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Aloe Vera: Optimizing Extraction and Evaluation for Therapeutic Benefits

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Abstract: *Aloe vera belongs to the family Xanthorrhoeaceae commonly known as Ghrit Kumari, is the oldest medicinal plant ever known and the most applied medicinal plant worldwide. Phytochemistry of aloe Vera gel has revealed the presence of more than 200 bioactive chemicals.The Proximate composition involves the moisture content, crude protein, crude fibre, crude fat, ash content and carbohydrate. Phytochemicals determined were Saponins, Glycosides, Cardiac glycoside, Saponin glycoside, Alkaloids, Balsams, Volatile oil, Anthraquinone, Tannin, Steroid and Flavonoids. Aloe barbadensis was found to be rich in Carbohydrate (78.88%), so it can be used as a good source of Carborhydrate. Results revealed very profound activities of the plant extracts against the tested gram positive strains including Staphylococcus aureus, Bacillus subtilis, Bacillus atrophoeus and gram negative bacterial strains ie. Escherichia coli, Klebsiella pneumoniae. Salmonella typhi. The extracts also showed considerable activity against the tested fungal strains Aspergillus flavus, Aspergillus niger and Candida albicans methanol was selected as organic solvent as fond maximum extraction of aloin with it the active principle aloin was quantified using WATER's HPLC system. The external use in cosmetic primarily acts as skin healer and prevents injury of epithelial tissues, cures acne and gives a youthful glow to skin, also acts as extremely powerful laxative.*

Keywords: Aloe vera, Extraction, Antioxidant

I. INTRODUCTION

Aloe vera (Syn. Aloe barbadensis Mill), a monocotyle donous plant, belonging to family Asphodelaceae (Ali & Qaiser, 2005) and is indigenous to the Eastern and Southern Africa, the Canary Island and Spain. The genus comprises about 300 perennial species (Reynolds 1985). Aloe vera, a monocotyledonous, is a member of the family liliaceae. The genus Aloe has more than 500 species but only a few are medicinally important (Deng et al., 1999). Aloe vera is well known for its marvelous medicinal properties. These plants are one of the richest sources of health for human beings coming from nature. It has been grown as an ornamental plant widely. Products of the plant are used in the treatmentof various ailments.There are over 250 species of aloe grown around the world. Only two species are grown commercially. Aloe barbadensis Miller and Aloe aborescens. The Aloe plant is grown in warm tropical areas and cannot survive freezing temperatures. In the United States, most of the Aloe is grown in the Rio Grande Valley of South Texas, Florida and Southern California. Intemationally, Aloe can be found in Mexico, the Pacific Rim countries, India, South America, Central America, the Caribbean, Australia and Africa .In Chinese medicine its skin and inner layer of leaves is described as a bitter cold recipe which is used to cure constipation because of heat accumulation; while its gel is moist and cold [4]. According to India's traditional medicine, Ayurveda, it is internally used as antihelminthic, laxative, uterine stimulant and 11 remedy against hemorrhoid. Externally it is used for the treatment of psoriasis and eczema, often in combination with licorice roots. Its gel is used to relief headache, coolant, laxative, disinfectant, anti-conjunctivitis and wood healing agent in Arabian medicine.Aloe vera is a stem-less or very short stemmed plant growing from 30-100 cm tall spreading by offsets. The leaves are thick and fleshy green to gray green in color. With some varieties showing white flecks on their upper and lower stem surface (Yates, 2002). Leaves are Lancelot and thick with serrated margin (Bourdreau and Beland, 2000).

Active Ingredient:
Leaves have three layers.

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1. Outer Protective Layer of Leaf

The outer most layer consist of the bitter yellow latex of pericyclic tubules in the outer layer of the leaves contain derivatives of hydroxyanthracene, anthraquinone and glycosides aloin A and B from 15% 40% in different investigations. The other active principles of Aloe include hydroxyanthrone, aloe- emodin-anthrone 10-C-glucoside and chrones.

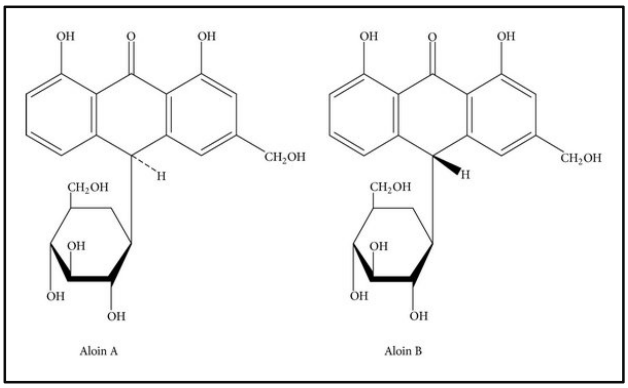

Fig.1

2. Middle layer of leaf

The bitter yellow latex containing anthraquinones and glycosides has been reported from the middle layers of cyclic acids, and amino acids. The juice that is originated from cells of the pericycle and adjacent leaf parenchyma, flowing spontaneously from the cut leaf get dried with or without the aid of heat and get solidified should not be confused with Aloe Veragel which is also the colorless mucilaginous gel that is obtained from the parenchymatous leaf cells The parenchymatous tissue or pulp shown to contain proteins, lipids, amino acids, vitamins, enzymes, inorganic compounds and small organic compounds in addition to the different carbohydrates.

3. Inner layer of leaf

The innermost layer of leaf gel contains water up to 99%, with glucomannans, amino acids, lipids, sterols and vitamins. Structure It has numerous monosaccharide's and polysaccharides; vitamins B1, B2, B6, and C niacinamide and choline, several inorganic ingredients, enzymes (acid and alkaline phosphatase, amylase, lactate dehydrogenase, lipase) and organic compounds (aloin, barbaloin, and emodin) as described.

II. MATERIALS AND METHOD

Collection of samples:

The whole fresh plant of Aloe vera (Aloe barbadensis Miller) was collected from the biological garden of Samarth institute of pharmacy, Belhe. The plant was identified and authenticated in the herbarium of Department of Biological Sciences, Samarth institute of pharmacy, Belhe

Plant Extraction and Concentration Formulation:

Fresh sample of Aloe vera leaf was cut into small pieces: 50g of the sample was weighed on weighing balance, the weighed sample (i.e. 50g in weight) was grinded using sterile blinder, the grinded sample was soaked into 100 ml of distilled water for 24 hours. The aqueous plant extract concentration was filtered using fine muslin cloth. The filtrate obtained was 100% extract concentration.

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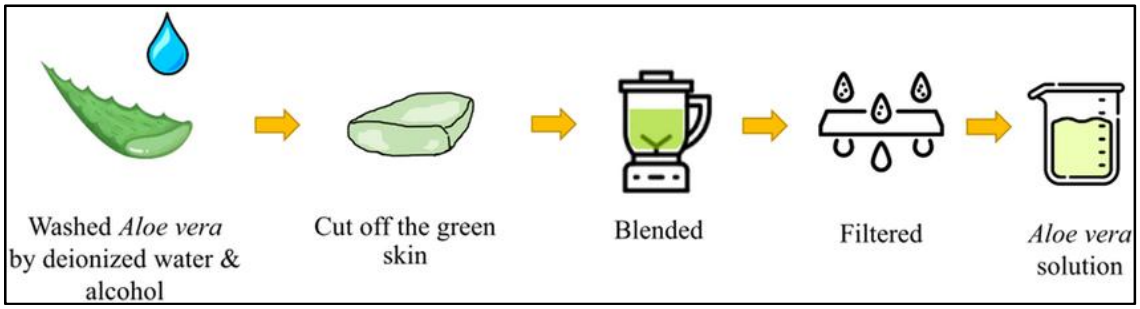

Fig.2

Screening of phytochemical constituent:

Flavonoid test

Ammonia solution (5ml) was added to a small portion of filtrate of chloroform extract followed by addition of conc H_2SO_4 A yellow coloration observed in each extract indicated the presence of flavonoids. The yellow coloration disappears on standing.

Tannins test

Five milliliters of extract were taken and boiled with 20ml of $CHCl_3$. On addition of 0.1% $FeCl_3$ solution to the filtrate and appearance of brownish color shows the presence of tannin.

Saponins test

About five milliliter of citrus sample was taken and boiled in 20 milliliters of $CHC1_3$ and filtered. To the 10-milliliter filtrate added five milliliters of double distilled water with 3 drops of olive oil, emulsion formation shows the presence of saponins.

Terpenoids test

Five milliliter of the sample was added to 2 milliliter of CHCls and three milliliter of conc. H_2SO_4. The formation of reddish brown colour would show the presence of terpenoids.

Steroids test

In this test 2ml of acetic anhydride and 2ml of H_2SO_4 were added to 5ml extract from each sample. Change of colour blue from violet would indicate the presence of steroids.

Cardiac glycocides test

Five milliliter of each sample juice was treated with two milliliter of glacial acetic acid containing one drop of $FeCl_3$ solution, this was under layered with 1 milliliter of conc. H_2SO_4. A brown ring shows the deoxy sugar characteristics of caredenolides.Sometime a violet ring may form indicating cardiac glycoside.

Sr. No.	Name of the test	Chloroform extract	n-Hexane extract
1	Tannins test	Positive	Positive
2	Saponin test	Positive	Positive
3	Flavonoids test	Positive	Negative
4	Steroids test	Positive	Positive
5	Terpenoids test	Positive	Positive
6	Cardiac glycoside test	Positive	Positive

Quantitative Analysis:

Determination of carbohydrates

The nitrogen free extraction (NFE) referred to as soluble carbohydrate was not determined directly but obtained as a difference between crude protein, sum of crude ash, lipid and crude fibre (Bakare, 1984).

Formula:

NFE = 100% - (% Ash+%crude lipid + Crude fibre + %Crude protein)

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Calcium and magnessium determination

Calcium and Magnesium were determined by EDTA methods. Calcium was obtained by pipetting 2ml aliquots of the samples solution into filtration flask. Three drops each of KCN, NH3. OH and Triethanolalamine were added together with 0.3g of Murexide and they were then filtrated with EDTA solution to the end point from pink to purple.

Formula:

% Ca = TV x 0.01 x 1000 / 20ml

Where

%Ca = percentage of calcium

TV = Titre volume of calcium.

0.01= standard EDTA concentration

1000 = unit measurement

20= Aliquot sample

Formula:

%Mg = TV x 0.01 x 100 / 20

Countercurrent Chromatography :

CCC separation and analysis of the fractions by HPLC After the stationary phase was fulfilled in the multilayer coiled columns, the crude aloin solution was injected into the column through the inlet by a syringe. Then, the mobile phase was pumped into the column at the flow rate of 0.8 mL/min, after the column was rotated at800 rpm of rotation speed. The effluent from the column outlet was collected into test tubes using a fraction collector (Advantec Co., Tokyo, Japan) at 2 min/tube and measured the absorbance at 300 or 430 nm, and then applied to the HPLC analysis. The HPLC conditions are as follows: column: Inertsil ODS-4, eluent: (A) 0.1% phosphoric acid, (B) MeOH, A/B = 45 : 55 for aloesin, aloenin, barbaloin and isobarbaloin, A/B = 10 : 90 for emodin and aloe-emodin, flow rate: 1.0 mL/min, column temperature: room temperature, detection: 300 nm or 430 nm.

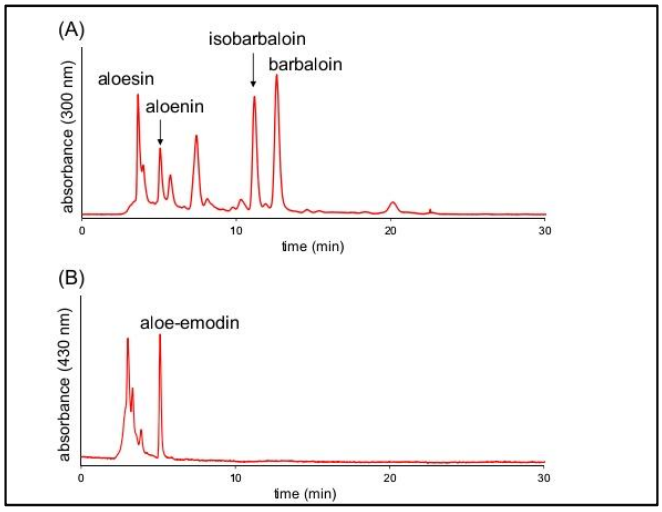

Fig.3

Clinical effects :

Wound healing

Clinical investigations suggest that Aloe Vera Gel preparations accelerate wound healing. In vivo studies have demonstrated that Aloe Vera Gel promotes wound healing by directly stimulating the activity of macrophages and fibroblasts. Fibroblast activation by Aloe Vera Gel has been reported to increase both collagen and proteoglycan synthesis, thereby promoting tissue repair. Some of the active principles appear to be polysaccharides composed of several mosaccharides, predominantly mannose. It has been suggested that mannose 6-phosphate, the principal sugar

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component of Aloe Vera Gel, may be partly responsible for the wound factor receptors on the surface of the fibroblasts and thereby enhance their activity.

Burn treatment

Aloe Vera Gel has been used for the treatment of radiation bums. Healing of radiation ulcers was reported in one study in patients treated with Aloe Vera cream, although the fresh gel was more effective than the cream. Complete healing was reported in another study, after treatment with fresh Aloe Vera Gel, in patients with radiation burns. Twenty- seven patients with partial-thickness burns were treated with Aloe Vera Gel in another placebo-controlled study. The Aloe Vera Gel-treated lesions healed faster than the burns treated with petroleum jelly gauze (18.2 days), a difference that is statistically significant (t-test, $P<0.002$).

Laxative Effects:

Anthraquinones present in latex are a potent laxative; it's stimulating mucus secretion, increase intestinal water content and intestinal peristalsis After oral administration aloin A and B, which are not absorbed in the upperintestine, are hydrolyzed in the colon by intestinal bacteria and then reduced to the active metabolites (the main active metabolite is aloe-emodin-9-anthrone) which like senna acts as a stimulant and irritant to the gastrointestinal tract Aloe latex is known for its laxative properties. The laxative effect ofAloe is not generally observed before 6 hours after oral administration, and sometimes not until 24 or more hours after.

Anti Diabetic

The five phytosterols of A. Vera, lophenol, 24-methyl- lophenol, 24-ethyl-lophenol, cycloartanol and 24-methylenecycloartanol showed anti-diabetic effects in type-2 diabetic mice. Aloe Veracontains polysaccharides which increase the insulin level and show hypoglycemic properties Traditional anti-diabetic 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.

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IV. CONCLUSION

This study has revealed the presence of many secondary metabolites in the leaves of A. barbadensis. It was further confirmed that the plant extracts could be used for the treatment of various infections and malfunctions in the body. The high concentration of alkaloids and moderate concentration of Tannins and Saponins and low concentration of Glycosides in the plant have therefore justified the widespread usage of the plant in traditional medicine. The high contents of Carbohydrate and crude fibre and lipid with a little bit of Protein; The nutritional and medicinal plant constituents could therefore, be used as a reason for use of the plant as an important dietary source of nutrients in a food based approach for combating micronutrient deficiency. The mineral analysis indicates that A. barbadensis contain macro/major elements which are needed in high quantity in meals with potassium being the highest; Sodium and Magnesium were also found to be abundant in this plant. These are all good indications of high nutritive value.

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