Technology Transfer and Project Management network

For Aloe Vera as semi finish products like Gel, Powder and finish products like Aloe Vera Drink or Fizzy Tablets

2006

"*Aloe Vera*"

– a plant with high but still not completely identified potential. The recent research shows, that this plant has a lot more to offer, than you can assume while looking at it. Its more than astonishing properties offer a lot of benefits that already have been identified centuries ago and are now more and more of interest to the medicine, industry and the health conscious human being. This report provides the information needed about *Aloe Vera*. What is Aloe and what is its history? Where does it grow and how big is the volume of production and the *Aloe Vera* market? What are the already identified substances and the known benefits? How can the substances be transferred into products, which do provide the benefits of *Aloe Vera* in the desired way?

1. What is Aloe?

The Aloe plant is considered to be out of Liliaceae and Aloeaceae family, which has numerous different species. Among this species, there is only one variety that has a legendary medical reputation dating back thousands of years, it's the "*Aloe Vera*" that has another - botanic –name is "*Barbadensis Miller*" which is used as a synonym. Aloe is supposed to be derived from the Arabic *"alloeh"* meaning *"bitter"* because of the bitter liquid found in the leaves. Vera, which means "true" in Latin, was added to this particular specimen in order to distinguish its primacy among the aloe plants. And only the authentic "*Aloe Vera*" provides the potent therapeutic effects, which nature has built in it.

Aloe is native to the drier parts of Africa, especially South Africa's Cape Province and the mountains of tropical Africa. It is also grown in other subtropical and tropical locations, including South America and the Caribbean.

For over 3,500 years, tales of "healing *Aloe Vera*" plants have been handed down through centuries by word of mouth. From the Bible's mention of removing Christ from the cross and wrapping his body in aloes and myrrh, (John 19:39), we find *Aloe Vera* mysteriously appearing in every phase of history, with many testimonials to its great medicinal values. The earliest documented use of *Aloe Vera* comes from the ancient Egyptians, but it was also grown and used by King Solomon, who was said to have valued it highly. Egyptians recorded use of the herbal plant in treating burns, infections and parasites in 1500 B.C. It is also known that Cleopatra had used the fresh *Aloe Vera* gel to keep her skin soft and young.

The Spanish carried Aloe from Europe to the New World in South America and the Caribbean. *Aloe barbadensis* was introduced to the West Indies at the beginning of the 16th century. Spanish missionaries in the west always planted Aloe around their settlements and carried it on their journeys to aid the sick.

2. Cultivation

Aloe “barbadensis” grows in middle- and South America, Australia, canaries, in Africa and in the areas of Middle Ocean with hot dry summer and mild winters. It needs this warm climate as it cannot survive freezing temperatures

(1) America,
(2) Caribbean,
(3) South America,
(4) canaries island,
(5) North Africa,
(6) South Europe,
(7) Egypt,
(8) South Africa,
(9) Sri Lanka,
(10) South China,

Aloe Vera barbadensis has her cactus-look thanks to the dry area she grows in. Because of the long periods without rain and strong sun shine she needs to build up her own water- and nutrition storage in order guarantee a proper supply.

Aloe grows to the hight of 60 to 90 cm /1,5 m. Almost everything are leaves that sit on a strong fibrous root close to the ground. Her 40 to 60 cm long, pale green, fleshy, thick, elongated and spiny leaves build a leaf rosette and are 6 to 10 cm wide at the sprout. The connection to the Tree Lilly does go unnoticed during the springtime, when aloe plants blossom with beautiful tubular shaped yellow to purplish drooping flowers in a long raceme at the top of the flower stalk. The fruit is a triangular capsule containing numerous seeds. *Aloe Vera* can be harvested by hand, with the leaves cut off at the base of the plant.


flourishing aloe vera

3. Benefits of *Aloe Vera*

As mentioned above *Aloe Vera* is known for its numerous benefits. No matter what area you look at, either it is the digestive, the immune, the musculoskeletal system or the simple cosmetic and skin care application you'll find proven testimonials of the healing Aloe Vera.

Aloe Vera gel is an extraordinary demulcent compound, composed of mannuronic and glucuronic units combined to form a polymer of high molecular weight. Gastric mucin contains only glucuronic units in its carbohydrate moiety. The uronic acids are natural detoxicants, and as they are released by the hydrolytic cleavage of Aloe Vera gel, they may take part in the healing process by stripping toxic materials of their harmful irritation. The gel is tenacious to a marked degree, in which property it excels over all other known gums, including methylcellulose. Unlike Methylcellulose, which is biochemically inert, Aloe Vera gel is certainly reactive. It serves as a biochemical "bandage" and is protectively helpful in restraining aggravating irritants from reaching the sensitive ulcer.

The gel coacervates (a chemical action resulting in physical change) pepsin in the same fashion that quince seed gel coacervates pepsin. Coacervated pepsin is reversible and can release its enzyme at the proper electrical charge. In coacervated form, pepsin loses its proteolvtic effectiveness but regains it when released. Food reverses the coacervation so that after the administration of the gel, the pepsin remains inert so long as the stomach is devoid of food, but on introducing food (particularly protein) the coacervate reverses and the pepsin is set free to digest the nutrients. The gel inhibits the secretion of hydrochloric acid by the parietal cells of the stomach. The acid develops at the membrane surface through the interaction of sodium chloride and carbonic acid. This reaction is halted by Aloe Vera gel. It thus acts as an antihistamine. The Aloe Vera gel also acts as a mild laxative, and since most peptic ulcer patients are also constipated, it helps this condition as well.

The clinical use of Aloe Vera gel for ulcer treatment is relatively new. The properties which make it valuable for this purpose, however, also make it a miraculous treatment for burns. Medical research on this phase of Aloe Vera was done in the early 1930's when the crude X-ray techniques of that time often resulted in painful and disfiguring colloids and burns. The fresh gel was used to promote healing of the injured tissue. As X-ray techniques improved, and other methods for curing diseases previously treated by X-ray (antibiotics, fungicides, etc.) were developed, interest in Aloe Vera again declined because no good method had been worked out for preserving and storing the essential curative elements for general use. Recent research, however, has revealed that Aloe Vera gel can be concentrated andabilized in a

powerful form. Many commercial preparations containing it are now on the market, in the form of ointments and creams for topical surface applications, and in a variety of surfactants for internal use.

Following are some areas of the benefits of the Aloe Vera plant, which have been identified, summarized and grouped:

Digestive System - *Aloe Vera* juice reduces acidity, detoxes, reduces pH levels and alleviates heartburn. It alleviates the inflammation of the digestive tract that is associated with Crohn's Disease. It also alleviates Constipation.

Immune System - *Aloe Vera* reduces fever, prevents detrimental Bacteria, fungus, Influenza Virus, Measles Virus.

Musculoskeletal System/ skin - *Aloe Vera* gel applied topically accelerates the healing of Canker Sores (Mouth Ulcers); Decubitis Ulcers (Bed Sores); Burns; Herpes Simplex lesions; alleviates the Itching associated with Hives as well as alleviates Sunburn.

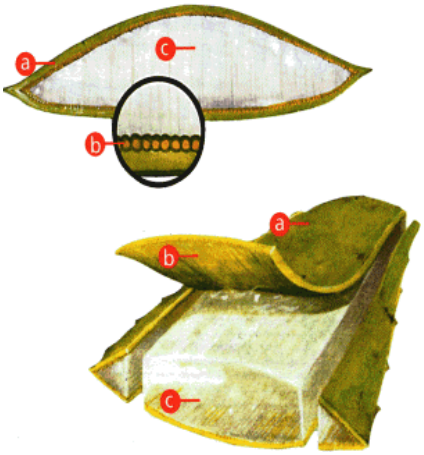
Physicians have greatly reduced external scarring with the use of *Aloe Vera*. It is effective, also, for sunburn, scratches, cuts and a cleansing purge for the body or skin. It is an aid to growing new tissue and alleviating the advance of skin cancer caused by the sun. It is a treatment for ringworm, boils, inflamed joints, scalds, itchy allergic conditions, insect stings and bites. It creates a definite softening of external skin, relief from dry or sensitive skin and skin diseases. Dentists and oral surgeons use *Aloe Vera* gel for surgery, swift healing, relief of pain and other oral treatment, including mouth ulcers, fever blisters, cold sores and cankers.

Cosmetic Application - From the dim history of the Greeks and Egyptians and other civilizations through the ages, gel has been used in cosmetics. *Aloe Vera* herb has been known to help in anti-wrinkle creams and make up, it is also beneficial for hair and scalp. Today, you will find many aloe-based cosmetics and skin care items on the market. Hundreds of people have reported that the enzyme activity actually reduces and eliminates scars, liver spots, age lines, marks and blotches, etc. The ability of new cell growth should eventually produce younger skin for women of any age. Many cosmetics have promised this in the past with other natural products, but never has one had the background of historical proof and testimonials that the *Aloe Vera* true and natural plant now does.

4. Biochemistry of *Aloe Vera*

The structure of *Aloe Vera* leaves is composed of three leyers:

a. The outer thick green rind
b. The pericyclic cells located at the top of the vascular bundles contain a yellow liquid called the "Yellow sap" or "Latex". This material contains high concentration of aloin and similar anthraquinones, which exerts a powerful laxative action, such as considerable abdominal cramping in humans body when taken internally.
c. The inner fillet which has structural integrity consisting of hexagonal structures containing the fillet fluid. It's the Aloe-Gel.



The thick leaves of Aloe-Vera consist of 96 % water. But the secret lies in its high portion of natural nutrients and vital substances. The scientists have identified around 200 components and are sure to find some more in future studies. The nutritious ingredients of *Aloe Vera* can be divided into the following groups:

Vitamins: It is rich in most vitamins like Vitamin D, A (the antioxidant beta-carotene), C, E B-1,2,6 and even traces of B 12, one of the very few plant sources of this vitamin. It also has zinc, beta carotene, calcium, niacinimide, folic acid, carotene, choline, copper, iron, magnesium, phosphorous and some more.

Enzymes: Several of these biochemical catalysts aid digestion by breaking down fat and sugars when taken orally. The *Aloe Vera* contains Lipases and proteases which break down foods and aid digestion. It also contains bradykinase, which helps to reduce excessive inflammation and pain when applied to the skin.

Minerals: *Aloe Vera* contains more than 20 minerals, like Calcium, Sodium, Potassium, Manganese, Magnesium, Copper, Zinc, Chromium and the anti-oxidant Selenium.

Even though minerals and trace elements are only needed in very small quantities, they are essential for the proper functioning of various enzyme systems in different metabolic pathways.

Salicylic acid: It is anti-inflammatory and anti-bacterial properties.

Sugars: Known as mucopolysaccharides, they enhance the immune system and help to detoxify. In topical preparations, the sugars are also the main moisturisers.

Anthraquinones: There are twelve of these Phenolic compounds which are found exclusive in the plant sap. In small quantities, they aid absorption from the gastro-

intestinal tract and have anti-microbial and pain killing effects. The important ones are the painkillers Aloin and Emodin. They also are anti-bacterial and anti-viral.

Lignin: It gives *Aloe Vera* a singular penetrative effect so the other ingredients are absorbed into the skin.

Saponins: They have cleansing, and antiseptic properties, acting powerfully against bacteria, viruses, fungi and yeasts.

Fatty Acids: Cholesterol, Campesterol, ß. Sisosterol and Jupeol. These four plant steroids found in *Aloe Vera* are important anti-inflammatory agents.

Amino acids: The body needs 22 amino acids - our *Aloe Vera* gel provides 20 of these. More importantly, it provides 7 out of the 8 essential amino acids which the body itself cannot synthesise. And it contains 11 of the 14 "secondary" amino acids.

It is important that these nutrients are protected during the process, as they are responsible for most of the immune enhancing properties documented by research.

The whole number of components evolves depending on the planting conditions and the care towards the plants after the period of up to 3 to 5 years. And since "*Aloe Vera*" is a product of nature the components can differentiate from one plant to another.

5. Processing – Plant into Gel and Powder

Aloe Vera can be harvested by hand, with the leaves cut off at the base of the plant. Individual leaves are wrapped, crated and transported to processing plants where the actual important part of the process takes place.


Harvesting

During the past several decades three basic and widely used methods of processing *Aloe Vera* leaves have been developed. This are:

1. Traditional Hand Filleted Aloe
2. Whole Leaf Aloe
3. Powdered Forms of Aloe:
   a. Spray-Dried Aloe Powder
   b. Lyophilized aloe Powder
   c. Dehydrated Aloe Powder

1. Traditional Hand-Filled Aloe

As mentioned the presence of aloin or its derivatives is undesirable both for internal consumption and topical usage. Thus in order to avoid contaminating the internal fillet with the yellow sap, the traditional hand-filleting method of processing Aloe leaves was developed. In this method, the lower 1" of the leaf base (the white part attached to the large rosette stem of the plant), the tapering point (2-4") of the leaf top, and the short, sharp spines located along the leaf margins are removed by a sharp knife, then the knife, is introduced into the mucilage layer below the green rind avoiding the vascular bundles, and the top rind is removed. The bottom rind is similarly removed, and the rind parts, to which a significant amount of mucilage remains attached, are discarded. Another portion of the mucilage layer accumulated on the top of the filleting table. This is of critical concern because the highest concentration of potentially beneficial Aloe constituents is found in this muselage, as this layer represents the constituents synthesized by the vascular bundle cells empowered by energy developed in the green (chlorophyll-containing) rind cells through sun-induced photosynthesis.


Hand filleting process

The materials of the mucilage layer, subsequent to their synthesis, are distributed to the storage cells (cellulose-reinforced hexagons) of the fillet, a process which is accompanied by dilution owing to the water (the major fillet constituent), which is stored in the fillet cells.

Because the gel's activity becomes unstable after removal from the leaves, a number of processes have been developed to overcome this instability. One method used to stabilize gel is to expose the gel to high temperatures for a short time (three minutes). Ultraviolet stabilization, chemical oxidation with hydrogen peroxide, and preservatives and additives are other methods of retaining the gel's activity.

It is to assume that the Hand-Filleting method is very labour intensive. Owing to this fact, machines have been designed and employed which attempt to simulate the Hand-Filleted techniques, but generally the product contains higher amounts of anthraquinone laxatives than the traditional Hand-Filleted approach, so that the product looses its purity.

2. Whole Leaf Aloe

The whole leaf *Aloe Vera* juices are supposed to contain higher levels of polysaccharides than are found in aloe juices manufactured by methods extracting only the inner gel of the aloe leaf. Polysaccharides are believed to be the most desirable constituents in the *Aloe Vera* leaf.


3 stages of filtering

The whole leaf process grinds the entire *Aloe Vera* leaf. Then, by a series of filtration steps, removes the outer rind, aloin and other unwanted substances. The remaining liquid contains the desirable constituents, including the mucilage which contains more of the polysaccharides. This process, developed in the 1980's, is considerably less labour intensive and is more cost effective.

3. Aloe Powders

Variously processed (traditional hand-filleting and whole leaf process) aloe juices can be reduced to powder form which improves shelf-life compared to liquid products and eliminates the cost of shipping water.

a. The *spray-dried* powder process entails the spraying of liquid aloe juice onto a matrix (usually high molecular weight maltodextrins which usually constitute 50% or more of the final product), and using high heat. The high heat exposure changes some of the potentially beneficial constituents.


aloe powder

b. *Lyophilised (freeze-dried)* powder utilizes cold and vacuum (usually

about 1/3 atmosphere) which causes evaporation and sublimation of only the water in the juice. During the freeze-drying process, water goes directly from a solid form (ice) to the gaseous state (water vapour) without going through a liquid phase. This process of going directly from a solid to a gas is called sublimation. The process requires a large amount of energy to obtain the very cold temperatures and high vacuum needed. Heat-induced changes are avoided, but the procedure is considerably expensive because of the costly and delicate machinery involved.

c. Fillets of aloe can be reduced to *dehydrated* pellets by placing them in a commercial-scaled vegetable dehydrator operated at relatively low temperatures (slightly above body temperature) but for many hours. The dehydrated pellets are ground to a fine powder.

Both the gel and the powder that result from the process described can be taken into further process to manufacture different kinds of products, which are listed in the following chapter.

6. Commercial Information

As already mentioned *Aloe Vera* is found/ reported to have various medical and cosmetic properties. Today a lot of *Aloe Vera* products are available in market like *Aloe Vera* health juices, moisturizers, cleansers, wound healing creams etc. Today's *Aloe Vera* is widely used in beauty/ cosmetic products. These beauty products are not only creams and lotions, but also different kind of capsules and that are supposed to have strong positive effects on body health and beauty condition.


Aloe Vera Produktrange

In order to get a good overview the products can be divided into three groups:

1. Health/ Medical
2. Cosmetics
3. Food

1. Health/ Medical Products

The different benefits of Aloe *Vera* within the medicine sphere have already been mentioned before. You can find Aloe as an ingredient in many different pharmaceutical products for many different treatments. But aloe is also an extraordinary and a valuable food supplement. It helps to guarantee a proper supply of the body with the needed nutrition, thus helps to avoid the negative consequences of insufficient food/ nutrition supply.

- Pharmaceutical products
  - Tonic
  - Tablets/ Capsules/ Fizzy tablets
  - Salve (for protection of delicate and irritated skin from body fluids and enzymatic drainage)
- Supplements
  - Juice
  - Tablets/ Capsules/ Fizzy tablets

2. Cosmetics Products

Aloe products are considered to be real liquidity oases. They provide the skin with the needed liquidity and coolness.


hair care

- Shampoo
- Hair conditioners/ Masks
- Hair tonics, Dressings, etc

- Eyeliner
- Eye Lotion
- Eye/ Face Makeup Remover
- Mascara
- Face powders
- Lipstick/ Lip care stick

- Body
  - Body (moisturising) lotion/ cream/ spray/ gel/ oil
  - Hand lotion/ cream
  - Foot/ Leg gel/ lotion/ cream
  - Body Scrub
- Face
  - Day/ night cream/lotion
  - Mask/ foam
  - Facial Scrub
- Cleanser
  - Cleansing water/ milk/ soap
  - Cleansing -Care Tissues
- Eyes
  - Under eye cooling/ Moisturizing gel/cream
  - Anti wrinkle gel

- Colognes and Toilet Waters
- Deo Roll-on/ spray

- Shave lotion/ cream/ foam
- After Shave lotion/ balsam/ water

- Sun blocker cream/ lotion/ spray
- After Sun lotion/ gel/ spray
- Self tanning lotion/ spray


other aloe products

- Tooth gel/ paste

3. Food

The benefits of *Aloe Vera* can also be experienced by drinking tee or drinks with different flavour.


aloe drinks

- Instant Drink powder (different flavours: Banana; Strawberry,Vanilla; Coffee; etc.)
- Tee
- Drinks (with different flavours: Apple; peach; etc.)
- Yoghurt

4. **Others**

- Detergent

8. Certification and labelling

There is probably no other industry in the world quite like the aloe industry. There are no official standards for purity or quality. The national institutions that are responsible for food control/ inspection such as the FDA in US or the governmental institution in Germany become the authority to certify/ control the product, only when it comes to the labelling and even then, the definition of what is pure aloe is totally up to the manufacturer/ marketer. The *Aloe Vera* product market is full of so called “aloe based” products, which actually do only contain a minute percentage of aloe inside. This forces the consumers to go deeper in control and to be more suspicious when buying products. This results in a hard marketing job for the manufacturer in order to sell their products.

Over the years, there have been many attempts by trade organizations and aloe suppliers to develop an analytical test that can verify an aloe product's purity. But still to date there is no reliable method of analysing aloe in the laboratory to determine purity and activity.

With this in mind, a non-governmental trade organization was formed by some of the aloe raw material companies. The International Aloe Science Council (IASC) was set up to give a certification to aloe suppliers so that the finished product manufacturers who purchased the aloe could be given assurance that the product would be pure and efficacious.

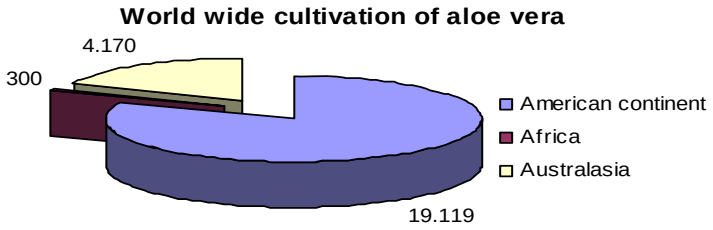
The certification is based on a combination of chemical tests and audits. Chemical test are only partially reliable, and tell us nothing of the aloes' activity. An audit would seem to be the best way to determine whether a company is supplying pure aloe.

However, the IASC audit consists only of verifying the harvesting and processing conditions.

The certification of products by the IASC became a very important and critical marketing instrument to communicate the quality of the product and that way to win the customers on the international market.

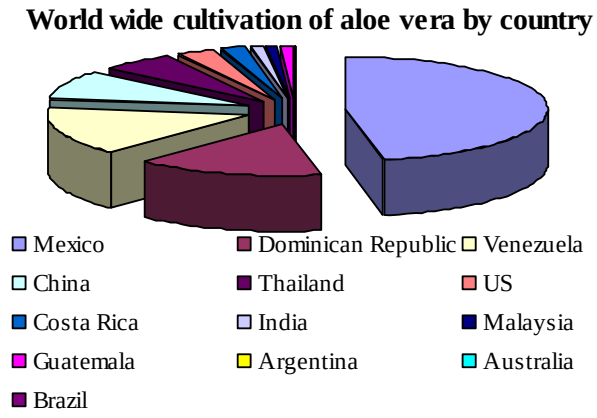
9. Economical/ World market report

The world wide cultivation of *Aloe Vera* is estimated to have a volume of 23,589 hectares. The numbers on how this is divided by the continents you can see in the chart. As you can see most of it is claimed to be on the American continent. The second chart differentiates further between the countries. There you can see the different countries that compete for the product market. The industry size for aloe raw material is estimated to be about $125 million dollars. The volume of the industry for finished products containing *Aloe Vera*, is alleged to be around $110 billion dollars.



The number of suppliers and distributors has grown in the past few decades. And many of them publish quite good sales growth. For example the company "Forever living products", who claims to be the world's largest grower, manufacturer and distributor of aloe products, publishes the figures shown in the chart – further down. The figures are based on calculated retail sales of worldwide affiliated companies (the first four show the average annual sales) and also include the sales records of "bee products", which are also distributed. The main revenue is made by *Aloe Vera* products. You can see continuously increasing sales. On average there is an increase of 14,3 % over the last four years.

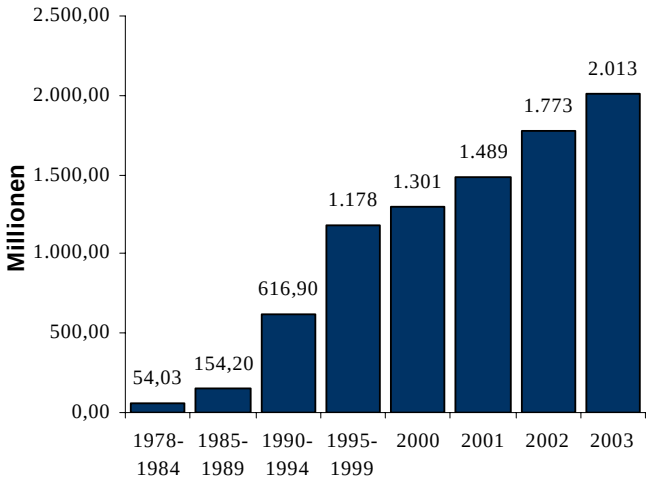
If you look at the different industries in the world you can see that the three fastest growing today are Health, Beauty and Nutrition. More and more people over the world start to take care of their health.



Some data about the amounts spend on products out of these industries:

In the U.K. £909 million are spent each year on health foods and drinks. £986 million are spent on vitamins and nutritional supplements alone and the cosmetic industry is even larger. Even through the worlds economy experiences recessionary times, sales of products related to the above industries have continued to rise and show no sign of abating.

In Germany there are statistics which prove, that the amount spend on food is sinking but the amounts spend on nutrition's and supplements are constantly increasing. If you look at the market of skin care products, you'll find the same increasing trend there. The customers are much more concerned about their beauty as they were years before. Especially the skin care products, no matter weather it is for face, hands or body, there is an unbroken demand on products that make the skin look healthier, younger, softer, etc. The advantage of skin care products that contain *Aloe Vera* is that this are products natural ingredients that are proven to have numerous benefits, which provides the customer with an even more satisfaction of doing something good for his skin.



10. Ensymm recommendation

Looking at this report on the plant “Aloe Vera” and at the current development on the world market regarding the health, beauty and nutrition industries it is definitely recommended to think about manufacturing products that provide the above described benefits.

Three issues have to be considered:

1. Product: The market for Aloe products is at the moment in a quite good condition to be entered. As mentioned in this report, there is a lot of research conducted on the benefits and the potentials provided by Aloe Vera. Further there is a high range of products that can be manufactured with Aloe Vera as an ingredient. This offers a number of choices and keeps flexible to change the submarket in case of a shifting demand, e.g. from body lotion to shampoo, and all this without considerable changes in production, which decreases potential losses. You are lowering your risk of sunk cost. It also provides the opportunity to select several products out of different markets, which opens the opportunity to make advantage of the synergy effect.

2. Technology: The technology to produce aloe gel as well as powder is already well developed and it is available in complete set on the market. There is no new high technology necessary to produce *Aloe Vera* Gel and/ or Powder. This is an important point since the corporation has to go through this process. The same is with the technology to produce any of the *Aloe Vera* products. The needed process and production line can be transferred from the food- and pharmaceutical industry.
3. Materials: The most important part of the product is the “Aloe Vera” plant. An Own plantation is an advantage there is no need to buy the raw material. This also reduces the production costs and the risk since the company does not have to rely on the supply of another corporation. All this contributes to lower the cost and to increase the stability of production and the offering to potential customers.

Ensymm recommends the following product choices:

1. **Drinks:** We recommend manufacturing refreshing drinks with different flavours according to the current trend in the market of refreshing beverages.

2. **Shower gel, Shampoo and Soap:** These products are relatively low cost in production and there is a big market for this sort of products. These products belong to a group of convenience goods that are used on the regular/ daily basis. This, combined with a proper marketing strategy ensures the desired sales.

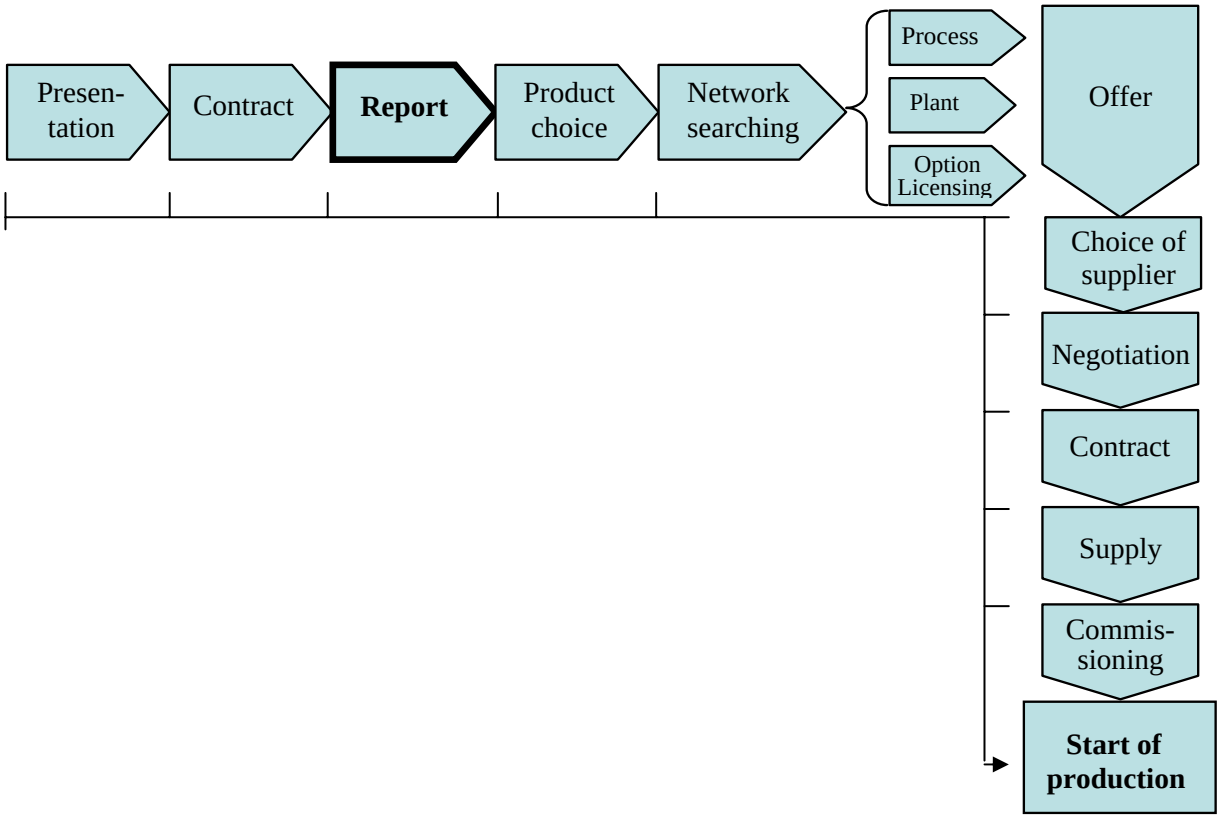
3. **Yoghurt:** This is the second product that will most likely meet a high demand in the native market and does promise high sales potential. Choosing this product Ensymm recommends to go by contract manufacturing or cooperation with a milk manufacturer. This might increase the production risk because of the common and not always avoidable risks of process outsourcing.

4. **Fizzy Tabs:** This product belongs to the line of food supplements. As described above the market for nutrition/ health products has increased in the past years and the trend shows further grow in future. We recommend fizzy tabs since this is a combination of a refreshing product and nutrition supply, thus it fulfils two functions and not just one as simple capsules would do. So you have two markets you can sell this product – 1st the market for refreshing products and 2nd the special market for supplements/ health.

11. Road map

As you can see on the road map we are now at the point where the report is given to you. This report should give the information needed to make a decision on the product you want to go for.

As you can see the following steps are: we will find the necessary partners for production process and plant supply and if possible/ reasonable licensing. You'll receive an offer with the recommended options approximately at the end of Mai. In the beginning of June we think that we can start the negotiation with the chosen supplier. By the end of June we plan to get the contract settled. The supply start depends on the contract conditions, which of course are part of the negotiation process. Probably in the second quarter of 2007 the production can be started.



We thank you for your attention

ensymm

looks forward to a fruitful co-operation

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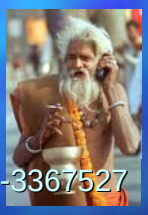

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