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RESEARCH ARTICLE

REVIEW ON ALOE VERA- THE PLANT OF MARVEL IN THE FILED OF MEDICINE AND DENTISTRY

Dr. Saraswathi Gopal, K. and *Amala Manivannan

Department of Oral Medicine and Radiology Meenakshi Ammal Dental College, Chennai, Tamilnadu, India

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ABSTRACT

Aloe vera is the oldest medicinal plant ever known and the most applied medicinal plant worldwide. The plant leaves contains numerous vitamins, minerals, enzymes, amino acids and other bioactive compounds with emollient, purgative, antimicrobial, anti inflammatory, anti-oxidant, aphrodisiac, anti-helmenthic, antifungal, antiseptic and cosmetic properties. *Aloe vera* has been used in dentistry for its wound-healing effects, gingivitis, plaque control & curing oral mucosal lesions. *Aloe vera* may also reduces pain and duration of oral ulcers by rapid healing. The dentists should use *Aloe vera* to maximize its therapeutic benefit.

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INTRODUCTION

Aloe vera is the oldest medicinal plant ever known and the most applied medicinal plant worldwide (Tulsi Subramaniam *et al*., 2014; Rajeswari *et al*., 2012). The aloe vera plant has been known and used for centuries for its medicinal and cosmetic properties (Richa Wadhawan *et al*., 2014). The name Aloe vera derives from the Arabic word "ALLOEH" meaning "shining bitter substance", while "VERA"in latin means "TRUE" (Richa Wadhawan *et al*., 2014). There are about 360 species of aloe vera. It is also known as Aloe Barbadensis Miller (Mani Amit *et al*., 2013). It is a native plant of Africa which is found In Africa, Northern America, India, Egypt, Australia, Barbados, Belize, Nigeria, and Sudan, (Urvashi nandal and Bhardwaj, 2012; Sujatha *et al*., 2014). 2000 years ago, the Greek scientist has regarded Aloe vera as the Universal panacea (Richa wadhawan *et al*., 2014). The cosmetic and medicinal properties are from the mucilageneous tissue in the centre of the plant called aloe vera gel (Tulsi Subramaniam *et al*., 2014). Aloe vera has number of uses and mainly they are used as a food preservative and medicine. pulp of Aloe arborescens species is used for medicinal purposes, including treatment of Constipation, Colitis, Asthma, Irritable Bowel Syndrome, Diabetes, Peptic Ulcer, Inflammation, Heart Burn, Stress etc (Paoulomi Chatterjee *et al*., 2013). Commercially, aloe can be found in pills, sprays, ointments, lotions, liquids, drinks, jellies, and creams (Karkala Manvitha and Bhushan Bidya, 2014).

Corresponding author: **Amala Manivannan,**
Department of Oral Medicine and Radiology Meenakshi Ammal Dental College, Chennai, Tamilnadu, India

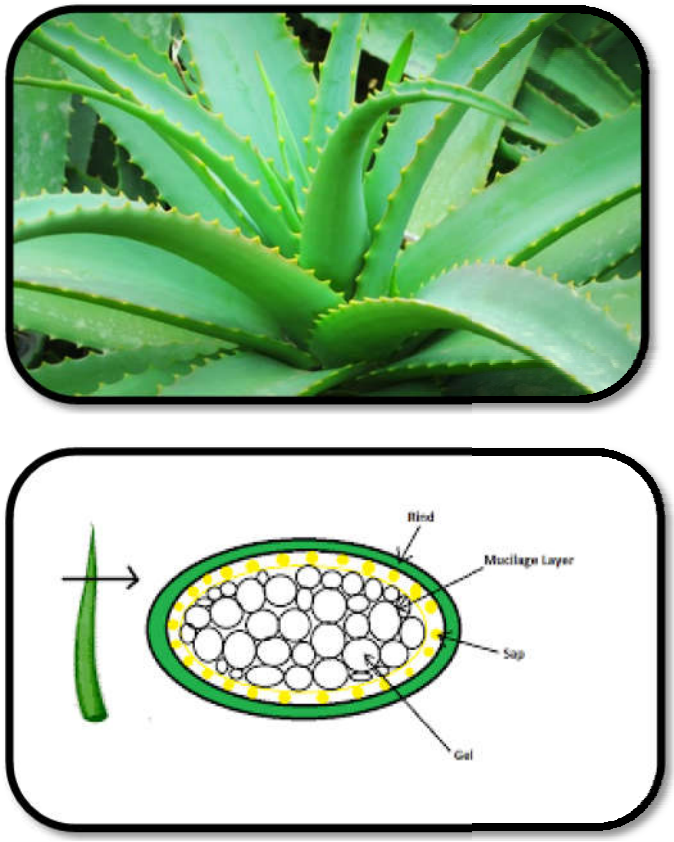
History

The usage of aloe vera dates back to the ancient biblical era (Richa Wadhawan *et al*., 2014). Aloe vera has been used for its medicinal properties in several cultures for several million years in Greece, Egypt, India, South Africa, Mexico, Japan and China. Alexander the great and Christopher Columbus used Aloe vera for treating wounded soldiers.Cleopatra used it as her regular beauty regimes (Kavyashree *et al*., 2015). Hannibal states, during 1750 BC war had been fought to obtain control over the growing area in North Africa (Richa Wadhawan *et al*., 2014; (Kavyashree *et al*., 2015). The plant is native to southern and eastern Africa along the Upper Nile in the Sudanand it was subsequently introduced into the northern parts of Africa and naturalized in the mediterrenean region and other countries across the globe. The plant is cultivated commercially in Aruba, Bonaire, Haiti, India, South Africa, United states of America and Venezuela, while the finest quality is grown abundantly in the deserts of Southern California (pankaj k. Sahu *et al*., 2013). Egyptians still hang an aloe plant over the door of a New house to provide a long and fruitful life for its occupants (Sikarwar mukesh *et al*., 2010).

Plant description

It is a succulent perennial herb with a triangular, sessile stem, shallow root system, fleshy serrated leaves arranged in rosette having 30-50cm in length and 10 cm breadth at the base and green in colour. It produces erect unbranched flowering stalks in the second year in winter season the flowers are bright yellow and orange coloured, tubular, 25-35 cm in length with

axillary spike and stamens and the fruit contains many seeds (Urvashi nandal and Bhardwaj, 2012; Sujatha *et al*., 2014). Each plant has 12 to 16 leaves usually and weighs up to 2-3 kg on maturity. The plants can be harvested after every 6 to 8 weeks by removing 3-4 leaves per plant (Urvashi nandal and Bhardwaj, 2012). Ideal environment to grow this plant is tropical climate and low rainfall areas. The leaves of the plant has three layers; The Outermost Layer, Middle and Inner Layer.



Aloe vera plant

Outer layer of the leaf

The outer most layer is 15-20 cells thick. It is a protective layer synthesizing carbohydrates and proteins. The bitter yellow latex layer of pericyclic tubules in the outer layer of the leaves contain derivatives of hydroxyanthracene, anthraquionone and glycosides aloin A and B from 15-40% in different investigations (Pankaj K. Sahu *et al*., 2013). The other active ingredient of aloe include hydroxyanthrone, aloe-emodin-anthrone 10-C-glucoside and chrones.

Middle layer of the leaf

The bitter yellow latex contains Anthraquinones and Glycosides. The juice originates from the cells of the pericycle and adjacent leaf parenchyma, flowing spontaneously from the cut leaf. The parenchyma contains protein, lipids, amino acids, vitamins, enzymes, inorganic compounds in addition to the different carbohydrates.

Inner layer of the leaf

The innermost layer of the leaf contains water upto 99% with the remaining 1-2% contains the active compounds, including Aloesin, Aloin, Aloe-Emodin, Aloemannan, Acemannan, Aloeride, Naftoquinones, Methylchromones, Flavonoids, Saponin, Sterols, Glucomannans, Lipids, Amino Acids, Enzymes, Minerals, Sugars, Liginin, Saponins, Salicylic Acid And Vitamins (Bushra Karim *et al*., 2014). It has numerous mono and polysachharides; vitamins B_1,B_2,B_6 and C; Niacinamide and Choline, several inorganic ingredients, enzymes (alkaline phosphatase, amylase, lactate dehydrogenase, lipase) and inorganic compounds (Aloin, Barbaloin And Emodin). Aloe gel is often commercialized as powdered concenterate.

Composition and its properties

Constituents	Properties and activities
Amino Acids	Basic building blocks of proteins in the body and muscle tissues
Anthraquinones	Analgesic, antibacterial
Enzymes	Antifungal and antiviral activity
Hormones	Wound healing and anti-inflammatory
Minerals	Essential for good health
Salicylic Acid	Analgesic
Saponins	Cleansing and antiseptic
Steroids	Anti-inflammatory agents
Sugars	Anti-viral,immune modulating activity of acemannan
Vitamins	Antioxidant,neutralises free radicals

Aloe vera and its uses

Aloe vera extracts may be useful in the treatment of wound and burn healing, minor skin infections, sebaceous cyst, diabetes, and elevated blood lipids in humans (Urvashi Nandal *et al*., 2012).

Wound healing property

Glucomannan, a mannose-rich polysaccharide and Gibberellin, a growth hormone, interacts with growth factor receptors on the fibroblast, thereby stimulating its activity and proliferation, which in turn significantly increases collagen synthesis after topical and oral Aloe vera application. Three characteristics of growth factor activity in aloe are:

1. Inhibition of pain & inflammation
2. Stimulation of fibroblasts to functionally produce collagen & proteoglycans
3. Increased wound tensile strength

In 1991, Thompson reported that topical application of the aloe vera-derived allatonin gel stimulated fibroblastic activity and collagen proliferation. Yagi *et al*. reported that Aloe vera gel contains a glycoprotein with cell proliferating-promoting activity (Yagi *et al*., 2003), while Davis *et al*. noted that Aloe vera gel improved wound healing by increasing blood supply (angiogenesis), which increased oxygenation as a result (Tulsi Subramaniam *et al*., 2014; Davis *et al*., 1989. The Aloe administration influences collagen composition (type III) and increased collagen cross linking for wound contraction and improving breaking strength. It also increases synthesis of hyaluronic acid and dermatan sulfate in the granulation tissue of a healing wound. Acemannan is considered the main functional component of *Aloe vera*.It accelerates wound healing and reduces radiation induced skin reactions. Macrophage-activating potential acemannan may stimulate the release of fibrogenic cytokines (Pankaj K. Sahu *et al*., 2013).

Anti-inflammatory action

The anti-inflammatory activity of *Aloe vera* gel has been revealed by a number of *in vitro* and *in vivo* studies through

Bradykinase activity. The peptidase bradykinase was isolated from aloe and it breaksdown the bradykinin, an inflammatory substance that induces pain (Tulsi Subramaniam *et al*., 2014). Anti-inflammatory compound, C-glucosyl chromone, was isolated from gel extracts. *Aloe vera* inhibits the cyclo-oxygenase pathway and reduces prostaglandin E2 production from arachidonic acid.

Antidiabetic effect

Type II diabetes is one of the leading causes of death Worldwide. Researchers have found that aloe plant polysaccharides have the potential to control blood sugar, stimulates body's own antioxidant production and even lower cholesterol. It lowers glucose and triglycoside levels in diabetic patients. Aloe polysaccharides improves the property of immune cells and are also very effective to eliminate toxins. *Aloe vera* juice enhances absorption of nutrients and maintains the sugar balance in blood by improving digestive functioning. *Aloe vera* enhances the action of the drugs or herbal preparations used with insulin for diabetes. Aloe vera contains polysaccharides which increase the insulin level and show hypoglycemic properties. The treatment of diabetes mellitus has been attempted with various indigenous plants and polyherbal formulations. Traditional antidiabetic plants might provide new oral anti-diabetic compounds, which can counter the high cost and poor availability of the current medicines for many rural populations in developing countries (Pankaj K. Sahu *et al*., 2013).

Builds immunity

Alprogen inhibit calcium influx into mast cells, thereby inhibiting the antigen-antibody-mediated release of histamine and leukotriene from mast cells. Acemannan stimulates the synthesis and release of interleukin-1 (IL-1) and tumor necrosis factor from macrophages which in turn initiates an immune attack that result in necrosis and regression of the cancerous cells (Tulsi Subramaniam *et al*., 2014). It is great for those who have chronic immune disorders like polysaccharides or fibromyalgia since the polysaccharides in *Aloe vera* juice stimulate macrophages, the white blood cells that fight viruses (Rajeswari *et al*., 2012).

Anti-cancer effects

The two fractions from Aloe vera that are claimed to have anticancer effects include glycoproteins (lectins) and polysaccharides (Tulsi Subramaniam *et al*., 2014; Josias H. Hamman *et al*., 2008). Different studies indicated antitumor activity for Aloe vera gel in terms of reduced tumor burden, tumor shrinkage, tumor necrosis and prolonged survival rates. An induction of Glutathione S-Transferase and an inhibition of tumour promoting effect of phorbol myristic acetate. It has been reported by several authors that different fractions of *A. vera* as well as unfractionated whole gel have anti-oxidant effects. Glutathione peroxidise activity, superoxide dismutase enzymes and a phenolic antioxidant were found to be present in *A. vera* gel, which may be responsible for these anti-oxidant effects. (Josias H. Hamman *et al*., 2008) *Aloe vera* acts as radiation protectors and inhibits testicular damage from gamma radiation and reduces cancer. *Aloe vera* leaf contains anthraquinones, saccharides, vitamin E and C, zinc, enzymes, acetyl salicyclic and others. Acemannan is the major carbohydrate fraction obtained from *Aloe vera* leaf. *Aloe vera* emodin, an anthraquinone, has the ability to suppress or inhibit the growth of malignant cancer cells making it to have antineoplastic properties (Urvashi Nandal and Bhardwaj, 2012).

Aloe vera in heart disease

Aloe vera juice taken by angina pectoris patient's results in marked reduction of serum cholesterol and triglycosides levels and increases HDL levels. Researchers have found that Aloe vera easily stimulates the fibroblasts for making new tissues. When fibroblasts are stimulated, proteoglycans, collagens are formed and thus the risk of cardio vascular disorders decreases.

Aloe vera and hepatitis

Oral use of aloe juice helps in maintaining and restoring stomach acid balance, beneficial for liver, helps in recovery of chronic hepatitis patients. The fresh juice obtained from the cut bases of the leaves is cathartic and cooling and used to treat liver, spleen and muscular pain (Urvashi Nandal and Bhardwaj, 2012).

Aloe vera role in aids

Acemannan present in *Aloe vera* juice is having ANTI-VIRAL and IMMUNE-MODULATING properties. A daily dose of minimum 1200 mg of active ingredients of *Aloe vera* showed substantial improvement in AIDS symptoms. It heals wounds and internal organ damge. *Aloe vera* contains glucomannan, it interacts with special cell surface receptors on those cells which repair damaged tissues, called fibroblasts, stimulating them, activating their faster growth and replication. Researchers found that *Aloe vera* stimulates the body's immune system, particularly T4 helper cells – white blood cells that activate the immune response to infection. It protects the immune system from the toxic side effects of AZT.

Arthritis, joint and muscle pain

Aloe vera is believed to reduce severe joint and muscle pain associated with arthritis, as well as pain related to tendinitis and injuries. When applied directly to the area of pain, Aloe vera penetrates the skin to soothe the pain. Ingestion of Aloe vera on a daily basis can help prevent and cause a regression of adjutant Arthritis (Karkala Manvitha and Bhushan Bidya, 2014).

Aloe vera fights stress

In the modern scenario many people suffer from stress. Aloe juice is helpful in smooth functioning of the body machinery. It reduces cell-damaging process during stress condition and minimizes bio-chemical and physiological changes in the body. Oxidative stress refers to chemical reactions in which compounds have their oxidative state changed. In the simplest case, oxidation describes the loss of electrons by a molecule, which then becomes what are termed as free radicals. This result in a pro oxidative shift in cellular balance which has been implicated in the cause of many serious diseases, including cancer, cardiovascular diseases such as hypertension and artherosclerosis, neurodegenerative diseases such as Parkinson's disease and Alzheimer's dementias, diabetes, ischemia/ reperfusion injuries, rheumatoid arthritis, and even

the process of aging. However, nature has evolved elegant regulatory mechanisms for countering this free radical damage. These primarily involve antioxidant reducing agents that can slow or stop oxidation reaction. Some antioxidants are part of the body's natural regulating machinery while other dietary antioxidants are derived from diet sources. Aloe vera is an excellent example of a functional food that plays a significant role in protection from oxidative stress (Urvashi Nandal and Bhardwaj, 2012).

Aloe vera improves digestive system

Aloe vera juice is useful to treat gastric intestinal problems like indigestion, candida, colitis and relief from digestive issues such as heartburn and irritable bowel Syndrome, although it bears significant potential to be toxic when taken orally. constipation, diarrhea, indigestion, irritable bowel syndrome etc. are cured by the flushing action of *it.* Aloe juice helps to flush out the residues boosting the digestion. *Aloe Vera* gel and leaf is used to relieve many types of gastrointestinal irritations

Antimicrobial property

The activity of *Aloe vera* inner gel against both Gram-positive and Gram-negative bacteria has been demonstrated by several different methods. Anthraquinones isolated from the exudate of *A. vera* have shown wide antimicrobial activity. The antibacterial activity of emodin against *Escherichia coli* was proposed to be mediated through inhibition of solute transport in membranes. Many anthraquinones have shown antiviral or virucidal effects on enveloped viruses. (Josias H. Hamman, 2008)

Radiation dermatitis

Reports in the 1930s of tropical aloe's beneficial effects on skin after radiation exposure, lead to widespread use in skin products. Currently *aloe vera* gel is sometimes recommended for skin irritation caused by prolonged exposure to radiation (Karkala Manvitha and Bhushan Bidya, 2014).

Application of aloe vera in dentistry

Oral cavity is a breeding ground for many bacteria, if oral hygiene is not maintained properly it may lead to major oral diseases. Aloe vera has many anti-bacterial properties which is said to be very effective in preventing in diseases.

Oral lichen planus

The efficacy of aloe vera in treating oral lichen planus has been measured by many researchers. In a study, 46 patients with oral lichen planus were randomly divided into two groups. Each group was treated with aloe vera mouth wash and triamcinolone acetonide 0.1%. The treatment period for both groups was 4 weeks. Patients were evaluated on days 8 and 16 and after completing the treatment course. Aloe vera mouthwash is an effective substitute for triamcinolone acetonide in treatment of OLP.

Apthous ulcer

Acemannan hydrogel accelerates healing of apthous ulcers and reduces pain associated with them.

Aloe vera in treatment of deciduous teeth

In pulpotomy aloe vera gel is applied to the remaining pulp stumps followed by non-eugenol cements and permanent restoration, it was found to be effective and patient is free of symptoms. There was no evidence of abscess, mobility, pain or swelling, on follow up after 30 days and 60 days.

Aloe vera in endodontic treatment

In many cases failure of endodontic treatment is due to persistent or secondary intraradicular infection. It's been found Enterococcus faecalis is associated with failure of root canal therapy. A study conducted by Suresh Chandra concluded that aloe vera show significant zone of inhibition against E.faecalis Aloe vera has been used as a sedative dressing and lubrication of files during biomechanical preparation.It has been found that aloe vera gel is effective in decontaminating Gutta percha cones within one minute.

Antibacterial activity

Aloe Vera plant leaves and gel were macerated in different organic solvents including ethanol, methanol and distilled water. Then, by using agar diffusion assay antibacterial activity was estimated. The Aloe Vera extract of Methanol showed the maximum antibacterial activity as compared to other solvent extracts.

Aloe vera in alveolar osteitis

Poor *et al*. compared the incidence of alveolar osteitis in patients treated with either clindamycin soaked gelfoam or salicept patches (Poor *et al*., 2002). The salicept patch - freeze-dried pledget containing Acemannan hydrogel obtained from the clear inner gel of aloe vera. Salicept patch significantly reduced the incidence of Alveolar osteitis compared with clindamycin soaked gelfoam

Gingivitis and periodontitis

Mouthwashes containing aloe Vera significantly reduces plaque and gingivitis but when compared with chlorhexidine the effect was less significant. Aloe vera mouth wash is an effective antiplaque agent and with appropriate refinements in taste and shelf life can be affordable herbal substitute for chlorhexidine. A recent study concluded that the administration of aloe vera gel resulted in improvement of periodontal condition.

Oral submucous fibrosis

Sudarshan *et al* carried out a study to compare the efficacy of aloe vera with antioxidants in treatment of oral submucous fibrosis. In this study, 20 subjects with OSMF were included. Patients were divided into two groups; group A received 5mg of aloe vera gel 3 times daily for 3 months and group B received antioxidant capsules twice daily for 3 months. He concluded that aloe vera group showed a better treatment response [reduced burning sensation and enhanced mouth opening than the antioxidants group. Hence it can be used in effective treatment of OSMF.

Aloe vera as a denture cleanser and adhesive

A small amount of aloe vera placed on the denture acts as an antifungal agent. This can also be used along with soft liners.

Because of the sticky and viscous nature of gel, a prototype Acemannan was formulated into a denture adhesive and evaluated for adhesive strength in both wet and dry conditions; the adhesive also was used to evaluate cytotoxicity to human gingival fibroblasts

Contraindications

In some cases contact dermatitis and hypersensitivity reactions Aloe vera gel have been noted. Hence it is contraindicated in cases of known allergy to plants in the Liliaceae family. In diabetic patients, increased hypoglycemia might be seen in conjunction with oral antidiabetics or insulin. Aloe vera gel for systemic application is not recommended in combination with antidiabetic, diuretic, or laxative drugs; sevoflurane or digoxin. Application of aloe to skin may increase the absorption of steroid creams such as hydrocortisone. It reduces the effectiveness and may increases the adverse effects of digoxin and digitoxin, due to its potassium lowering effect. Combined use of Aloe vera and furosemide may increase the risk of potassium depletion. It decreases the blood sugar levels and thus, may interact with oral hypoglycaemic drugs and insulin (Tulsi Subramaniam *et al*., 2014). Aloe vera is contraindicated in intestinal obstruction, acute inflamed intestinal disease. Oral aloe vera is contraindicated in pregnancy as it stimulates uterine contraction and in breast feeding mother it can sometimes cause gastrointestinal distress in the infants. Oral use is also contraindicated in children less than 10 years of age[9].Allergic reactions are mostly due to anthraquinones, such as aloin and Barbaloin. It is best to apply it to a small area first to test for possible allergic reaction. (Karkala Manvitha and Bhushan Bidya, 2014)

Conclusion

Many Indian herbs are being used in traditional practices to cure various human ailments. Aloe vera, has an important place among wound healing medicinal plants, it is also used in treating inflammation, pain and ulcer. Aloe vera, has a long history as a medicinal plant with different therapeutic applications. It has an increasing demand in the international market for its both medicinal and cosmetical properties. Since the 1st century aloe has provided humankind with numerous valuable medicinal products. Human clinical studies continue to substantiate its therapeutic use.

REFERNCES

Bushra karim, Dara John Bhaskar2, Chandan Agali, Devanand Gupta4, Rajendra Kumar Gupta, Ankita Jain6, Alpana Kanwar. Effect of aloe vera mouthwash on periodontal health: triple blind randomized control trial. OHDM - vol. 13 - no. 1 - march, 2014

Davis, R. H., M. G. Leitner, j. M. Russo and M. E. Byrne, 1989. "Wound healing. Oral and topical activity of aloe vera," *Journal of the American Paediatric Medical Association*, vol. 79, no. 11, pp. 559-562.

Dr. Tulsi Subramaniam, Dr.Arun Subramaniam, Dr.Asha Chowdhery, Dr.Sreeja Das, Dr.Mishali Gill. Versatility of aloe vera in dentistry- a review iosr journal of dental and medical sciences (iosr-jdms) e-issn: 2279-0853, p-issn: 2279-0861. Volume 13, issue 10 ver. Iii (oct. 2014), pp 98-102

Josias H. Hamman, 2008. Composition and applications of aloe vera leaf gel. Molecules, 13, 1599-1616.

Karkala Manvitha and Bhushan Bidya. 2014. Aloe vera: a wonder plant its history, cultivation and medicinal uses. *Journal of Pharmacognosy and Phytochemistry*, 2 (5): 85-88

Kavyashree G. and Rosamma George. Aloe vera: its uses in the field of medicine and dentistry. Iosr journal of dental and medical sciences. Volume 14, issue 10 ver. V (oct. 2015), pp 15-19

Mani amit, mani shubanghi, shinde shagar, shukla prachi, patil ishwardas, hartalkar sheetar. 2013. Aloe vera-novel protagonist in periodontal healing ujmds, 01(02): page 11-16

Pankaj k. Sahu, Deen Dayal Giri, Ritu Singh, Priyanka Pandey, Sharmistha Gupta, Atul Kumar Shrivastava, Ajay Kumar, Kapil Dev Pandey. 2013. Therapeutic and medicinal uses of aloe vera: a review. *Pharmacology & pharmacy*, 4, 599-610.

Paoulomi Chatterjee, Bodhisattwa Chakraborty and Subhangkar Nandy. aloe vera plant: review with significant pharmacological activities mintage *Journal of Pharmaceutical & Medical Sciences,* 21-24; Vol 2 issue 3, july – sep 2013

Poor Mr, Hall Je and Poor As. 2002. Reduction in the incidence of alveolar osteitis in patients treated with the sali cept patch, containing acemannan hydro gel. *Journal of Oral and Maxillofacial Surgery*, 60(4), 374–379.

Rajeswari R *et al*. 2012. Aloe vera: the miracle plant its medicinal and traditional uses in india, *Journal of Pharmacognosy and Phytochemistry*, 1(4) :118-24

Richa Wadhawan, Siraj Daa Khan, Gaurav Solanki, Sabreena Sabir. Aloe vera: a boon in dentistry. International journal of pharmacy review & research. Vol 4 | issue 3| 2014 | 147-151

Sampath kumar, K. P., Debjit Bhowmik, Chiranjib, Biswajit, 2010. Aloe Vera : a potential herb and its medicinal importance. *J. Chem. Pharm. Res*., 2(1): 21-29

Sikarwar mukesh *et al*. 2010. Aloe vera: plant of immortality international journal of pharma sciences and research (*IJPSR*) Vol.1 (1), 7-10

Sujatha, G., G. Senthil Kumar, J.Muruganandan, T.Srinivasa Prasad, Aloe vera in dentistry. *Journal of Clinical and Diagnostic Research*, 2014 oct, vol-8(10): zi01-zi02

Urvashi Nandal, R.L. Bhardwaj. Aloe vera: a valuable wonder plant for food, medicine and cosmetic use - a review. *International Journal of Pharmaceutical Sciences Review and Research*, volume 13, issue 1, March – April 2012; article-010

Yagi, A., A. Kabash, K. Mizuno, S. M. Moustafa, t. I. Khalifa and h. Tsuji, 2003. "radical scavenging glycoprotein inhibiting cyclooxygenase-2 and thromboxane a2 syn-thase from aloe vera gel," *Planta Medica*, vol. 69, no. 3, pp. 269-271.

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