Pre-Feasibility Study

ALOE VERA PROCESSING

Small and Medium Enterprise Development Authority

Government of Pakistan

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1 INTRODUCTION TO SMEDA

The Small and Medium Enterprise Development Authority (SMEDA) was established with the objective to provide fresh impetus to the economy through the launch of an aggressive SME Support Program.

Since its inception in October 1998, SMEDA had adopted a sectoral SME Development Approach. A few priority sectors were selected on the criterion of SME presence. In depth research was conducted and comprehensive development plans were formulated after identification of impediments and retardants. The all-encompassing sectoral development strategy involved recommending changes in the regulatory environment by taking into consideration other important aspects including Finance, Marketing, Technology and Human Resource Development.

SMEDA has so far successfully formulated strategies for sectors including, Fruits and Vegetables, Marble and Granite, Gems and Jewelry, Marine Fisheries, Leather and Footwear, Textiles, Surgical Instruments, Transport and Dairy. Whereas the task of SME development at a broader scale still requires more coverage and enhanced reach in terms of SMEDA's areas of operation.

Along with the sectoral focus a broad spectrum of Business Development Services is also offered to the SMEs by SMEDA. These services include identification of viable business opportunities for potential SME Investors. In order to facilitate these Investors, SMEDA provides business guidance through its help desk services as well as development of Project Specific Documents. These documents consist of information required to make well-researched investment decisions. Pre-feasibility Studies and Business Plan Development are some of the services provided to enhance the capacity of individual SMEs to exploit viable business opportunities in a better way.

This document is in the continuation of this effort to enable potential investors to make well-informed Investment Decisions.

2 PURPOSE OF THE DOCUMENT

The objective of this proposed Pre-feasibility is primarily to facilitate potential entrepreneurs with the Investment information and provide an overview about the **"Aloe Vera Processing Unit".** The proposed Pre-feasibility may form the basis of an important investment decision and in order to serve this objective, the document covers various aspects of Aloe Vera Processing Unit concept development, start-up, operations, marketing, and finance and business management. This document also provides sectoral Information, brief on government policies and international scenario, which have some bearing on the project itself.

This particular Pre-feasibility is regarding setting up **"Aloe Vera Processing Unit".** In meeting the above tasks we have obtained information from industry sources and officials of major Aloe Vera processors in Pakistan.

Our report is based on the information obtained by us from industry sources as well as our discussions with businessmen. For financial model, since the forecast/projections

relate to the future periods, actual results are likely to differ because of the events and circumstances that don't occur frequently as expected.

Whilst due care and attention has been taken in performing the exercise, no liability can be inferred for any in-accuracy or omissions reported from the results thereof. It is essential that our report be read in its entirety with financial model in order to fully comprehend the impact of key assumptions on the range of values determined.

3 CRITICAL SUCCESS FACTORS IN DECISION MAKING FOR INVESTMENT

3.1 SWOT ANALYSIS

Before making a decision, whether to invest in setting up a Aloe Vera Processing unit or not, one should carefully analyze the associated risk factors. A SWOT analysis can help in analyzing these factors, which can play important role in making the decision.

3.1.1 Strengths

Aloe Vera contains numerous vitamins and minerals, enzymes, amino acids, natural sugars and agents which may be anti-inflammatory and anti-microbial. The combination and balance of the plant's ingredients are what purportedly gives it its healing properties. Some of the strengths of this project are;

i- Availability of Cheaper Labor & Raw Material in the form of Aloe Plant.

ii- Since the processing facility is totally automated, there is less involvement of man power.

iii- Owned supply chain.

iv- The project shall have its own raw material (Aloe Vera Plants) cultivation and harvesting facility.

3.1.2 Weaknesses

i. Non-availability of the Plant technical staff in the local market as there is no such totally automated processing unit already established in Pakistan

3.1.3 Opportunities

i- The competition in the Domestic Market is very limited as most of the Aloe Vera powder is imported.

ii- Growing market of Pharmaceutical and Cosmetics industry which is creating the high consumption opportunities of Aloe Vera.

3.1.4 Threats

i- In order to penetrate in and capture the market heavy promotional charges are expected to be incurred.

ii- The cultivation may be exposed to natural disaster.

3.2 CRITICAL SUCCESS FACTORS

There are many obstacles in the road to producing a Aloe Vera product. The reason for this is centered on the delicate nature of the star of this botanical, mannose. As soon as harvesting commences, the nature of the plant is to break down its own healing substances (polymannose) due to the enzyme cellulose found in the tissues of the plant. This response enables the plant to repair its wound and to provide a new skin (similar to what polymannose does in the human body). This process also provides immunity to the leaf (again, similar to the role polymannose plays within the body's biology) and will ensure the plants survival. Without this protective system, the leaf and plant would become susceptible to viruses, bacteria, parasites, and fungus. Therefore, it is imperative to keep the leaves cool, as well as completing processing as quickly as possible, in order to minimize this self-induced degradation.

Manufacturing of Aloe Vera concentrate/powder requires the basic knowledge of Aloe Vera Plant quality. Aloe Vera Plant is the main raw material and the entire finished product highly depends upon the quality of the Aloe Vera plant. The information and technical know how about the quality of Aloe Vera plant plays a vital role in the desired yieldage of the final product.

3.2.1 Other Success Factors

i- Advance Orders for sale can ensure the success of the Business.

ii- High quality of Raw Material.

iii- Low Prices.

iv- Reliability in Delivery.

4 PROJECT PROFILE

4.1 PROJECT BRIEF

The proposed project is for setting up **ALOE VERA PROCESSING UNIT**. The Project will cater to the needs of domestic market.

Aloe Vera cannot tolerate a hard freeze; therefore it cannot be grown in areas that have temperatures that fall below freezing. Aloe Vera will freeze at 28 degrees Fahrenheit, and if freezing does occur, the plants will die. Aloe Vera Barbadensis Miller is the most common type grown. It can be distinguished by its yellow flower. 150 ml of water a month is required in order to produce a quality leaf weighing around 1 Kg. When the Aloe Vera leaf is starved of water, there is an increase production of aloin and emmodin which causes the gel to have a very bitter taste, a brownish color, and a very strong odor. If Aloe Vera is planted in rows at 31 inch centers, with 36 inches between the rows, around 5,000 aloe plants per acre can be planted. Harvest aloe plants can be harvested 4 times per year. Three leaves per plant can be obtained. This makes a total of 12 leaves per plant per year. At an average weight of 1 kg one can expect an annual return of 60,000 kg of aloe leaves per acre. Filleting depends on whether it is done manually or through an automated extraction machine; whatever the case may be one should yield at least 43 to 45 percent from a 1 kg aloe leaf.

Aloe leaves are harvested one leaf at a time and are generally chosen from the outermost edge of the plant, then removed by creating an incision at the bottom of the leaf, nearest to the stalk. The leaves are immediately packed and transported to an on-site processing plant to be prepared for stabilization

4.2 OPPORTUNITY RATIONALE

The Aloe Vera powder available in the local market is mainly processed in the province of Sindh which is not sufficient to meet the requirements of the domestic market. In addition some niches of the market are also served by imports mainly from Australia, Africa and America. The demand for Aloe Vera powder is increasing in the domestic market as well as in the international market due to the vast benefits that can be driven out from the product. Aloe Vera Processing is a viable profitable business if done properly on Commercial basis. There is a huge business opportunity in this area.

4.3 TARGET CUSTOMERS

The proposed project shall cater to the needs of the domestic market of Pakistan. The target market for this proposed project would be Pharmaceutical and Cosmetic Industry.

The commercial Aloe Vera plant is grown on professionally managed farms. The plants are monitored and sampled at regular intervals throughout the year and checked for any signs of stress. Specially designed irrigation systems and the latest cultivation techniques are employed to ensure that the Aloe Vera juice plants are kept in peak condition. These programs guarantee that only the finest and purest plants are harvested and used to produce the Aloe Vera concentrate/powder that will become the core of many high-quality creams, lotions and drinks.

4.4 MARKET ENTRY TIME

Various products and services have high dependence on their commercialization, timing and delivery to the customers but the Aloe Vera Processing unit can be started at any time during the year due to the availability of raw material throughout the year.

4.5 PROPOSED BUSINESS LEGAL STATUS

The said project can be a sole proprietorship or a partnership and even it can be registered under the Companies Ordinance, 1984 with the Securities & Exchange Commission of Pakistan. The selection totally depends upon the choice of the entrepreneur. This pre-feasibility assumes the legal status of a sole proprietorship/partnership as this does not involve heavy investment. Moreover less legal requirements and costs are involved in forming, administration and running the sole proprietorship or partnership business. Lower tax rates for this type of business legal status would be an added advantage.

4.6 PROJECT CAPACITY AND RATIONALE

Selection of the project size is really critical. After doing thorough market research, it is decided that the proposed feasibility will be based on the processing capacity of 55,000/- aloe leaves per day with the production of aloe Vera powder of 550 kgs per day. As it is evident from rise in the pharmaceutical and cosmetic industry that there is a huge demand of aloe products in the domestic market, a sizeable production is required.

4.7 PROPOSED LOCATION

The said project can be started in any industrial area of cities like Lahore, Karachi, Islamabad, Sialkot or Faisalabad etc. It is however recommended to establish the Project at Lahore – Raiwind Road.

4.8 PROPOSED PRODUCT OFFERED

This unit is capable of selling high quality Aloe Vera powder from own cultivated Aloe Vera plant.

4.9 PROJECT INVESTMENT

Total Project cost is Rs. 45,195,486 worked out in the following table:-.

Table 1 Total project cost

COST	RUPEES
Capital Investment	43,305,500
Working Capital Requirement	1,889,986
Total Investment	45,195,486

4.10 RECOMMENDED PROJECT PARAMETERS

Capacity	Human Resource	Location	
3,600,000 Aloe Leaves per annum	50	Raiwind Road, Lahore	
Financial Summary			
Project Cost	**IRR**	**NPV (Rs.)**	**Payback period**
45,195,486	26.45%	14,559,388	4.66 years

The pre-feasibility is based on the assumption of 50% debt and 50% equity. However this composition can be changed as per the requirements of the Investor.

5 ALOE VERA - INTRODUCTION

Aloe is one of the oldest healing plants known to mankind. It is even described in the bible for its healing properties. Hundreds of Scientific Research Papers describe the activities of Aloe Vera taken internally or applied externally to the skin or hair. These Research Papers include, but are not limited to the following nutritional uses: A natural cleaner, powerful in penetrating tissue, relieving pain associated with the joints and muscles, bactericidal, acts as a strong antibiotic, virucidale when in direct contact for long periods, fungicidal, anti-inflammatory, instrumental in increasing circulation to area, breaks down and digests dead tissue, and moisturizes tissues.

Aloe has been used topically for cuts, burns, insect stings, bruises, acne and blemishes, poison ivy, welts, skin lesions, eczema, and sunburns. Aloe also has a history of traditional use by Native Americans for stomach disorders and intestinal disorders including constipation, hemorrhoids, colitis and colon problems. Additionally, numerous

constituents within Aloe Vera have demonstrated enhancement of immune system functioning within the body.

This plant has been traditionally used through the centuries; for both internal ingestion as well as for topical purposes. Historically, the aloe plant has enjoyed wide use for its enhancement of normal gastrointestinal functioning. It has been used by many for constipation, intestinal colic, and inflammatory conditions of the small and large intestine and for digestive disturbances. Topically, aloe has demonstrated benefits in assisting in the healing of minor cuts, wounds and burns. More recent research and clinical use has shown even wider applications for this amazing plant including enhancing immunity, balancing blood sugar and providing pain relief. With the impressive elements found in Aloe that work in synergy with one another, it's no wonder that Aloe Vera is so effective in the nutritional assistance and supplementation of the human metabolism.

5.1 CONSTITUENTS OF ALOE VERA:

There are over 100 active biologic constituents found within aloe. The plant is a rich source of many natural health-promoting substances including:

i. **Vitamins/Minerals** - Vit C, A, E, B vitamins, B-carotene, Zinc, Calcium, Copper, Magnesium, Manganese, and Phosphorous.

ii. **Enzymes** - At least five different enzymes have been identified and likely more are contained within.

iii. **Amino Acids** - Twenty-two amino acids are found within aloe.

iv. **Plant sterols** - These plant based compounds are potent anti-inflammatory agents.

v. **Gibberellins** - A growth factor which assists in healing.

vi. **Polysaccharides** - Including B1-3 and B1-4 Glucomannans known for their immune stimulating effects Based on its constituent make up, aloe has a wide array of applications.

5.2 DESCRIPTION OF ALOE VERA PLANT

Aloe Vera is a perennial plant with turgid green leaves joined at the stem in a rosette pattern just as we appreciate on Picture 1. The leaves of a mature plant may be more than 20 to 30 inches long with saw-like spikes along their margins, as we appreciate on Picture 2.

Picture 1 - View of the Aloe Barbadensis

Picture 2 - View of the Aloe Barbadensis miller Leaf

When the leaves are removed from the basal portion of the mother plant, a yellow liquid, which is the sap, starts draining immediately from the basal portion of the Aloe leaf. This liquid is contained within the inner vascular bundles of the Aloe leaves and start dripping out of the Aloe leaf, as soon as a transversal cut is made as we appreciate on Picture 3. This yellow sap liquid as shown on Pictures Four, has laxative properties and is mainly composed by a glucosidal anthraquinone known as Aloin, as well as other similar quinines and anthraquinones.

Picture 3 - View of the yellow sap dripping after a transversal cut of the Aloe leaf.

Picture 4 - View of the yellow sap after draining completely from the Aloe Vera leaf.

This inner gel, is the mucilagenous jelly from the inner paenchymal cells of the plant and after processing it, is referred to as Aloe Vera gel. In Picture Eight we can notice the viscosity of the inner Aloe fillet, and its white color. The inner Aloe fillet gel is composed generally by 98.5 % water, where more than 60 % weight of the total weight of solids contained in this Aloe gel, are made up of polysaccharides of carbohydrate origin along with a vast variety of other biochemical substances having biological activity. Most of the Aloe vera gel available in the market are named Fillet Aloe vera gel, since it is made by processing the inner Aloe vera gel only.

Picture 5 - View of the inner Aloe fillet as it is removed from the inner portion of the Aloe leaf.

Picture 6 - View of the the Aloe fillet after being completely removed from the inner Aloe leaf.

However, on Pictures 7 and 8 we notice that a thick viscous mucilage is still attached firmly to the Aloe vera outer skin, after the removal of the inner Aloe fillet.

Picture 7 - View of the viscous mucilage that is still attached to the inner portion of the Aloe leaf, after the removal of the internal Aloe fillet.

Picture 8 - View of the viscous mucilage that is still attached to the inner portion of the Aloe leaf, after the removal of the internal Aloe fillet.

This viscous layer contains a long molecular weight polysaccharides sub- stance which has been confirmed scientifically to have many important biological properties which plays major role in the healing process. The main feature of the new Bifurcated Aloe vera gel, is that this viscous mucilage is also processed and included into the final product. In other commercial Aloe vera fillet gel preparations this portion is not included, since the final Aloe rind is generally discarded.

However this viscous mucilage and the outer Aloe vera rind contain a large number of biological active substances. On Picture 9, we observe the Aloe vera outer rind after the total removal of the inner Aloe vera gel, and on Picture Twelve we observe both, the Aloe vera outer rind and the inner gel already separated from the Aloe vera leaf. In Bifurcated Aloe vera gel we take advantage of all the substances present in both parts of the plant as different from than other similar Aloe vera preparations.

Picture 9 - View of the Aloe Vera outer rind after total removal of the Aloe Vera gel.

5.3 BENEFITS OF ALOE VERA

Aloe vera contains numerous vitamins and minerals, enzymes, amino acids, natural sugars and agents which may be anti-inflammatory and anti-microbial. The combination and balance of the plant's ingredients are what purportedly gives it its healing properties. Some of the strengths of this project are;

i. May help sooth skin injured by burns, irritations, cuts and insect bites.

ii. May help moisturize and soften the skin.

iii. May help speed the healing of skin wounds, burns and other injuries.

iv. May help (when taken internally) with constipation, diarrhea and other intestinal problems.

v. May speed and improve general healing when taken internally.

vi. May relieve itching and swelling of irritated skin.

vii. May help kill fungus and bacteria.

viii. May improve the effectiveness of sun screen products.

6 PRODUCTION PROCESS

There are two basic processes used in the manufacturing of aloe Vera products:

a. Whole Leaf processing in which the entire aloe leaf is used to manufacture whole leaf gels, whole leaf concentrates, and whole leaf powders.

b. Aloe Vera gel processing in which only the inner gel fillet is used to manufacture aloe Vera gels, aloe Vera concentrates, and aloe Vera powders.

In order to get a good quality aloe gel, the tips and the ends of the leaf are removed then the spiny sides are removed. The aloe rind can be removed by squeezing the leaf, filleting the leaf or by grinding up the entire leaf. There are several types and versions of aloe filleting machines. Aloe rinds should be placed back in the fields for fertilizer.

Aloe concentrates are produced removing the water content. There are various ways to do this, reverse osmosis, thin film evaporators, and vacuum distillation process is a few examples. Aloe Vera gel will have approximately 0.5% solids. It is common to concentrate up to 20% solids making a 40:1 concentrate.

The kinds of aloe Vera powders produced are:

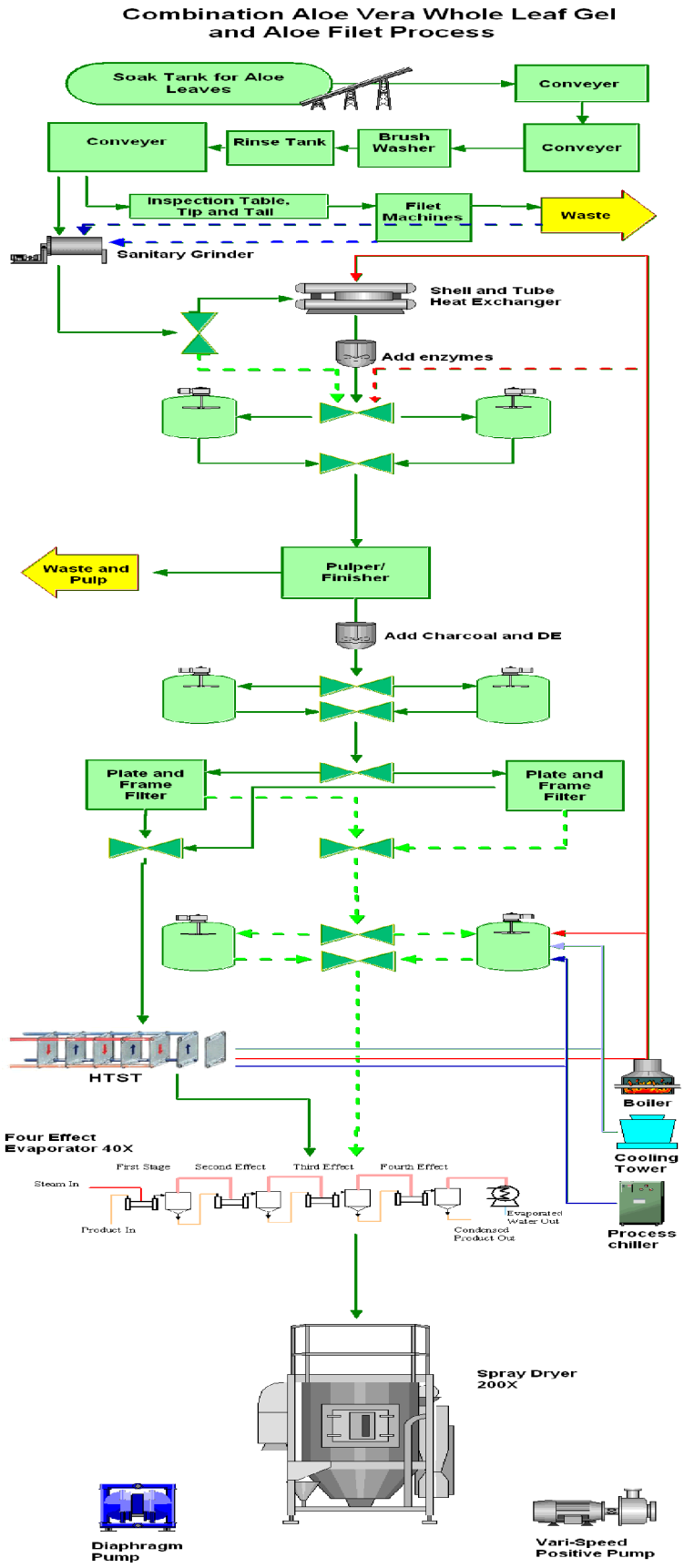
a. A 200:1 pure aloe powder made from the inner gel.

b. A 100:1 pure whole leaf aloe powder from the leaf.

Basically there are two types of equipment used to make powders:

a. Freeze drying

b. Spray drying


Combination Aloe Vera Whole Leaf Gel and Aloe Filet Process
Soak Tank for Aloe Leaves
Conveyer
Conveyer
Rinse Tank
Brush Washer
Conveyer
Inspection Table, Tip and Tail
Filet Machines
Waste
Sanitary Grinder
Shell and Tube Heat Exchanger
Add enzymes
Waste and Pulp
Pulper/ Finisher
Add Charcoal and DE
Plate and Frame Filter
Plate and Frame Filter
HTST
Boiler
Four Effect Evaporator 40X
First Stage
Second Effect
Third Effect
Fourth Effect
Steam In
Product In
Evaporated Water Out
Condensed Product Out
Cooling Tower
Process chiller
Spray Dryer 200X
Diaphragm Pump
Vari-Speed Positive Pump

6.1 SOAK TANK

This is the first station for the Aloe as it arrives to the Processing Plant. Most companies use a large pool filled with potable water. This could also be untreated well water. The purpose for this initial tank is to soften and partially release foreign particles and dirt from the surface of the leaves. There are several options on how to operate this first station:

a. Just immersion: Here the Aloe leaves are just dumped into the water with no further action; they could then be manually removed out of the vat or mechanically by means of a conveyor.

b. Forced agitation: This is a variation in which the tank has high pressure water jets that create a whirlpool in the soaking tank. The advantage of using this system is that dirt and other foreign material is removed in a more efficient way.

c. Manual brushing: Here leaves are hand picked and brushed as they are pulled out of the soaking tank, then they are placed into a conveyor. The advantage of this type of treatment is that it is very gentle on the leaves, and removal of dirt and foreign material is optimal. Also, this can work as an inspection/rejection point. The downside is the higher labor cost.

6.2 CONVEYOR

After leaves are soaked and pre-cleaned they are moved by a conveying system. This can consist of a conveyor belt, stainless steel mesh or polypropylene conveying system. Some companies also use a fluid conveying system, in which the leaves are placed in a canal with water that is being pumped so that the flow moves the leaves along.

6.3 BRUSH WASHER

Just before the leaves receive the final wash and rinse, they are mechanically brushed. The brushers have plastic brushes that pick the leaves up from the conveyor and press them against two or more brushes giving a cleaning action on every side of the leaves. The purpose for this step is to remove dirt and

other foreign material from the surface of the leaves. Depending on the capacity of the plant one or several simultaneous lines of brushes can be installed. Usually the material of choice for these brushes is soft plastic, which vigorously removes unwanted material from the surface of leaves while being gentle enough to prevent injury to the leaf.

6.4 RINSE TANK

This is where the final wash of the leaves occurring. The function of this wash is to do the final cleaning to the leaf before entering the manufacturing facility. Options for this step include the use of sanitizing agents such as Chlorine, Quaternary ammonium salts and others. The tank can be made of stainless steel, fiber glass or concrete.

This process can also be a two-stage final rinse, first in a sanitizing solution and secondly a final rinse with water to remove the sanitizing agent.

6.5 INSPECTION TABLE

Leaves must have an acceptance specification. At this point, the leaves get inspected one by one as they enter the process. Leaves that do not meet specs are rejected here. Layout for this station is usually a conveyor that feeds leaves coming from the rinse tank into the table. It has a conveyor to carry waste out and either a series of tables or conveyors to carry the leaves to the next processing step.

It is important at this step to reject any leaves with evident injuries, cuts, or lesions in order to avoid contamination of the product downstream. Tips, tails, and spines are usually cut off the leaves by hand at this stage, so again the layout is such that would accommodate enough people to perform these duties. Typically 6 to 8 people can process 1000 Kg of leaves through this step.

6.6 FILET MACHINE

After leaving the inspection table, the aloe leaves goes to the filet machine. The filet machine is a device used to separate the rind from the inner gel of the leaf. The name comes from the resemblance of the inner gel to a fish fillet. An alternative to the use of this machine is to hand-fillet the leaf. The advantage of using a machine is the lower cost of operation in terms of labor, but a disadvantage is that the

yield may go down as compared to hand filleting.

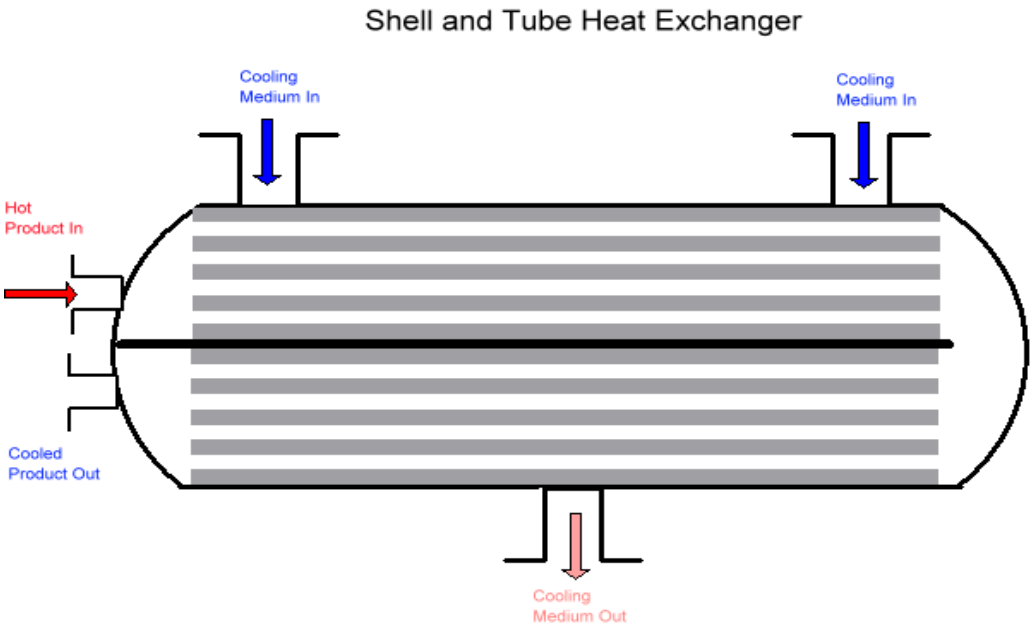
6.7 WASTE

All the insoluble rind and fibers goes to waste once the process has finished. This is organic waste, however and can be composted and recycled in the farm.

6.8 GRINDER

Whether the aloe leaves are coming off of the conveyor (whole leaf process), or the filets are coming out of the filet machine (aloe filet process), the grinder is where they are both headed. There are specific grinder designs for the mincing of whole leafs of aloe. This machine grinds by impact, then sieves thru a screen with a whole size about 5mm in diameter. The most used type of grinder used in the aloe industry is a hammer mill, with non-swiveling hammers. This type of grinder is the preferred type when processing whole leaf aloe. The intention of this process is to extract the liquid contained in the aloe leaf. Typically the tips and tails are removed before this step. The particle size is controlled by the size of a mesh placed at the bottom of the grinder

6.9 HEAT EXCHANGER



Shell and tube heat exchangers consist of a bundle of parallel sanitary tubes with the ends expanded in tube sheets. The bundle is contained in a cylindrical shell. Connections are

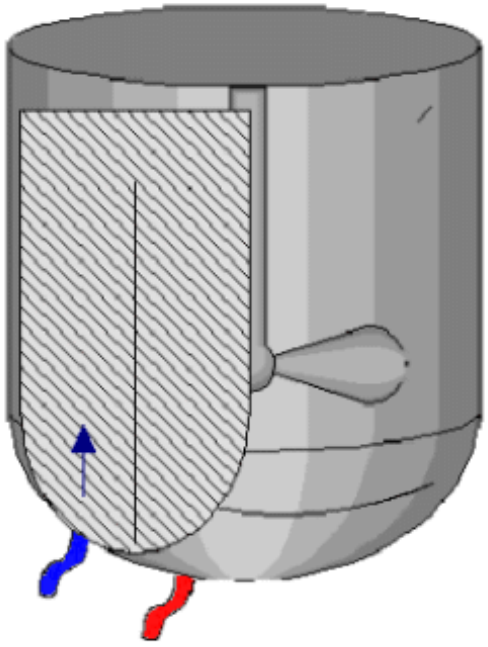
such that the tubes can contain either the product or the media, depending upon the application. The major limitation is that they cannot be used to regenerate, but they can transfer lots of heat due to the surface area.

6.10 ENZYMES

Recently extracted Aloe is a very viscous liquid so very commonly subject to an enzymatic treatment aimed at reducing the viscosity. Most commonly used enzyme is Cellulase, which is commercially available from a variety of sources. Enzymatic reaction usually takes two to four hours at room temperature. The enzyme, usually in liquid form is added to the vat, mixed and let to react. Typical ratio of use is 20 grams of enzyme for 100 grams of aloe solids in the gel.

6.11 AGITATED JACKETED TANKS

A jacketed tank is a tank with an outer jacket designed to contain heating or cooling media. Product is heated or cooled while being mixed blended or agitated. A dimple jacketed tank utilizes a simple heat transfer element. First, the heating element is created by pressing a dimpled profile into a flat sheet of stainless steel. This dimpled sheet, referred to as an embossing, is then spot welded to the non contact side of a stainless steel tank to create a flow passage for the heating or cooling media. The end result is a fully welded heat transfer element that is extremely thin (approximately?" overall thickness). The coils can remain exposed, or they can be covered with an insulation material and then covered with a sheet of stainless steel. Jacketed tanks are not thermally efficient and they cannot be used in a continuous operation



6.12 PULPER / FINISHER

The Pulper/Finisher is used to remove the insoluble fiber resulting from crushing either the whole leaf or the inner gel fillet. This device usually has a rotating part that is either an endless screw or paddles that push the mixture against a screen. The liquid goes thru the screen and the insoluble fiber is pushed to the end of the machine. The screen can have several different pore sizes, typically ranging from 800 to 500 microns. This machine serves its purpose as a coarse filter very efficiently and quickly

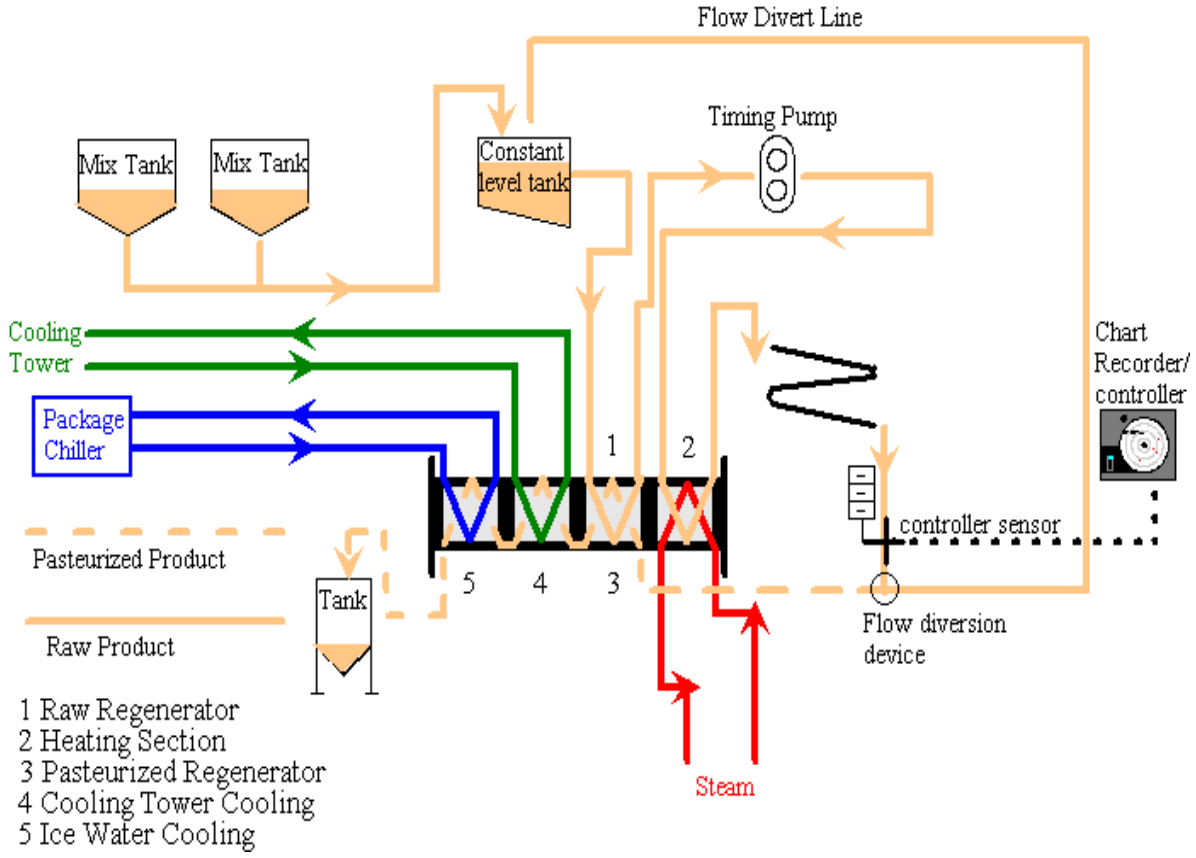
6.13 CHARCOAL AND DE

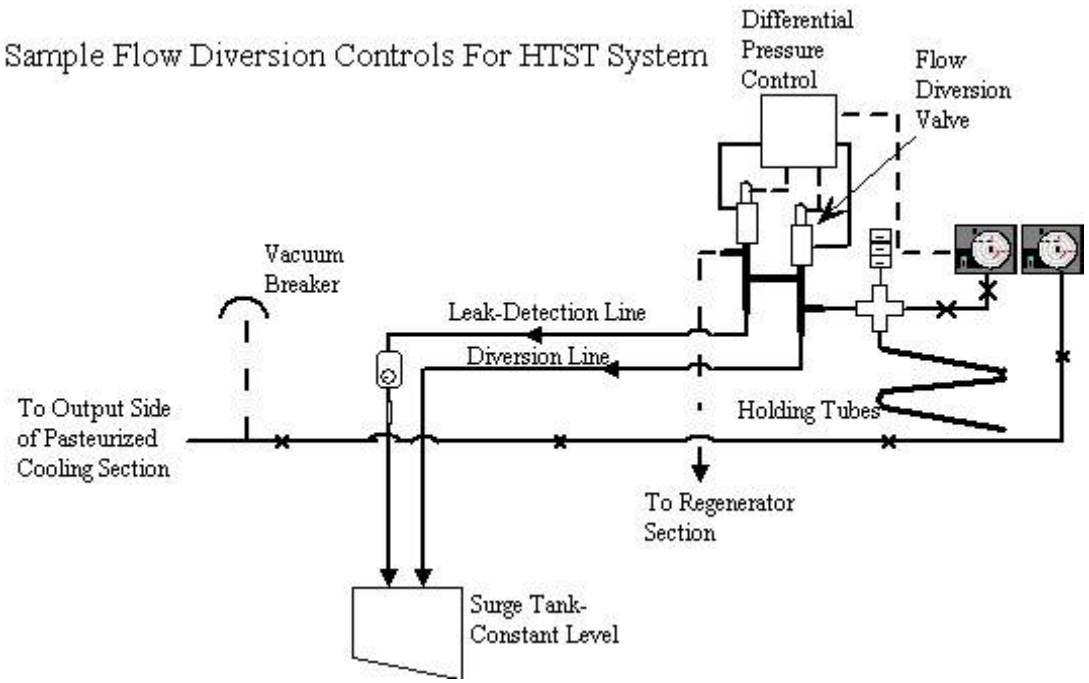
Aloe Vera contains a series of chemical compounds from the family of phenols, particularly anthraquinones. The most common of them is Aloin. These compounds have a potent laxative effect when ingested, so the allowed amounts in finished products are small. The origin of these compounds is the rind of the leaf, being completely absent in the inner fillet gel. Even though inner fillet gel is being produced, contamination with anthaquinones coming from the rind is virtually impossible, and in the case of whole leaf aloe, the amount of antraquinones is very high. The amount of these compounds needs to be controlled and one very effective way by using activated charcoal. This can be accomplished by adding activated charcoal to a tank and then removing the charcoal by filtration or by pumping the liquid thru a column that contains the activated charcoal.

6.14 FILTER

This step in the process may consist of a single filter or a series of them. The purpose of this step is either to remove the charcoal added in the previous step or to remove unwanted insoluble fiber. Filtering aids can be used here to facilitate filtration. Most typical types of filters used here are filter presses; however other types of filters have been used as well.

6.15 HTST





6.16 PASTEURIZATION

This is a thermal treatment aimed at reducing the bioburden of the product. Typically Aloe contains a natural flora of microorganisms. These once the leaf has been crushed start to reproduce rapidly, so at a later stage of the process the population needs to be reduced to assure stability of the final product. Reduction of microbial population can be achieved using a thermal treatment such as pasteurization. Typical reduction of population is 4 orders of magnitude. There are mainly three types of pasteurization done today:

6.16.1 Low Temperature Long Time (LTLT)

The acronym stands for Low Temperature Long Time. In this configuration the whole batch is placed in a tank where is heated typically to 140 F (60C) for 30 minutes.

6.16.2 High Temperature Short Time (HTST)

This configuration is a continuous process in which the product is heated very quickly (30-60 seconds) in a heat exchanger to temperatures of 170F (77C) and the temperature is held for a brief period of time, 1 to 2 minutes. Then the product is chilled back to room temperature or a little above. HTST systems use a heat recovery system called regeneration in which the hot product is used to exchange heat with the incoming product. This way it self cools and transfers that energy to the incoming product. If necessary or if the desired final temperature of the product is lower than room temperature, and additional section of the heat exchanger is added and water from either a cooling tower or a process chiller is used to further cool the product.

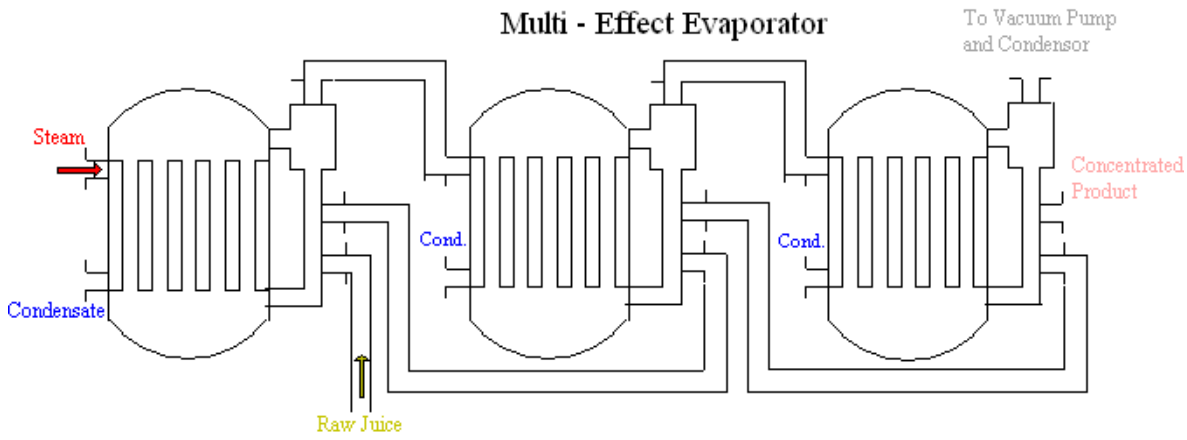
6.16.3 Ultra High Temperature (UHT)

This configuration is also a continuous process that works in a very similar fashion as the HTST, but the fluid here is heated to an even higher temperature, 230F (110C) but heat

transfer is done very fast, 2 to 5 seconds, and the peak temperature is only held for a fraction of a second.

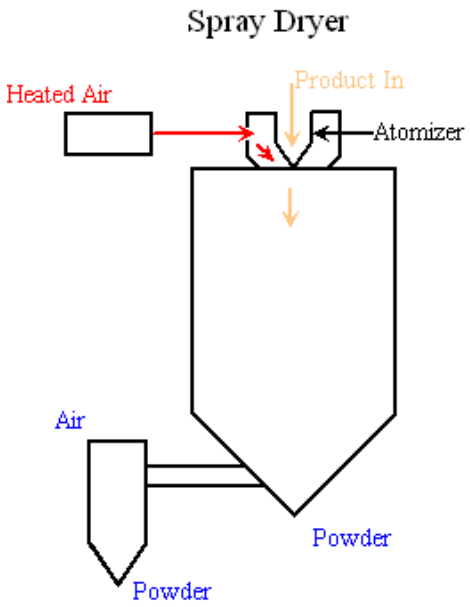
6.17 EVAPORATOR

In order to increase stability and also to improve efficiency in storage and transportation, it is desirable to concentrate Aloe. Final products that are currently marketed in the liquid form range from 5 times concentrated (5X) to 40X. However since Aloe is sensitive to heat, the concentration must be carried out at the lowest possible temperature. There are numerous designs of evaporators that work under high vacuum to facilitate water evaporation at low temperature. It is also important here to maximize heat transfer efficiency to lower the operational cost of the unit, therefore several evaporation chambers are placed in series and the hot evaporated gases from the first go to heat the second and so forth. This is called a multiple effect evaporator. The more the effects, the more efficient the operation. Typical operating temperature is about 140F (60C).



6.18 SPRAY DRYER

The Aloe concentrate most marketed today is the powder form. This product is known as 200X powder from aloe inner gel fillets or 100X powder from whole leaf aloe. Final evaporation must also be performed at low temperature to preserve the natural components of Aloe. This is especially important once the aloe solids become more concentrated since they are more suitable to chemically react between each other.



Spray dryers work by converting the Aloe concentrate into a very fine mist of droplets. The droplets form in a conical shaped chamber when the concentrate encounters flow of warm dry air. This then causes the drops to become so small that it increases the surface to volume ratio of the drop facilitating evaporation. The droplets are suspended inside the chamber until they become denser due to the evaporation. They then fall to the bottom of the chamber in a powder form and collected.

Two types of devices are currently used to make the fine mist of droplets. One is a very high pressure valve in which the liquid is force by pressure (2000psi) to go through a very small orifice which causes the liquid to spray out in a very fine mist. The other consists of a rotating disk on which a stream of liquid is dropped. The centrifugal force of the spinning disk then jets out the liquid, converting it into a fine mist. Rotation of the disk must be very fast, 10,000 rpm typically. Most disks use an air driven turbine to do this.

6.19 BOILER

The boiler provides steam as a source of energy for process heating. It is used for the pasteurization and evaporation operations, as well as a source of heat to produce hot water for formulation and for cleaning. Boilers are usually sized by their steam producing capacity, and by the pressure at which the steam is delivered. The higher the pressure, the higher energy delivered per pound of steam.

6.20 COOLING TOWER

6.21 PROCESS CHILLERS

6.22 POSITIVE PUMP

Positive displacement pumps are used to transport fluids from one place to another in the processing facility. These pumps are required for filtering, since the pressures at which they operate are higher.

6.23 DIAPHRAGM PUMP

Diaphragm pumps are used to move fluids with high solids content. Usually they are compressed air actuated. They are very useful in hazardous environments.

7 PROJECT PRE-REQUISITES

7.1 LAND REQUIREMENT

Land for the proposed business can be acquired on lease or it can be purchased based on the judgment of the entrepreneur. It is however recommended to purchase the Land as the availability of the raw material mainly depends upon this factor

Description	Land Area	Rent per Kanal	Rupees
Land required for Factory Building (in Kanals)	3	1,500,000	4,500,000
Land required for Agricultural Activity (in Acers)	60	15,000	900,000
Total			**5,400,000**

7.2 BUILDING REQUIREMENT

Following Table shows the detailed building requirements for the Project. The break - up of the required area and construction cost is produced below

Building & Civil works	Space Required in Sq. ft	Construction Cost Per Sq. Ft.	Total Cost
		Rupees	Rupees
Plant Area	7,000	700	4,900,000
Laboratory	250	700	175,000
Generator space	500	700	350,000
Management Offices	500	800	400,000
Accessories store	500	650	325,000
Store Room	900	600	540,000
Loading/unloading Bay	1,500	200	300,000
Garage - open Plot Area	1,450	250	362,500
Water Tank	300	600	180,000
Kitchen	100	600	60,000
Toilets	500	500	250,000
Total Infrastructure Cost	**13,500**		**7,842,500**

7.3 MACHINERY & EQUIPMENT

List of Plant and Machinery required is given in table below

Items	No. of Items	Cost (US$)	Cost (PKR)
Soak Tank	1	400,000	24,000,000
Conveyor	2		
Brush Washer	1		
Rinse Tank	1		
Inspection Table	1		
Grinder	1		
Heat Exchanger	1		
Agitated Jacket Tank	6		
Pulper/Finisher	1		
Filter	1		
HTST	1		
Evaporator	1		
Spray Dryer	1		

7.4 FITTINGS & INSTALLATIONS REQUIREMENT

Following fittings & installations are required for factory and management offices

Items	No. of Items	Cost per Unit	Total Cost
		Rupees	Rupees
Split Units	3	25,000	75,000
Generator	1	500,000	500,000
Tube well	3	350,000	1,050,000
Electric Installations & Fittings - cables & wires		200,000	200,000
TOTAL			**1,825,000**

7.5 OFFICE EQUIPMENTS REQUIREMENT

Following office equipments are required for factory and management offices

Items	No. of Items	Cost per Unit	Total Cost
		Rupees	Rupees
Computers	3	30,000	90,000
Printers	2	25,000	50,000
Fax Machine	1	10,000	10,000
Telephone Sets	10	500	5,000
Telephone exchange	1	10,000	10,000
Fire Fighting Equipments	3	4,500	13,500

TOTAL	**178,500**

7.6 FURNITURE & FIXTURES REQUIREMENT

Following furniture & fixtures are required for factory and management offices

Items	Cost	Total Cost
	Rupees	Rupees
Office Furniture - including tables, chairs, cabinets, almarahs etc.	200,000	**200,000**

7.7 VEHICLES REQUIREMENT

The schedule of Vehicles required for the proposed project is presented below

Items	Quantity	Unit Cost (Rs.)	Total Cost (Rs.)
Cars	2	650,000	1,300,000
Suzuki Pickup	2	450,000	900,000
Motor Cycles	1	55,000	55,000
Tractor (messey - 360)	2	365,000	730,000
Trolley	2	175,000	350,000
Cycles	2	3,500	7,000
Total Cost			3,342,000

7.8 HUMAN RESOURCE REQUIREMENTS

Following table shows the requirements of Human Recourses required

Description	Number of Employees	Per Month Salary	Annual Salary
			Rupees
PRODUCTION DEPARTMENT SALARIES & WAGES			
Production Manager	1	35,000	420,000
Engineer	1	25,000	300,000
Technical supervisor	2	10,000	240,000
Quality In charge	1	12,000	144,000
Lab Assistant	2	5,000	120,000
Plant Operators	5	7,000	420,000
Unskilled Factory Labor	20	4,000	960,000
Total Production Salaries			**2,604,000**
Other benefits[1] (10%)			**26,040**

[1] *Other benefits include EOBI, Social Security, Gratuity, Medical and Other welfare expenses*

Total Production Salaries & Wages incl. other benefits			**2,630,040**
ADMINISTRATIVE DEPARTMENT SALARIES			
Admin Manager	1	30,000	360,000
Finance Manager	1	25,000	300,000
Account Officer	1	8,000	96,000
Store Supervisor	1	6,000	72,000
Store Assistant	1	4,500	54,000
Office Boy	2	4,000	96,000
Driver	4	5,000	240,000
Security Guard, Gate Keepers	1	4,500	54,000
Sweeper	1	3,000	36,000
Total Administrative Salaries			1,308,000
Other benefits (10%)			13,080
Total Administrative Salaries incl. other benefits			**1,321,080**
SELLING AND MARKETING			
Sales Manager	1	30,000	360,000
Sales Officer	4	8,000	384,000
Total Selling & Marketing			744,000
Other benefits (10%)			74,400
Total Marketing & Selling Salaries incl. other benefits			**818,400**

7.9 UTILITIES REQUIREMENT

Following utilities would be required for the showroom

Serial	Utilities
1.	Electricity
2.	Water
3.	Telephone
4.	Gas

8 PROJECTED FINANCIAL STATEMENTS

8.1 PROJECTED INCOME STATEMENT

		Year - 1	Year - 2	Year - 3	Year - 4	Year - 5	Year - 6	Year - 7	Year - 8	Year - 9	Year - 10
		RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES
Sales - Net of Sales Tax		18,578,182	28,913,250	32,604,449	36,009,197	39,705,558	43,775,846	48,262,910	53,209,862	56,874,820	59,805,248
Cost of Sales	10.10	12,252,205	13,531,347	13,393,153	13,217,937	13,278,275	13,371,074	13,595,069	13,891,675	14,255,631	14,682,734
Gross Profit		6,325,977	15,381,903	19,211,295	22,791,260	26,427,283	30,404,772	34,667,841	39,318,187	42,619,189	45,122,514
Gross Profit Margin %		34.05	53.20	58.92	63.29	66.56	69.46	71.83	73.89	74.94	75.45
Operating Expenses:											
Administrative Expenses	10.11	2,848,762	2,787,129	2,824,290	2,875,209	2,952,173	3,044,044	3,154,664	3,280,518	3,421,049	3,575,669
Marketing Expenses	10.12	1,360,900	1,297,945	1,253,871	1,363,827	1,484,007	1,615,395	1,759,071	1,916,222	2,088,150	2,276,286
Total Operating Expenses:		4,209,662	4,085,074	4,078,161	4,239,036	4,436,180	4,659,439	4,913,735	5,196,740	5,509,199	5,851,956
Operating Profit		2,116,315	11,296,829	15,133,134	18,552,224	21,991,103	25,745,333	29,754,106	34,121,447	37,109,990	39,270,558
Other Income		232,227	361,416	407,556	450,115	496,319	547,198	603,286	665,123	710,935	747,566
Total Operating Profit		2,348,542	11,658,245	15,540,690	19,002,339	22,487,423	26,292,531	30,357,392	34,786,570	37,820,925	40,018,124
Financial & Other Charges											
Mark up on Long Term Loans		-	3,220,178	2,542,246	1,864,314	1,186,382	508,449	-	-	-	-
Bank Charges		27,867	43,370	48,907	54,014	59,558	65,664	72,394	79,815	85,312	89,708
Total Financial & Other Charges		27,867	3,263,548	2,591,153	1,918,328	1,245,940	574,113	72,394	79,815	85,312	89,708
Profit before Taxation		2,320,675	8,394,697	12,949,537	17,084,011	21,241,483	25,718,418	30,284,998	34,706,755	37,735,613	39,928,416
Taxation		580,169	2,098,674	3,237,384	4,271,003	5,310,371	6,429,604	7,571,249	8,676,689	9,433,903	9,982,104
Profit after Taxation		1,740,506	6,296,022	9,712,153	12,813,008	15,931,112	19,288,813	22,713,748	26,030,066	28,301,709	29,946,312
Accumulated Profits - brought forward		-	1,740,506	8,036,529	17,748,682	30,561,690	46,492,802	65,781,616	88,495,364	114,525,430	142,827,140
Accumulated Profits - carried to the Balance Sheet		1,740,506	8,036,529	17,748,682	30,561,690	46,492,802	65,781,616	88,495,364	114,525,430	142,827,140	172,773,452

8.2 PROJECTED BALANCE SHEET

		Year - 1	Year - 2	Year - 3	Year - 4	Year - 5	Year - 6	Year - 7	Year - 8	Year - 9	Year - 10
		RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES
Tangible Fixed Assets	10.6	36,606,075	32,100,521	28,253,133	24,964,278	22,149,896	19,738,989	17,671,536	15,896,742	14,371,578	13,059,557
Long Term Deposits											
Electricity		299,280	299,280	299,280	299,280	299,280	299,280	299,280	299,280	299,280	299,280
Deferred Cost		1,417,500	1,260,000	1,102,500	945,000	787,500	630,000	472,500	315,000	157,500	-
Current Assets:											
Stock in Trade		1,162,225	1,340,413	1,363,137	1,358,152	1,372,676	1,390,396	1,420,275	1,457,122	1,503,901	1,555,459
Trade Receivables		1,526,974	2,376,432	2,679,818	2,959,660	3,263,471	3,598,015	3,966,815	4,373,413	4,674,643	4,915,500
Stores & Spares		11,640	16,295	17,110	17,966	18,864	19,807	20,798	21,837	22,929	24,076
Advances, Deposits & Other Receivables	10.7	473,572	485,658	497,065	510,792	534,297	560,372	589,274	621,025	655,761	693,648
Cash in Hand / Bank		6,723,151	15,227,768	24,940,953	37,137,956	51,948,670	69,763,479	95,329,523	124,012,871	154,448,808	186,152,954
		9,897,562	19,446,565	29,498,083	41,984,525	57,137,977	75,332,069	101,326,683	130,486,269	161,306,042	193,341,636
		48,220,417	53,106,367	59,152,996	68,193,083	80,374,653	96,000,338	119,769,999	146,997,291	176,134,400	206,700,473
Owners Equity:											
Capital Introduced		22,597,743	22,597,743	22,597,743	22,597,743	22,597,743	22,597,743	22,597,743	22,597,743	22,597,743	22,597,743
Accumulated Profits		1,740,506	8,036,529	17,748,682	30,561,690	46,492,802	65,781,616	88,495,364	114,525,430	142,827,140	172,773,452
		24,338,249	30,634,272	40,346,425	53,159,433	69,090,546	88,379,359	111,093,107	137,123,174	165,424,883	195,371,195
Long Term Loan	10.8	18,078,195	13,558,646	9,039,097	4,519,549	-	-	-	-	-	-
Current Liabilities:											
Current Portion of Long Term Loan	10.8	4,519,549	4,519,549	4,519,549	4,519,549	4,519,549	-	-	-	-	-
Accrued Charges		394,619	408,463	416,603	426,020	449,419	474,694	502,356	532,305	564,679	599,609
Mark - up payable		-	1,525,348	1,186,382	847,415	508,449	169,483				
Sales Tax Payable		309,636	361,416	407,556	450,115	496,319	547,198	603,286	665,123	710,935	747,566
Provision for Taxation		580,169	2,098,674	3,237,384	4,271,003	5,310,371	6,429,604	7,571,249	8,676,689	9,433,903	9,982,104
		5,803,973	8,913,449	9,767,474	10,514,101	11,284,107	7,620,979	8,676,892	9,874,117	10,709,517	11,329,278
		48,220,417	53,106,367	59,152,996	68,193,083	80,374,653	96,000,338	119,769,999	146,997,291	176,134,400	206,700,473

8.3 PROJECTED CASH FLOW STATEMENT

	Year - 1	Year - 2	Year - 3	Year - 4	Year - 5	Year - 6	Year - 7	Year - 8	Year - 9	Year - 10
	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES	RUPEES
Profit before Taxation	2,320,675	8,394,697	12,949,537	17,084,011	21,241,483	25,718,418	30,284,998	34,706,755	37,735,613	39,928,416
Amortization	157,500	157,500	157,500	157,500	157,500	157,500	157,500	157,500	157,500	157,500
Depreciation	5,281,925	4,505,554	3,847,388	3,288,855	2,814,383	2,410,907	2,067,453	1,774,794	1,525,164	1,312,021
	7,760,100	13,057,750	16,954,426	20,530,366	24,213,366	28,286,824	32,509,951	36,639,049	39,418,277	41,397,937
Stock in Trade	(1,162,225)	(178,188)	(22,724)	4,985	(14,524)	(17,720)	(29,879)	(36,848)	(46,778)	(51,558)
Stores & Spares	(11,640)	(4,656)	(815)	(856)	(898)	(943)	(990)	(1,040)	(1,092)	(1,146)
Advances, Deposits & Other Receiv	(473,572)	(12,086)	(11,408)	(13,727)	(23,505)	(26,075)	(28,901)	(31,751)	(34,737)	(37,887)
Trade Receivables	(1,526,974)	(849,458)	(303,386)	(279,842)	(303,811)	(334,544)	(368,800)	(406,599)	(301,229)	(240,857)
Accrued Charges	394,619	13,844	8,141	9,416	23,400	25,274	27,662	29,949	32,373	34,930
Mark - up payable	-	1,525,348	(338,966)	(338,966)	(338,966)	(338,966)	(169,483)	0	0	0
Sales Tax Payable	309,636	51,779	46,140	42,559	46,205	50,879	56,088	61,837	45,812	36,630
	(2,470,155)	546,583	(623,017)	(576,431)	(612,100)	(642,096)	(514,303)	(384,451)	(305,651)	(259,888)
Cash form other Sources										
Sponsors' Equity	22,597,743	-	-	-	-	-	-	-	-	-
Debt Financing	22,597,743	-	-	-	-	-	-	-	-	-
	45,195,486	-	-	-	-	-	-	-	-	-
Total Sources	50,485,431	13,604,334	16,331,408	19,953,935	23,601,266	27,644,729	31,995,648	36,254,598	39,112,625	41,138,049
Applications:										
Fixed Assets	41,888,000	-	-	-	-	-	-	-	-	-
Long Term Deposits	299,280	-		-	-	-	-	-	-	-
Deferred Cost	1,575,000									
Re -Payment of Loan	-	4,519,549	4,519,549	4,519,549	4,519,549	4,519,549	-	-	-	-
Taxation	-	580,169	2,098,674	3,237,384	4,271,003	5,310,371	6,429,604	7,571,249	8,676,689	9,433,903
	43,762,280	5,099,717	6,618,223	7,756,933	8,790,551	9,829,919	6,429,604	7,571,249	8,676,689	9,433,903
Cash Increase/(Decrease)	6,723,151	8,504,616	9,713,185	12,197,003	14,810,714	17,814,809	25,566,044	28,683,349	30,435,937	31,704,146
Opening Balance	-	6,723,151	15,227,768	24,940,953	37,137,956	51,948,670	69,763,479	95,329,523	124,012,871	154,448,808
Closing Balance	6,723,151	15,227,768	24,940,953	37,137,956	51,948,670	69,763,479	95,329,523	124,012,871	154,448,808	186,152,954

9 KEY ASSUMPTIONS

9.1 PROJECT ASSUMPTIONS

Projected Life of The Project in Years	10
Sponsors' Equity	50%
Debt Financing	50%
Annual Mark Up Rate (Short Term & Long Term)	14%
Debt Tenure in Years	5
General Inflation Rate	5%

9.2 OPERATING ASSUMPTIONS

Total No. of Days in One Year	365
Total No. of Months in One Year	12
No of Working Days in One Year	300
Capacity (Sales) growth rate &%)	5%

9.3 REVENUE ASSUMPTIONS OF ALOE VERA POWDER PRODUCED - SALE PRICE

Description	Value Excl. Sales Tax	Sales Tax 15%	Sale Value (Inc Sales Tax)
	Rupees	Rupees	Rupees
Sale price per kg of Aloe Vera Powder	140	21	161
No. of Plants per acres			5,000
Total Land under Cultivation (acres)			60
Leaves per plant (Average)			3
No. of Crops per Year			4
Aloe Leaves production per acre			60,000
Total Aloe Leaves production per year of 60 acres			3,600,000
Average Leaf Weight (Kg)			1
Aloe Vera Gel Production in %-age of leaf weight			45.00%
Aloe Vera Gel Production (Kg)			1,620,000
Aloe Vera Powder production			17.00%
Total annual Aloe Powder production (Kg)			275,400
1st Year Sales Volume in months			9
Capacity utilization in first year			70%

9.4 COST OF ALOE VERA PLANTATION

Plants per Acre	5,000
Land under Cultivation	60
Total Plants	300,000
Total Plants Required for Cultivation	50%
Initial Plants required for seeding purposes (incl. 7500 plants as margin of waste)	157,500
Per Plant Cost (Rs.)	10
Plants per Acre	5,000
Cost per Acre of Aloe Vera Plantation	
Diesel & Repair/Maintenance of Tube Wells for water	5,000
Wages of Labor	9,480
Fertilizers	5,000
Chemicals	1,500
Total Per Acre	**20,980**
Total Land (Acres)	60
Total Cost of Aloe Vera Plantation	**1,258,800**

9.5 DEPRECIATION RATE ASSUMPTIONS

Land	0%	of the Written Down Value
Buildings	5%	of the Written Down Value
Fittings & Installations	10%	of the Written Down Value
Office Equipments	10%	of the Written Down Value
Furniture & Fixtures	10%	of the Written Down Value
Vehicles	20%	of the Written Down Value

9.6 LONG TERM SECURITY DEPOSITS

Electricity	2	months Electricity expense
Sui Gas	2	months Sui Gas expense

9.7 WORKING CAPITAL TURNOVER ASSUMPTIONS

Raw Material	45	Days Aloe Plant consumption
Finished Goods	30	Days Stores & Spares Consumption
Stores and Spares	30	Days Stores & Spares Consumption

9.8 ACCOUNTS PAYABLE

Expenses	30	Days of Total Annual Expenditure

9.9 ADVANCES & PRE PAYMENTS

Trade Receivables	30	Days of Total Annual Turnover
Advances to Staff	20%	of the one month's salary
Loans to Staff	10%	of the Total annual salary
Advances against expenses	5%	of the traveling, entertainment, repair, vehicle running, sale promotion and other general expenses

9.10 LONG TERM LOAN

Term (years)	5
Installments per year	2
Total Installments	10
Markup per annum	14%

9.11 VEHICLE RUNNING EXPENSES

Fuel Consumption (Km per Liter/Kg)			**Rate per liter/Kg**		**Traveling Km/ day**	**Annual Tours**
2	Cars	12	CNG	35	50	300
2	Suzuki Pickup	8	CNG	35	80	600
2	Motor Cycles	50	Petrol	57	40	300
2	Tractor (messey - 360)	5	Diesel	42	100	300

9.12 MISCELLANEOUS ASSUPTIONS

Carriage & Freight Inward	4%	of Cost of Aloe Vera
Stores & Spares	15%	of Cost of Aloe Vera
Research & Development Cost	10%	of Turnover for 3 years
Repair & Maintenance		
Building and fittings & installations	8%	of the Cost
Building Insurance	2%	of the Cost of Building
Traveling & Conveyance	1.50%	of Total Cost of Goods Sold
Printing & Stationary	0.80%	of Total Cost of Goods Sold
Consultancy Charges		
Audit Fee	50,000	5000
Out of Pocket Expenses	5,000	5000

Income Tax & Sales Tax Consultancy	70,000	5000
Inflation rate of Consultancy charges	10%	
Entertainment	1%	of Total Cost of Goods Sold
Telephone Fax and Postage	.85%	of Total Cost of Goods Sold
Utility Charges	.4%	of Total Cost of Goods Sold

9.13 INSURANCE ASSUPTIONS

Office vehicles insurance rate	4%	of Written down value
Insurance rate of Display Furniture and stores	3.5%	of the Cost of Stock in trade
Repair & Maintenance	10%	of the Cost.