



Importance and Properties of Aloe Vera In the Production of Hair Shampoo

Mario Hernández García • José Adrián Trevera Juárez • Acela Dávila Jiménez

Division of Postgraduate Studies and Research in Administrative Engineering, National Institute of Technology of Mexico, Technological Institute of Apizaco, Tlaxcala, Mexico
mariioo.hernandez@gmail.com

Abstract: Aloe Vera has several uses in the food, pharmaceutical, and cosmetic industry; this plant has functional, antioxidant and therapeutic properties, adequate use and consumption of these plants, is associated with a stable state of health. In the present work, a compilation is made of the origin of the plant, its properties, uses, conditions and its use in the production of Shampoo

To cite this article

[García, M. H., Juárez, J. A. T. & Jiménez, A. D. (2019). Importance and Properties of Aloe Vera In the Production of Hair Shampoo. *The Journal of Middle East and North Africa Sciences*, 5(7), 18-23]. (P-ISSN 2412- 9763) - (e-ISSN 2412-8937). www.jomenas.org. 4

Keywords: Aloe (Aloe Vera); Shampoo; Production.

1. Concepts:

Aloe. Aloe is a succulent plant belonging to the Liliaceae family, related to onions, garlic, asparagus, tulips, lilies and hyacinths (Machado Inca, 2013). It is a perennial plant native to Africa naturalized in our country (México) in which there are more than 250 species, the structure of the leaf is a gelatinous and transparent core (pulp) wrapped by a thin yellow liquid layer (acíbar) protected all by the thin but resistant green outer bark (Albiter, 2010).

Shampoo. It is a personal hygiene product that is formulated based surfactants accompanied by other substances that contribute to generate an emulsifying, foaming, moisturizing and mainly cleaning properties that have as objective to eliminate whitish or yellowish residues from the fat that produces the glandules sweat. Is a product used for cleansing of the scalp and hair or preparation made mainly of surfactants, conditioners and foaming agents (together or separately) whose primary action is clean and remove from the scalp the excess fat and accumulated particles, according to Samaniego, 2015 cited in Aguirre Jara, 2018.

Production. It is an economic activity of the company whose objective is to obtain a product or service (depending on the type of production), to satisfy the needs of consumers, that is, those who are interested in acquiring this product or service (Groover, 2015). The production activity is carried out through the execution of a set of operations integrated to processes. For this reason, production management is often referred to as operations management, the production area that was normally excluded from strategic planning is an essential part for some decades, occupying the foreground during the design and creation of any group of activities where

transformation of raw material into a product or into a good is carried out, the reason for strategic importance is simply where its greater or lesser added value is generated, from which a greater benefit can be obtained (Barraza et al., 2008).

2. Introduction:

For a long time, the human being has used the Aloe, for its healing properties and the nutrients it contains, it is a plant that belongs to the Liliaceae family and it is like to small maguey and is propagated by division of mata. According to Grindlay and Reynolds, 1986 cited in Domínguez Fernández et al. 2012, the first classification of Aloes from the island of Barbados was made by the botanist Miller (Grindlay and Reynolds, 1986), who reports that Aloe barbadensis is native to the island of Barbados and It was introduced to the world as a product of maritime trade in the Caribbean.

In terms of healing properties, aloe vera has been used practically empirically, has a wide application to improve intestinal problems, skin conditions and cosmetic use is used in the treatment and care of hair. In recent years, several studies have been conducted with which it has been possible to know more in detail the multiple benefits that this plant provides in terms of food, pharmaceutical, and cosmetic uses.

3. Aloe Vera

3.1. Origin of the Aloe Vera.

Aloe Vera is a succulent plant belonging to the family Liliaceae, so it is related to onions, garlic, asparagus, tulips, lilies, and hyacinths. This is a very diverse family in terms of aspects and aromas, but at the time of flowering, it shows its identity unequivocally. It is

a perennial plant native to Africa naturalized in our country (México) in which there are more than 250 species, the structure of the leaf is a gelatinous and transparent core (pulp) wrapped by a thin yellow liquid layer (acíbar) protected all by the thin but resistant green outer bark (Machado Inca, 2013).



Image 1. Aloe Vera.

Source: Machado Inca, 2013.

According to Boudreau and Beland, 2006; Surjushe et al., 2008, cited in Domínguez Fernández et al. 2012 the first references of Aloe Vera are found in the Ebers Papyri and there are numerous historical documents of the Egyptians, Greeks, Romans, Algerians, Arabs, Tunisians, Indians, and Chinese, among, that talk about their use for medicinal and cosmetic use. Its name comes from the Greek "aloé"; and in Arabic, it is called "alloeh", which means: "the bitter substance"; the word vera comes from the Latin and means: "truth", just as in Sanskrit Aloe vera its meaning refers to the goddess.

Table 1. *Scientific Classification Aloe Vera.*

Scientific Classification	
Kingdom	Plantae
Division	Magnoliophyta
Class	Liliopsida
Order	Liliales
Family	Liliaceae
Subfamily	Asphodeloideae
Gender	Aloe
Species	A. Vera

Source: Own elaboration based on Albiter, 2010.

This species of short stem reaches a height of 60 cm and has rosettes of thick, narrow and lanceolate leaves of grayish green color with small whitish teeth at the edges. In summer, small orange-yellow flowers appear on spikes up to 1m high (Álvarez et al., 2012).

Aloe flowers are usually tubular or trumpet-shaped and are arranged in clusters and their fruit is capsular, there are more than 20 species of aloe and their number is growing steadily, as new hybrids are constantly being created. The acíbar when influence the surface of the leaves of the different species of aloe, it gets a viscous yellow juice and bitter taste that is concentrated in the heat of the sun, or by boiling, is transformed into a dark brown amorphous mass and very bitter taste, called acíbar or blond fish, the acíbar contains from 40% to 80% of resin, and up to 20% of aloin, anthraquinone glucoside that is its active principle (Albiter, 2010).

The bark represents approximately 20 to 30% of the weight of the whole plant and said the structure is green or bluish green, depending on various factors such as place, climate or nutrition of the plant. The parenchyma, commonly known as pulp or gel, is located in the central part of the leaf and represents 65 to 80% of the total weight of the plant (Domínguez Fernández et al., 2012).

Once fertilized, the flower loses its petals and matures into a small fruit, which later releases its seeds that are scattered by the wind, however, it seems that nature considered that this means of reproduction was not enough for a plant that often it must lives in very difficult conditions, for which it also granted the possibility of reproducing itself by stolons or shoots, which are born at the base of the stem, a few centimeters below the surface of the earth, thus forming new plants that grow together to the "mother plant", thus arriving, in the wild, to form true colonies of great density (Albiter,2010).

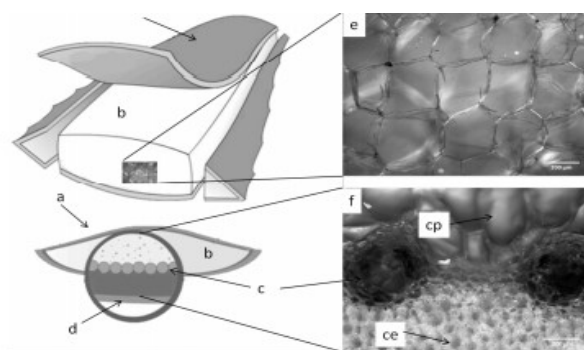


Image 2. Structure and microstructure of the Aloe vera leaf.

Source: Domínguez Fernández et al., 2012.

In the previous image, the structure and microstructure of the Aloe vera leaf according to Domínguez Fernández et al. 2012 is shown: exocarp (a), pulp or parenchymal tissue (b), aloin (c) and cuticle (d). The figure shows images of light microscopy taken at 5x magnification of the parenchyma cells (e) and a sectional section of the Aloe vera leaf (f) where internal cells of the exocarp (ce) are observed in great detail, parenchyma cells (cp) and aloin channels (c).

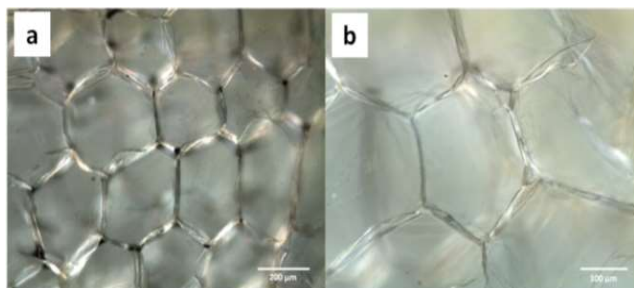


Image 3. Aloe vera is fresh.

Source: Domínguez Fernández et al. 2012.

Images of fresh Aloe vera gel obtained with an optical microscope at 5x (a) and 10x (b). In the images, the tissue structure of the gel (a) and an approach of the hexagonal cells of the parenchyma (b) are observed.

3.2 Properties of Aloe.

Aloe Vera has been used since ancient times for a multitude of applications and this is due to the great variety of nutritive elements that it contributes to tissues, it is a broad source of essential micronutrients (Na 3660 mg / 100 g, Ca 3319 mg / 100 g, Mg 1536 mg / 100 g, K 4060 mg / 100 g) and active phytochemicals, such as ascorbic acid (127.6 mg / 100 g), tocopherols or vitamin E (0.217 mg / 100 g) and total phenolic compounds (79.2 mg equivalents of acid gallic / 100 g), which are capable of reducing the free radicals that cause the oxidation reactions associated with various conditions and diseases, such as aging, cardiovascular diseases and carcinogenesis (Domínguez Fernández et al., 2012). Basically Aloe Vera is a cellular regenerator and therefore acts with very positive results, in multiple conditions: Aloe has many uses, for example, the aloe juice that is obtained from the pulp of its fleshy leaves, which give off a sticky juice, almost transparent and tasteless taste, it is due to the fame that the aloe gel is acquiring in the last years, especially for its healing action on the skin.

Aloe Vera can exert many benefits in a cutaneous way in local areas for example:

In wounds, whether clean or infected, the aloe juice is applied in compresses, although the pulp of the leaf can also be placed directly on the wound, facilitating cleaning, accelerating healing and reducing the scar.

Skin conditions: The aloe juice applied in lotion has a favorable action in cases of psoriasis and eczema of the skin, as well as in acne, athlete's foot (infection by fungi) and herpes, among others. To reinforce the effect, it is also recommended to take it orally. In children, aloe juice lotion is used in the treatment of eczema caused by diapers, to relieve itching and facilitate skin healing in exanthematic diseases such as measles, rubella, and varicella (Garcés Mendoza, 2004).

The beauty of the skin: Aloe revitalizes the skin, giving it a greater smoothness, resistance, and beauty. Applied on the skin, it improves the appearance of

anesthetic scars and is also used in the care of hair and nails (Saldaña Gil, Huarachi Castillo, & Velasco Vaca, 2014).

It has been found that some aloe gel polysaccharides have antioxidant properties and protective effects in cells of animal origin (Wu et al., 2006), report that the antioxidant properties depend on the degree of acetylation, the molecular weight, the type of sugars and the glycosidic bond of the polysaccharides present in aloe; they conducted studies on the whole aloe plant as well as its structural components (gel and skin) and characterized the chemical components and evaluated the antioxidant activities of the polysaccharides extracted from the gel and from the exocarp of aloe leaves (Domínguez Fernández et al., 2012).

Cholesterol is a very important fact for the organism, since it is found in each and every one of its cells. This fatty substance is manufactured by the liver and used by the body in the construction of cell membranes, the constitution of bile acids. High levels of LDL cholesterol are related to cardiovascular problems since if there is an excess of this fat in the blood, it accumulates in the walls of the arteries forming a plaque that narrows the lumen of the vessel, this narrowness is known as atherosclerosis. The cholesterol known as HDL has an opposite action, that is to say, it acts as a cleanser since it liberates the walls of the vessels from the accumulation of the sclerous plaque (Saldaña Gil, Huarachi Castillo, & Velasco Vaca, 2014).

Pogribna et al. (2008) investigated the effect of the extract of aloe in crops of pure and mixed bacteria of the human intestine, through the evaluation of bacterial growth and changes in the production of short chain fatty acids. The results indicated that Aloe vera possesses bacteriogenic activity in vitro and that it alters the production of acetic, propionic and butyric acids of the microorganisms selected for the study. These results suggest that the consumption of a dietary supplement based on Aloe can alter the production of short chain fatty acids by the human intestinal microflora. On the other hand, it has been observed that Aloe vera can have a very important role in the reduction of the levels of LDL (low density lipoprotein) and TG (triacylglycerides), since it can significantly increase HDL (high-density lipoprotein) cholesterol, due to plant sterols (sterol, cytosterol), organic germanium, chromium, acemannan, vitamins, amino acids and enzymes (Dixit and Joshi, 1983).

According to Thompson et al. 1991 cited in Domínguez Fernández et al., 2012 regarding angiogenic activity, it is known that Aloe Vera improves wound healing and reduces pain. Angiogenesis is the growth of new capillaries from preexisting capillaries and posterior to capillary venules (Bischo_, 1995, Folkman and Klagsbrun 1987). The application of Aloe Vera externally according to Albiter & Ramírez L, s.f. prevents and stops hair loss and, due to its content of Cysteine and Lysine, is



involved in detoxification, mainly as an antagonist of free radicals and helps to maintain the health of the hair due to its high sulfur content. The use of aloe shampoo helps hair regeneration, strengthens hair follicles, prevents hair loss, stimulates growth, prevents hair aging, combats dryness, provides shine, volume, stimulates collagen production, hydrates and humecta (Certificates, s.f).

It also reduces the swelling of the hair according to Machado Inca, 2013, who in his study "Evaluation of the anti-sponge effect of the mucilages of *Opuntia ficus*, *Aloe vera* and the American agave saponins in a shampoo in people with fluffy hair" obtained as The result was that the highest percentage of reduction of hair swelling by application was observed in the treatment performed with Aloe shampoo, having ascending values in each application thus reaching a maximum value in the fourth application as shown in the next table.

Table 2: Variation of the reduction percentage of hair swelling by application in each treatment.

Results of Application in%				
Treatment	1	2	3	4
Anua	23	34	45	56
Sábila	27	38	49	59
Tuna	20	34	44	52
Cabuya	15	26	35	46

Source: Own elaboration based on Machado Inca, 2013.

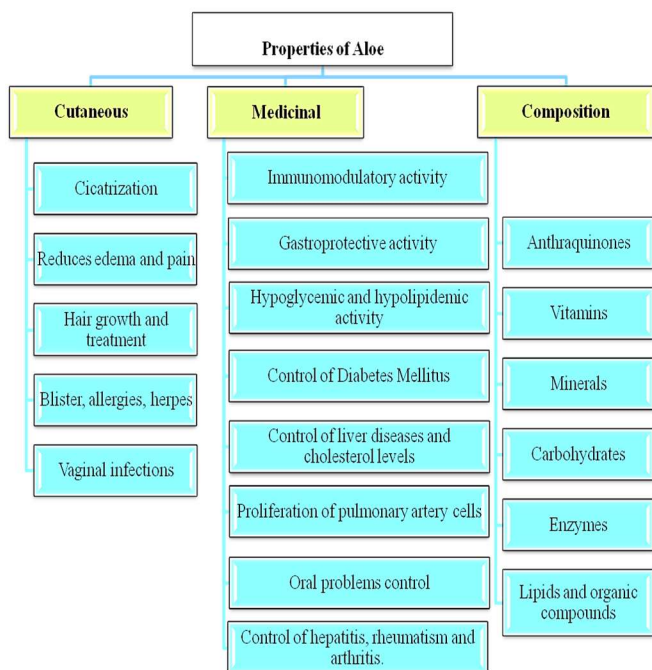


Image 4. Properties of Aloe.

Source: Own elaboration based on Domínguez Fernández et al., 2012.

4. Shampoo Production.

The shampoo belongs as such to the group of cosmetics, is a specific product for hair care. This word dates from 1762 and literally means to massage (Cunguán Cevallos, 2015). The history of Shampoo dates back to approximately the 1930s, before this the hair and scalp hygiene was done with bar soap, with not very good aesthetic results due to the residues that remained attached to the hair, especially, in combination with hard water.

The shampoo is a product designed to clean the scalp and hair fiber from environmental pollution, sebaceous secretion, cell detritus and the remains of other cosmetic products. While this is their primary function, they also condition and beautify the hair and, sometimes, act as adjuvants to certain treatments for some disorders of the scalp (Arbós, 2009). According to Campos & Carrillo 2010, cited in Cunguán Cevallos, 2015, Shampoo is a surfactant production based on fatty alcohol sulphates whose main function is to eliminate dirt and worrisome diseases of hair and scalp.

The shampoo production process, as well as the manufacturing of other products, is that activity carried out through the execution of a set of operations sequenced and integrated into processes. A production system is a process in which resources are used to transform inputs into some desired output, a production system uses operational resources to transform inputs into some type of the desired result, whether products or services (Arbós, 2009).

To carry out the production of aloe shampoo, a production process is required which consists of the following operations.

Table 3. The sequence of operations for the artisanal production of Aloe Vera shampoo.

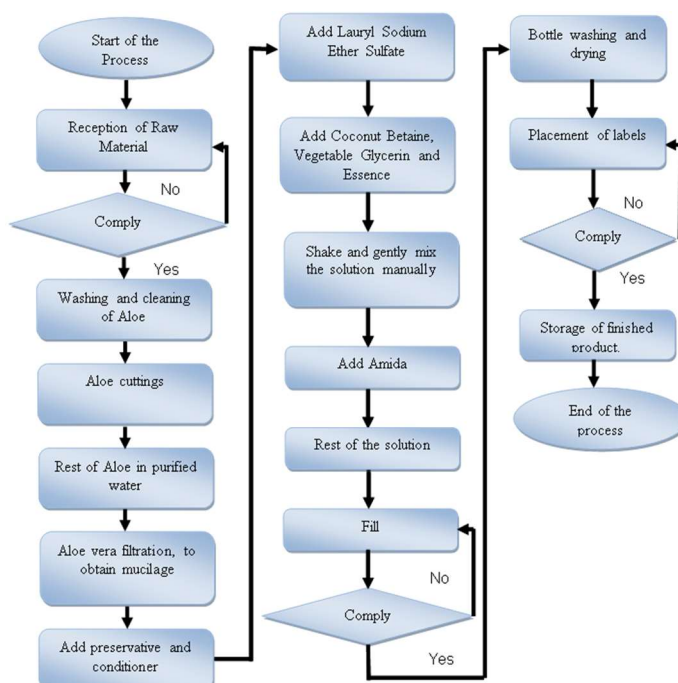
SEQUENCE	SYMBOL	DESCRIPTION OF OPERATION
1		Reception of raw material (Aloe Vera, Sodium Lauryl Sodium Sulfate, Coconut Amide, Vegetable Glycerin, Essence, Ethyl Alcohol, Green Vegetable Dye, EDTA Preservative).
2		Washing and cleaning of Aloe.



SEQUENCE	SYMBOL	DESCRIPTION OF OPERATION
3		Cutting of aloe leaves.
4		Repose of the Aloe in purified water.
5		Aloe vera filtration, to obtain the mucilage.
6		Add preservative, conditioner, and purified water to obtain 60% of the total solution.
7		Add sodium lauryl ether sulfate.
8		Add Coconut Betaine and Vegetable Glycerin.
9		Add essence
10		Shake and gently mix the solution manually.
11		Add Amide to start the viscosity increase, in dosages of 100 ml, until reaching the desired viscosity.
12		The product is left to rest to release the air bubbles trapped in the process.
13		Manual filling one bottle at a time.
14		Washing and drying bottles to remove residues of splashed product.

SEQUENCE	Symbol	Description of operation
15		Placement of two labels, front, and back.
16		Storage of finished product.

Source: Own elaboration.



Flow chart 1. Operations that are currently carried out for the artisanal production of Aloe Vera Shampoo.

Source: Own elaboration.

6. Conclusions:

The Aloe Vera is a plant that has uses in the pharmaceutical, food and in the cosmetics industry. In the industrial sector in this case specifically, cosmetics in the production of Shampoo of Aloe has multiple benefits in the treatment of hair.

The Aloe improves wound healing, reduces pain and generates an angiogenic process during which there is the growth of new capillaries from preexisting capillaries and posterior to the capillary venules.

The application of Sábila externally prevents and stops hair loss and in general contributes to maintain the health of the hair, by its chemical composition. The use of aloe-based shampoo helps hair regeneration strengthens the hair follicles prevents hair loss, and stimulate growth,



prevent aging hair combat dryness, adds shine, volume, stimulates collagen production, hidrata and humecta.

Corresponding Author:

Mario Hernández García, Eng.

Division of Postgraduate Studies and Research in Administrative Engineering, National Institute of Technology of Mexico, Technological Institute of Apizaco, Tlaxcala, Mexico

E-mail: mariioo.hernandez@gmail.com

References:

1. Aguirre Jara, M. D. (2018). Desarrollo de un shampoo a base de consuelda (*symphytum officinale*) (Bachelor's thesis, Quito: Universidad de las Américas, 2018).
2. Albitzer, A. E., Ramírez L, C., & Mar Polanco, J. (s.f). Aprovechamiento de la Sábila (*Aloe Vera*), Nopal (*Opuntia sp.*) y residuos vegetales en la obtención de productos asi como otro tipo de aplicaciones. Recuperado el 15 de 02 de 2019, de http://sappi.ipn.mx/cgpi/archivos_anexo/20080257_65_65.pdf
3. Álvarez, L. J., Gálvez, M. Y. L., & Vega, A. M. (2012). *Aloe vero (Sábila): cultivo y utilización*. Editorial Paraninfo.
4. Arbós, L. C. (2009). Diseño avanzado de procesos y plantas de producción flexible: técnicas de diseño y herramientas gráficas con soporte informático. Profit Editorial.
5. Barraza, M. F. S., & Dávila, J. Á. M. (2008). Encontrando al Kaizen: Un análisis teórico de la Mejora Continua. *Pecvnia: Revista de la Facultad de Ciencias Económicas y Empresariales, Universidad de León*, (7), 285-311.
6. Cunguán Cevallos, A. A. (2015). UDLA. Recuperado el 18 de 03 de 2019, de Localización, distribución y capacidad productiva para la creación de una planta dedicada a la producción de shampoo bajo la normativa legal vigente.: <http://dspace.udla.edu.ec/handle/33000/4166>
7. Certificados, P. E. (s.f). IBIZALOE. Recuperado el 22 de 03 de 2019, de <https://ibizaloe.com/champu-de-aloe-vera/>
8. Domínguez-Fernández, R. N., Arzate-Vazquez, I., Chanona-Perez, J. J., Welti-Chanes, J. S., Alvarado-González, J. S., Calderon-Dominguez, G., ... & Gutierrez-Lopez, G. F. (2012). El gel de Aloe vera: estructura, composición química, procesamiento, actividad biológica e importancia en la industria farmacéutica y alimentaria. *Revista mexicana de ingeniería química*, 11(1), 23-43.
9. GARCÉS, M. (2004). *Identificación de los Aminoácidos esenciales para uso medicinal en la sábila (Aloe Vera)* (Doctoral dissertation, Tesis (Doctora en Química y Farmacia). Guayaquil, Ecuador: Universidad de Guayaquil, Facultad de Ciencias Químicas, 2004. 1-15p).
10. Groover, M. P. (2015). Fundamentos de manufactura moderna: materiales, procesos y sistemas. México: Pearson Prentice Hall. Recuperado el 02 de 10 de 2018.
11. Machado Inca, J. G. (2013). Escuela Superior Politécnica Facultad De Ciencias. Obtenido de Evaluación del efecto antisponge de los mucílagos *Opuntia ficus*, *Aloe vera* en un shampoo en personas con cabello esponjado.: <http://dspace.esPOCH.edu.ec/handle/123456789/3223>
12. Saldaña Gil, B., Huarachi Castillo, L., & Velasco Vaca, S. (2014). Elaboración de acondicionador para cabello de uso externo a base de extracto de Aloe Vera e infusión de Romero. Obtenido de <http://www.dui.uagrm.edu.bo/Informacion/Expociencia2014/1009.pdf>

Received June 12, 2018; revised June 17, 2018; accepted June 23, 2018; published online July 04, 2019