



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 6, June 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Antioxidant Properties of *Aloe Vera* Species

¹Pinki Rathod, ²Smruti Sohani

¹Research Scholar, Institute of Biological Science, Sage University, Indore, India

²Professor, Institute of Agriculture Science, Sage University, Indore, India

ABSTRACT: Kumar et al. observed that different agro-climatic conditions have effects on the phytochemicals, total phenolic content and antioxidant potential of the *A. vera* plant. The authors studied the crude methanolic extracts of *A. vera* from the different states of India for presence of various phytochemicals, total phenolic content and *in vitro* antioxidant activity. A significant positive correlation was detected between total phenolic content and antioxidant activity of different accessions. Extracts of highland and semi-arid zones possessed maximum antioxidant potential. Accessions from tropical zones showed the least antioxidant activity in all assays. Sultana et al. checked for antioxidant activity of *Aloe vera* leaf extracts obtained using four extracting solvents and two unique extraction techniques. They reported that the extracts had good DPPH scavenging properties. The ethanolic extracts of leaves of *A. vera* prepared by the reflux technique showed better scavenging activity as compared with those prepared by the shaking technique. The aqueous organic solvent extracts of *Aloe vera* exhibit greater reducing power than absolute solvents. In an *in vivo* study, Golestan et al. showed that dietary *Aloe vera* have adverse effects on antioxidant defense system in rainbow trout (*O. mykiss*).

KEYWORDS- *Aloe vera*, antioxidant, extracts, treatment, uses

I. INTRODUCTION

Aloe vera (*A. vera*), one of the most popular medicinal plants, is regularly used throughout the world to prevent or treat cancer, metabolic problems, cardiovascular diseases, and skin concerns. In this study, we investigated the antioxidant properties of *A. vera* skin extract, which are neglected during gel extraction. In the current work, we investigated the phytochemical and antioxidant profiles of an *A. vera* by-product using three different solvents and two different drying methods. The findings of the study showed that sample drying and solvent extraction methods had a significant impact on the phytochemical content and *in vitro* antioxidant activity. The oven-dried sample of the *A. vera* by-product contained more phytochemicals, antioxidants, and *in vitro* activity than the sun-dried sample does. The study of solvent effects also indicated that an acidified methanolic solvent for *A. vera* by-products was the most effective extraction medium for phytochemicals and antioxidants than methanolic or aqueous ethanolic extract. Additionally, the comparison of solvent effects in the assessment of antioxidant activity in various *in vitro* models was investigated, and findings revealed that the maximum antioxidant activity and radical scavenging activity were found in oven-dried acidified methanolic (O-AM) extracts. The principal component analysis (PCA) has shown that the biggest variation was 87.3% and O-AM has the highest contribution to the dimension 1 (68.7%) in the PCA. These findings will spur attempts to describe the bioactivities of *A. vera* by-products and increase their application in the cosmetics, food, and healthcare sectors.[1,2,3]

II. DISCUSSION

Aloe vera is a medicinal plant with antioxidant and antibacterial properties. *Aloe vera* benefits can include reducing dental plaque, accelerating wound healing, preventing wrinkles, and managing blood sugar.

Aloe vera is a thick, short-stemmed plant that stores water in its leaves. It is best known for treating skin injuries but has several other uses that could potentially benefit health.

1. It contains healthful plant compounds



Share on Pinterest Aloe vera may help treat skin injuries.

The cosmetic, pharmaceutical, and food industries use aloe vera extensively, and the plant has an estimated annual market value of \$13 billion globally.

Aloe vera is known for its thick, pointed, and fleshy green leaves, which may grow to about 12–19 inches (30–50 centimeters) in length.

Each leaf contains a slimy tissue that stores water, making the leaves thick. This water-filled tissue is the “gel” that people associate with aloe vera products.

The gel contains most of the beneficial bioactive compounds in the plant, including vitamins, minerals, amino acids, and antioxidants.

2. It has antioxidant and antibacterial properties

Antioxidants are important for health. *Aloe vera* gel contains powerful antioxidants belonging to a large family of substances known as polyphenols.

These polyphenols, along with several other compounds in *Aloe vera*, help inhibit the growth of certain bacteria that can cause infections in humans.[4,5,6]

Aloe vera is known for its antibacterial, antiviral, and antiseptic properties. This is part of why it may help heal wounds and treat skin problems.

3. It accelerates wound healing

People most often use aloe vera as a topical medication, rubbing it onto the skin rather than consuming it. In fact, it has a long history of use in treating sores, and particularly burns, including sunburn.

The United States Pharmacopeia described aloe vera preparations as a skin protectant as early as 1810–1820.

Studies suggest that it is an effective topical treatment for first and second-degree burns.

For example, a review of experimental studies found that aloe vera could reduce the healing time of burns by around 9 days compared with conventional medication. It also helped prevent redness, itching, and infections.

The evidence for aloe vera helping heal other types of wounds is inconclusive, but the research is promising.

4. It reduces dental plaque

Tooth decay and diseases of the gum are very common health problems. One of the best ways to prevent these conditions is to reduce the buildup of plaque, or bacterial biofilms, on the teeth.

In a study of 152 school children ages 8-14 years, researchers compared an *Aloe vera* mouthwash with the standard mouthwash ingredient chlorhexidine.

After 4 weeks of use, the aloe vera mouth rinse decreased plaque, gingivitis, and salivary *Streptococcus mutans* (a plaque-producing bacterium), making it comparable to that of chlorhexidine.[7,8,9]

Another 2021 study concluded that *Aloe vera* mouthwash is an effective natural alternative to chemically formulated mouthwashes.

Aloe vera gel is also effective in killing a yeast found in the mouth known as *Candida albicans*.

5. It helps treat canker sores

Many people experience mouth ulcers, or canker sores, at some point in their lives. These usually form underneath the lip, inside the mouth, and last for about a week.

Studies have shown that aloe vera treatment can accelerate the healing of mouth ulcers.

For example, a 2022 review of nine randomized controlled trials concluded that *Aloe vera* treatment can accelerate the healing of mouth ulcers better than other interventions. It also offers a shorter healing time.

In another older study, *Aloe vera* gel not only accelerated the healing of mouth ulcers but also reduced the pain associated with them.

6. It reduces constipation

Aloe vera may help treat constipation.

This time, it is the latex, not the gel, that provides the benefits. The latex is a sticky yellow residue present just under the skin of the leaf.

The key compound responsible for this effect is called aloin, or barbaloin, which has well-established laxative effects.

However, people have raised concerns about safety with frequent use. For this reason, aloe latex has not been available in the U.S. as an over-the-counter medication since 2002.

Contrary to popular belief, *Aloe vera* does not appear to be effective against other digestive conditions, such as irritable bowel syndrome or inflammatory bowel disease.[10,11,12]

7. It may improve skin and prevent wrinkles

There is some preliminary evidence to suggest that topical *Aloe vera* gel can slow aging of the skin.

In a 2009 study of 30 females over the age of 45, taking oral *Aloe vera* gel increased collagen production and improved skin elasticity over a 90-day period.

Reviews also suggest that *Aloe vera* could help the skin retain moisture and improve skin integrity, which could benefit dry skin conditions.

8. It lowers blood sugar levels

People sometimes use *Aloe vera* as a remedy for diabetes. This is because it may enhance insulin sensitivity and help improve blood sugar management.

Indeed, a 2021 review concluded there is a moderate to high quality of evidence in favor of the effects of *Aloe vera* in patients with prediabetes or type 2 diabetes.

However, the quality of these existing studies is not ideal, so scientists do not currently recommend using *Aloe vera* for this purpose.

9. It potentially helps hair growth

The benefits of *Aloe vera* for the hair have mainly been studied in relation to seborrheic dermatitis – a skin condition that causes a reddish rash with crusty, yellow-white scales, usually on the face and scalp.

One older study indicated that aloe vera significantly reduces itchiness, scaliness, and affected area size in those with the condition.

Given that seborrheic dermatitis can lead to temporary hair loss, this underscores *Aloe vera* potential for promoting hair growth.

Aloe vera can come in various forms, including a topical gel or ointment, it can be used in its raw form, or it can even be consumed as a liquid.

Aloe vera is a safe remedy with few known side effects.[13]

The National Center for Complementary and Integrative Health (NCCIH) say that topical use is likely safe.

That said, the oral use of aloe vera may cause stomach cramps or diarrhea due to its laxative effects. There have also been some reports of liver injury associated with oral forms of *Aloe vera*.

Also, there may be risks associated with non-decolorized whole leaf extract of *Aloe vera*. This form of *Aloe vera* is taken from the plant's leaves and is not filtered to remove cancer-causing chemicals.

Indeed, the NCCIH report that nondecolorized whole leaf extract of *Aloe vera* seems to be associated with cancer risk in rats.

Aloe vera has a range of therapeutic properties, especially as an ointment for the skin and gums.

People can use bottled aloe vera gel or take it directly from the leaf of plant. *Aloe vera* juice has different uses than *Aloe vera* gel.

Oral options should contain decolorized whole leaf extract to minimize risk.

A person should always speak to a doctor before using aloe products to treat a condition.

III.RESULTS

Aloe vera (also known as *Aloe barbadensis* Mill.) is a flowering succulent plant of the family Asphodelaceae currently naturalized in many tropical and sub-tropical countries. In traditional medicine, it has been widely used for centuries to treat skin disorders and other ailments, as well as for its purgative effect [1]. Today, this species is used worldwide as a valuable ingredient for functional foods (such as healthy drinks and other beverages), cosmetics (including creams, lotions, soaps, and shampoos), and drugs (such as tablets and capsules) [2].

The dagger-shaped leaves are the most used part of the plant, in which two major fractions can be identified, namely the outer, photosynthetically active green cortex, usually known as rind, and the inner parenchyma, known as pulp or fillet. Furthermore, the leaf secretes two different exudates—the reddish-yellow latex produced by the pericyclic cells under the cutinized epidermis and the transparent, slippery mucilage or gel produced by the thin-walled tubular cells in the inner parenchyma [3,4]. The gel is approximately 98% moisture, and the non-aqueous remainder largely consists of acemannan (a bioactive acetylated glucomannan) and other polysaccharides, sugars, minerals, organic acids, and vitamins [1,4,5,6]. Traditionally, it is used topically to treat wounds, minor burns, and skin irritations and internally to treat constipation, coughs, ulcers, and diabetes, among other ailments [1,7]. The latex, on the other hand, contains hydroxyanthracene derivatives, including anthraquinone C- and O-glycosides, and is a natural drug well-known for its cathartic effect and also used as a bittering agent in alcoholic beverages [8,9].

Today, *Aloe vera* is produced on a large scale in many countries around the world to supply the still growing and economically important industry [1]. For production of *Aloe vera* gel, the leaves can be processed

either by grinding the inner fillet after removing the rind (treated as bio-waste) and rinsing away the latex, or the whole leaf. However, in the second case, a subsequent filtration/purification step is required to remove unwanted constituents, especially those from latex [10,11]. The gel has been marketed fresh or in powdered concentrate and included in different formulations for food, health, medicinal, and cosmetic purposes [9,10,12].

Over the last few decades, the *Aloe vera* leaf has been the subject of several scientific studies that aimed to characterize its chemical and biological properties [4,5,6,13,14]. Still, there are compositional and bioactive parameters that deserve further study, and the flower remains an underexploited plant part. Moreover, a lack of information on the exact part of the plant analysed or even the species involved is common in many works. There are confusing descriptions, mostly about the inner part of the leaf, due to the different terms that have been used interchangeably, such as fillet, pulp, mucilage, gel, and parenchyma, among others. Technically, these terms do not refer to the same part, since fillet or pulp refer to the fleshy inner part of the leaf including the cell walls, while gel or mucilage refer to the viscous clear liquid contained within the parenchyma cells [4].

The extracts antioxidant capacity was evaluated by the in vitro assays of oxidative haemolysis inhibition (OxHLIA), thiobarbituric acid reactive substances formation inhibition (TBARS), and β -carotene bleaching inhibition (β -CBI), following methodologies previously described [28,29]. Extract concentrations ranging from 5 to 0.0159 mg/mL were used. Trolox was the positive control.

OxHLIA assay—An erythrocyte solution (2.8%, v/v; 200 μ L) was mixed with 400 μ L of either extract solution in PBS, PBS solution (control), or water (for complete haemolysis). After pre-incubation at 37 °C for 10 min with shaking, AAPH (200 μ L, 160 mM in PBS, from Sigma-Aldrich) was added, and the optical density (690 nm) was measured every 10 min in a microplate reader (Bio-Tek Instruments, ELX800) until complete haemolysis [28]. The results were expressed as IC_{50} values (μ g/mL) at a Δt of 60 min, i.e., extract concentration required to keep 50% of the erythrocyte population intact for 60 min.

TBARS assay—A porcine brain cell solution (1:2, w/v; 0.1 mL) was incubated with the extract solutions (0.2 mL) plus $FeSO_4$ (10 μ M; 0.1 mL) and ascorbic acid (0.1 mM; 0.1 mL) at 37 °C for 1 h. Then, trichloroacetic (28% w/v, 0.5 mL) and thiobarbituric (TBA, 2%, w/v, 0.38 mL) acids were added, and the mixture was heated at 80 °C for 20 min. After centrifugation at 3000 \times g for 10 min, the malondialdehyde (MDA)-TBA complexes formed in the supernatant were monitored at 532 nm (Specord 200 spectrophotometer, Analytik Jena, Jena, Germany) [29]. The results were expressed as EC_{50} values (μ g/mL), i.e., extract concentration providing 50% of antioxidant activity.

β -CBI assay—A β -carotene-linoleic acid emulsion (4.8 mL) was mixed with the extract solutions (0.2 mL) and the absorbance was measured at 470 nm as soon as mixed ($A_{\beta T0}$) and after 2 h of incubation at 50 °C ($A_{\beta T2}$). The β -CBI capacity was calculated as follows: $(A_{\beta T2}/A_{\beta T0}) \times 100$ [29]. The results were expressed as EC_{50} values (μ g/mL).[14,15,16]

IV. CONCLUSION

This study showed that 58% of the total *Aloe vera* leaf weight corresponds to inner fillet, but the green rind also accounted for a considerable percentage. The fillet consisted mainly of moisture, followed by dietary fibre and available carbohydrates (mainly glucose and fructose). Malic acid, which is an excellent freshness indicator, and α -tocopherol, a powerful fat-soluble chain-breaking antioxidant, were detected in high amounts in this jelly-like parenchyma. Based on the glycosidic-linkage composition, it was concluded that the fillet sample is composed mainly by mannans, possibly acemannan.[17,18,19]

The three leaf samples revealed similar phenolic profiles, with predominance of chromones (aloesin and 2'-*p*-methoxycoumaroylaloesin) and anthrones (aloin A and B, malonyl aloin A and B, and 10-hydroxyaloin A and B). The highest contents of phenolic compounds were found in the mucilage and rind extracts, which also revealed interesting antioxidant properties. On the other hand, the flower extract was rich in apigenin glycoside derivatives, effective against the multidrug-resistant *P. aeruginosa*, and capable of inhibiting the activity of the enzyme tyrosinase. The fillet, rind, and flower extracts also showed a powerful antifungal activity against *A. flavus*, *A. niger*, *P. funiculosum*, and *C. albicans*, higher than that of ketoconazole. Therefore, all the studied *Aloe vera* samples present high potential to be exploited by food or cosmeceutical industries.[20]

REFERENCES

1. Sánchez-Machado, D.I.; López-Cervantes, J.; Sendón, R.; Sanches-Silva, A. *Aloe vera*: Ancient knowledge with new frontiers. *Trends Food Sci. Technol.* 2017, *61*, 94–102. [Google Scholar] [CrossRef]
2. Eshun, K.; He, Q. *Aloe vera*: A valuable ingredient for the food, pharmaceutical and cosmetic industries: A review. *Crit. Rev. Food Sci. Nutr.* 2004, *44*, 91–96. [Google Scholar] [CrossRef] [PubMed]
3. Baruah, A.; Bordoloi, M.; Deka Baruah, H.P. *Aloe vera*: A multipurpose industrial crop. *Ind. Crops Prod.* 2016, *94*, 951–963. [Google Scholar] [CrossRef]
4. Hamman, J.H. Composition and applications of *Aloe vera* leaf gel. *Molecules* 2008, *13*, 1599–1616. [Google Scholar] [CrossRef]
5. Femenia, A.; Sánchez, E.S.; Simal, S.; Rosselló, C. Compositional features of polysaccharides from *Aloe vera* (*Aloe barbadensis* Miller) plant tissues. *Carbohydr. Polym.* 1999, *39*, 109–117. [Google Scholar] [CrossRef]
6. Simões, J.; Nunes, F.M.; Domingues, P.; Coimbra, M.A.; Domingues, M.R. Mass spectrometry characterization of an *Aloe vera* mannan presenting immunostimulatory activity. *Carbohydr. Polym.* 2012, *90*, 229–236. [Google Scholar] [CrossRef]
7. Maan, A.A.; Nazir, A.; Khan, M.K.I.; Ahmad, T.; Zia, R.; Murid, M.; Abrar, M. The therapeutic properties and applications of *Aloe vera*: A review. *J. Herb. Med.* 2018, *12*, 1–10. [Google Scholar] [CrossRef]
8. Saccù, D.; Bogoni, P.; Procida, G. *Aloe* exudate: Characterization by reversed phase HPLC and headspace GC-MS. *J. Agric. Food Chemistry* 2001, *49*, 4526–4530. [Google Scholar] [CrossRef]
9. Bozzi, A.; Perrin, C.; Austin, S.; Arce Vera, F. Quality and authenticity of commercial *aloe vera* gel powders. *Food Chem.* 2007, *103*, 22–30. [Google Scholar] [CrossRef]
10. The International Aloe Science Council. Available online: <https://www.iasc.org/Home.aspx> (accessed on 22 July 2019).
11. Sehgal, I.; Winters, W.D.; Scott, M.; David, A.; Gillis, G.; Stoufflet, T.; Nair, A.; Kousoulas, K. Toxicologic assessment of a commercial decolorized whole leaf *Aloe vera* juice, lily of the desert filtered whole leaf juice with aloe sorb. *J. Toxicol.* 2013, *2013*, 802453. [Google Scholar] [CrossRef]
12. Kim, K.H.; Lee, J.G.; Gyuun, D.; Kim, M.K.; Park, J.H.; Shin, Y.G.; Lee, S.K.; Jo, T.H.; Oh, S.T. The development of a new method to detect the adulteration of commercial *aloe vera* gel powders. *Arch. Pharm. Res.* 1998, *21*, 514–520. [Google Scholar] [CrossRef] [PubMed]
13. Cesar, V.; Jozić, I.; Begović, L.; Vuković, T.; Mlinarić, S.; Lepeduš, H.; Borović Šunjić, S.; Žarković, N. Cell-type-specific modulation of hydrogen peroxide cytotoxicity and 4-hydroxynonenal binding to human cellular proteins in vitro by antioxidant *Aloe vera* extract. *Antioxidants* 2018, *7*, 125. [Google Scholar] [CrossRef] [PubMed]
14. Wu, X.; Yin, S.; Zhong, J.; Ding, W.; Wan, J.; Xie, Z. Mushroom tyrosinase inhibitors from *Aloe barbadensis* Miller. *Fitoterapia* 2012, *83*, 1706–1711. [Google Scholar] [CrossRef] [PubMed]
15. *AOAC Official Methods of Analysis of AOAC International*, 20th ed.; AOAC International: Rockville, MD, USA, 2016.
16. Osborne, D.R.; Voogt, P.; Barrado, A.M. *Análisis de los Nutrientes de los Alimentos*; Editorial Acribia: Zaragoza, Spain, 1985; ISBN 8420005711. [Google Scholar]
17. Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers. *Official Journal of the European Union* 2011, *L 304*, 16–63.
18. Iyda, J.H.; Fernandes, Â.; Ferreira, F.D.; Alves, M.J.; Pires, T.C.S.P.; Barros, L.; Amaral, J.S.; Ferreira, I.C.F.R. Chemical composition and bioactive properties of the wild edible plant *Raphanus raphanistrum* L. *Food Res. Int.* 2019, *121*, 714–722. [Google Scholar] [CrossRef] [PubMed]
19. Pinela, J.; Barreira, J.C.M.; Barros, L.; Cabo Verde, S.; Antonio, A.L.; Carvalho, A.M.; Oliveira, M.B.P.P.; Ferreira, I.C.F.R. Suitability of gamma irradiation for preserving fresh-cut watercress quality during cold storage. *Food Chem.* 2016, *206*, 50–58. [Google Scholar] [CrossRef] [PubMed] [Green Version]
20. Pereira, C.; Barros, L.; Carvalho, A.M.; Ferreira, I.C.F.R. Use of UFLC-PDA for the analysis of organic acids in thirty-five species of food and medicinal plants. *Food Anal. Methods* 2013, *6*, 1337–1344. [Google Scholar] [CrossRef]



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details