Extraction methods of Alhagi Maurorum (camel thorn) and its therapeutic applications

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Abstract. Alhagi maurorum (A. maurorum) is one of the medicinally important plants that belongs leguminasae family, commonly known as Camel thorn. This article we will present the methods of Alhagi maurorum plant extraction, the compounds of the extract and the compounds in the plant extract and its various therapeutic applications in the medical field and highlight the importance of plant extracts as alternatives to manufactured medicines with multiple side effects, the plant extracts has many compounds the most important is flavonoid and phenolic because of their therapeutic properties such as anti-oxidants and anti-inflammatory.

Keywords: Alhagi maurorum, Alcoholic extracts, Camel thorn, anti-oxidant, anti-inflammatory.

1. Introduction

Plants are considered as valuable and important source for human food and animal feed, well as natural remedies to cure many health disorders. Plants contain different bioactive compounds commonly classified as secondary metabolites [1]. Phenolic and flavonoids are the most common plant-based bioactive phytochemicals that is abundant in the kingdom Plantae. A multitude of bioactive phytochemicals has been explored as indispensable origin of novel antimicrobial, anti-tumor, cholesterol-lowering, immunomodulatory, anti-inflammatory, and antioxidant agents[2]. Since ancient times, herbs have been used to protect human and treat chronic health maladies in addition to flavor food improvement[3]. Alhagi camelorum belongs(Figure 1) to the family of (Fabaceae) Leguminosae, which includes 550 genera and 13,000 species, many of which are used in traditional medicine and pharmaceutical purposes [4,5]. The species of A. maurorum is legumes[6]. Alhagi maurorum , commonly known as Camel thorn showed a potential anti-inflammatory, anti-rheumatic actions in Rajasthan[7] and in traditional medicine[8]. This grows in different regions of Iran, especially the north to the border of central deserts, North Africa, Saudi Arabia, Syria, Iraq, Turkmenistan, Central Asia and other countries[9,10]. Alhagi species contains many active constituents such as flavonoids, fatty acids, coumarins, sterols, vitamins, and alkaloids[11]. is review highlights the importance of Alhagi camelorum as an alternatives natural source for therapeutic instead of manufactured pharmaceutical compounds and describes methods of extraction.
2. Method of Extraction of Alhagi maurorum

2.1. Alcoholic Extraction

To prepare the Alhagi camelorum alcoholic extract, after providing the aerial parts and removing impurities, 800 g of the collected plant samples were crushed and mixed with ethyl alcohol 98% by the ratio of 1 : 5. The obtained content was kept in a package for 48 h and then carefully filtered by passing through different sizes filters. The filtrate was, concentrations (about 15 g per 100 g of crushed plant) and used to prepare a series of different diluted concentrations by normal saline [13]. The aerial parts of the plant were dried under shade and powdered. Powdered plant material (500 g) was extract out using Soxhlet extractor at 60 °C using 95% ethanol. The percentage yield was found to be 34% w/w. The fractionation was done according to a previous method [14]. The aerial parts of plant were cleaned and dried in shade for 14 days and then bowdlerized for maceration extraction. To prepare ethanolic, methanolic, and aqueous-acetic acid extracts, 25 g of powder was extracted using 100 ml of solvents containing 90% ethanol, 80% methanol, and 2% aqueous acetic acid respectively. The solutions were shaken for 48 h, filtered and incubated at 40°C in order to remove the solvents [15]. Thirty-two compounds in methanolic extract [16]. The GC-MS is a method used for screening, identification and quantification of several compounds in plant extracts. Gas chromatography (GC) is used to separate drugs that exist in the sample. The retention time (RT) is an identifying distinctive of a drug. The mass spectrometry (MS) is the detector for the GC[17].

2.2 Aqueous Extraction

To obtain aqueous extract, powdered plant material (500 g) was extract out with distilled water by cold percolation method. The yield % was found to be 20% w/w[14]. A weight of 10g of the prepared powder was diluted with 100 ml of distilled water and let to infuse. After 48h the solution was centrifuged at was 2000 cycle/minute for 10 minutes. The fluid was used after passing through filter papers. Extracts prepared at 10%, 20%, 30%, 40% and 50% using sterilized distilled water, stored at
4°C and used within two weeks only [18]. A. maurorum fresh flowers (10 g) were collected, thoroughly washed in running tap water for 15 min and surface sterilized by 1% mercuric chloride solution. Shade dried these flowers for 2 days at room temperature and was grounded into a fine powder by surface-sterilized pestle and motor. A weight of 0.1 g of this powder was suspended in 10 ml of distilled water and boiled for 15 min before finally decanting. The extract thus formed was filtered through a cheese cloth, and the filtrate was stored at 4°C which was used further as flower extract for all the experiments [19]. Seventeen compounds in aqueous extract were identified [16].

Table 1. The difference between the methods

Both methods are similar in terms of principle of work and preparation, except difference solvents shows that the alcoholic method is the preferred to extract the Camel thorn plant.

| Method   | Alcoholic | Aqueous |
|----------|-----------|---------|
| Solvent  | Ethanol   | Distilled water |
| Yield    | 34% w/w   | 20% w/w |
| No. of compounds | 32   | 17     |
| Time     | 48 h      | 48 h    |
| Temperature | 60°C | 25°C    |

3. The extract of alhagi maurorum

Alhagi maurorum (camel thorn plant) is a promising medicinal plant due to the presence of flavonoid sand phenolic compounds as major contents [20]. Different parts of the plant including its leaves are rich in various phytochemicals such as; polysaccharides, sitosterols, glycosides, terpenoids, coumarins, saponins, carotenoids, vitamins, tannins, phenolics and flavonoid compounds that act as natural antioxidants [21–23]. It is a very common woody perennial shrub with more than twelve different isolated flavonoids [24]. It contains flavonoids, saponins, alkaloids, essential oil, tanning agents, organic acids, vitamins, sugar, resins, and wax [25]. Ethanolic extracts of A. maurorum. Chemical investigation on this species revealed the presence of antioxidant compounds, essential oils, terpenoids, ketones acid derivatives, hydrocarbons, alkaloids [26], flavonoids [27]. fatty acids, sterols [28]. Coumarins [29]. Vitamins [8], and phenolic constituents [30]. Several species of the family Fabaceae have been explored, revealing the presence of phenolic compounds [31]. Phenolic acids are a large group of phenolic compounds in plants include two main groups, hydroxyl benzoic acid and hydroxyl cinnamic acid derivatives with different number and position of hydroxyl and methoxy groups in the aromatic ring. These compounds reported to have a wide spectrum of pharmacological activities including antioxidant [32].

Table 2. Compounds detected in alcoholic extract

| Chemical name                                                                 | Nature of compound            |
|-------------------------------------------------------------------------------|-------------------------------|
| Propanedioic acid, dimethyl ester                                             | Fatty acid methyl ester       |
| 2,3-Dihydro-3,5-dihydroxy-6-methyl-4h-pyran-4-one                             | Phenol                        |
| 4H-pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl                            | Phenol                        |
| 2-Furan- carboxaldehyde, 5-(hydroxymethyl)                                    | Aldehyde                      |
| 2-Ethoxyethyl- beta-phenylpropionate , 2-ethoxyethyl, 3-phenylpropanoate      | Phenol                        |
| (E) -1-(2,3,6-trimethylphenyl)buta-1,3-diene                                   | Phenol                        |
| Aceticacid,(1,2,3,4,5,6,7,8-octahydro-3,8,8-trimethylnaphth-2-yl)methyl ester  | Unsaturated fatty acids       |
| Ethanone, 1-(2,3-dihydro-1,1-dimethyl-1 h –inden-4-yl)                        | Phenol                        |
| Benzene , 1-ethyl-3,5-diisopropyl-benzene                                     | Aromatic compound             |
4-(2,6,6-Trimethylcyclohexa-1,3-dienyl)but-3-en-2-one  
dodecanoic acid  
tetradecanoic acid  
(>-Loliolide  
9,11-Octodecadiynoic acid, 8-hydroxy-methyl ester  
Hexadecanoic acid  
Mome inositol  
9,12,15-Octadecatrienoic acid, methyl ester  
Phytol, 2-hexadecen-1-ol, 3,7,11,15-tetramethyl  
9,12-Octadecadienoic acid  
9,12,15-Octadecatrienoic acid, linolenic acid  
Octadecanoic acid  
Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester  
Bis(2-ethylhexyl) phthalate acid, bis(2-ethylhexyl) ester  
2H-1-Benzopyran-7-ol, 3-(2,4-dimethoxyphenyl)-3,4-dihydro  
Linolenic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester  
1a,12-Dihydrobenzo[b]oxireno[9,10].phenanthro(3,2d)thiophene  
Vitamin E  
(E) -5,10-secocholest-1(10) – en-3,5-dione  
Stigmasterol (+) 2.62 Steroid 51.49 Stigmast-5-en-3-ol  
Table 3. Compounds detected in aqueous extract  
Chemical name  
Nature of compound  
2,3-Butanediol, 2,3-butandiol  
Phenol  
1,3-Butanadiol, 1,3-butylene glycol  
Phenol  
Oxime, methoxy-phenyl, methyl-hydroxybenzenecarboximidoate  
Phenol  
1,2-Benzenediol, 3-methoxy-pyrocatehol, 3-methoxy  
Phenol  
1,2-Ethanediol, 1-phenyl-styrene glycol  
Phenol  
Erythritol  
Terpene  
(E) -1-(2,3,6-trimethylphenyl) buta-1,3-diene  
Phenol  
Phenol, 4-(methoxymethyl)  
Phenol  
Ledol  
Terpene  
2,3-Dimethylbenzene-1,4-dicarbonitrile  
Phenol  
4-Fluoroveratrole, fluoro benzene, 3,4-methoxy  
Phenol  
2-Furanmethanol, -beta,-ethoxy  
Phenol  
Tetradecanoic acid, methyl ester  
Fatty acid  
(3,4-Dihydroxyphenyl) hexylamine  
Phenol  

4. Applications of extract therapeutic  
Natural products have useful and interesting biological activities in traditional medicating. 
Researchers are progressively turning their attention towards natural products to develop better drugs. 
against disease, such as cancer or viral and microbial infections [34]. One of the most common chronic 
inflammatory conditions in developed countries is rheumatoid arthritis (RA). In (RA) systemic 
inflammation causes structural changes in bones and release of Interleukin-17, a potent cytokine which 
promotes synovitis [35]. Alhagi maurorum drenched is customarily used as a remedy for rheumatic 
pains, schistosoma, liver disorders, and for various types of gastrointestinal discomfort [36]. It is widely 
used in Iraq for urinary tract in fection, rheumatic pains and liver disorders [37]. It is used as a laxative.
and an effective drug for liver diseases and urinary tract[38]. The oil extracted from its leaves use to treat the rheumatism and its flowers are useful to cure migraine and wart [26]–[28] [42]. In traditional medicating, water extract of camel’s-thorn is drunk at enterocolitis, dysentery, dyspepsia, gastritis, peptic ulcer and duodenal ulcer, as well as diuretic, exogenous, emollient in the catarrh of the upper respiratory tract, migraine, opacification of the cornea and for the treatment of rheumatism [44]. It is being used in diuretic, diaphoretic, and anti-ulcer treatments, in addition to its properties as tissue-repairing [44]. And laxative effect [45]. In an experimental study on rats, administration of ethanolic extract of A. maurorum ethanol extract protected against inflammation caused by aspirin. The acid output diminished for Alhagi extract more than for ranitidine[8]. An aqueous extract of A. maurorum had anti-inflammatory activities among mice in the model of formalin-induced paw edema assay. The aqueous extract of Alhagi expressed protective effects against free radicals mediated inflammatory diseases[46]. Oral administration of methanolic extract of A. maurorum (200 and 400 mg/kg) using acetic-induced writhing and tail-flick tests in mice showed anti-nociceptive effect [47]. The nature of Alhagi is hot and dry and has diuretic property and prevents kidney spasms, therefore, since ancient times, it has been used to alleviate kidney pain from kidney stones and urinary tract stones expulsion. In addition, it is efficient to attenuate urinary tract infection (UTI) and renal colic [9]. Previous experimental studies showed that 66% of patients who treated with Alhagi extract for 4 weeks expelled urinary tract stones[48]. The aqueous extract of Alhagi reduces calcium oxalate kidney stones[49].

Conclusion:

Alhagi maurorum is one of the most important medical plants that are used to treat many disorders and are located in several areas around the world, such as Iraq, China, Pakistan, Iran and Africa. Several extraction methods are used including ethanolic and aqueous methods. These methods used different solvents, however the alcoholic method is featured more important than aqueous method due to the more extracted compounds. The extract contains many compounds and the most important compounds are flavonoids and phenolic due to their many therapeutic properties such as anti-oxidation and anti-inflammatory.

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