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A review on: Extraction of mimosine from *Leucaena leucocephala* tree & their phytochemical study and pharmacological activity

Vivek MuraniDOI: <https://doi.org/10.33545/26646765.2023.v5.i1a.56>**Abstract**

Mimosine [α -amino- β -(3-hydroxy-4-oxo-1, 4- dihydropyridin-1-yl)-propanoic acid] is toxic element, that found naturally in *Leucaena* (*Leucaena-leucocephala* de Wit) tree. *Leucaena leucocephala* trees are commonly known as White Lead tree. It has been used for medicinal purposes because of possessing multiple pharmacological properties. Studies have shown the presence of various secondary metabolites such as alkaloid, cardiac glycosides, tannins, flavonoids, saponins, and glycosides in this species. Phytochemically, this plant has been reported to contain numerous alkaloids, flavonoids, saponins, tannins, and triterpenoids. Pharmacologically this plant has been reported as antibacterial, antidiabetic, anti-inflammatory, anticancer, anthelmintic, antioxidant. In the present review article is to explore extraction method of mimosine, pharmacological study and phytochemical study.

Keywords: Mimosine, pharmacological, pharmacological, extraction**1. Introduction**

Leucaena leucocephala (Family: Fabaceae) may be a little, fast growing tree, and has multiple common names by that it's known like pigment tree, lead tree, Jumbay, and Wild Tamarind^[1]. Genus *Leucaena* originated from the Greek words "leuc," which suggests "white," and "caen," which suggests that "new," pertaining to the whitish flowers. The species name conjointly refers to the flowers: leucocephala from "leu," which means white, and "cephala," which means "head." *L. leucocephala* was referred to as a miracle tree thanks to its worldwide success as a long and extremely alimentary forage tree accustomed turn out fuel, timber, human food, manure, shade and conjointly to manage erosion. it's calculable to hide 2-5 million angular distances worldwide^[2-4]. Medicinally it's been used for its antimicrobial, anthelmintic, medicament, anti-proliferative and antidiabetic drug, anticancer, cancer preventive, diuretic, medicinal drug, antioxidant; antitumor, antihistaminic, nematicide, pesticide, anti-androgenic, hypocholesterolemic, and hepatoprotective properties^[5]. Genus *Leucaena* leaves seem the same as those of tamarind, having white flowers colorful with yellow, and having long planate pods. Seeds square measure dark brown with the hard shining reproductive structure. it's hard significant wood (about 800 kg/m), with a yellowness wood and lightweight reddish-brown duramen. Bark on young branches is sleek and grey-brown or pink, whereas older barks square measure darker grey-brown, and rough with shallow, rusty orange-brown vertical fissures, and red inner bark^[6].

1.2 Mimosine

Mimosine [β -[N-(3-hydroxy-4-oxypyridyl)]- α -aminopropionic acid] may be a non-protein aminoalkanoic acid, and may be a major compound gift all told plant elements of Mimosaceae, which has *Leucaena* (*Leucaena-leucocephala*), *Leucaenaglauca*, and alternative legumes belonging to *Mimosa* spp. Structurally, mimosine is AN analog of di-hydroxyphenylalanine with a 3-hydroxy-4-pyridone ring rather than a 3,4-dihydroxy-phenyl ring (Fig-1)

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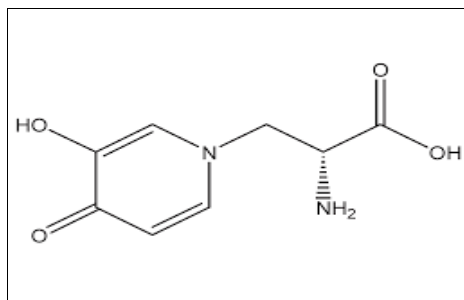


Fig 1: Structure of Mimosine

Although leucaena includes a made macromolecule content and high annual yield, the presence of mimosine has restricted the wide use of this plant as animal feed. This compound causes phalacroisis, growth retardation, cataracts and physiological condition in animals. Mimosine possesses antimetabolic activity that blocks the cell cycle within the giant G1 section and inhibits DNA synthesis, that prevents the formation of the replication fork by sterilisation deoxy-ribonucleotide metabolism [7]. Mimosine has molecular formula C₈H₁₀N₂O₄ and molecular wt. 198.18 eighteen with freezing point 291 OC.

Thus this analysis was done out to spot the presence of poisonous compound mimosine in white popinac victimisation differing types of ways and solvents. aside from that, this analysis additionally highlights the economical thanks to scale back the poisonous compound mimosine therefore the usage of the plant may be maximised either as a supply of energy.

2. Materials and Methodology

The material and methodology follows to extract the mimosine from the *Leucaena-leucocephala* de wit leaves is as follows.

2.1 Raw Material Required

- *Leucaena-leucocephala* de wit leaves
- Distilled Water
- Ethanol
- Hydrochloric Acid
- Ortho-phosphoric

2.3 Methods of Extraction

1. Fresh *Leucaena* leaves are collected from forest facet. 1 kg of healthy leaves of *Leucaena-leucocephala* washed with lots of H₂O to get rid of the dust adhered on the leaves, so allowed to dry at temperature for 2 days.
2. The dried leaves then crushed by hand and bark are separated through the screen of size 20 mesh. Then it's grind with pulveriser in powder kind.
3. A 750 ml H₂O is taken within the 1000 ml beaker to hold water extraction.
4. Then 150 gram leaves powder is taken for extraction.
5. 750 gram H₂O and 150 grams of powder is charged consecutive to 3 liter glass kettle. The kettle is placed in to constant temperature water tub to keep up the extraction mass temperature at 59 to 60 OC for 16-17 hours. The experimental discovered is accommodates reaction kettle placed in constant temperature water tub, equipped with glass condenser to minimise the vapour loss throughout extraction at 59 to 60 OC temperature by

applying cooling water the condenser.

6. Once complete extraction, extraction mass is filter through buchner filter under vacuum and filtrate is collected in another 1000 ml size flask.
7. Then the filtrate mass received from previous stage is additional with 350 gram grain alcohol and permit for mimosine extraction for 24 hrs, as shown in fig9. throughout twenty four hrs the solid kind the extraction mass is settled at heart and clear mass continued grain alcohol and water answer is stay clear at top as supernatant.
8. Once complete extraction the ph of extraction mass is adjusted by using HCL and ph is maintained at 5 by exploitation ph meter.
9. Once ph adjustment the extraction mass is additional filter through buchner filter below vacuum, and filtrate is collected 1000 ml size flask
10. The filtrate received from previous step is allowed to concentrate at 20-30 °C below vacuum, until the ultimate material remains at volume of 20 grams solely. this can be done in distillation setup at lab scale.
11. Once completion of concentration the dark viscous material is stay within the re-boiler of distillation setup is collected within the 100 ml beaker and allowed to chill at temperature. Additional this mass is analysed to know the content of mimosine by using HPLC technique.

2.4 Method of Analysis

Paper and thin layer chromatography were used to identify mimosine, however, mimosine content could not be quantified. Gas-liquid chromatography, liquid chromatography, and reversed-phase ion-pair highperformance liquid-chromatography were also applied for mimosine determination. However, these methods require elaborate preparation of samples, but with no appreciable improvement in the range of sensitivity.

Other methods were the coupling of mimosine with p-nitroaniline or mimosine with N-1(naphthyl)ethylenediamine (NEDA) forming a pinkcolored azodye with an absorbance of 540 nm, and the use of indirect spectrophotometricity which is based on its reaction with diazotized sulfanilamide. These methods were reported to increase the sensitive estimation of mimosine. A useful HPLC system to determine mimosine and DHP contents that influenced *Rhizobium* isolates was reported by Soedarjo *et al.* They applied a C18 HPLC column, UV detection at 280 nm, a solvent system of 0.2% orthophosphoric acid to detect mimosine and DHP at 2.7 and 4.8 min, respectively [8].

3. Phytochemical Review

The phytochemical screening of leaf extract of *L. leucocephala* discovered the presence of varied secondary metabolites as organic compound, cardiac glycosides, tannins, flavonoids, saponins and Glycosides [8].

Bioactivity studies on this plant discovered its anthelmintic, antibacterial, anti-proliferative and antidiabetic activities [9]. The *L. leucocephala* leaves possess several biological properties like antimicrobial, anticancer, cancer preventive, diuretic, medicine, antioxidant; antitumor, antihistaminic, nematicide, pesticide, antiandrogenic, hypocholesterolemic and hepatoprotective [10].

Table 1: Phytochemical compounds identified from the *L. leucocephala* leaf extracts and their therapeutic Activity

No.	Compound	Secondary metabolite	Therapeutic activity
1	Phytol	Diterpene	Antimicrobial, anticancer, cancer preventive, diuretic, anti-inflammatory
2	Squalene	Triterpene	Antibacterial, antioxidant, antitumor; cancer-Preventive, chemopreventive; immunostimulant, lipoxygenase-inhibitor, perfumery, pesticide, sunscreen
3	n-Hexadecanoic acid	Palmitic acid	Antioxidant, hypocholesterolemic nematocide, pesticide, antiandrogenic, flavor, hemolytic, 5-alpha reductase inhibitor
4	Pentadecanoic acid, 14-methyl-, methyl ester	Palmitic acid methyl ester	Antioxidant.
5	Hexadecanoic acid, 15-methyl-, methyl ester	Fatty acid ester	Antioxidant, nematocide, pesticide, flavor, antiandrogenic
6	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	Terpene alcohol	Antimicrobial
7	9,12,15-Octadecatrienoic acid, methyl ester	Linolenic acid ester	Anti-inflammatory, insectifuge hypocholesterolemic, cancer preventive, nematocide, hepatoprotective, insectifuge, antihistaminic, antieczemic, antiacne, 5- alpha-reductase inhibitor, antiandrogenic, antiarthritic, anti-coronary
8	9,12-Octadecadienoic acid, methyl ester	Linolenic acid ester	Anti-inflammatory, nematocide, insectifuge, hypocholesterolemic, cancer preventive, hepatoprotective, antihistaminic, antiacne, antiarthritic, antieczemic
9	Oxalic acid, allyl hexadecyl ester	Dicarboxylic acid	Acaricide, antiseptic, CNS-paralytic, fatal, hemostatic, irritant, pesticide, renotoxic, varroacide

L. leucocephala seeds have great medicinal properties and are used to control stomachache, as contraception and abortifacient. The seed gum used as a binder in tablet formulation [10]. A sulfated glycosylated form of polysaccharides from the seeds was reported to possess significant cancer chemo-preventive and antiproliferative activities [11]. The extracts of the seeds have reported as anthelmintic, antidiabetic and have a broadspectrum antibacterial activity [11]. Recently, the seed oil was used in engineering as a novel bio-device useful in biomembrane modelling in lipophilicity determination of drugs and xenobiotics [11]. The plant is reported to be a worm repellent.

4. A review on pharmacological activities

4.1 Antioxidant activity

L. leucocephala leaf and seed extracts have antioxidant activity [20]. Leaf extracts contain, as a principal constituent, 2-(H)- benzofuranone-5, 6, 7, 7a-tetrahydro-4, 4, 7a-trimethyl [13] and phenoplast compounds and flavonoid quercetin was additionally isolated from the leaves extracts [14].

L. leucocephala seed extracts have inhibitor activity. The inhibitor activity is probably going because of the phenolic content. Associate in Nursing application of this extract should be thought-about because it will have an effect on renal operate by reducing the degree of simple protein, mountain and total macromolecule [15].

4.2 Antimicrobial activity

L. leucocephala seed oil extract had a concentration-dependent activity against each gram-positive (*Staphylococcus aureus*, *Bacillus subtilis*) and gram-negative (*Pseudomonas aeruginosa*, *Escherichia coli*) microorganism and also the lotion formulation with an emulsifying agent had smart pharmaceutical properties [16]. The crude extract of *L. leucocephala* leaves exhibits anti-tubercular activity that supports the utilization of this plant as mentioned within the folklores [17].

4.3 Anti-inflammatory

The medicinal drug property of chloroform, ester and wood spirit extracts of leaves of *L. leucocephala* was rumored [10].

4.4 Antitumor activity

Hexane, fossil fuel ether, ester and wood spirit extracts of leaves of *L. leucocephala* showed antineoplastic activity [10].

4.5 Wood uses of *L. leucocephala*

Its uses are swollen to gum production, piece of furniture and construction timber, pole wood, and softwood [18, 19].

5. Conclusion

Mimosine can be extracted by using different sources of legume tree, like mimosa pudica, leucaena-leucocephala. Mimosine can be extracted easily from *Leucaena leucocephala* leave by using water and ethanol as solvent. Extracted mimosine is determined by using HPLC method.

L. leucocephala is one of the miracle timber trees. It has multipurpose uses including beneficial pharmacological properties. Further studies revealed the presence of various secondary metabolites as alkaloid, cardiac glycosides, tannins, flavonoids, saponins and Glycosides. Its seeds have great medicinal properties and used to control stomachache, as contraception and abortifacient. Mimosine exhibited selective influence against the germination and growth of certain indicator plants including *Bidens pilosa* L, *Mimosa pudica*, *Brassica rapa*, *Lolium multiflorum*, and *Phaseolus vulgaris*.

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