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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.

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Figure 1. Alhagi maurorum (camel thorn) plant [12]

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. These 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

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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].

Table1. 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 mauroruma

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, sitosteroles, glycosides, terpenoides, 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 alconolic 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-Ethoxyethylbetaphenylpropionate ,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		

Table 2. Compounds detected in alcoholic extract

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4-(2,6,6-Trimethylcyclohexa-1,3-dienyl)but-3-en-2-one	alkanes
Dodecanoic acid	Fatty acid
Tetradecanoic acid	Fatty acid
(-)-Loliolide	Terpene
9,11-Octedecediynoic acid,8-hydroxy-methyl ester	Fatty acid
Hexadecanoic acid	Fatty acid
Mome inositol	Phenol
9,12,15-Octadecatrienoic acid, methylester	Fatty acids, methyl ester
Phytol,2-hexadecen-1-ol, 3,7,11,15-tetramethyl	Alkanes
9,12-Octadecadienoic acid	Unsaturated fatty acids
9,12,15-Octadecatrienoic acid,linolenic acid	Unsaturated fatty acids
Octadecanoic acid	Unsaturated fatty acids
Hexadecanoicacid,2-hydroxy-1-(hydroxymethyl)ethyl ester	Fatty acids ethyl ester
Bis(2-ethylhexyl) phthalatehalic acid, bis(2-ethylhexyl)ester	Phenol
2H-1-Benzopyran-7-ol,3-(2,4-dimethoxyphenyl) -3,4-dihydro	Phenol
Linolenic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester	Fatty acids methyl ester
1a,12b-Dihydrobenzo[b]oxireno-	A nometic compound
[9,10].phenanthro(3,2d)thiophene	Aromatic compound
Vitamin E	vitamin
(E) $-5,10$ -secocholest- $1(10)$ – en- $3,5$ -dione	Phenol
Stigmasterol (+) 2.62 Steroid 51.49 Stigmast-5-en-3-ol	Steroid

 Table 3. Compounds detected in aqueous extract

Chemical name	Nature of compound
2,3-Butanediol,2,3-butanediol	Phenol
1,3-Butanadiol,1,3-butylene glycol	Phenol
Oxime-,methoxy-phenyl,methyl-hydroxybenzenecarboximidoate	Phenol
1,2-Benzenediol, 3-methoxy-pyrocatechol, 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-Dimethylpenzene-1,4-dicarbonitrile	Phenol
4-Fluoroveratrole, fluorobenzene, 3, 4-methoxy	Phenol
2-Furanethanol,betaethoxy	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 Journal of Physics: Conference Series 1853 (2021) 012053 doi:10.1088/1742-6596/1853/1/012053

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 [43]. It is being used in diuretic, diaphoretic, and anti-ulcer treatments, in addition to its properties as tissuerepairing [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 urnary tract infection (UTI) and renal colic[9]. Previous experimental studies showed that 66% of patients who treated with Alhagi extract for 4 weeks expulsed 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 antiinflammatory.

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References

- [1] Muhammad G, Hussain M A, Anwar F, Ashraf M and Gilani A-H 2015 Alhagi: a plant genus rich in bioactives for pharmaceuticals. *Phytother. Res.* **29** 1–13
- [2] Saleem H, Sarfraz M, Khan K M, Anwar M A, Zengin G, Ahmad I, Khan S U, Mahomoodally M F and Ahemad N 2020 UHPLC-MS phytochemical profiling, biological propensities and in-silico studies of Alhagi maurorum roots: a medicinal herb with multifunctional properties *Drug Dev. Ind. Pharm.* 46 861–8
- [3] Panickar K S 2013 Benefical effects of herbs, species and medicinal plants on the metabolic syndrome, brain and cognitive function. Cent. Nerv. syst 13–29
- [4] Zarei, A., Changizi Ashtiyani, S., and Vaezi G 2014 A study on the effects of the hydroalcholic extract of the aerial parts of Alhagi camelorum on prolactin and pituitary-gonadal activity in rats with hypercholesterolemia. Archivio Italiano di urologia e andrologia 86 188–192.
- [5] Abbas S R and Campus H 2020 The Holy Quran narrates about Alhagi Maurorum 24 23–4
- [6] Duke J. . (2007). D hand book of medicinal plants of the B usa. crc. press. 2008 Handbook of medicinal plants of the Bible
- [7] Tripathi Y C, Prabhu V V, Pal R S and Mishra R N 1996 Medicinal plants of rajasthan in Indian system of medicine. *Anc. Sci. Life* **15** 190–212

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Journal of Physics: Conference Series

- **1853** (2021) 012053 doi:10.1088/1742-6596/1853/1/012053
- [8] Shaker E, Mahmoud H and Mnaa S 2010 Anti-inflammatory and anti-ulcer activity of the extract from Alhagi maurorum (camelthorn) *Food Chem. Toxicol.* 48 2785–90
- [9] Zargari.A 1997 Medicinal Plants *Tehran Univ Press* 924–5
- [10] Ghasemi-Dehkordi NA, Sajadi SE, Ghanadi AR, Amanzadeh Y, Azadbakht M, Asghari GR et al 2003 Iranian Herbal Pharmacopeia *Hakim J* 6 63–9
- [11] Khalil R, Yusuf M, Bassuony F, Gamal A and Madany M 2020 Phytotoxic effect of Alhagi maurorum on the growth and physiological activities of Pisum sativum L. South African J. Bot. 131 250–8
- [12] Cpmkutty Alhagi graecorum, Alhagi maurorum
- [13] Zarei A, Ashtiyani S C and Vaezi G H 2014 A study on the effects of the hydroalcholic extract of the aerial parts of Alhagi camelorum on prolactin and pituitary-gonadal activity in rats with hypercholesterolemia Arch. Ital. di Urol. e Androl. 86 188–92
- [14] Gandhi AP, Joshi KC, Jha K, Parihar VS, Srivastav DC, Raghunadh P, Kawalkar J J S 2003 Tripathi RN Studies on alternative solvents for the extraction of oil-I soybean Int J Food Sci Technol 38 369–375
- [15] Shakiba Y, Rezatofighi S E, Nejad S M S and Ardakani M R 2018 Inhibition of foot-and-mouth disease virus replication by hydro-alcoholic and aqueous-acetic acid extracts of alhagi maurorum *Iran. J. Pharm. Sci.*
- [16] Reham M. Mostafa H S E 2019 Assessment of camel thorn (Alhagi maurorum) as new sources of bioactive compounds using GC-MS technique *Plant Omi. Journal*, *POJ* 12(01) 70–7
- [17] Reham M. Mostafa H S E 2019 Assessment of camel thorn (Alhagi maurorum) as new sources of bioactive compounds using GC-MS technique *Plant Omi. Journal,POJ*
- [18] .J.B H 1984 Phyto chemical methods Chapuan Hau. Press. Newyork
- [19] Jain Preeti, Malik Ashish, Sharma Swati S R A 2017 Alhagi maurorum Flower Extract Mediated Novel Synthesis of Gold Nanoparticles Asian J. Pharm. 11 (1)
- [20] Sheweita S A, Mashaly S, Newairy A A, Abdou H M and Eweda S M 2016 Changes in oxidative stress and antioxidant enzyme activities in streptozotocin-induced diabetes mellitus in rats: role of Alhagi maurorum extracts *Oxid. Med. Cell. Longev.*
- [21] Hamidpour R, Hamidpour S, Hamidpour M, Shahlari M, Sohraby M, Shahlari N H R R olive (Elaeagnus angustifolia L . 2016 From a variety of traditional medicinal applications to its novel roles as active antioxidant, antiinflammatory, anti-mutagenic and analgesic agent. J Tradit Complement Med
- [22] G. I 2014 Volatile composition, antimicrobial and antioxidant properties of different parts from Elaeagnus angustifolia L. J Essent. Oil-Bear Plants 17(6) 1187–202
- [23] Okmen G T O 2013 The antibacterial activity of Elaeagnus angustifolia L. against mastitis pathogens and antioxidant capacity of the leaf methanolic extracts J Anim Vet Adv. 12(4) 491–6
- [24] Al-Jaber N A, Awaad A S and Moses J E 2011 Review on some antioxidant plants growing in Arab world *J. Saudi Chem. Soc.*
- [25] D. Guo, W. J. Xue, G. A. Zou and H A A 2016 Chem. Nat. Compd 52 1095
- [26] Muhammad G, Hussain MA, Anwar F, Ashraf M G A 2015 Alhagi: a plantgenusrich in bioactives for pharmaceuticals. *Phytother Res* **29**(**1**) 1–13
- [27] Amani AS, Maitland DJ S G 2006 Antiulcerogenic activity of Alhagi maurorum *Pharm Biol.* 44(4) 292–296
- [28] Weber DJ, Ansari R, Gul B K M 2007 Potential of halo-phytes as source of edible oil. J Arid Env. 68(2) 315–321
- [29] Ahmad S et al 2009 Secondary metabolites from Alhagi maurorum *J Chem Soc Pak* **31(1)** 960–963
- [30] Laghari A H, Ali Memon A, Memon S, Nelofar A, Khan K M and Yasmin A 2012 Determination of free phenolic acids and antioxidant capacity of methanolic extracts obtained from leaves and flowers of camel thorn (Alhagi maurorum) *Nat. Prod. Res.* 26 173–6

Journal of Physics: Conference Series

- [31] Al-Yahya, M.A., Mossa, J.S., Al-Badr, A.A., Tariq, M.S., & Al-Meshal I A 1987 Phytochemical and biological studies on Saudi medicinal plants Part 12 Int. J. Crude Drug Res. 25 65–71
- [32] Tarnawski M, Depta K, Grejciun D and Szelepin B 2006 HPLC determination of phenolic acids and antioxidant activity in concentrated peat extract—a natural immunomodulator *J. Pharm. Biomed. Anal.* 41 182–8
- [33] Mostafa R M and Essawy H S 2019 Assessment of camel thorn (Alhagi maurorum) as new sources of bioactive compounds using GC-MS technique *Plant Omics* **12** 70–7
- [34] Revathi P and Parimelazhagan T 2010 Traditional knowledge on medicinal plants used by the Irula tribe of Hasanur Hills, Erode District, Tamil Nadu, India *Ethnobot. Leafl.* **2010** 4
- [35] Shah A L D 2012 Harrison TR Harrison's principles of internal medicine . McGraw Hill
- [36] Awaad Amani A S, Maitland D J and Soliman G A 2006 Antiulcerogenic Activity of Alhagi maurorum. *Pharm. Biol.* **44** 292–6
- [37] Nedhal, A. L A-D and Y A-E 2010 Asurvay of plants used in Iraq. Traditional medicine *Jordan J. Pharm. Sci.* 100 – 108
- [38] Abdul Hafeez Laghariab, Ayaz Ali Memona, Shahabuddin Memona*, Aisha Nelofarb K M K and A Y 2015 Determination of free phenolic acids and antioxidant capacity of methanolic extracts obtained from leaves and flowers of camel th orn (Alhagi maurorum)
- [39] Atta A H, Nasr S M, Mouneir S M, Alwabel N A and Essawy S S 2010 Evaluation of the diuretic effect of Conyza dioscorides and Alhagi maurorum *Int J Pharm Pharm Sci* **2** 162–5
- [40] Kahrizi D, Molsaghi M, Faramarzi A, Yari K, Kazemi E, Farhadzadeh A M, Hemati S, Hozhabri F, Asgari H and Chaghamirza K 2012 Medicinal plants in holy Quran Am J Sci Res 42 62– 71
- [41] Awaad A S, El-Meligy R M, Qenawy S A, Atta A H and Soliman G A 2011 Anti-inflammatory, antinociceptive and antipyretic effects of some desert plants J. Saudi Chem. Soc. 15 367–73
- [42] Bown D 1995 The Royal Horticultural Society encyclopedia of herbs & their uses. (Dorling Kindersley Limited)
- [43] Nishanbaev S Z, Bobakulov K M, Nigmatullaev A M, Sham I D, Okhundedaev B S and Abdullaev N D 2016 Volatile compounds from the aerial parts of four Alhagi species growing in Uzbekistan Chem. Nat. Compd. 52 167–70
- [44] AE A-S 2015 Alhagi maurorum as a potential medicinal herb: An Overview Int. J. Pharm. Rev. Res. 5 130–6
- [45] Marashdah M S and Al-Hazimi H M 2010 Pharmacological activity of ethanolic extract of Alhagi maurorum roots Arab. J. Chem. 3 39–42
- [46] Neamah N F 2012 A pharmacological evaluation of aqueous extract of Alhagi maurorum *Glob J Pharmacol* **6** 41–6
- [47] Atta A H and El-Sooud K A 2004 The antinociceptive effect of some Egyptian medicinal plant extracts J. Ethnopharmacol. 95 235–8
- [48] Cyrus A, Goudarzi D and Jahangiri V 2010 The effect of Alhagi Pseudalhagi distillate on ureteral stone expulsion J. Arak Univ. Med. Sci. 13 56–62
- [49] Shafaeifar A, Mehrabi S, Malekzadeh J, Jannesar R, Sadeghi H, Vahdani R and Mohammadi R 2012 Effect of hydrophilic extract of Alhagi maurorum on ethylene glycol-induced renal stone in male wistar rats