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An Innovative Method for Using Himalayan Alkaline Water to Enhance the Production of Bioactive Secondary Metabolites in Aloe Vera Barbadensis

Junaid H. Saeed, Hayder S. Muttaleb
Iraqi Inventors and Researchers Syndicate, Baghdad, Iraq

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Abstract: This work utilized Himalayan alkaline water technology, in specific proportions, to enhance the active substances in the Aloe Vera Barbadensis plant. This approach aims to leverage the plant's known medicinal and economic benefits, stemming from its therapeutic compounds utilized since antiquity in medicine and cosmetics. By applying Himalayan alkaline energy water to the aloe vera plant, an increase in these active substances was achieved through a simple, scientific method. The Himalayan alkaline water has secured international and local patents, signifying a breakthrough due to its unique properties that improve active substance effectiveness per unit area compared to regular water. Salicylic acid, a key compound with unique properties found in aloe vera, was a particular focus. Active substances were measured using specific devices, comparing plants watered with regular water versus Himalayan water (both neutral and alkaline) through lyophilization and pH analysis. Gas chromatography–mass spectrometry (GC–MS) was employed to detect substances like flavonoids. Results

indicated that alkaline Himalayan water surpassed both neutral Himalayan water and regular water in terms of the proportion and quantity of active ingredients.

Introduction

Himalayan alkaline water is associated with the concept of structured water or biowater. Studies indicate the presence of an additional phase of water known as the exclusion zone (EZ) [1,2,4], which contributes to biological reactions and cell functions. Hypotheses have also been proposed regarding the formation of coherent quantum fields [3], and nanostructures are stable even after dilution [7], supporting the idea that water may carry information or memory [5,6]. Philosophically, it is viewed as a medium of consciousness and harmony [8,9], while some studies add a controversial cultural and spiritual dimension [10]. Thus, the degree of dependence of the Himalayas is not only a means of hydration and balance, but is perceived and then understood for the structure of endurance in the intellectual and philosophical structure.

Aloe vera (barbadensis Aloe), a member of the Liliaceae family, is a perennial plant with fleshy green leaves connected to the stem in a rosette shape. It is widespread and considered a succulent species in many regions of the world. The aloe leaves consist of a thick skin covered by a surrounding tissue that can be differentiated into chlorenchyma cells and cells with thinner walls forming the parenchyma. The majority of the leaf in terms of size contains the aloe gel, which is synonymous with the inner leaf or leaf fillet [11-12]. Aloe vera is considered one of the easiest succulent plants to care for in reality, as it actually needs dry periods between waterings, as it is usually used to dry arid conditions due to its origin from Africa and the Arabian Peninsula [13-14]. It is a perennial evergreen plant, native to the Arabian Peninsula, but also grows wild in tropical, subtropical, and arid climates around the world [15-17]. It is cultivated for commercial products, mainly as a topical treatment used for centuries. This type is attractive for decorative purposes, and succeeds in indoor use as a potted plant [18-19]. Aloe vera leaves contain large amounts of polysaccharide-rich acemannan, which can be used for topical purposes. Aloe vera skin contains aloin, a toxic substance usually used in products made from aloe vera gel only. Aloe vera Linnaeus or barbadensis Aloe is a succulent tropical plant. Aloe vera gel is obtained from the leaves of the aloe plant and contains 99.5% water, with the remaining part of the gel consisting of carbohydrates, mucilaginous polysaccharides, proteins, enzymes, anthraquinones, chromones, minerals, vitamins, and phenolic compounds [20-21]. Aloe vera has immune, moisturizing, wound healing, antioxidant, anti-inflammatory, anti-tumor, antibacterial, and antifungal effects. It is important to highlight that aloe vera has a long history in providing countless health benefits. Being one of the most used herbal treatments in the various diseases, which is mainly related with sugars and major phenolic compounds, the biologically active ingredients in aloe vera, however, the geographical location including soil and climate, growth periods, horticultural conditions, and post -harvesting transfers [13-19]. As a result of this effect, the role of the importance of the elements of Himalayan salts in the water appeared, as shown in the attached tables and accompanying graphs.

Experimental part

A group of Aloe Vera Barbadensis (AVB) plants were watered with 750 ml of regular water and alkaline Himalayan water when the plant needed watering every 27 hours. The results of the analyses issued by the Industrial Research and Development Authority (Plant Extraction Research Division Instructions) at Ibn al-Bitar Research Center revealed the effect of regular water and alkaline Himalayan water on the active ingredients found in the aloe vera plant.

Results and Discussions

From Phytochemical Screening tests which carried out at Ibn Al-Bitar Research Center, Industrial Research and Development Directorate, Plant Extraction Research Division. The phytochemical screening was performed for two *Aloe vera* samples: one treated with normal water and the other treated with alkaline Himalayan water with Ph scale 9.0 and under room temperature as shown in figure 1 and 2. The results were obtained as mentioned in Tables 1 and 2.

Fig 1. Aloe vera plant treated with regular water.

Fig 2. Aloe vera plant treated with alkaline Himalayan water.

Alkaline treatment of Himalayan water stimulates the aloe vera plant to produce flavonoids and coumarins, both of which are secondary metabolites produced by plants. They are active substances with antioxidant and anti-inflammatory properties due to their effect on bacteria, fungi and viruses, and are anti-cancer. These substances also have medicinal and therapeutic properties, as they work to reduce the incidence of heart disease and blood vessels, high fat and sugar, the presence of these substances was proven using chemical reagents that form color reactions that show the presence of these active substances or not, and do not give numerical measurements or percentages [20-25].

Table 1. Phytochemical Screening of *Aloe vera* Extract (regular water)

Test type	Results
Tannins	+
Carbohydrate	+
Glycosides	+
Phenols	-
Resins	-
Flavonoid	-

Saponin	+
Alkaloid	+
Protein	-
Coumarins	-
Terpenes	-
Steroid	-

Table 1. Phytochemical Screening of *Aloe vera* Extract (alkaline Himalayan water)

Test type	Results
Tannins	+
Carbohydrate	+
Glycosides	+
Phenols	-
Resins	-
Flavonoid	+
Saponin	+
Alkaloid	-
Protein	-
Coumarins	+
Terpenes	-

Overall, normal water treatment preserved a richer phytochemical profile, while alkaline water appeared to alter secondary metabolism and reduce bioactive diversity [5].

GAS Chromatography mass spectroscopy GC-MASS was examined for two samples that were treated with normal water and Himalayan alkaline water as shown in Figure 3 and 4. The results show that the sample that was treated with Himalayan alkaline water was dominated by nitrogenous and cyclic compounds such as Pyrimidine, 4,6-dimethoxy-5-nitro, Ethane dicarboxamide, N-allyl-N'-(2,5-dimethylphenyl), Urea, and presence of Furandione, dihydro-3-methylene-2,5 it is a compound associated with oxidation or breakdown processes of organic molecules. The proportions between the compounds are close (about 48-51%), which indicates the presence of multiple secondary compounds formed from non-fatty metabolic pathways [23-27].

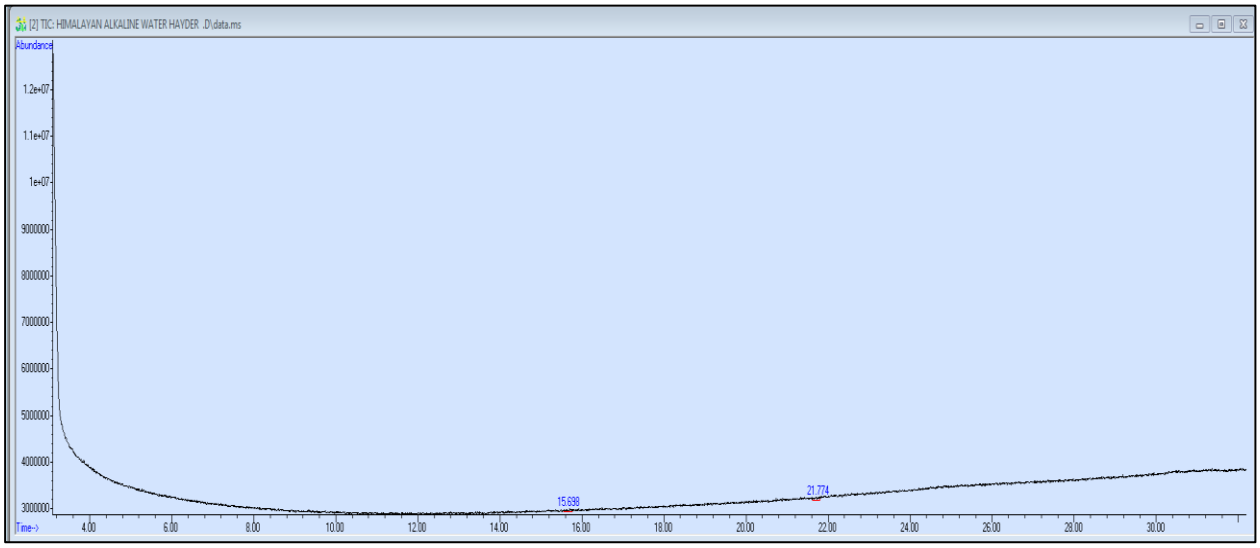

Fig 3. GC-MASS of Aloe vera plant treated with Himalayan alkaline water

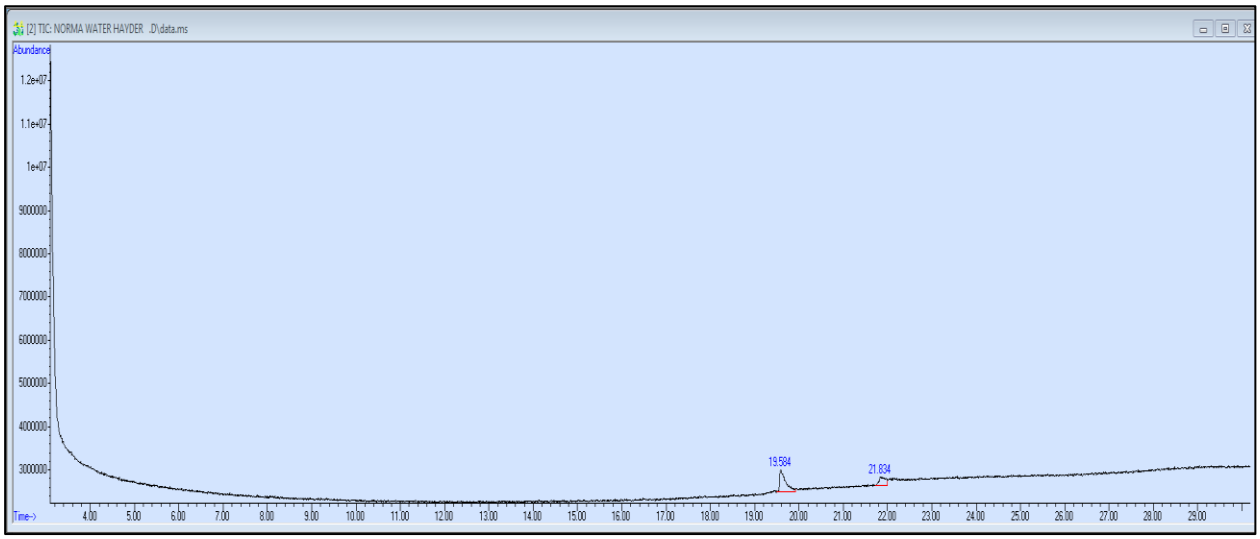

Fig 4. GC-MASS of Aloe vera plant treated with regular water

While the results of the examination of the sample that was treated with plain water showed that the compound hexadecenoic acid, methyl ester was clearly dominant, as its percentage was 70.54%, which is a fatty acid ester common in plants and indicates that the plant maintains its natural fat content. Other compounds such as cis-Aconitic anhydride are associated with carboxylic acid metabolism pathways and organic acid biosynthesis.

Possible Effects of Himalayan Alkaline Water can modify the pH (=9.0) within Aloe vera cells, influencing enzyme activity and metabolic pathways. Elevated alkalinity may prompt the plant to synthesise nitrogenous and cyclic chemicals (such as pyrimidine and urea) rather than accumulating fatty acids. The plant may recognise alterations in water quality as a stressor, so triggering pathways for the synthesis of defensive or adaptive chemicals. Nitrogenous cyclic molecules frequently serve defence or regulatory roles in plants. Reduced synthesis of lipid substances. The diminished presence of methyl ester and Hexadecenoic acid in the treated sample relative to the untreated sample indicates that the metabolic route for fatty acid synthesis has been altered or redirected [-33 28].

We find that treatment with Himalayan alkaline water has altered the secondary metabolites in the Aloe vera plant, shifting from a predominance of fatty compounds in the untreated plant to a predominance of nitrogenous and cyclic compounds in the treated plant. This transformation may indicate three possibilities: firstly, modified metabolic pathways resulting from pH alterations. Secondly, a potential defence reaction of the plant. Thirdly, impacts on the equilibrium of mineral elements and nutrients inside the tissues.

Alterations in pH may compel the plant to reallocate energy and metabolic resources towards the synthesis of proteins and nitrogenous substances to facilitate adaptive processes. The excerpt suggests that the treated plant is experiencing a nitrogen rebalancing process as a result of alkaline water conditions. Nucleotide synthesis to stress response (Furandione) derived from 4. (Pyrimidine) The stress response is linked to the stimulation of pyrimidine compound formation, which is utilised in DNA and RNA synthesis or as defense agents. This route may facilitate plant cells in repairing damage or adapting to new environments. The alkaline Himalayan water used in this study has been previously described in patents [34-38].

Conclusion

The effectiveness of alkaline Himalayan water on the Aloe Vera (Barbadensis) plant (Aloe Vera) to obtain flavonoids and the active ingredient salicylic acid. High alkalinity may reduce the activity of enzymes responsible for fatty acid synthesis and increase oxidation processes, leading to the accumulation of compounds such as furandione. Untreated plant maintains normal activity of fatty acid pathways and energy cycle. Plant treated with alkaline Himalayan water: Shifts its activity

towards stress pathways and nitrogenous compounds, with reduced fatty acid production.

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