# MINERAL CONTENT AND SOME OPTICAL PROPERTIES OF *ALOE VERA* JUICE

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## ABSTRACT

**INTRODUCTION: Aloe (Aloe barbadensis Miller) is the most used medicinal plant in the world. Many of its beneficial properties are due to the presence of proteins, carbohydrates, amino acids, trace elements, etc. in the gel found in its leaves. It is part of various nutritional supplements, juices, cosmetic products, etc.**

**AIM: The aim of the present study is to compare the elemental composition and fluorescence spectra of a natural aloe vera gel and one with different additives.**

**MATERIALS AND METHODS: The present study investigated and compared two types of commercial products, pure *aloe vera* gel and *aloe vera* supplemented with other plant species (*aloe vera* &). The content of some minerals in the two products was analyzed by flame atomic absorption spectrometry (FAAS). A fiber optic spectrometer was used to measure the fluorescence spectrum of the studied samples.**

**RESULTS: The emission peaks of the fluorescence spectrum of the samples are due to the content of phenolic compounds and antioxidants. Addition of honey, agave syrup, and acai puree to aloe vera gel resulted in a significant change in Mg and Fe contents, while Mn, Zn, and Cu were less affected.**

**CONCLUSION: Both tested *aloe vera* gel products (with and without additives) showed the presence of phenolic compounds, antioxidants, and high concentrations of magnesium.**

**Keywords:** *Aloe vera gel, elemental composition, fluorescence spectra*

## INTRODUCTION

There are more than 400 species of aloe in the world, belonging to the *Liliaceae* family and native to South Africa. Of these, *aloe vera* (*Aloe barbadensis* Miller) is the most researched and most used plant in folk medicine. It has characteristic leaves with sharp, lance-shaped tips. Its leaves contain two main sources of fluid, a yellow latex and a clear gel. The latex layer contains aloin, which has been proven to have negative effects on the human body (1), while the aloe vera gel contains more than 200 bioactive substances (2) and is believed to have various beneficial pharmacological properties.

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For example, it accelerates wound healing (3,4). *Aloe vera* (*Aloe barbadensis* Miller) has been shown to have a positive effect on collagen content, which promotes wound healing in rats through topical or oral application of gels (5). *Aloe vera* (*Aloe barbadensis* Miller) has anti-carcinogenic effects (6). Its juices and gel can also be used to treat oral infections (7). The most common way of administration is to take the gel orally (8). Since *aloe vera* (*Aloe barbadensis* Miller) can provide many benefits to human health, the industry already offers many products—aloe drinks, nutritional supplements, ointments and cosmetic products such as soaps, shampoos, creams, lotions, etc. Their production and variety is increasing every year. In order to obtain more effective and high-quality products, other healthy components are often added to the gel. When it comes to drinks, juices, nectars or purees from other fruits are most often added—mangoes, blueberries, apples, etc. This gives the drinks not only a different taste, but also additional phytonutrients and minerals.

## AIM

The aim of the present study is to compare the elemental composition and fluorescence spectra of a natural *aloe vera* (*Aloe barbadensis* Miller) gel and one with different additives.

## MATERIALS AND METHODS

### *Samples*

The following products were purchased from the market:

- natural *aloe vera* gel (aloe vera)
- *aloe vera* gel 89.5%, honey 5%, agave syrup 3%, acai puree 2% (aloe vera &).

### *Determination of Elements*

A sample of about 10 g was weighed on an analytical balance (Sartorius Secura 224-1S Balance, Goettingen, Germany) and treated with $HNO_3$ (65%, Suprapur®, Merck, Germany) on a hot plate to remove the organic part. The residue was transferred into a 25-mL flask and diluted with distilled water. A Thermo SOLAAR M5 flame atomic absorption spectrometer with deuterium background correction (Thermo Scientific, USA) was used. Standard solutions of Mg, Fe, Zn, Cu, and Mn (1,000 g $L^{-1}$ (Merck, Germany) were used to prepare diluted working calibration standards for flame AAS. Samples were further diluted as necessary

### *Fluorescence Measurements*

A pair of plates was used to measure the fluorescence spectrum of the investigated samples, with the receiving optical fiber placed between the two plates and the receiving end immersed in the sample. The sample in the section before the receiving fiber was irradiated transversely with a parallel beam of light from the corresponding light-emitting diode (LED).

In this way, the optical fiber received a fluorescence signal perpendicular to the excitation radiation, thereby minimizing illumination from stray excitation radiation. Semiconductor diodes operating at wavelengths of 245, 285, 370, 380, 390, and 400 nm, respectively, were used.

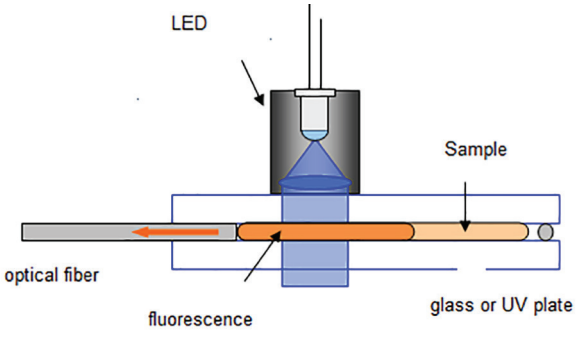


*Fig. 1. Scheme for measuring weak fluorescence of absorbing samples*

## RESULTS AND DISCUSSION

Plants are a valuable source of minerals for humans. The essential macro- and micronutrients influence many biochemical processes in living organisms and are of great importance for human health (9). Their deficiency or excess can cause a number of diseases, so an optimal daily intake of essential minerals is recommended (10). For example, diabetics have been found to be deficient in elements such as Mg, Fe, Zn, Mn, and Cu. These elements are involved in insulin secretion and their optimal concentration levels can significantly improve glucose tolerance (11). In addition to phytotherapy, medicinal plants can also be used as dietary supplements of essential minerals (12). Studies on the mineral composition of various species of *aloe vera* (*Aloe barbadensis* Mill-

er) from different geographical regions show that, in addition to its many pharmacological properties, the plant can also be a good source of essential elements (11, 13, 14). *Aloe vera (Aloe barbadensis* Miller) gel is about 99% water and 1% solids, with water-soluble minerals making up about 16% of it (15).

In the present work, the content of Mg, Fe, Zn, Mn, and Cu in the two *aloe vera* products was analyzed by the flame atomic absorption spectrometry (FAAS) technique. The results of the analysis are given it Table 1.

Magnesium is a macronutrient for plants. As expected, its concentration in both types of aloe vera products is significantly higher than concentration of the other elements. It can be seen that the pure *aloe vera* (*Aloe barbadensis* Miller) gel contains about 10 mg/kg more Mg than the supplemented product. This may be due both to the specific conditions in which the plant grew (geographical location, climate, and type of the soil) and to the fact that the pure gel is extracted from the leaves, in which Mg is an important component of chlorophyll.

*Table 1. Concentration of Mg, Fe, Zn, Cu, and Mn in the tested samples (RSD = 3–7%).*

| Sample | Mg, mg kg$^{-1}$ | Fe, mg kg$^{-1}$ | Zn, mg kg$^{-1}$ | Cu, mg kg$^{-1}$ | Mn, mg kg$^{-1}$ |
|---|---|---|---|---|---|
| (1) *Aloe vera* | 43.5 ± 3 | 2.15 ± 0.1 | 0.28 ± 0.01 | 0.18 ± 0.01 | 1.48 ± 0.04 |
| (2) *Aloe vera* & | 33.1 ± 2 | 1.35 ± 0.1 | 0.32 ± 0.01 | 0.22 ± 0.01 | 1.67 ± 0.05 |

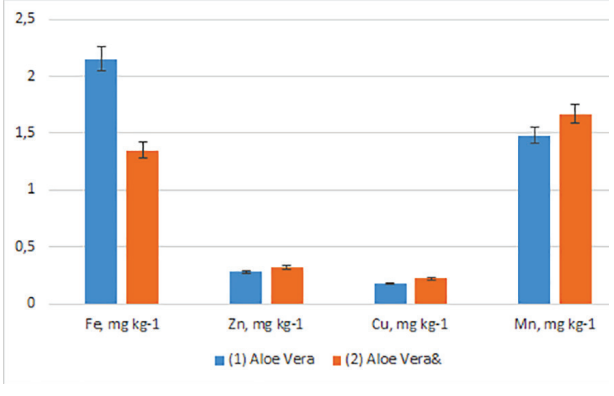


*Fig. 2. Concentrations of Fe, Mn, Zn and Cu in the samples*

The concentrations of micronutrients Fe, Mn, Zn, and Cu in the two samples are compared on Fig. 2. It is noteworthy that the pure *aloe vera* (*Aloe barbadensis* Miller) gel contains more Fe than Mn, while the reverse relationship is observed in the supplemented product. Research shows that the acai berries included as an additive in the second sample are extremely rich in Mn. Among 47 other fruits, acai berry has the highest content of this essential element (16). The content of Zn and Cu in both samples is significantly lower than that of Fe and Mn. The aloe vera & product is slightly richer in zinc and copper than pure *aloe vera* (*Aloe barbadensis* Miller) gel.

Upon excitation with short-wavelength light waves, *aloe vera* (*Aloe barbadensis* Miller) samples showed

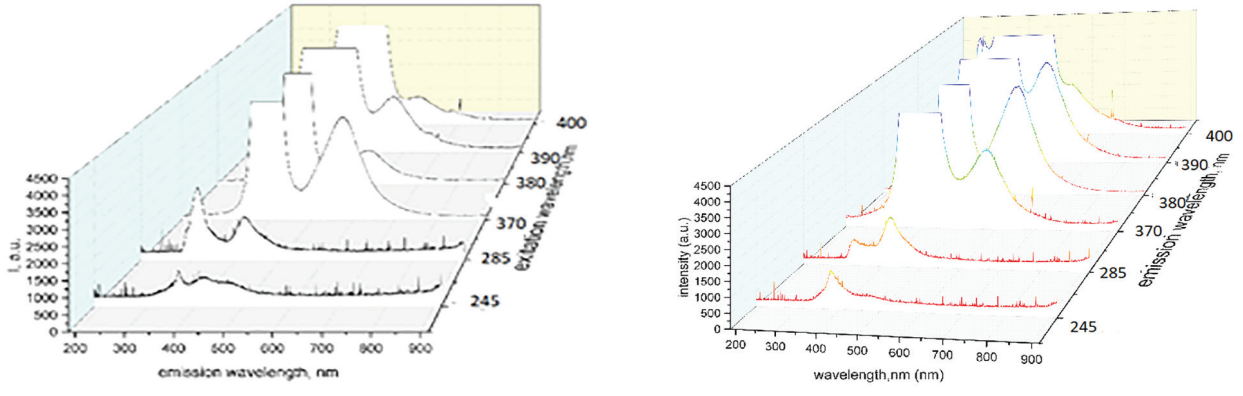


*Fig. 3. Fluorescent spectra in visible range (a) aloe vera, (b) aloe vera &*

a relatively weak peak at around 450 nm, which could be attributed to the presence of phenolic compounds contributing to the antioxidant activity of aloe products. For the pure gel, this peak was more pronounced compared to the supplemented *aloe vera* (*Aloe barbadensis* Miller) gel. Upon excitation with a light wave from the visible range, a relatively intense chlorophyll peak was observed. The available literature does not provide information from studies on the fluorescence measurements for *aloe vera* (*Aloe barbadensis* Miller) gel, but there are plant leaf fluorescence data to estimate chlorophyll and pigment content in the presence of water and light stress in plants (17).

## CONCLUSION

This research adds to the scientific knowledge of *aloe vera*. The elemental composition was investigated and fluorescence spectra of a gel made only from aloe vera and one with additives were obtained. It was found that the addition of honey, agave syrup, and acai puree to *aloe vera* gel significantly changed the contents of Mg and Fe, while Mn, Zn, and Cu remained less affected. The observed emission peaks in the fluorescence spectrum at the wavelengths used are related to the presence of phenolic compounds and antioxidants.

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