such as statistical process control, production boards, visual workplaces, and continuously monitor the process.


# Define

# 2. Define

## 2.1. Identification of Project CTQ

**Customer**: Narmada Drinks Pvt.Ltd management and plant workers

**Determining and Prioritizing of CTQ:**

The following illustration shows the verbatim VOCs of the customers and subsequent identification of CTQs from them.

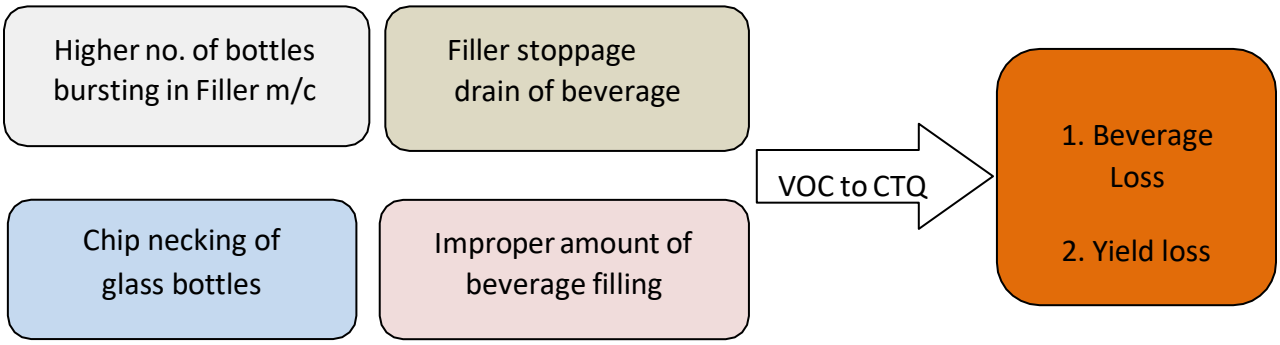


Figure 2(a): Prioritizing CTQ (RGB)

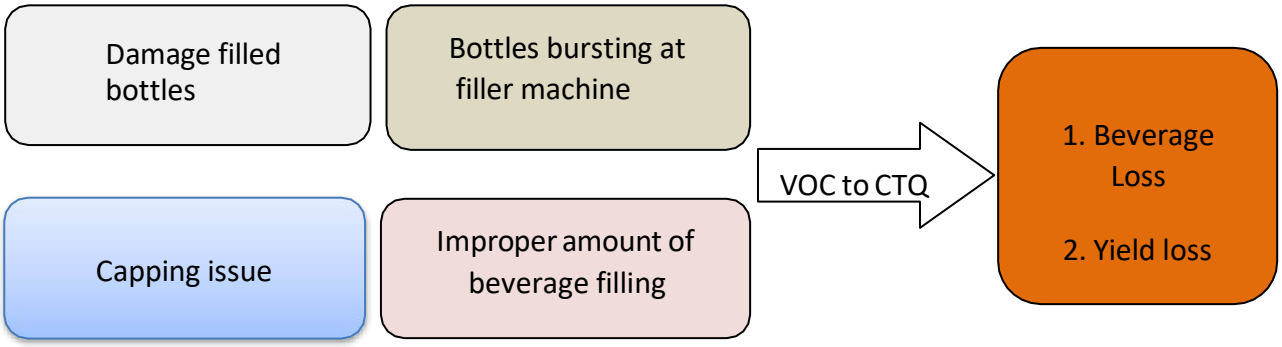


Figure 2(b) : Prioritizing CTQ (PET)

**Concentrate**: It is the liquid in concentrated form for each SKU.

**Beverage**: It is prepared by mixing Concentrate with sugar syrup, which can be directly filled in bottles.

**Yield** = (Actual Output / Standard Output)*100

- In case of RGB bottling plant, output is measured in terms of number of Cases. Each Case contains24 bottles of Carbonated Soft Drink (CSD) .

- In case of PET bottling plant, output is measured in terms of number of Cases. Each Case contains 9 bottles of Carbonated Soft Drink (CSD) in case of 300ml, 1L and 2L .

- In case of PET bottling plant, output is measured in terms of number of Cases. Each Case contains 30 bottles of Carbonated Soft Drink (CSD) in case of 250ml.

**Production Yield** = (Actual number of Cases produced / Standard number of cases)*100

## 2.2. Kano Model

We use KANO model to prioritize the CTQ's identified, but we did not find any 'must be' or 'delighters' among them. So we decide to take above identified CTQ's as our project Y's.

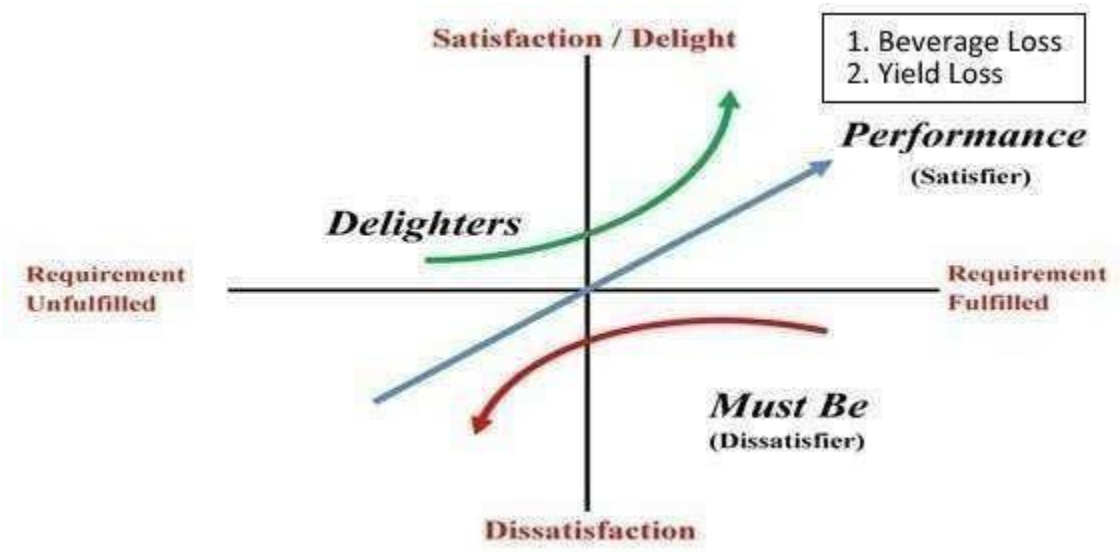


Figure 3: Kano Model

## 2.3. Project In Scope and Out Scope

**Project Objectives:**

- Analysis of factors affecting Yield loss SKU wise
- Measurements of filled rejects SKU wise
- Root cause analysis for beverage loss
- Suggesting improvement opportunities based on data analysis
- Analyzing the cause of damage in bottles

**Project goal**

- Improvement in Yield from 99.8% to 100%.
- Reduction in damage PET bottles
- Reduction in damage of RGB bottles
- Reduction in filled bottles rejection

**In Scope**

- All machines and processes involved in production process of bottle filling
- Support processes like boiler, syrup making, yard that may interfere with functioning of main processes

**Out of Scope**

- Internal functioning and logic control of ASEBI machine(empty bottle inspection m/c)
- Kinley Retail water line

## 2.4. Project Charter

Following table exhibits the project charter:

<table>
<tr><th colspan="6">Project Charter</th></tr>
<tr><td colspan="2">Project Title:</td><td colspan="4">Improvement in Yield of Carbonated Soft Drinks (CSDPolyethylene Therephthalate Bottels (PETB ) and Returnable Glass Bottles (RGB)</td></tr>
<tr><td colspan="3">Business Case</td><td colspan="3">Problem/Opportunity Statement</td></tr>
<tr><td colspan="3">Due to losses at various stages of manufacturing plant, 100%Yield is not achieved.</td><td colspan="3">As per existing data Yield of RGB line is 99.8%, which can be improved further to 100%</td></tr>
<tr><td colspan="3">Goal Statement</td><td colspan="3">Scope</td></tr>
<tr><td colspan="3">• Improve the concentrate yield of Carbonated Soft Drinks (CSD) on RGB line from 99.8 to100%<br>• Improve the concentrate yield of Carbonated Soft Drinks (CSD) on PET line from 99.7 to 100%</td><td colspan="3">In-Scope: Returnable Glass Bottles and PET Soft DrinksLine<br>Out of Scope: Kinley Soda Line</td></tr>
<tr><td colspan="3">Team Members</td><td colspan="3">Project Timeline</td></tr>
<tr><td>Key Stakeholders</td><td colspan="2">Project CTQ</td><td>Key Milestone</td><td>Start Date</td><td>Target Date</td></tr>
<tr><td>Production Dept.</td><td>Unit Existing Target</td><td></td><td>Define</td><td>28-03-22</td><td>31-03-22</td></tr>
<tr><td>Quality Dept.</td><td>Yield % 99.8 100</td><td></td><td>Measure</td><td>01-04-22</td><td>03-04-22</td></tr>
<tr><td>Maintenance Dept.</td><td></td><td></td><td>Analyze</td><td>04-04-22</td><td>07-04-22</td></tr>
<tr><td></td><td></td><td></td><td>Recommendations</td><td>08-04-22</td><td>12-04-22</td></tr>
<tr><td colspan="6">Approval</td></tr>
<tr><td colspan="2">Project Sponsor:</td><td colspan="4">Narmada drinks Pvt.Ltd<br>Bilaspur (C.G)</td></tr>
</table>

## 2.5. Process Mapping (RGB Line)

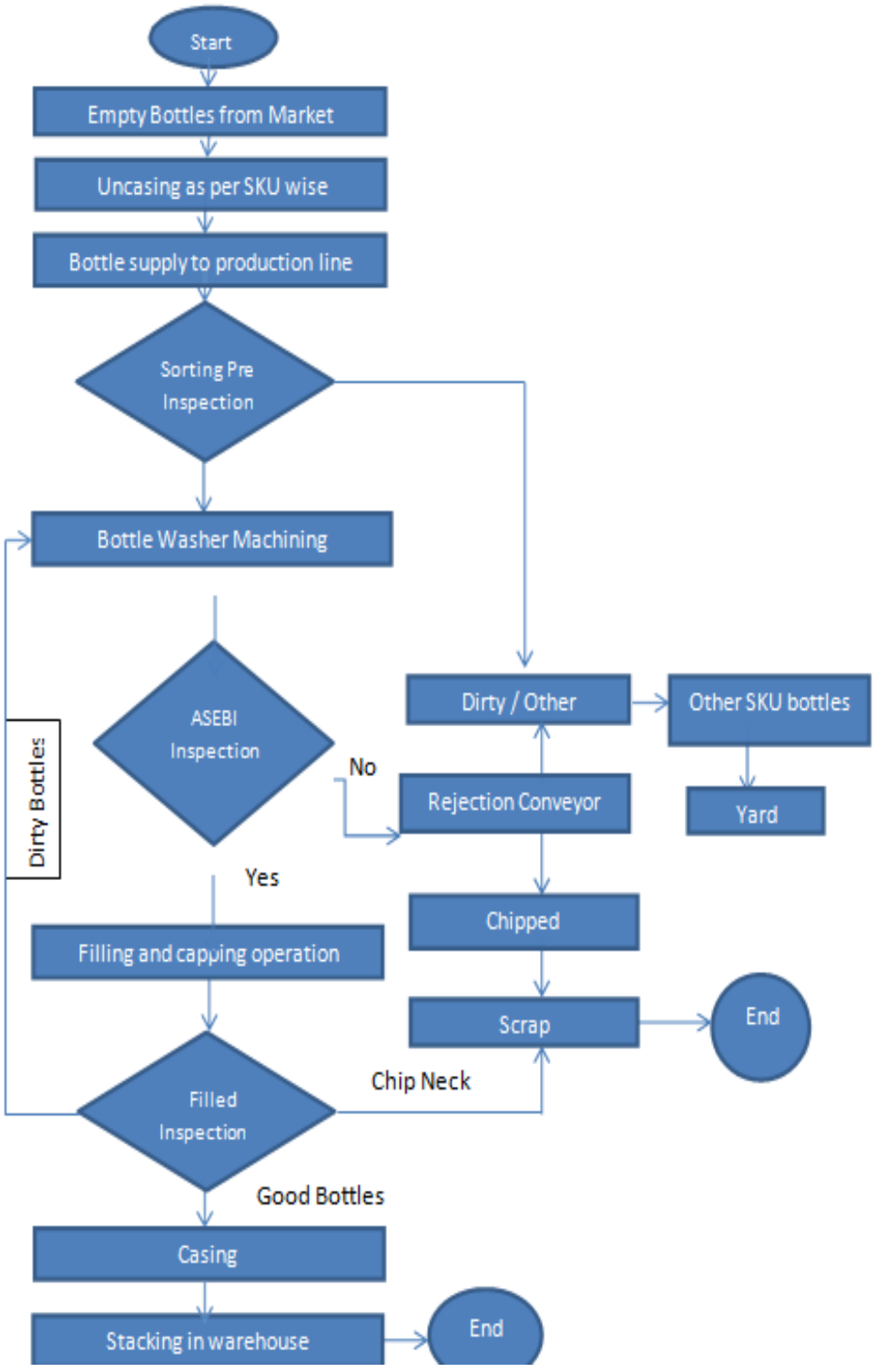


Figure 4 (a): Process Map of RGB Bottling Plant

In returnable glass bottles (RGB) line. The bottle filling done in 2 sizes viz. 200 ml and 300 ml and 6 different brands viz. Coca-Cola, Thums-up, Fanta, Limca, and Sprite. The process flow chart of entire bottling process is given below.

Important operations which are carried out are given below:

I. **Uncasing**:

a. Resources Used: Semi-automatic uncaser, operators
b. Operation: Empty glass bottles which are collected from retailers enter the production line in the form of cases. Each case consists of 24 bottles. Removal of bottles from cases and putting them onto the conveyor is known as uncasing.
c. Output: Empty dirty bottles which may need sorting and moved to washing station.

**II. Sorting and pre-inspection:**

a. Resources Used: Inspection Personnel, White backlit screen
b. Operation: Inspection person inspects dirty empty bottles for Crowns, straws, other foreign material. He also sorts the bottles that are from different brands than that of production run.
c. Output: All same brand bottles free from foreign material.

**III. Bottle Washing**

a. Resources Used: Bottle washer machine, operator, straightening tongue
b. Operation: Washing takes place at several stages. The stages include Caustic soda wash, Water wash at 3 different temperatures and finally chlorine wash.
c. Output: Cleaning bottles free from dirt.

**IV. ASEBI Machine Inspection**

a. Resources: ASEBI machine, Operator, 3 conveyors.
b. Operation: ASEBI is acronym for All Surface Empty Bottles Identification. The machine consists of set of sensors and cameras that detect the physical damage to the bottles from all the surfaces. The machine can operate at the speed of up to 1200 bottles per minute.
c. Output: Bottles are sorted onto 3 conveyors
   i. No physical damage bottles acceptable for filling operation
   ii. Dirty bottles that needed rewash before filling
   iii. Physically damaged bottles (chip-necks) that have to be scrapped off

Figure 5: ASEBI Machine inspection

## V. Filling and Capping Operation


Figure 6: Bottle Filler

a. Resources: filler machine, Skilled operator
b. Operation: Bottles are filled with respective flavor and then crowning takes place. Filler operates at rated speed of 340 bottles per minute.
c. Output: Filled and crowned bottles passes through date coder where date, batch and price are printed and then they go for final inspection.

**VI. Casing and warehouse storage:**

a. Resources: Casing personnel, empty cases, stacker and stacker operator
b. Operation: filled and inspected bottles are converted into cases. Cases are stacked on pallets such that each pallet consists of 63 cases. These pallets are then stacked in the warehouse by using stacker.
c. Output: Bottles ready for casing and storing in warehouse

## Process Mapping (PET Line)

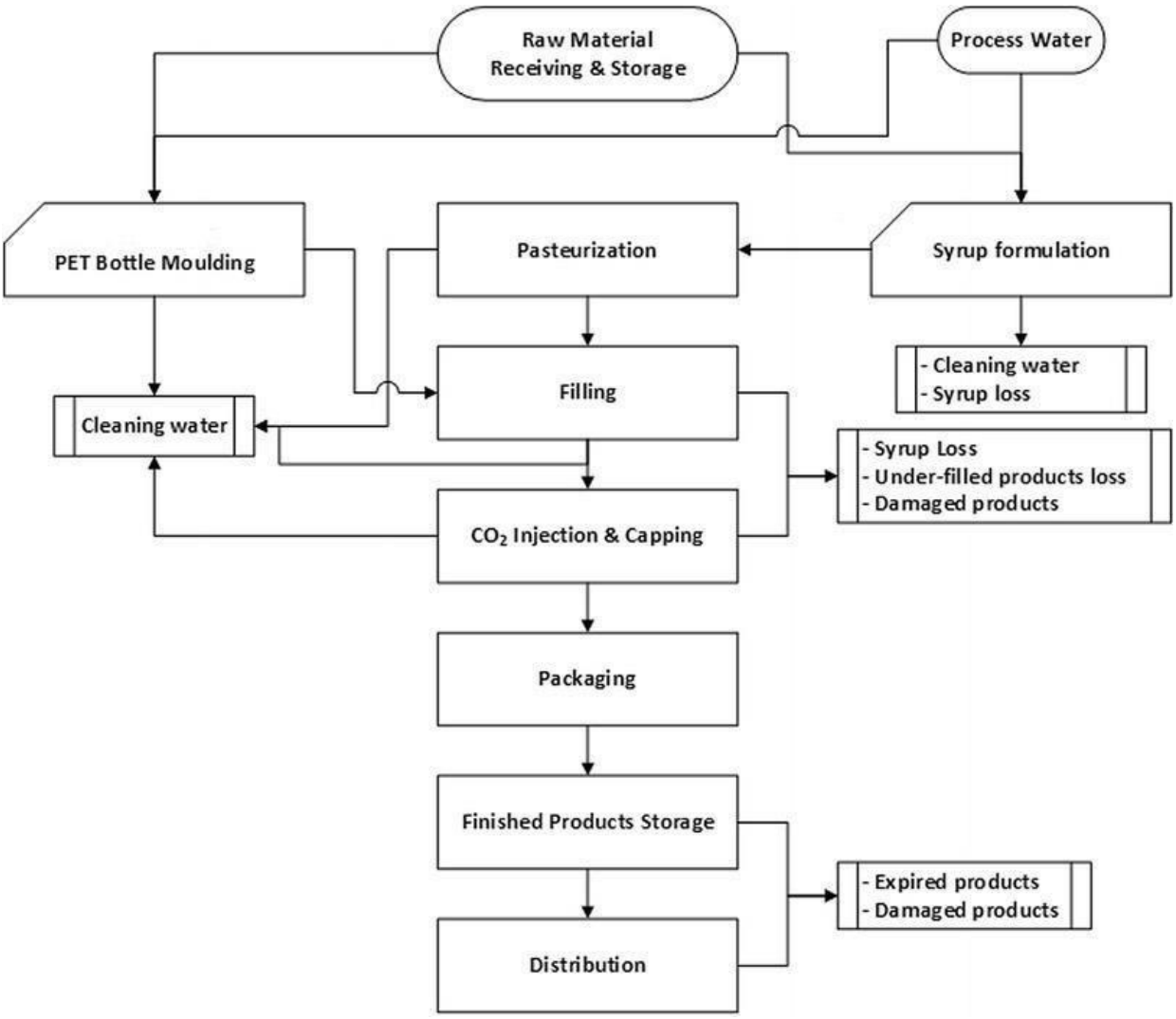


Figure 7: Process Map of PET Bottling Plant

In PET line . The bottle filling is done in 4 sizes viz. 250 ml and 750, 1L and 2L of 6 different brands viz. Coca-Cola, Thums-up, Fanta,Limca, Kinley Soda and Sprite. The process flow chart of entire bottling process is given below.

Important operations which are carried out are given below:

I. **Preform uncasing**:
   a) Resources Used: it is done manually.
   b) Operation: a preform is bought from other industry and collected from outside supplier, and then it is inter in production line, in each case there is around 5000 preform which will be go for further process.

II. **Blowing or moulding preform:**
   a) Resources Used: blower machine and air conveyer.
   b) Operation: firstly heating of preform and it goes in to desired mould size and shape then the pressure air will be through into the mould preform will be formed as we need.
   c) Output: desired shaped bottle goes with the help of air conveyer.

III. **Bottle Washing, filling and capping.**
   a) Resources Used: filler machine, Skilled operator.
   b) Operation: Washing takes place at starting of filler then by mechanical system it forward for filling of beverage in bottles then capping mechanism can done the process of closer of bottles.
   c) Output: filled bottles.


Figure 8: Bottle Filler

**IV. Warm water washing**

a) Resources: Warmer machine.
b) Operation: bottles filled with beverage is could at this state it will not go for further process so in warmer machine bottles temperature will go down in room temperature and move forward for further process
c) Output: normal temperature bottles

**V. Labeling and date coding :**

a) Resources: labeler (labeling machine), laser date coder
b) Operation: A high skilled worker will be operate the labeler a labeler will unroll the label and by perfect mechanism and then done its labeling job then after conveyer bottles go in front of laser date coding machine and date, time expiry, price and batch number will be written in bottle successfully
c) Output: bottles are not ready for final inspection

**VI. Light inspection**

a) Resources: light inspector, skilled worker
b) Operation: Checking that bottles are filled properly or not and capping date coding labeling are perfectly done or not
c) Output: fresh bottles with proper filling

**VII. Packaging and warehouse storage:**

a) Resources: Casing personnel, empty cases, stacker and stacker operator
b) Operation: filled and inspected bottles are converted into cases. Cases are stacked on pallets such that each pallet consists of 63 cases. These pallets are then stacked in the warehouse by using stacker.

Figure 9: warehouse


# Measure

# 3.0 Measure

## 3.1 Cause and Effect Diagram

During this phase, the key activities in the entire process map that affect the CTQ (in this case beverage losses) are identified. Measurements related to the CTQ are made in this phase. The MEASURE phase involves more numerical study and data analysis than the DEFINE phase. This phase focuses on measurement system validation and gathering root causes.

A Cause-and-Effect Diagram is a tool that helps identify, sort, and display possible causes of a specific problem or quality characteristic. It graphically illustrates the relationship between a given outcome and all the factors that influence the outcome. This type of diagram is sometimes called an "Ishikawa diagram" because it was invented by Kaoru Ishikawa, or a "fishbone diagram" because of the way it looks.

As the project involved lot of complicated and interlinked factors affecting the problem, finding out the root cause became a tedious job. It required a lot of technical detailed study to understand which could be the probable cause. Hence, a cause and effect diagram was prepared to understand the various causes of losses.

The cause and effect diagram for Beverage losses (Concentrate Yield) is as shown below, which is used for finalizing data collection plan.

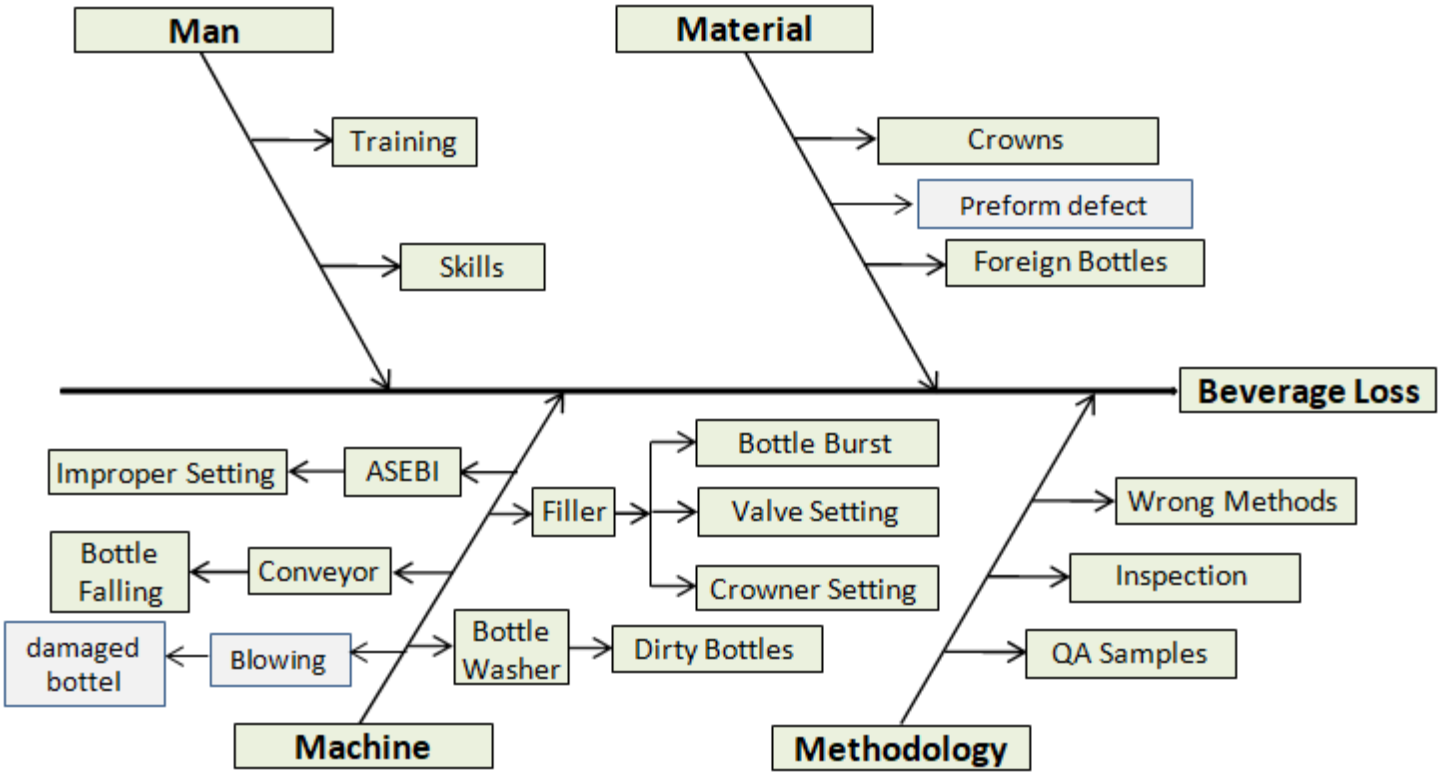


Figure 10: Cause and Effect diagram

## 3.2 Data Collection Plan

The data collection plan was prepared to maintain uniformity in the data collection process. Data collection plan for beverage losses is as shown below:

Table 1: Data Collection Plan

| Particulars | Description |
|---|---|
| **Purpose of Data Collection** | To analyze the reasons for Beverage losses and hence for loss in Concentrate Yield |
| **Measure** | Loss of beverage(Number of bottles), Concentrate Yield |
| **Operational Definition of Measure** | Beverage Losses: Amount of saleable beverage wasted due losses in operations and rejections<br><br>Concentrate Yield: It is calculated by using the data of theoretical output and actual output<br><br>Bottle losses: amount of bottles damaged<br><br>Yield(%) = (Actual Output/Theoretical output)*100 |
| **Sampling Strategy** | Random: Rational Subgrouping |
| **Sample Size** | Readings are taken for 12 days |
| **Data Collection Plan** | Record beverage losses for the whole system using filler process as the main process |
| **Measurement System Analysis** | Not Required (As counting of bottles and cases is done in unit of numbers) |

## 3.3 Data Collection Template

Based on the cause & effect diagram and data collection plan, following template is made for data collection:

Table 2: Filled Bottles Inspection - Data Collection Template

| Filled Bottles Inspection: Data Collection for Concentrate Yield | | | | | |
|---|---|---|---|---|---|
| | **31-03-22** | **02-04-22** | **04-04-22** | **06-04-22** | **08-04-22** |
| **Parameter SKU** | **Sprite 200** | **Fanta 200** | **Limca 200** | **THU 200** | **Fanta 300** |
| Dirty Bottle/damage | | | | | |
| Under filled & Over filled | | | | | |
| Bottle bursting at Filler/labeler | | | | | |
| Uncrowned Bottles | | | | | |
| Miscellaneous Losses | | | | | |
| Foreign Bottles | | | | | |
| Logo Missing | | | | | |
| Chip Neck | | | | | |
| Filler Stoppages/Drain | | | | | |
| QA Samples | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **Theoretical Cases** | | | | | |
| **Actual Cases** | | | | | |
| **Concentrate Yield** | | | | | |

As indicated in below figure data collection is done at these two stations by manual counting of number of bottles.

3.3.1 Bottle filling and capping

3.3.2 Filled bottle inspection

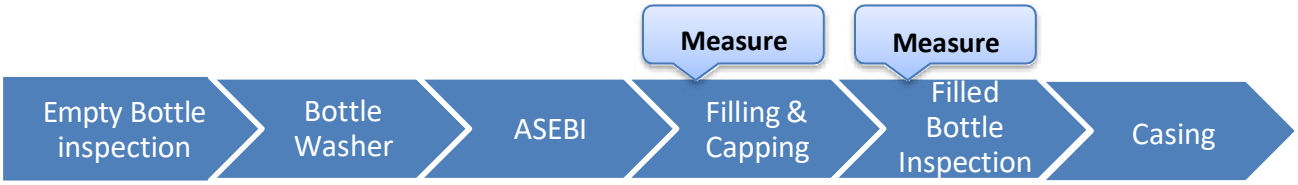


Figure 8: Filled Bottles Inspection - Data Collection Stations

Table 3: Filled Bottles Inspection - Data Collection Sample (RGB Line)

| Filled Bottles Inspection: Data Collection for Yield | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 31/3/22 | 01/4/22 | 02/4/14 | 03/4/22 | 04/4/22 | 05/4/22 | 06/4/22 | 07/4/22 | 08/4/22 | 09/4/22 | 11/4/22 | 12/4/22 |
| Parameter SKU | THU 200 | THU 200 | Coke 200 | Coke 200 | Sprite200 | Sprite200 | THU 200 | Sprite 200 | Fanta 200 | THU 200 | Coke 200 | Coke 200 |
| **Run wise Losses** | | | | | | | | | | | | |
| Dirty Bottle | 2 | 2 | 58 | 8 | 4 | 4 | 9 | 16 | 11 | 25 | 6 | 10 |
| Underfilled & Overfilled | 34 | 22 | 105 | 62 | 49 | 17 | 30 | 54 | 58 | 101 | 32 | 79 |
| Bottle bursting at Filler | 1 | 3 | 5 | 1 | 3 | 3 | 1 | 0 | 0 | 1 | 2 | 1 |
| Uncrowned Bottles | 2 | 1 | 3 | 4 | 2 | 1 | 2 | 1 | 1 | 1 | 0 | 0 |
| Miscellaneous Losses | 1 | 2 | 6 | 6 | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 4 |
| Foreign Bottles | | 2 | 4 | | | 1 | 2 | | | | 2 | 6 |
| Logo Missing | | | 9 | | | | 1 | | 1 | | | |
| Chip Neck | | 2 | 11 | 2 | | 1 | 3 | | | | 1 | 2 |
| Filler Stoppages/Drain | | | | | | | | | | | | |
| QA Samples | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Theoretical Cases** | 8742 | 9554 | 10201 | 9950 | 11052 | 9933 | 5418 | 7772 | 3352 | 8873 | 10242 | 9252 |
| **Actual Cases** | 8702 | 9520 | 9991 | 9867 | 10992 | 9903 | 5366 | 7697 | 3276 | 8741 | 10197 | 9150 |
| **Concentrate Yield** | 99.54% | 99.64% | 97.94% | 99.16% | 99.45% | 99.69% | 99.04% | 99.03% | 97.73% | 98.51% | 99.56% | 98.89% |

Table 3: Filled Bottles Inspection - Data Collection Sample (PET Line)

| Filled Bottles Inspection: Data Collection for Yield | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 31/3/22 | 01/4/22 | 02/4/14 | 03/4/22 | 04/4/22 | 05/4/22 | 06/4/22 | 07/4/22 | 08/4/22 | 09/4/22 | 11/4/22 | 12/4/22 |
| Parameter SKU | Thum 2L | Thum 2L | Sprite 2L | Sprite 2L | Sprite 250ml | Sprite 250ml | Sprite 250ml | Thum 250ml | Thum 250ml | Sprite 250ml | Sprite 2L | Sprite 2L |
| **Run wise Losses** | | | | | | | | | | | | |
| Damage Bottle | 16 | 1 | 2 | 11 | 4 | 2 | 7 | 13 | 3 | 4 | 1 | 2 |
| Underfilled | 38 | 4 | 9 | 82 | 49 | 21 | 30 | 62 | 34 | 5 | 21 | 7 |
| Overfilled | 46 | 2 | 13 | 74 | 67 | 14 | 34 | 54 | 49 | 16 | 1 | 9 |
| Capping issue | 9 | 1 | 2 | 4 | 11 | 2 | 2 | 9 | 3 | 1 | 0 | 2 |
| Bursting in labeling m/c | 2 | 0 | 1 | 4 | 3 | 1 | 4 | 5 | 8 | 0 | 2 | 1 |
| Miscellaneous Losses | 10 | 3 | 2 | 6 | 11 | 2 | 8 | 5 | 6 | 2 | 4 | 11 |
| Filler Stoppages/Drain | 6 | 1 | 5 | 3 | 6 | 1 | 4 | 3 | 3 | 4 | 7 | 6 |
| QA Samples | | | | | | | | | | | | |
| Total wastage | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Theoretical Cases** | 14250 | 16120 | 16720 | 9742 | 10120 | 11352 | 12100 | 9348 | 12002 | 8990 | 13232 | 15230 |
| **Actual Cases** | 14123 | 16108 | 16686 | 9558 | 9969 | 11309 | 12008 | 9197 | 11896 | 8958 | 13178 | 15192 |
| **Concentrate Yield** | 99.01% | 99.92% | 99.79% | 98.11% | 98.50% | 99.62% | 99.23% | 99.38% | 99.11% | 99.64% | 99.59% | 99.75% |

## 3.4 Measurement System Analysis

A Measurement System Analysis (MSA) is a specially designed experiment that seeks to identify the components of variation in the measurement. Just as processes that produce a product may vary, the process of obtaining measurements and data may have variation and produce defects. A Measurement Systems Analysis evaluates the test method, measuring instruments, and the entire process of obtaining measurements to ensure the integrity of data used for analysis and to understand the implications of measurement error for decisions made about a product or process. MSA is an important element of Six Sigma methodology and of other quality management systems.

While checking for variation in the system, it is important check whether that variation is because of measurement system or because of equipment. But in this project there is no variation due to measurement system as counting of bottles or cases is done in unit of numbers.

## 3.5 Run chart for Yields

Following are the Run chart for various yields – Sugar, Concentrate and CO2. Runchart shows how yield fluctuates over 12 days for which we have taken the readings whereas box plot gives the median and quartile values for the same readings.

### 3.5.1. Sugar Yield

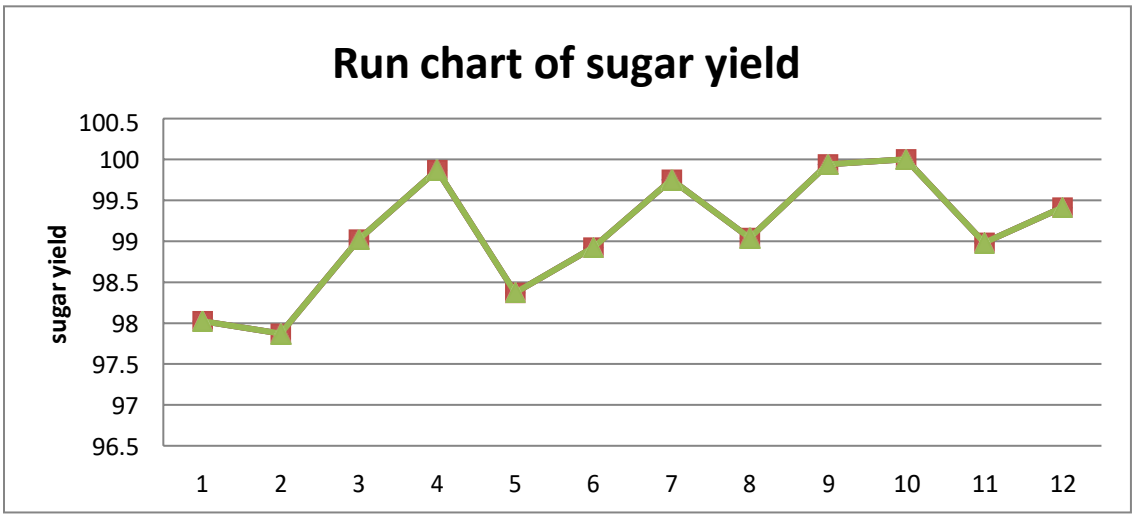


Figure 11: Run Chart of Sugar Yield

Average Yield: 99.09%
Yield Range: 97.87% - 100.02%

Sugar is bought from different vendors with an allowed tolerance in weight up to ± 2% of the weight. But the calculations are done with a fixed value of sugar weight notified by the vendor. In case of presence of excess sugar than the notified figure, the actual yield exceeds 100%.

Say for E.g., sugar is bought in bags of 100 Kgs but one bag consists of 102 kgs of sugar in actual. The yield calculation is performed as per 100 kgs but because of an extra couple of grams sugar presence, the calculated yield might exceed 100%.

### 3.5.2 Concentrate Yield

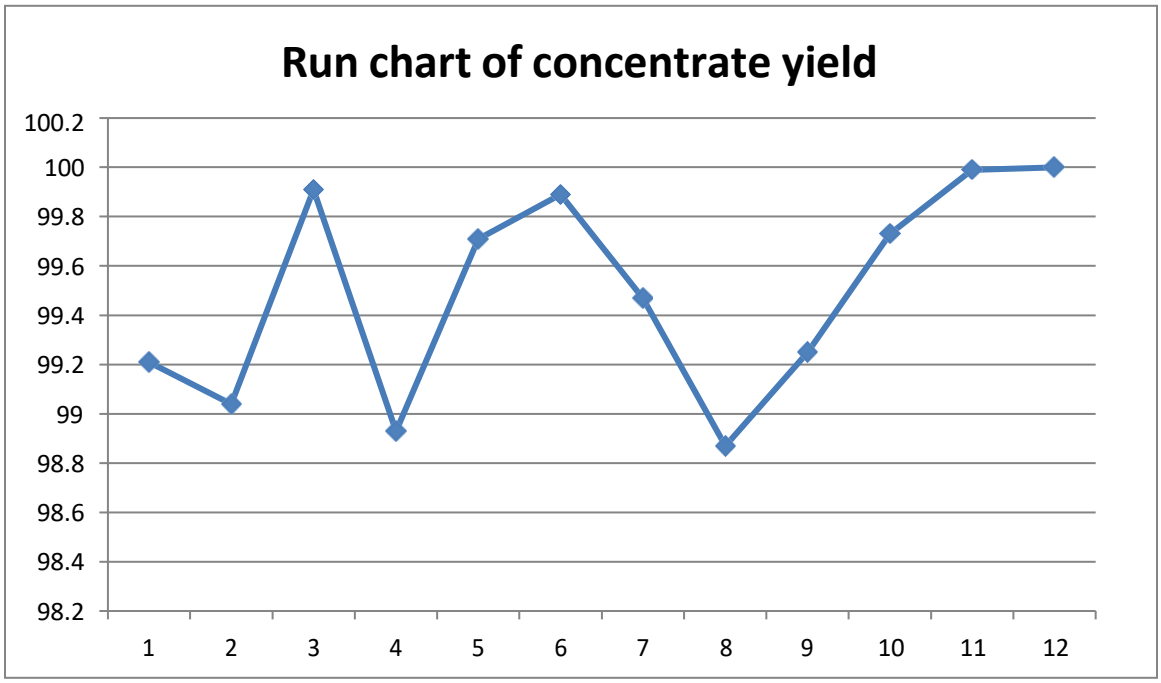


Figure 12: Run Chart of Concentrate Yield

Average Yield: 99.95%

Yield Range: 98.98.87% - 100%

### 3.5.3 CO2 Yield

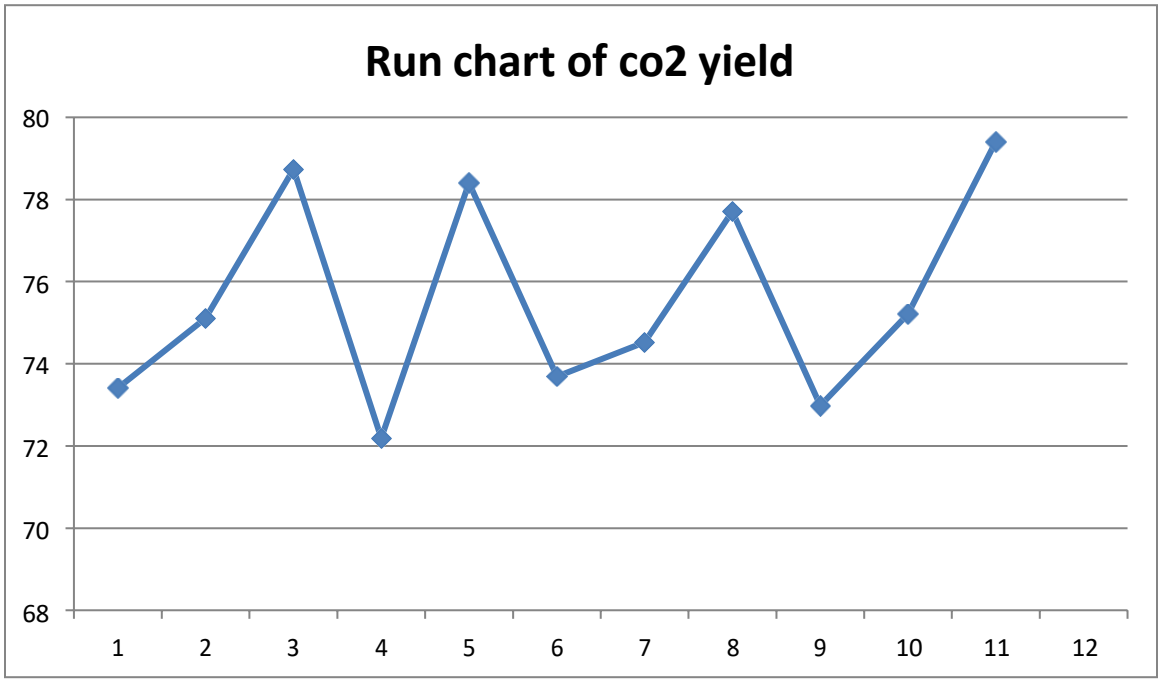


Figure 13: Run Chart of CO2 Yield

Average Yield: 75..38%

Yield Range: 72% - 80%


# Analyze

# 4 Analyze

## 4.1 Sigma Level

**For RGB line (from 31/03/22 to 12/04/22)**

- Avg. yield for **Thumsup 200ml**
  readings taken is around 99.20% which indicates a sigma level of 4 (from the abridged sigma table,by interpolation) means 6,210 defects are occurring in manufacturing per 10 Lakh cases.

- Avg yield for **coca cola 200ml**
  readings taken is around 98.89% which indicates a sigma level of 3.8 (from the abridged sigma table,by interpolation), means 10,700 defects are occurring in manufacturing per 10 Lakh cases.

- Avg yield for **sprite 200 ml**
  readings taken is around 99.42% which indicates a sigma level of 4.1 (from the abridged sigma table,by interpolation), means 4,660 defects are occurring in manufacturing per 10 Lakh cases.

- Avg yield for **Fanta 200ml**
  readings taken is around 97.73% which indicates a sigma level of 3.5 (from the abridged sigma table,by interpolation), means 22,700 defects are occurring in manufacturing per 10 Lakh cases.

**For PET line (from 31/03/22 to 12/04/22)**

- Avg yield for **Thumsup 2L**
  readings taken is around 99.54% which indicates a sigma level of 4.1 (from the abridged sigma table,by interpolation), means 4,660 defects are occurring in manufacturing per 10 Lakh cases.

- Avg yield for **Sprite 2L**
  readings taken is around 99.43% which indicates a sigma level of 4 (from the abridged sigma table,by interpolation), means 6,210 defects are occurring in manufacturing per 10 Lakh cases.

- Avg yield for **Sprite 250ml**
  readings taken is around 99.54% which indicates a sigma level of 4.1 (from the abridged sigma table,by interpolation), means 4,660 defects are occurring in manufacturing per 10 Lakh cases.

- Avg yield for **Thumsup 2L**
  readings taken is around 99.25% which indicates a sigma level of 3.9 (from the abridged sigma table,by interpolation), means 8,190 defects are occurring in manufacturing per 10 Lakh cases.

**For sugar (from 31/03/22 to 12/04/22)**

Avg. sugar yield readings taken is around 99.09% which indicates a sigma level of 3.9 (from the abridged sigma table,by interpolation).

**For Concentrate (from 31/03/22 to 12/04/22)**

Avg. concentrate yield readings taken is around 99.5% which indicates a sigma level of 4.1 (from the abridged sigma table,by interpolation).

**For Concentrate (from 31/03/22 to 12/04/22)**

Avg. co2 yield readings taken is around 75.38% which indicates a sigma level of 2.2 (from the abridged sigma table,by interpolation).

**The recommendations in the improvement phase are provided considering data collected in the time duration of project, there will be chances of variation when we will consider on basis of annual duration.**

### 4.1.1 SKU wise analysis

## RGB LINE

**THUMS UP 200ml**

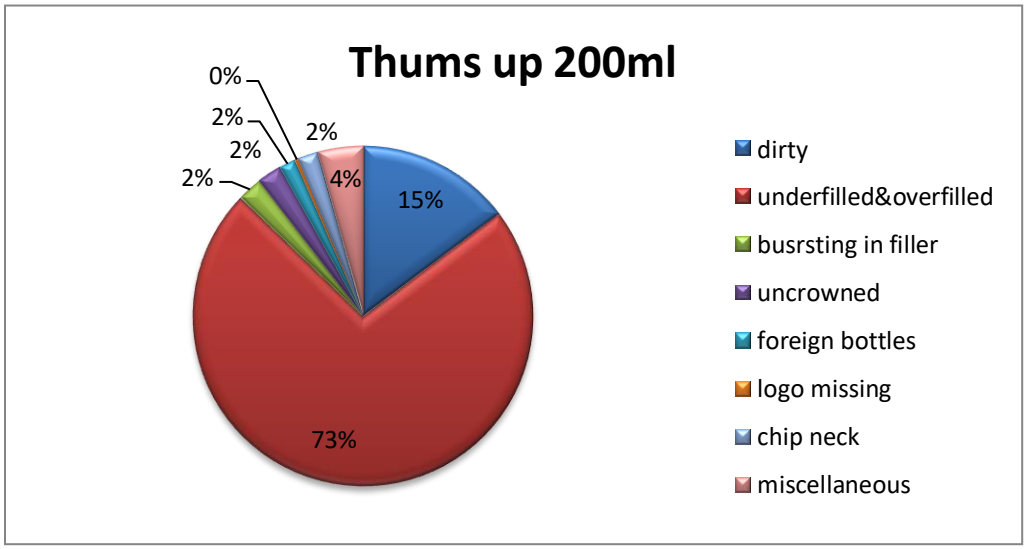


Figure 14: Pie Chart of beverage losses in Thumps up 200ml

MRP: Rs. 15/bottle
Planned Production: 32587 Cases
Actual Production: 32329 Cases
Yield: 99.20%
Highest Contributors to Yield loss: Dirty bottles & (Under+Over)filled
Opportunity Cost: Rs. 92,880

**Coca cola 200ml:**

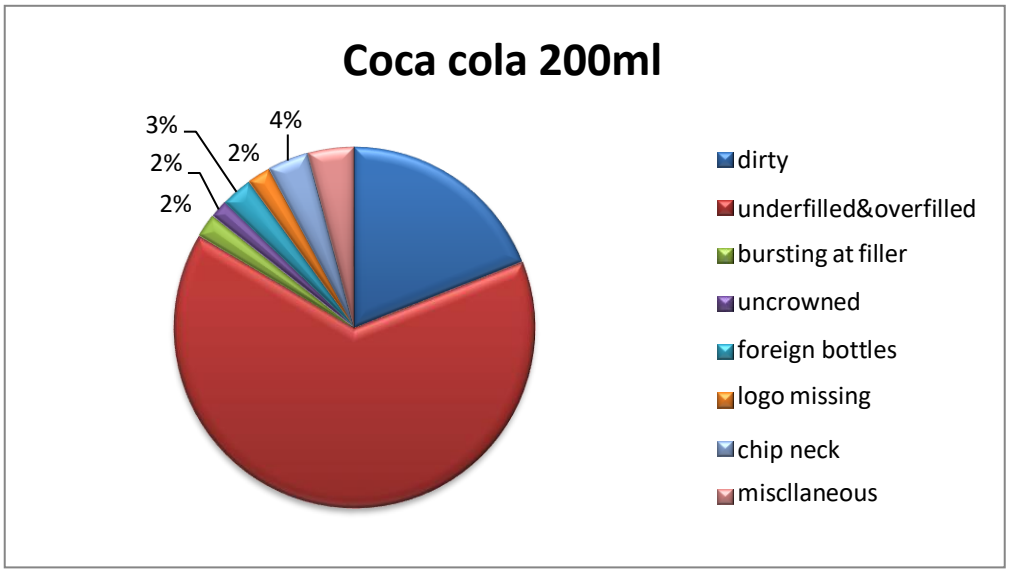


Figure 15: Pie Chart of beverage losses in Coca cola 200ml

MRP: Rs. 15/bottle
Planned Production: 39645 Cases
Actual Production: 39205 Cases
Yield: 98.89%
Highest Contributors to Yield loss: (Under+Over) filled & Dirty bottles
Opportunity Cost: Rs. 1,58,400

**Sprite 200ml:**

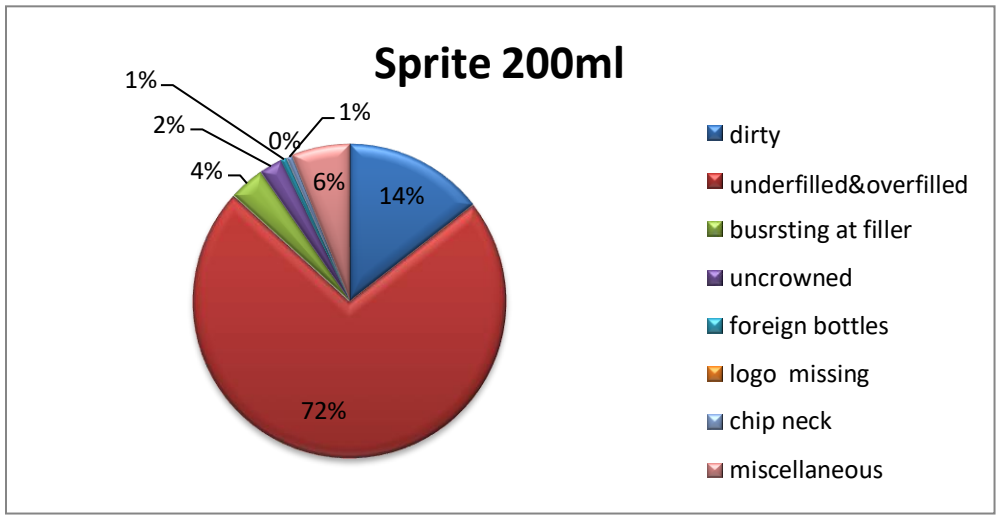


Figure 16: Pie Chart of beverage losses in Sprite 200ml

MRP: Rs. 15/bottle
Planned Production: 28757 Cases
Actual Production: 28592 Cases
Yield: 999.42%
Highest Contributors to Yield loss: Dirty bottles & (Under+Over )filled
Opportunity Cost: Rs. 59,400

**Fanta 200ml :**

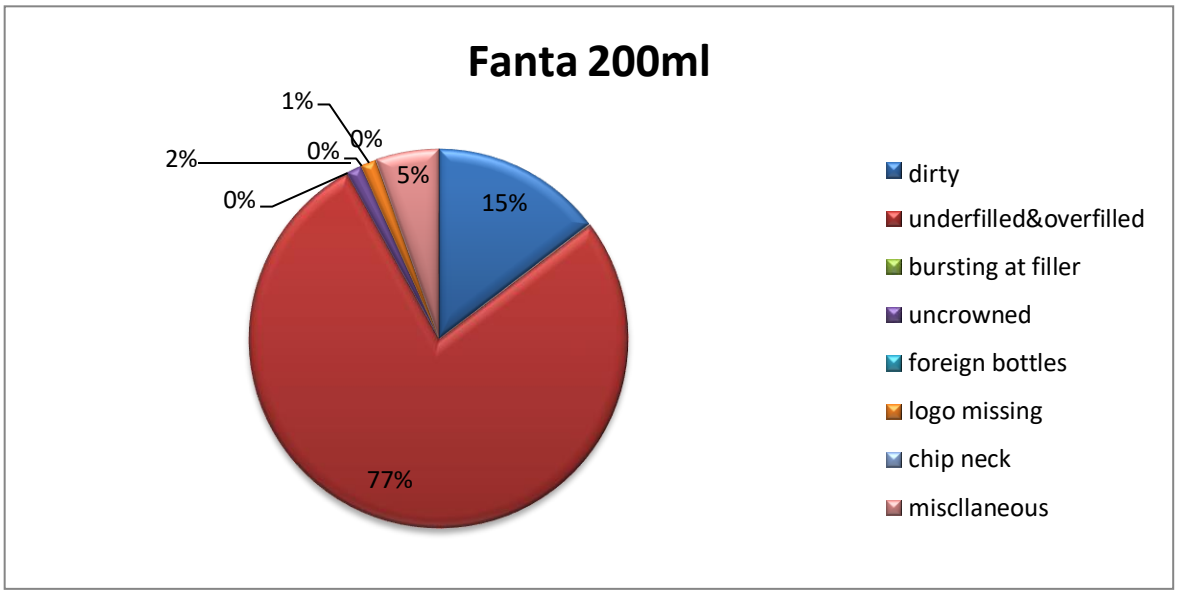


Figure 17: Pie Chart of beverage losses in Fanta 200ml

MRP: Rs. 15/bottle
Planned Production: 3352 Cases
Actual Production: 3276 Cases
Yield: 97.73%
Highest Contributors to Yield loss: Dirty bottles & (Under+Over )filled
Opportunity Cost: Rs. 27,360

# PET LINE

**ThumsUp 2L:**

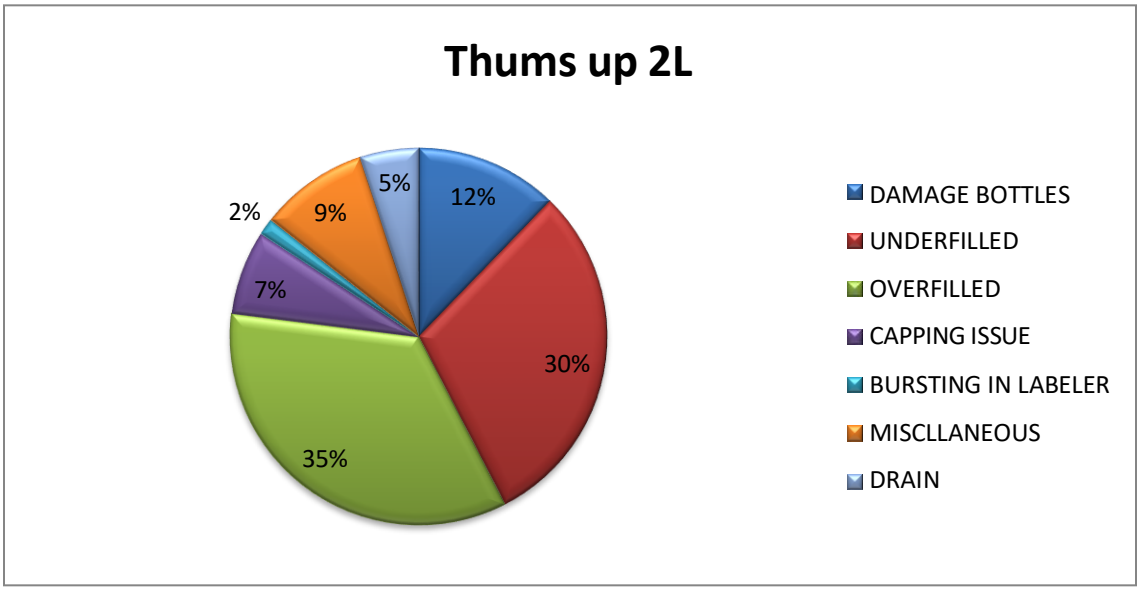


Figure 18: Pie Chart of beverage losses in ThumsUp 2L

MRP: Rs. 90/bottle
Planned Production: 30370 Cases
Actual Production: 30231 Cases
Yield: 999.54%
Highest Contributors to Yield loss: (Under+Over)filled & damage bottles
Opportunity Cost: Rs. 1,12,590

**Sprite 2L:**

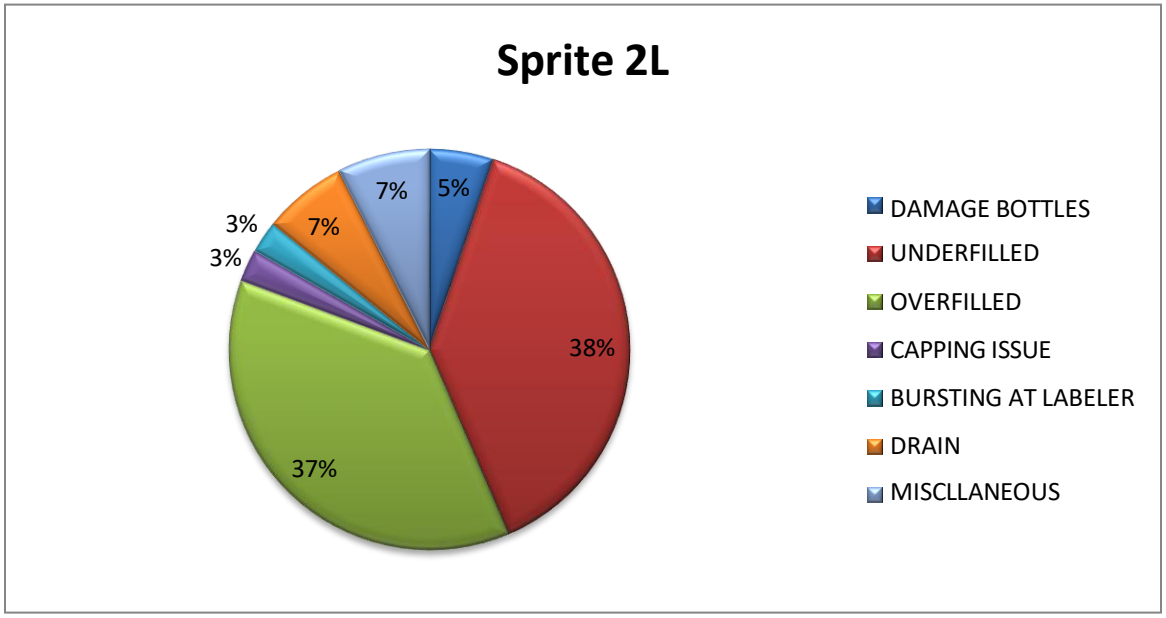


Figure 19: Pie Chart of beverage losses in Sprite 2L

MRP: Rs. 90/bottle
Planned Production: 54924 Cases
Actual Production: 54614 Cases
Yield: 99.43%
Highest Contributors to Yield loss: (Under+Over)filled & damage bottles
Opportunity Cost: Rs. 2,51,100

**Sprite 250ml:**

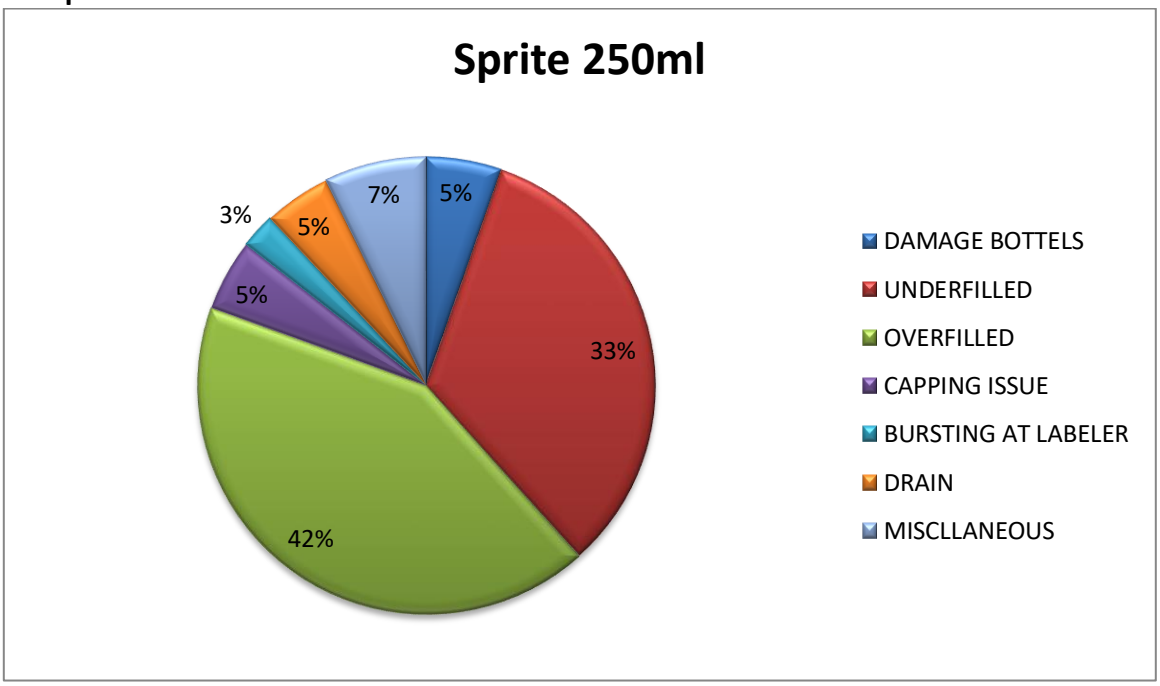


Figure 20: Pie Chart of beverage losses in Sprite 250ml

MRP: Rs. 20/bottle
Planned Production: 42562 Cases
Actual Production: 42244 Cases
Yield: 99.25%
Highest Contributors to Yield loss: (Under+Over)filled & damage bottles
Opportunity Cost: Rs. 1,90,800

**Thumps 250ml**

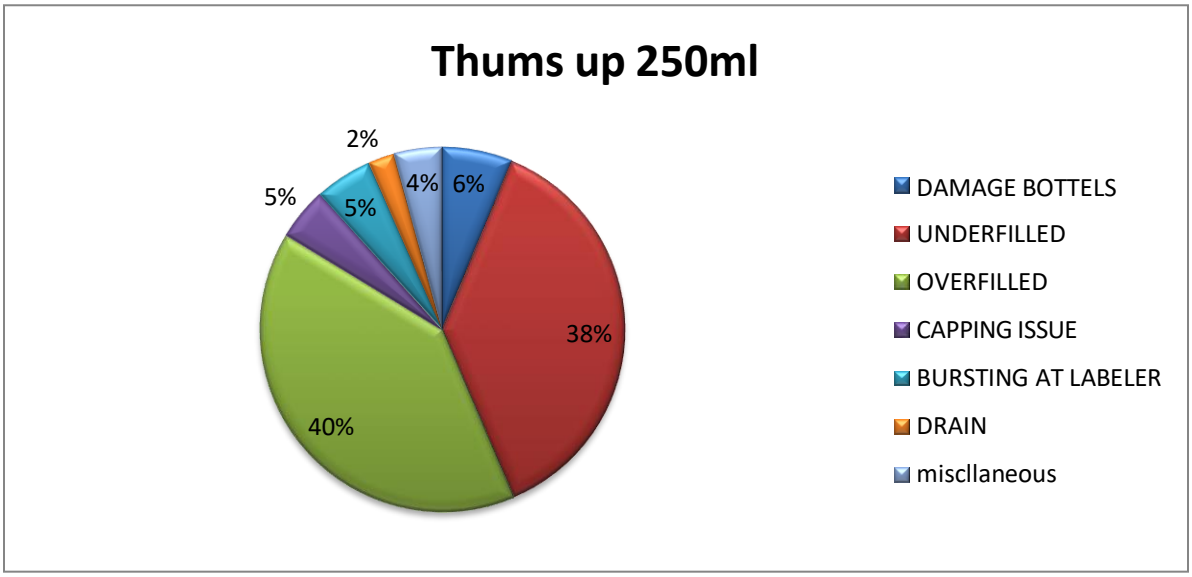


Figure 21: Pie Chart of beverage losses in Thumsup 250ml

MRP: Rs. 20/bottle
Planned Production:21350 Cases
Actual Production: 21093 Cases
Yield: 98.79%
Highest Contributors to Yield loss: (Under+Over)filled & damage bottles
Opportunity Cost: Rs. 1,54,200

### 4.1.2 Histogram representation of losses

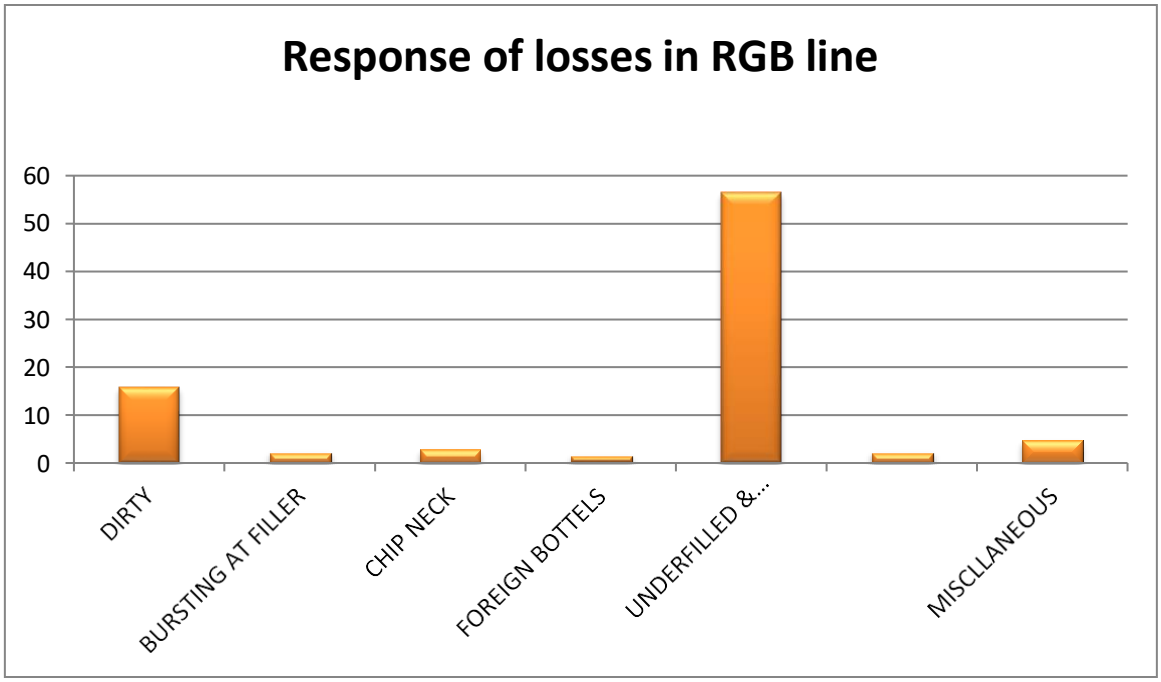


Figure 22: Histogram representation of beverage losses in RGB line

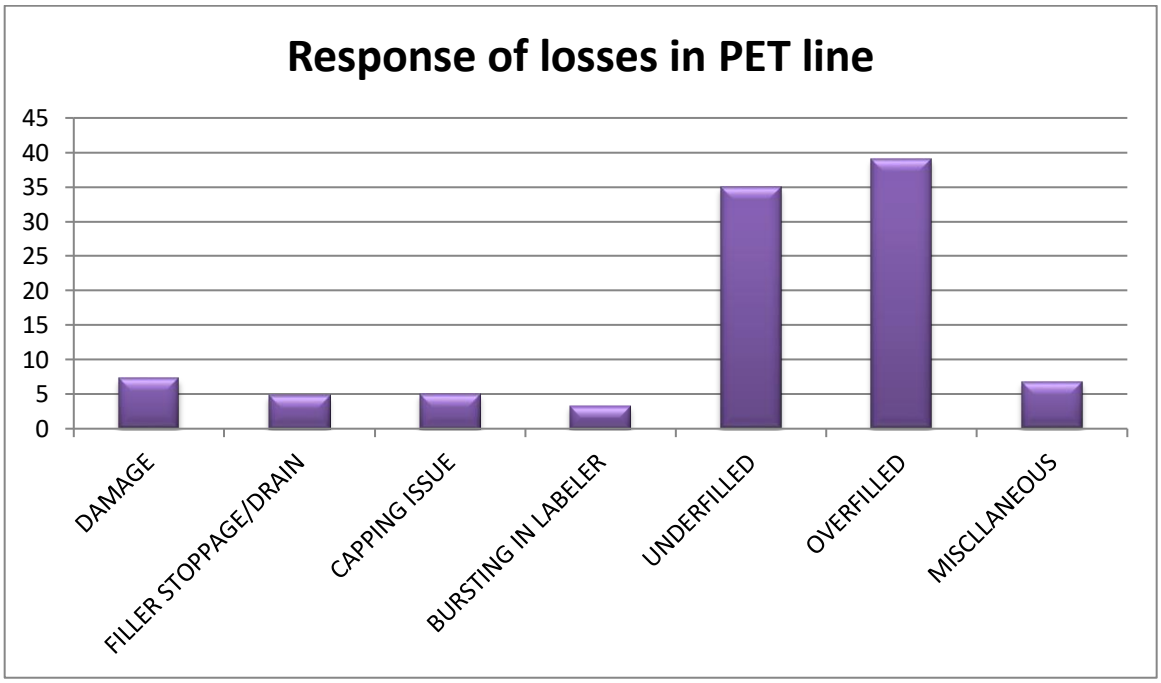


Figure 23: Histogram representation of beverage losses in PET line

### 4.1.3 Interpretation of the results

**RGB LINE**

- With the help of collected data we will make histogram for losses analysis, so with the help of above histogram it indicates that the major cause of beverage loss in RGB line is under filling and overfilling of bottles
- After the under filling and overfilling cause for losses in beverage is dirty bottles of RGB because of that losses will occur in the form of beverage loss as well as money loss.
- After that reason there will be some minor reasons like bursting in filler machine , chip neck, foreign bottles, and miscellaneous losses they all are are relatively less related to loss.

**PET LINE**

- Like RGB line main cause reason for beverage loss is almost same like overfilling of the bottlers and by some less loss is by under filling of the bottles
- The second most reason of beverage loss is damage bottles due to many operations, and filler stoppage/ drain, capping issue and miscellaneous causes are there.
- Bursting in filler is relatively less related to beverage loss.

## 4.2 Why Why Analysis

**For Filler & Crowning Machine:**

Table 4: Why Why Analysis - Filler & Crowning machine

| S.N. | Problem | Indication | Why Why |
|---|---|---|---|
| 1 | Bottle Filling | Under Filling | Filler Valve Setting |
| 2 | Bottle Filling | Over Filling | Filler Valve Setting |
| 3 | Bottle setting in Filler | Bottle bursting | Bottle alignment, valve operation, Beverage filling pressure |
| 4 | Bottle Crowning | Uncrowned bottles | Crown jamming in crown chute line |
| 5 | Bottle Crowning | Uncrowned bottles | Crown unavailability in hopper |
| 6 | Bottle Crowning | Improper crowning | Crown jamming in crown chute line |
| 7 | Bottle setting in Crowner | Bottle bursting | Bottle alignment |
| 8 | Filler stoppages/drainage | Bottle bursting | Bottle alignment |
| 9 | Bottle Crowning | Chip neck at bottle | Bottle alignment |

**For ASEBI Machine:**

Table 5: Why Why Analysis – ASEBI machine

| S.N. | Problem | Indication | Why Why |
|---|---|---|---|
| 1 | Automated Inspection | Logo Missing | Machine setting neglects logo area |
| 2 | Automated Inspection | Wrong bottle | Machine setting neglects logo area |
| 3 | Automated Inspection | Dirty bottles | Machine setting neglects logo area |


# Improve

# 5. Improve

## 5.1. Generic recommendations

### 5.1.1. Problem: Under filling and over filling of bottles(RGB/PET)

**Observation:**

During data collection process it has been observed that there are frequent incidences of number of under filled and over filled bottles getting rejected at filled bottles inspection station.

**Root Cause:**

Bottle filling process consists of positioning, pre evacuation, pressurization and filling stages, which are majorly controlled by valve and vent tube operation. Any mismatch between preset specifications and available SKU results in improper functioning of filling operation.

**Suggestion:**

Define schedule for timely maintenance of filler machine and related subassemblies, which will ensure proper bottle filling operation.

Maintenance activities should include:

- Valve setting for beverage filling operation
- Vent tube setting
- Co2 pressure setting
- Bottle sealing

Appoint well trained and skilled Filler machine operator.

### 5.1.2. Problem: Dirty bottles at filled bottles inspection station (RGB)

**Observation:**

It has been observed that there are number of dirty filled bottles getting rejected at filled bottles inspection station, which leads to beverage loss.

**Root Cause:**

Dirty bottles observed at filled bottles inspection station are not segregated according to defect observed. There is high probability that these same bottles rejected at filled bottles inspection station remain dirty after one more run in bottle washer.

**Suggestion:**

Dirty bottles observed at filled bottles inspection station need to be stored separately, which can further undergo special process of cleaning in bottle washer.

In addition to this additional worker should be appointed at pre-inspection station to identify incidences of extreme dirt.

### 5.1.3. Problem: Bottle bursting (RGB)

**Observation:**

From data analysis calculations, it can be observed that bottle bursting leads to beverage losses. This bottle bursting majorly occurs in bottle filling and bottle crowning operation.

**Root Cause:**

Bottle bursting in bottle filling and bottle crowning operation occurs due to various factors like filler speed, crowner gear setting, bottle platform setting etc.

**Suggestion:**

- Replace crowner transfer gear (Already implemented)
- Replace the crowner spider and SS pad
- Replace the in feed running track and guide
- Leveling of bottle platform
- Replace the out feed guide and spider

### 5.1.4. Problem: Uncrowned filled bottles- (RGB/PET)

**Observation***:*

During data collection process it has been observed that there are frequent incidences of number of uncrowned filled bottles getting rejected at filled bottles inspection station. Although frequently 4-5 uncrowned bottles are observed coming in sequence out of crowner assembly, in some extreme cases this number goes beyond 15 bottles in sequence.

**Root cause:**

There are two major reasons for occurrence of this problem of uncrowned bottles-

a. Unavailability of crowns in hopper
b. Jamming of crowns in crown chute line passage

Maintenance of stock of crowns in hopper and its refilling is manual activity, which gets affected by operator availability and in some cases operator negligence.

**Suggestion:**

A sensor can be installed in hopper assembly of crowner, which will ensure availability of minimum quantity of crowns in hopper. In case, crown level in hopper drops beyond certain limit, it will provide signal through alarm and stop crowner operation. This mechanism will avoid beverage loss due to uncrowned bottles.

### 5.1.5. Problem: Logo Missing from bottle (RGB)

**Observation:**

During data collection process it has been observed that there are incidences of missing SKU logo from some of the bottles, which are then rejected at filled bottles inspection station leading to beverage loss.

**Root Cause:**

Due to rough handling of bottles SKU logo is damaged. Such bottles need to be rejected at Pre-inspection station before bottle washer. Due unskilled labour or labour negligence some of these bottles are passed on to RGB line and get rejected at filled bottles inspection station.

**Suggestion:**

Proper training needs to be provided to labour working at Pre-inspection station to identify SKU logo missing bottles.

### 5.1.6. Problem: Wrong bottle (RGB)

**Observation:**

During data collection process it has been observed that there are incidences of wrong SKU bottles getting filled, which are then rejected at filled bottles inspection station leading to beverage loss.

**Root Cause:**

During unloading operation at yard sometimes different SKU bottles get mixed. Such bottles need to be rejected at Pre-inspection station before bottle washer. Due unskilled labour or labour negligence some of these bottles are passed on to RGB line and get rejected at filled bottles inspection station.

**Suggestion:**

Proper training needs to be provided to labour working at Pre-inspection station to identify different SKU bottles.

### 5.1.7. Problem: Damage due to many operations (PET)

**Observation:**

During data collection process it has been observed that there are incidences of damage bottles due to many operations like in labeler machine, stack in conveyer, which are then rejected inspection station leading to beverage loss.

**Root Cause:**

Maintenance of machines are not properly due to which stack and damages are taking place..

**Suggestion:**

Proper training needs to be provided to labour working at all station toidentify problems and to solve them.

## 5.2. Project Impact

Currently the RGB line yield of Narmada drinks, bilaspur is approximately 99.2 to 99.6 %

E.g. Average daily production = 10,500Cases

Average daily production (theoretical) = 10422 Cases

Average daily difference = 78 Cases = (78*24 bottles) = 1872 bottles

Avg. loss = 1872*300 (days) = 561600 bottles

Yearly loss = 561600*15 = Rs. 84,24,000

Currently the PET line (250ml) yield of Narmada drinks, bilaspur is approximately 98.8 to 99.6 %

E.g. Average daily production = 11,200 Cases

Average daily production (theoretical) = 11,108 Cases

Average daily difference = 92 Cases = (92*30 bottles) = 2760 bottles

Avg. loss = 2760*300 (days) = 8,28000 bottles

Yearly loss = 561600*15 = Rs. 1,65,60,000

Currently the PET line (2L) yield of Narmada drinks, bilaspur is approximately 99.5 to 99.8 %

E.g. Average daily production = 15,900 Cases

Average daily production (theoretical) = 15,825 Cases

Average daily difference = 75 Cases = (75*9 bottles) = 675 bottles

Avg. loss = 675*300 (days) = 2,02,500 bottles

Yearly loss = 2,02,500 *90 = Rs. 1,82,25,000

It is very difficult to achieve 100% Concentrate Yield due to inherent losses in the system. But if recommendations mentioned above are implemented successfully then the yearly loss can be reduced significantly.

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