Introduction:

Agriculturally pineapple, the third most grown fruit worldwide, grows very well in tropical and subtropical areas. Most of our Pineapple grows in Tangail, Sylhet, Moulvibazar, and Chittagong regions. Although Pineapple is widely available, not enough pineapple juice is being produced and only local producer is Pran Drinko Pineapple juice. And due to lack of proper management a major amount of our production rots every year. Furthermore, people get tired of eating seasonal fruits and like to enjoy them occasionally.

Pineapple is an exotic fruit and is equally arresting in flavor and aroma. It is rich in Carbohydrate, Protein, vitamins, minerals, calcium, magnesium as well as act as an electrolytic juice, i.e., magnesium, potassium, and an immune booster [1].

Our Products aims to exploit this untapped market and bring benefit for both the consumers and the produces.

Market Research:

Fuit juice is already very familiar with consumers and generally drink such as mango, orange, grape, berry juice as well as functional juices like electrolyzed orange and banana juice, chocolate milk, mango etc. found in retail stores. Pineapple is also popular but traditionally consumed as fruits or juice at home. Processing it into a bottled juice product is something very few companies has tried. Marketing liquid pineapple as juice is relatively unexplored and will arouse customer curiosity. Also, during the summer season, demand rises for electrolytic juice [2] e.g., SMC electrolyzed orange juice, Active plus lemon juice. It is necessary to provide enough nutrients as well as energy in this situation. And pineapple juice is a creative way to capitalize into juice market.

Recipe Development:

“Pineapple Plus” is a functional juice that contains pure pineapple juice as main concentrate. The concentrated juice is diluted with water in 2:1. As the juice already contain nutrients in adequate amount and considering addition of new nutrients may develop undesirably during improper retail store storage, any new nutrients aren’t introduced. 3g salt [3], 70g sugar [4] added to per liter of diluted juice as flavoring agent as well as to increase electrolytic property. The juice is then left

for incubation with lab grown 10^6 cfu/ml lactobacillus probiotic bacteria strain and fermented for 24h during which the bacteria colony increases to 10^9 cfu/ml. The PH of normal pineapple juice is between PH 3.5-4.5 [5]. PH of the juice is then increased to 6.7 by addition of 1M NAOH. During the fermentation the solution become acidic and thus the ph. decrease to PH 4.2, which is perfectly consumable. Sodium benzoate is added as preservative to increase shelf life. The juice is then Bottled in metal can or in modified PET plastic bottle.

Production Facility:

We deal with two types of production facilities. Primary production facility is concerned with processing raw pineapple into drinkable juice. Our second production facility is to uses wastes generated in first production facility to make ethanol and animal feed. There is a QC lab that is woks on increasing efficiency, and innovation of these facilities.

Staff Training:

To make the company up and running from the incubation. We are planning to include a 14-day training program to train our workers on the principles of our factory. By the end of this program, they will know how to operate various machinery, rules, do and don’ts, chain of command and activities regarding production.

The machineries we use for daily production are not something new, instead we are purchasing machineries that are widely used in other industries. So, the learning course will be easier for worker with previous experience and those that are new can learn quickly and can use the knowledge elsewhere. Our trainer will have high expertise and qualification in this sector.

All the new workers joining later will receive a shorter and more practical session developed our management. All the rights and resources will be managed under Human Resource Department.

Packaging:

Our product will be available in two types of bottles i.e., PET bottles and Metal cans. Pineapple juice is prone to oxidation, resulting in a loss of vitamins and undesirable changes in taste and appearance in presence of sun lights [5]. PET plastics give good protection against UV light. Using white colorant agent decreases the transparency of the packaging and thus increases the shelf life.

White color also increases the visual attractiveness of packaging and reflects UV-rays, helping with the maintenance of temperature. Also, the cost of PET plastic is low relative to others in this category. Migration from PET plastic is also very low and falls under regulatory compliance.

Metal cans will also be available due to their inherent quality of retaining product quality in any condition. They characteristically provide a separated environment that protects the juice from outside condition. Metals cans are made with aluminum (75%) and Tin-Plated Steel (25%) [6].

Distribution and Logistic:

As the products shelf life is moderate and not prone to damage during transportation, we decided to use Truck transportation system. In future when we plan to export our products to foreign countries, we may consider other logistic systems. Our budget has a portion allocated to buy our own fleets and transport, so our variable cost of hiring third party companies will be reduced. The trucks will carry Truckloads (TL) to carry products to the distribution centers. We plan to have 20 distribution centers across country. They will be locating district wise and their geographic location. Product then will be distributed to retail stores from the distributor inventory by LTL or Milk run, as needed.

Layout:

1. Receiving area:

   The raw pineapple and ingredients are received at receiving dock, weighted, and then carried to the washer according to the process line. But before they are permitted to enter the industrial process, representative samples are sent to QC lab to check if they meet our requirements. If not, they are discarded. For example, sugar, salt etc. are tested and then stored into ingredient room. Pineapple directly goes into washer.

2. Washing area:

   A washer with capacity 500kg/h is used to wash the incoming materials. Fruits coming into washer are subjected to turbulent water and detergent flow from all directions and thus the dirt, soil and other foreign bodies are dissolved. Then rinsed with clean water.

3. Sorting:

Fruits are sorted using Optical sorter and analyzed for any visible damage. All damaged fruits are removed from the line and subjected to human supervision to see if any parts of the fruits are usable.

4. Peeling:

   A peeling machine, with capacity of 700kg/h, separates the crown and peel and sends them to a channel that is connected to the waste treatment plant. The peeled part then goes to further processing down the line.

5. Crushing and filtration:

   An extractor machine, with capacity 700kg/h, presses the pulp to a high pressure and extracts the juice. The juice is then immediately filtrated and sent to the degassing unit to remove any unwanted smell. The other separated part is rich in ethanol and can be converted into animal feed thus sent to waste management plant.

6. Pasteurization:

   The juice contains Bromelain enzyme that though have some beneficial health effect, reduces the shelf life of the produced juice, and have adverse reaction with some other constituents. Juice is pasteurized at 80°C for 30s and then immediately cooled to room temperature at the next step.

7. Long term Storage:

   Juice will be evaporated to make more concentrated so that any microbial growth and storage occupancy will be minimum. Thus, increasing capacity and shelf life of the stored concentrate. The temperature -18°C is suitable in this situation as at this temperature any kind of water activity comes to an end microbial growth minimizes.

8. Mixing:

   Here two things happen. First the juice is diluted with water in a 10:1 ratio. 1 liter juice is mixed with 10 liters of water. Thus, making the product very soft. Also, lactobacillus grown in lab is added to the juice here. The addition concentration is 10^6 that increases to 10^9 by the time the process ends.

9. Fermentation:

The juice mixed with water and lactobacillus strain are stored at room temperature in an incubator for 24h. After that the plat count should be 10^9 cfu/ml. It is an acceptable and recognized amount that is present in various food products.

10. Preservation:

The juice is added with Sodium Benzoate and Citric Acid equivalent to 0.05 percent and 0.03 percent of total volume [3].

11. Packaging:

The juice is packed into two types of bottles. Plastic bottle and metal can. Though metal can is preferable due to its ability to resist light, light protective white plastic bottle can also be used. Most of our bottles will be recycled thus costing will be reduced.

12. Storage:

Bottled juiced will be stored at 4°C. this will help to inhibit microorganism growth and will maintain various properties of the juice.

13. Loading Dock:

Product ready to be shipped are loaded into truck in this region.

14. Quality Control Lab:

Our quality control lab performs qualitative analysis of both the raw pineapple received and the product created batch by batch. Without conformation from QC lab no product can go in or out of the industry. Here we analyze PH, Brix, Acidity, and other physicochemical analysis. Also, lactobacillus strains are curated here and are strained into culture media.

Define the Food Product:

Raw Pineapple juice sometimes can be sour and feel too strong. Also, it's not commercially viable due to reason that they are perishable. Thus, it is necessary to use methods that enhances the product quality as well as increases the shelf life. The juice is diluted with water. Sugar and Salt are added to make the juice taste better and add some electrolytic characteristics. Probiotic bacteria added as a multipurpose factor. It converts sugar of juice into lactic acid. Thus, makes it drinkable for people with diabetes problems. It also increases polyphenol and antioxidant properties of the juice. Also, viable prebiotics are beneficial for our gut media when consumed viable. Normally the ph. of pineapple juice is 4. It is maintained through various processes. Salt is added for two

objectives. First it gives juice a blended flavor that taste better than raw juice and act as an electrolyte source. As the juice is already rich in nutrients, no further nutrients were added intentionally. The final juice tastes good and all the research and reviews indicate no immediate health effect. But it is advised to use with caution for people with allergy.

SWOT Analysis:

Strengths:

1. Increasing consumer awareness of probiotics and their health benefits.
2. Pineapple's popularity as a tropical fruit and its perceived health benefits.
3. Growing demand for functional beverages like probiotic juices.
4. Potential for product differentiation through unique probiotic strains and formulations.
5. Health-conscious consumer trends driving interest in natural and nutritious beverages.

Weaknesses:

1. Limited shelf life of probiotic pineapple juice due to live cultures.
2. Higher production costs compared to regular pineapple juice.
3. Challenge in maintaining consistent probiotic counts during production and storage.
4. Limited consumer acceptance or understanding of probiotic benefits.
5. Intense competition in the beverage industry.

Opportunities:

1. Increasing interest in gut health and digestive wellness.
2. Expanding market in health-conscious and fitness-oriented demographics.
3. Collaboration with health professionals to promote probiotics.
4. Innovation in packaging and distribution to improve shelf life.
5. Entry into international markets with rising health-consciousness.

Threats:

1. Fluctuating prices of pineapple and other raw materials.

2. Stringent regulations and labeling requirements for probiotic products.

3. Potential for contamination and spoilage during production and transportation.

4. Competing with other probiotic products, such as yogurt and kefir.

5. Economic downturn affecting consumer spending on premium products.

Please note that this analysis may not cover all aspects or be up-to-date with the latest industry developments. Conducting a comprehensive analysis would require more detailed research and data specific to the current state of the probiotic pineapple juice industry.

Research and Development:

Already a wide range of research has been made in this disciplinary to enhance various functionality of pineapple juices. Pineapple juice is Traditionally consumed without any harmful effect on health. Addition of selected ingredients won't change much characteristically. Addition of probiotics and various physicochemical changes are already analyzed in [4] here. It compares various properties of both normal pineapple juice and probiotic added juice. No major changes were visible, and some minor changes were made to meet the regulatory demand.

Site Selection:

One of our primary objectives was, during initial planning, to minimize cost of total production by reducing fixed cost as much as possible. We had to choose a location where sourcing raw materials was easy, transportation cost would be minimum, and facility expansion would be attainable while taking into consideration weather, expansion opportunity, neighbors, access to roads, water, power, manpower and cost of land.

Madhupur, Tangail fits all our requirements. It is cost efficient to acquire raw pineapple from our distributor as they are produced here. So, the transportation cost of raw materials can be saved. This place is place to some already established industries and proven itself to be production

friendly in terms of resource availability, access to major highway and transportation system, sewage system, manpower and technical administration.

Our site is located at latitude: 24°19'20.04"N, longitude: 89°55'29.10"E. which is approximately 0.5 km from Bonsai River. It is near Elenga, Tangail and right by Tangail-Dhaka highway.

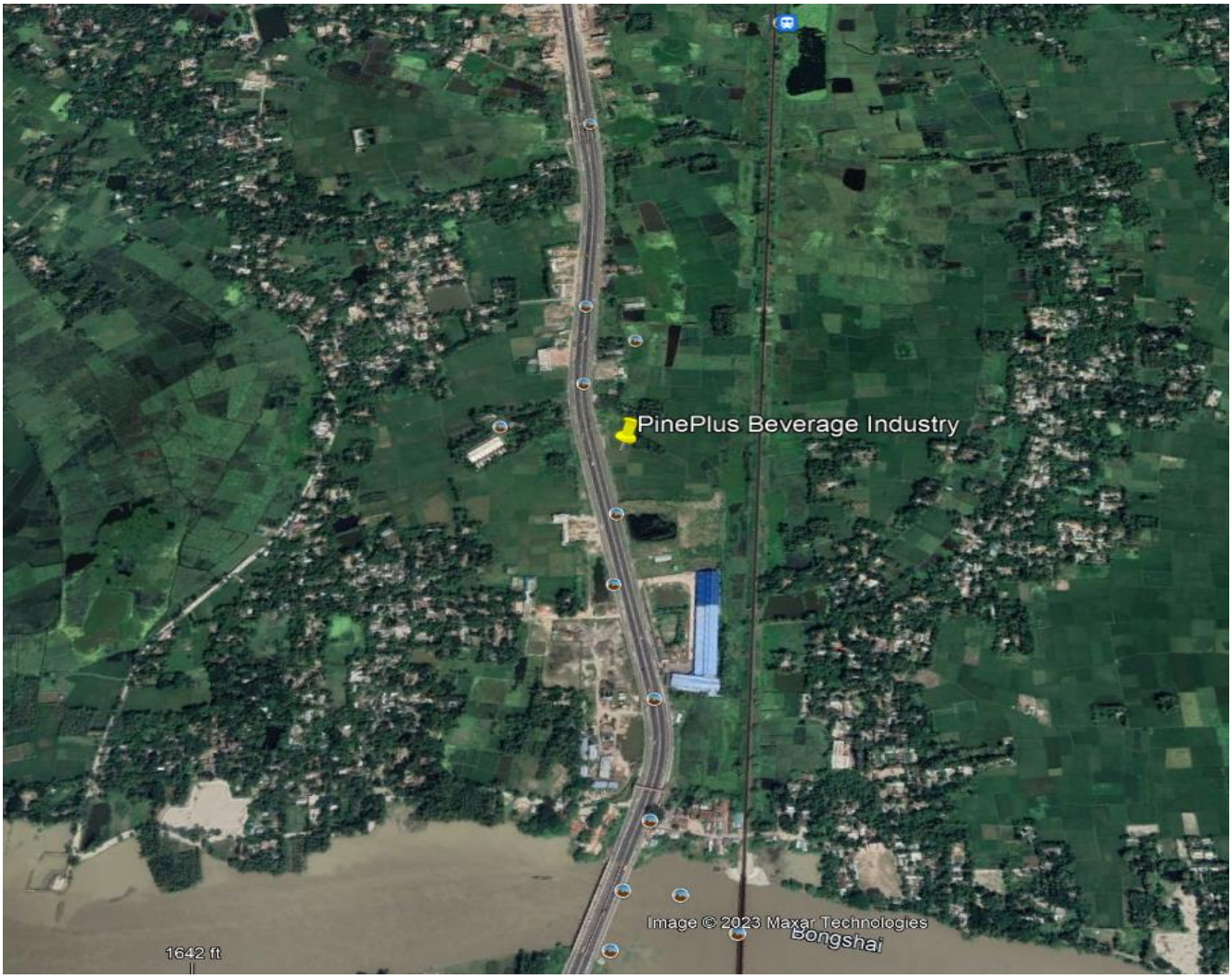

Fig: Selected Sight

Sourcing:

Pineapple would be collected from wholesale distributor from Madhupur, Sreemongol, and Sylhet. All the raw materials would be transported to our facility by truck. As we yet don't have enough truck to use only our trucks, we will use help of our third-party partners.

All other required ingredients, including salt, sugar, coloring agent, preservatives, will be bought by tendering out to various companies.

Ingredients and Materials:

- Fresh Pineapple juice
- Water
- Sodium Chloride
- Lactobacillus strain
- Glucose
- Sodium Benzoate

Equipment's:

- Mild steel weight bridge

QC:

- Refractometer
- PH meter
- Moisture Meter
- Colorimeter
- Texture analyzer
- Digital scale

Raw material storage

- Pulp Storing fridge.
- Ingredients storing Fridge.

Sorting:

- Optical Sorter

Washing:

- Fruit washer machine

Peeling:

- Peeling Machine

Crushing:

- Extractor

Filtration:

- Juice filtering machine

Fermentation:

- Fermenter

Evaporation and Drying:

- Single effect evaporator

Tank:

- Mixing Tank
- Dilution tank

Homogenizer

Filling:

- Filling Machine

Sealing:

- Bottle or Can sealer

Storage:

- Refrigeration

Boiler:

- 20-ton boiler

Generator

Procedure:

1. Raw Pineapple is Collection
2. Quality of is checked.
3. The pineapple then washed, sorted, peeled, crushed, and filtrated.

Food Safety Plan (HACCP):

HACCP analysis is done to identify various CP and CCP's across our production line. Their mitigating measures are also analyzed and applied to our facility.

Steps	Hazards	Type	Preventive Measures	Cp/CCP
1. Reception	Weightlifting Fruits	Physical	Lifts Fruits Weighting	Cp
2. Washing	Metals	Physical	Equipment Maintained Properly	CCP
	Microbials	Biological	Testing Microbial Quality of water	CP
	Chemicals	Chemical	Testing chemical Quality of water	CP
3. Peeling and blending	Microbials	Biological	Sanitize equipment	CP
	Metal Plastics	Physical	Maintain downstream screening	CP
4. Flash Pasteurization	Microbes	Biological	Maintain process time, temperature	CP
5. Cooling	Microbes	Biological	Screening microbial growth	CP
6. Mixing	Metal Particles	Physical	Use metal detector	CP
7. Degassing	Denatured air bubbles or gasses	Chemical	Proper aqueous solution should be used	CCP
8. Fermentation	Unwanted microbes	Biological	Sanitize the fermentation equipment's	CCP
9. Packaging	Unwanted foreign particles	Physical	Correct Cleaning procedure to be followed	CCP

Fig. HACCP ANALYSIS

Quality Control:

The Quality Control department will ensure that products produced are safe and constantly meet certain standards. Quality control operations begin with the reception dock. The raw pineapple and ingredients that enter the industry are taken to the lab.

1. **Inspection of raw materials**: All the Information according to the following table are taken.

Category	Confirm	Not Confirm	Pending
1. Quantity			
2. Weight			
3. Dimension and Weight			
4. Shipping mark and Packaging			
5. Storage Condition			
6. Microbiological Testing			
7. Chemical Testing			
8. Physical Testing			

2. **Probiotic strain verification:**
   Confirm the presence and viability of the intended probiotic strains in the juice.
3. **PH and acidity testing:**
   Check the pH level and acidity of the juice to ensure it meets the desired specifications.
4. **Microbiological testing:**
   Conduct tests to detect the presence of harmful microorganisms and ensure the probiotic count is at the desired level.
5. **Nutritional Analysis:**
   Verify that the juice contains the intended nutrients and probiotic concentrations.
6. **Packaging integrity:**
   Inspect the packaging to ensure it is sealed properly and prevents contamination.
7. **Stability Testing:**
   Assess the product's shelf life under various storage conditions.

8. **Sensory Evaluation:**
   Conduct taste and odor tests to ensure the juice is pleasant and consistent.
9. **Regulatory Compliance:**
   Ensure the product complies with relevant food safety and labeling regulations.

Packaging and labelling:

Labelling will include the following information according to Food Act Law:

1. **Name of the product:** PinePlus.
2. **Volume:** 250ml.
3. **Ingredients:** Pineapple juice, water, sugar, salt, Preservatives, Lactobacillus Bacteria.
4. **Nutritional Value**: Manganese, Copper, Vitamins B6 and C, trace amount Iron, Calcium.
5. **Expiration Date**: 2 months from production.
6. **Storage:** 4 Degrees Celsius.
7. **Name of Allergens:** Pineapple.

Waste Management:

The waste generated from pineapple peel, and by products after crushing are used to make Ethanol and animal feed. Pineapple wastes goes through mincing and grinding to create solid pineapple waste. 1000 kg of pineapple, including the crown, peel, produce approximately 516kg of waste materials. The waste is then pressed and separated into liquor (350kg) and press cake (160kg). The liquor is centrifuged and then filtrated. Filtered juice is fermented into Bioethanol (25litre). The press cake goes through SSF and convert into Animal Feed (160kg).

Record Keeping:

All activities, such as temperature, PH, brix, Acidity, will be recorded by our superintendent and relatives. They will process the data and then input them in a computer system. Which will store the data in long term memory and can be recalled and shown as required. These data can be used to further optimize our system.

Financial Analysis:

The fixed costs of total production are BDT. 133100000/= only for purchasing equipment's, developing facilities, accommodation, transportation system etc.

Our daily production target is 80000 bottles of juice. It requires sourcing 22000kg of pineapples each day. 22000 kg of pineapples costs tk. 1188000 daily, including transportation cost. At the same time other ingredients such as salt, sugar, Preservatives, coloring agent would require tk. 179000/= per day.

We have a total of 55 workers to pay. On average each worker takes about tk. 20000 salary, and includes guard, facility workers, drivers. So, the total cost would be about tk. 1500000 monthly. There are also 25 blue hat workers including managers and supervisors who would take tk. 55000 on average. That's sums up to a total of tk. 1375000 monthly.

For each product our net profit will be near tk. 1.2/pc. we will sell each product to distributor at a rate of tk.20/pc, and it takes us tk. 18.8, from sourcing to supple to customer.

According to our analysis it would take about 5 years to reach our break even point and in terms of bottle produces, we would need to produce 111 million bottles during that time.