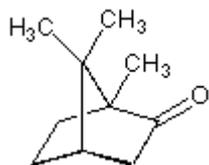


## REFERENCES

SAGE

*Salvia officinalis*

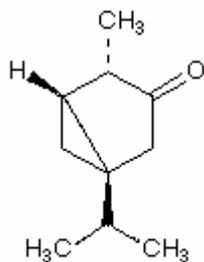
**Dewick**, Paul M.: Medicinal Natural Products - a biosynthetic approach. John Wiley & Son. ISBN No.0-471-97478-1 (ppb), 0-471-97477-3 (hardback).



Most monoterpenes are optically active, and there are many examples known where enantiomeric forms of the same compound can be isolated from different sources, e.g. (+)-camphor in sage (*Salvia officinalis*) .....

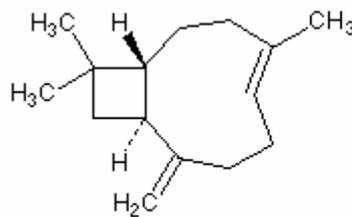
Fig.1. camphor

The fresh flowering tops have between 0.7-2.5% oil, which is a mixture of thujone 40-60%, camphor 5-22%, cineole 5-14%,  $\beta$ -caryophyllene 10% and limonene 6%

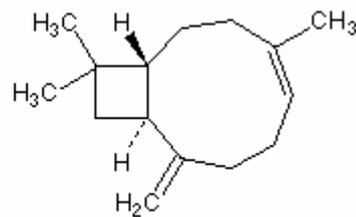


$\beta$ -Thujone

Fig.2  $\beta$ -thujone



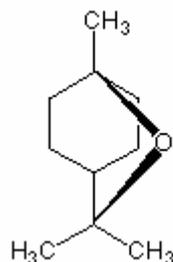
Caryophyllene



Isocaryophyllene

Fig.3 Caryophyllene

Fig.4 Cineole



**Wichtl**, Max, editor Norman Grainger Bisset.; Herbal drugs and Phytopharmaceuticals - a handbook for practice on a scientific basis. Medpharm Scientific Publishers. 1994 English edition. ISBN No. 3-88763-025-4. Also CRC Press ISBN No. 0-8493-7192-9.

DAB 10: Salbeiblatter

OAB: Folium Salviae  
Ph. Helv. VII: Salviae folium  
St. Zul. 1229.99.99

**Plant source:** *Salvia officinalis* L., garden or red sage (Lamiaceae). The pharmacopoeial specification corresponds only with subsp. *minor* (GMELIN) GAMS and subsp. *major* (GARSAULT) GAMS, but not with subsp. *lavandulifolia* (VAHL) GAMS (which according to the Flora Europaea is a separate species). Recent morphological/anatomical studies support the view that the subspecies of *S. officinale* should be treated as independent species: subsp. *minor* = *S. officinale* s.s., subsp. *major* = *S. tomentosa* MILLER, and subsp. *lavandulifolia* = *S. lavandulifolia* VAHL [4].

**Synonyms:** Garden or Broad-leafed sage, Sawge (EngL), Salbeiblatter, Edelsalbei, Gartensalbei (Ger.), Feuilles de sauge officinale, Feuilles de sauge commune (Fr.).

*Extract from the German Commission E monograph (BANz no. 90, dated 15. 05. 1985)*

**Uses:** Externally - inflammation of the mucous membranes of the mouth and throat.  
Internally: dyspeptic complaints, excessive secretion of sweat.

**Contraindications:** The pure essential oil and alcoholic extracts should not be taken during pregnancy.

**Side effects:** On prolonged use of alcoholic extracts and the pure essential oil, epileptiform convulsions may occur.

**Interactions:** None known.

**Dosage:** Unless otherwise prescribed:

Internally: daily dose 4-6 g drug, 0.1-0.3 g essential oil, 2.5-7.5 g tincture (as in Erg. B. 6), 1.5-3 g fluid extract (as in Erg. B. 6).

As a gargle and rinse: 2.5 g drug as infusion or 2-3 drops of the essential oil to 100 ml water or 5 g alcoholic extract to a glass of water.

As a paint: undiluted alcoholic extract.

**Mode of administration:** Chopped drug for infusions, alcoholic extracts, and distillates for gargling, rinsing, and painting, and for internal use and the fresh press juice of the plant.

**Effects:** Antibacterial, fungistatic, virostatic, astringent, secretion-promoting, sweat-inhibiting.

**Note:** A separate monograph has been prepared for *Salvia triloba*.

**Origin:** Native in the Mediterranean region, especially in the Adriatic; cultivated to some extent in various European countries. Imports of the drug come from Albania and former Yugoslavia.

**Constituents:** 1-2.5% essential oil, consisting of thujone (up to ca. 35-60%) and other

monoterpenes (particularly cineole) and small amounts of sesquiterpenes; 3-7% tannins, including rosmarinic acid; diterpenoid bitter substances, e.g. carnosol (= picrosalvin), carnosic acid 12-methyl ether  $\gamma$ -lactone, rosmanol and its 7-methyl ether, manool, etc.; triterpenes, e.g. oleanolic acid and derivatives [1, 5]. Extraction of an ethanol extract with supercritical carbon dioxide yields a product with greater antioxidant activity than butylated hydroxyl toluene [5].

**Indications:** As an antiphlogistic for inflammation of the mouth and throat, for gingivitis and stomatitis, mainly in the form of a gargle, but also as a tea for digestive complaints, flatulence, inflammation of the intestinal mucosa, in diarrhoea. As an antisudorific (antihydrotic), e.g. against night sweats in tuberculosis patients, but also against excessive sweat formation of psychosomatic origin.

Use of the drug in the two areas indicated is purely empirical. Pharmacological experiments with isolated constituents are still lacking; however, the antisudorific action has been demonstrated in animal experiments and clinically in man, e.g. pilocarpine-induced sweating is rapidly curtailed.

In folk medicine, because of an inhibiting effect on the secretion of milk, garden sage is also used to aid the cessation of lactation; it is also said (but not proved) to have mild hypotensive and emmenagogic effects. Although not a cholagogue, the drug is sometimes used in this way in mixtures with other drugs (action of bitter substances?).

**Side effects:** Only likely with overdoses (more than 15 g sage leaves/dose) or on prolonged use. The toxic constituent of the essential oil, thujone, causes symptoms such as tachycardia, hot flushes, convulsions, and dizziness.

**Making the tea:** Depending on the indication; as a gargle, boiling water is poured over 3 g of the chopped drug and strained after 10 min.; against night sweats, the infusion prepared like the previous one, but the drink is allowed to cool; for gastrointestinal complaints, boiling water is poured over 1.5-2.0 g of the finely chopped drug and strained after 5 min. 1 Teaspoon = ca. 1.5g.

**Herbal preparations:** The chopped drug is also available in tea bags (1.0 or 1.6 g).

**Phytomedicines:** The drug, extracts made from it (tincture, fluid extract), or the essential oil are components of some prepared mouth and throat remedies, e.g. Salus® Salbei-Tropfen (drops), Salviathymol®, etc., Gastrointestinal Remedies, e.g. Enterosanol® (dragees, juice, capsules), etc., and cholagogues and some other remedies. Products available in the UK include Seven Seas Catarrh Tablets, Arkopharma Phytomenopause, etc.

**Regulatory status (UK):** General Sales – List Schedule 1, Table A.

**Authentication:** Macro- (see: Description) and microscopically, following the DAB 10. See also [4, 6] and the BHP 1983. It should be noted that the covering trichomes on the upper and lower surfaces of the leaf are the same (distinction from *Salviae trilobae folium* - Greek sage): ca. 200-600 pm long, not more than 20 um wide at the base, and with a short, strongly thickened basal cell (Fig. 4). The DAB 10 TLC procedure examines the composition of the essential oil:

**Test solution:** 0.30 g freshly powdered drug shaken for 2-3 min. with 5 ml dichloromethane and filtered over ca. 2 g anhydrous sodium sulphate.

**Reference solution:** 3.0mg borneol, 5 ml bornyl acetate, and 10 µl cineole dissolved in 10 ml toluene.

**Loadings:** 30 µl test solution and 10 µl reference solution, as 2-cm bands on silica gel G.

**Solvent system:** acetone + ethyl acetate+di-chloromethane (2+3+95), 10 cm run.

**Detection:** sprayed with anisaldehyde reagent, followed by heating at 100-105 °C for 5-10 min. while under observation.

**Evaluation:** in daylight. Reference solution: the lowest zone, the brownish grey borneol zone; slightly above, the greyish violet to blue cineole zone; and above that, the brownish grey bornyl acetate zone. Test solution : these three zones, approximately equal in intensity; directly below the bornyl acetate zone, the weakly coloured reddish violet thujone zone; and somewhat below that, the weakly coloured pinkish red caryophyllene epoxide zone, followed by an intense violet zone; just below the cineole zone, another violet zone of similar intensity (viridiflorol); in the lowest part of the chromatogram, other violet or greenish yellow zones, some of them very prominent; in the upper part of the chromatogram, two intense violet to blue zones (terpene and sesquiterpene hydrocarbons). Fig. 3: Upper surface (left) and lower surface (right) of sage leaf. In UV 365 nm light. Test solution: thujone, directly below the bornyl acetate zone, as an intense sealing-wax red fluorescent zone; cineole, a bluish green fluorescent zone; borneol and bornyl acetate zones, almost no fluorescence.

TLC study of the flavonoids is also useful in aiding the identification (see: Adulteration).

*Wording of the package insert, from the German Standard Licence:*

#### 6.1 Uses

Inflammation of the gums and the mucous membranes of the mouth and throat; pressure spots caused by prostheses; in supportive treatment of gastrointestinal catarrh.

#### 6.2 Dosage and Mode of administration

For treating gastrointestinal complaints, boiling water is poured over half a teaspoonful (1-3 g), and for inflammation in the mouth, over one teaspoonful (ca. 3 g), of Red sage and after 10 min. passed through a tea strainer. Unless otherwise prescribed, for gastrointestinal complaints a cup of the warm tea is drunk several times a day half-an-hour before meals.

For inflammation of the mucous membranes of the mouth and throat, the still warm infusion is used as a rinse or gargle several times a day.

#### 6.3 Duration of use

Infusions of red sage should not be taken over a long period of time.

#### 6.4 Note

Store protected from light and moisture.

**Quantitative standards:** DAB 10: Thujone-rich volatile oil, not less than 1.5%. Foreign matter, not more than 3% stem fragments and not more than 2% other foreign matter. Loss on drying, not more than 10.0%. Ash, not more than 10.0%.

OAB: Volatile oil, not less than 1.5%. Foreign matter, not more than 3% stem fragments. Ash, not more than 8.0%.

Ph. Helv. VII: Volatile oil, not less than 1.5%. Foreign matter, not more than 3% stems; leaves of *S. triloba* absent. Sulphated ash, not more than 12.0%.

BHP 1983: Foreign organic matter, not more than 3%. Total ash, not more than 8%.

**Adulteration:** Occasionally with the leaves of other *Salvia* species, principally those of *S. triloba* L.f., Greek sage; these have a white, velvety tomentum on both surfaces, which is denser than that of *S. officinalis* (compare Fig. 3 and *Salviae trilobae folium*: Fig. 3). The trichomes on the upper surface are not tortuous and whip-like, but are straight and stiff, and mostly 30-40  $\mu\text{m}$  wide at the base (*Salviae trilobae folium*: Fig. 4).

In the DAB 10 TLC examination set out above, adulteration can be recognized by the divergent composition (a higher cineole and lower thujone content). Differentiation is also possible on the basis of the flavonoid profile; the TLC procedure is as follows:

**Test solution:** 1 g powdered drug refluxed for 10 min. with 10 ml methanol, filtered, the filtrate taken to dryness, and the residue dissolved in 4.0 ml methanol.

Fig. 4: Long, multicellular, tortuous covering trichomes, from the upper leaf surface

**Reference solution:** 10mg rutin and 5mg hyperoside dissolved in 10 ml methanol.

**Loadings:** 2  $\mu\text{l}$  test solution and 2  $\mu\text{l}$  reference solution, as bands on silica gel.

**Mobile phase:** ethyl acetate + anhydrous formic acid + water (88+6+6), 5 cm run.

**Detection:** after drying in a current of hot air, sprayed with 1% methanolic diphenyl-boryloxyethylamine, followed by 5% ethanolic polyethylene glycol 400.

**Evaluation:** in UV 366 nm light. Reference solution: orange-yellow fluorescent zones, rutin at  $R_f$  ca. 0.2 and hyperoside at  $R_f$  ca. Fig. 5: TLC on 4 x 8 cm foil 1: Red sage 2: Rutin and hyperoside (reference compounds) 3: Greek sage For details, see the text 0.45; Test solution (*S. officinalis*): several yellowish orange and bluish fluorescent zones between  $R_f$  0.2 and 0.9, especially just above the level of the hyperoside zone. Test solution (*S. triloba*): similar zones, but the main ones are below the level of the hyperoside zone (Fig. 5).

**The solvent system:** toluene + ethyl acetate (95 + 5) with silica gel F 60354 and detection with anisaldehyde reagent also allows red sage and Greek sage to be distinguished by: (a) the greater intensity of the violet-red double (a- and ft-) thujone zone in the red sage (*S. officinalis*) chromatogram and (b) the very intense cineole zone in the Greek sage (*S. triloba*) chromatogram [7].

**Storage:** Protected from light, in well-closed (but not plastic) containers. Stability on storage [2, 3]: this depends on the degree of comminution (the coarsely powdered drug keeps better than the finely powdered one) and on the packaging (vacuum packs are better than double-thickness paper bags).

## Literature:

- [1] Kommentar DAB 10.
- [2] D. Fehr, Pharm. Ztg. 127, 111 (1982).
- [3] L. Kreutzig, Pharm. Ztg. 127, 893 (1982).
- [4] R. Langer, Th. Ruckenbauer, J. Jurenitsch, and W. Kubelka, Sci. Pharm. 59, 321 (1991).
- [5] Z. Djarmati et al., Phytochemistry 31, 1307 (1992).
- [6] B.P. Jackson and D.W. Snowdon, Atlas of microscopy of medicinal plants, culinary herbs and spices, Belhaven Press, London, 1990, p. 204.
- [7] P. Pachaly, Dtsch. Apoth. Ztg. 130, 169 (1990).

**Leung, A.Y. and Foster, Steven:** Encyclopedia of Common Natural Ingredients used in food, drugs and cosmetics. 2nd. edition. John Wiley 1996 ISBN No. 0-471-50826-8.

## SAGE

Source: Sage *Salvia officinalis* L.; Spanish sage *Salvia lavandulaefolia* Vahl (Family Labiatae or Lamiaceae).

Synonyms. Garden sage, true sage, and Dalmation sage (*S. officinalis*).

## GENERAL DESCRIPTION

*Salvia officinalis* is a small, evergreen shrubby perennial with woody stems near the base and herbaceous ones above, much branched; up to about 0.8 m high; native to the Mediterranean region; cultivated worldwide (Albania, Turkey, Greece, Italy, United States, etc.). Part used is the dried leaf from which sage oil is obtained by steam distillation.

*Salvia lavandulaefolia* is closely related to *S. officinalis*. It grows wild in Spain and southwestern France. Spanish sage oil is obtained by steam distillation of its leaves.

A recent study found that most commercial sage sold in the United States (from 50 to 95%) was represented by *S. fruticosa* Mill. (*S. triloba* L. f.), characterized by compound or simple leaves with 1-2 pairs of lateral segments and a large terminal segment, rather than *S. officinalis* as purported.

## CHEMICAL COMPOSITION

Sage (*S. officinalis*) contains 1.0 to 2.8% volatile oil; 2 picrosalvin and carnosol (bitter principles); 3 salvin, salvin monomethyl ether, and carnosic acid; 45 flavonoids including genkwanin, 6-methoxygenkwanin, luteolin, luteolin-7-methyl ether, 6-methoxyluteolin, 6-methoxyluteolin-7-methyl ether, hispidulin, and salvigenin; 6, 7 phenolic acids (rosmarinic, labiatic, caffeic, and trace of chlorogenic); 8, 9 salviatannin (a tannin of the condensed catechin type which on storage undergoes degradation to phlobaphenes); and others (MARSH, MARTINDALE, STAHL).

Sage oil contains  $\alpha$ - and  $\beta$ -thujones (normally ca. 50%) as the main components. Other compounds present include cineole, borneol, viridiflorol, 2-methyl-3-methylene-5-heptene, and sesquiterpenes.

Spanish sage contains a volatile oil composed of highly variable amounts of camphor (11 to 34%), cineole (18 to 35%), limonene (1 to 41%), camphene (5 to 30%),  $\alpha$ -pinene (4 to 20%),  $\beta$ -pinene (6 to 19%), linalool, linalyl acetate, borneol, and others. It also contains numerous polyphenolic compounds, including luteolin-4'-O-glucuronide, rosmarinic acid, salvigenin, eupatorin, nepetin and apigenin, among others.

Sage extracts, like those of rosemary, have strong antioxidative activities; labiatic acid and carnosic acid are reported to be the active compounds (see rosemary). Sage is also reported to have fish odour-suppressant properties.

#### PHARMACOLOGY OR BIOLOGICAL ACTIVITIES

Sage reportedly has antibacterial, fungistatic, virustatic, astringent, secretion-stimulating, and perspiration-inhibiting effects.

Phenolic acids (e.g., salvin and salvin monomethyl ether) isolated from sage have antimicrobial activities, especially against *Staphylococcus aureus*. Spanish sage oil has also been reported to have antimicrobial properties. Sage oil has been reported to have neurotropic antispasmodic effects against acetyl-choline spasms in laboratory animals.

Although sage oil contains more thujone than absinthium oil, it has not been reported to be toxic (see absinthium). Dalmation sage oil has been reported to be non-irritating and non-sensitizing to human skin when tested in a diluted form. When applied undiluted it produced one irritation reaction in 20 subjects and was moderately irritating to rabbits.

Spanish sage oil was non-irritating and non-sensitizing to human skin and skin of laboratory animals; it was also nonphototoxic on mice and swine.

Infusions and suspensions of Spanish sage have hypoglycemic activity in rabbits.

#### USES

Medicinal, Pharmaceutical, and Cosmetic.

The dried leaves, the essential oil, tincture and fluid extract, are used in European phytomedicine for dyspeptic symptoms and diaphoretic effects; external use (gargles and rinses) for inflamed mucous membranes of the oral mucosa and throat.

Both sage oil and Spanish sage oil are used (the former much more extensively) as fragrance components in soaps, detergents, creams, lotions, and perfumes (e.g., colognes and after-shave lotions), with maximum use level of 0.8% reported for both oils in perfumes. Spanish sage oil is generally more commonly used in soaps, detergents, and industrial fragrances.

Food. Sage is widely used as a flavour ingredient in baked goods, meat and meat products, condiments and relishes, processed vegetables, soups, gravies, fats and oils, and others. Highest average maximum use level reported is 0.477% in baked goods.

Sage oleoresin is also widely used in baked goods, meat and meat products, and condiments and relishes. Highest average maximum use level reported is about 0.014% (139 ppm) in meat and meat products.

Sage oil and Spanish sage oil are extensively used in most categories of food products, including alcoholic (e.g., vermouths and bitters) and non-alcoholic beverages, frozen dairy desserts, candy, baked goods, gelatins and puddings, meat and meat products, and condiments and relishes. Highest average maximum use levels reported are about 0.013% (126 ppm) and 0.004% (40.5 ppm) for sage oil and Spanish sage oil, respectively, in meat and meat products.

Health Food/Herb Teas. Dried leaves used as a tea ingredient; occasionally in tablets, capsules, tincture, etc., for traditional indications.

Traditional Medicine. Sage is used as a tonic, digestive, antiseptic, astringent, and antispasmodic. It is used to reduce perspiration (e.g., night sweats), to stop the flow of milk, to treat nervous conditions (e.g., trembling, depression, and vertigo), dysmenorrhoea, diarrhoea, gastritis, sore throat, insect bites, and others, usually in the form of a tea or infusion.

Sage has been reported used in cancers.

Others. Like rosemary, sage can serve as source of natural antioxidants (see rosemary).

#### COMMERCIAL PREPARATIONS

Sage, sage oleoresin, and Dalmation sage oil; Spanish sage oil. Sage was formerly official in N.F. Dalmation sage oil and Spanish sage oil are official in F.C.C. Regulatory Status. GRAS (sage, §182.10 and §182.20; Spanish sage, §182.20); no thujone limit for sage oil is specified (see absinthium). Subject of a positive German therapeutic monograph; allowed for internal use in dyspeptic complaints, and as a diaphoretic; internally for inflamed oral mucous membranes. A separate monograph on *S. fruticosa* (*S. triloba*) is pending.

**British Herbal Pharmacopoeia, The:** 1983. ISBN 0-903032-07-4. British Herbal Manufacturers Association (B.H.M.A)

#### SALVIA

##### SYNONYMS

Sage; Red Sage.

##### DEFINITION

Salvia consists of the dried leaves of *Salvia officinalis* L. (Fam. Labiatae), a perennial herb growing up to 50 cm in height. Salvia is indigenous to Southern Europe and the United States, and yields 1-2.5% of volatile oil containing salvene, pinene, camphor, cineole, borneol, thujone, salvene esters and sesquiterpenes.

B.P.C. (1934), p. 921. Martindale 27th Edn., p. 1026.

## DESCRIPTION

Macroscopical: Leaves oblong-lanceolate or ovate, 2-10 cm long and 1-2.5 cm broad; apex acute, base rounded or somewhat cordate, frequently lobed; margin crenulate; upper surface grey-green and pubescent when young, nearly smooth with a depressed midrib and veins when older; lower surface light green, prominent midrib, minutely reticulate and densely pubescent; petiole 1-5 cm long, upper side grooved, grey-purple. Odour aromatic; taste aromatic and bitter.

Microscopical: Dark green powder; epidermal fragments polygonal and thick-walled, stomata caryophyllaceous; covering trichomes long, narrow, uniseriate, 2-6 celled with thick walls and sharply acute apices; glandular trichomes of two types, 1-4 celled stalk and a mono or bicellular head, sessile rosette-shaped trichomes with 6-8 encapsulated cells.

Total Ash: Not more than 8 %.

Foreign Organic Matter: Not more than 3 %.

Thin-Layer Chromatography: Ruffini, G. (1965), J. Chromatography, 17, 483.

## THERAPEUTICS

Action: Carminative. Spasmolytic. Antiseptic. Astringent. Antihidrotic.

Indications: Flatulent dyspepsia. Pharyngitis, uvulitis, stomatitis, gingivitis, glossitis-internally or as a gargle or mouthwash. Hyperhidrosis. Galactorrhoea.

Specific Indications: Inflammation of the mouth, tongue or throat, as a gargle or mouthwash.

Combinations used: Salvia may be combined with Potentilla and Gileadensis as a gargle in throat conditions. Combines with Filipendula and Chamaemelum in dyspepsia.

Preparations and Dosage: (thrice daily)

Dried herb. Dose 1-4 g or by infusion. Liquid Extract 1:1 in 45 Vo alcohol. Dose 1-4 ml.

**Newall**, Carol A.; **Anderson**, Linda A. and **Phillipson**, J. David: Herbal Medicines - a guide for health-care professionals. London. The Pharmaceutical Press. 1996. ISBN No. 0-85369-289-0.

## SAGE

### Species (Family)

*Salvia officinalis* L. (Labiatae)

### Synonyms(s)

Garden, Dalmatian and True Sage

Red sage refers to *S. haematodes* Wall.

Greek sage refers to *Salvia triloba*

## Part(s) Used

Leaf

## Pharmacopoeial Monographs

BHP 1983

BPC 1934

Martindale 30th edition

Pharmacopoeias - Aust., Fr., Ger., Hung., Rom., Russ., Swiss, and Yug.

## Legal Category (Licensed Products)

GSL

## Constituents

*Acids* Phenolic - caffeic, chlorogenic, ellagic, ferulic, gallic, rosmarinic.

*Tannins* (3 - 8%). Hydrolysable and condensed.

*Volatile oils* (1 - 2.8%) Major components are  $\alpha$ - and  $\beta$ - thujones (35 - 50%, mainly  $\alpha$ -).

Others include 1,8-cineole, borneol, camphor, caryophyllene, linalyl acetate and various terpenes.

It has been noted that commercial sage may be substituted with *Salvia triloba*. In contrast to *S. officinalis* the principal volatile oil component of *S. triloba* is 1,8-cineole with  $\alpha$ -thujone only accounting for 1 - 5%. Compared to *S. officinalis* volatile oil yield of various *Salvia* species is lower, with total ketone content and higher total alcohol content.

## Food Use

Sage is commonly used as a culinary herb. Sage is listed by the Council of Europe as a natural source of food flavouring (category N2). this category indicates that sage can be added to foodstuffs providing the concentration of thujones ( $\alpha$  and  $\beta$ ) present in the final product does not exceed 0.5 mg/kg, with the exceptions of alcoholic beverages (10 mg/kg), bitters (35 mg/kg), food containing sage (25 mg/kg) and sage stuffing (250 mg/kg).

## Herbal Use

Sage is stated to possess carminative, antispasmodic, antiseptic, astringent and antihidrotic properties. Traditionally, it has been used to treat flatulent dyspepsia, pharyngitis, uvultis, stomatitis, gingivitis, glossitis (internally or as a gargle/mouthwash), hyperhidrosis, and galactorrhoea.

## Dose

**Leaf:** 1 - 4 g or by infusion three times daily

**Liquid extract:** (1:1 in 45% alcohol) 1- 4 ml three times daily

## Pharmacological Actions

*Animal studies* Hypotensive activity in anaesthetised acts, CNS-depressant action (prolonged barbiturate sleep) in anaesthetised mice, and an antispasmodic action *in vitro* (guinea pig ileum) have been reported for a sage extract and for the essential oil 60 - 80% inhibition of

contractions induced by acetylcholine, histamine, serotonin and barium chloride has been noted for a total sage extract, with lesser activity exhibited by a total flavonoid extract. An initial spasmogenic action exhibited by low doses of sage oil has been attributed to the pinene content. Antispasmodic activity *in vitro* (iv, guinea pig), has been reported for sage oil, which released contraction of Oddi's sphincter induced by intravenous morphine.

*In vivo* studies have indicated different activities for *S. triloba* and *S. verbenaca* compared to *S. officinalis*.

Antimicrobial activity of the volatile oil has been attributed to the thujone content. Anti microbial activity *in vitro* was noted against *Escherichia coli*, *Shigella sonnei*, *Salmonella* species, *Klebsiella ozanae* (Gram-negative), *Bacillus subtilis* (Gram-positive), and against various fungi (*Candida albicans*, *C. krusei*, *C. pseudotropicalis*, *Torulopsis glabrata*, *Cryptococcus neoformans*). No activity was observed versus *Pseudomonas aeruginosa*. Microencapsulation of the oil in gelatin-acacia capsules introduced a lag-time with respect to the antibacterial activity and inhibited the antifungal activity.

Hypoglycaemic activity *in vivo* has been reported for *S. lavandulifolia* (rabbit) and for mixed phytotherapy preparations involving various *Salvia* species, including *S. officinalis*. Activity in normo-glycaemic, hypoglycaemic and in alloxan-diabetic rabbits was observed, although no change in insulin concentrations was noted.

Various activities in rats, mice and rabbits have been reported for a related species, *S. haematodes* Wall. (commonly known as red sage), including wound healing, anti-inflammatory, analgesic, anticonvulsant and hypotensive, and positive inotropic and chronotropic actions (*in vitro*).

### **Side-effects, Toxicity**

A case of human poisoning has been documented following ingestion of sage oil for acne. Convulsant activity in both humans and animals has been documented for sage oil. In rats, the subclinical, clinical and lethal doses for convulsant action of sage oil are estimated as 0.3, 0.5, and 3.2 g/kg. This toxicity has been attributed to the ketone terpenoids in the volatile oil, namely camphor and thujone. Acute LD<sub>50</sub> values for sage oil are documented as 2.6 g/kg (orally, rat) and 5 g/kg (intradermal, rabbit).

Sage oil is reported to be a moderate skin irritant and is not recommended for aromatherapy.

### **Contra-indications, Warnings**

Sage oil is toxic (due to the thujone content) and should not be ingested. In view of the toxicity of the essential oil, sage extracts should be used with caution and not ingested in large amounts. Sage may interfere with existing hypoglycaemic and anticonvulsant therapies, and may potentiate sedative effects of other drugs.

*Pregnancy and lactation* Sage is contraindicated during pregnancy. Traditionally, it is reputed to be an abortifacient and to affect the menstrual cycle. The volatile oil contains a high proportion of  $\alpha$  and  $\beta$  thujones which are known to be abortifacient and emmenagogic.

### **Pharmaceutical Comment**

The characteristic components of sage to which its traditional uses can be attributed are the volatile oil and tannins. However, the oil contains high concentrations of thujone, a toxic ketone and should not be ingested. Sage is commonly used as a culinary herb and presents no hazard when ingested in amounts normally encountered in foods. However, extracts of the herb should be used with caution and should not be ingested in large amounts or over prolonged periods.

**Price, Shirley:** Practical Aromatherapy - How to use essential oils to restore health and vitality. Dealerfield. 3rd. edition. 1994. ISBN No. 1-85927-048-4.

Recommends the use of sage for rheumatism and aches and pains in joints. She also says that it is a good nerve tonic. It is used in cases of sluggish or congested ulcers and on wounds.

**Fluck, Hans:** Medicinal Plants, 1988 W.Foulsham & Co. Ltd. ISBN 0-572-00996-8.

In small doses it is anti-inflammatory, and that it is mildly diuretic and checks excessive perspiration. LARGE DOSES ARE TOXIC. Because of the tannin content it is astringent and anti-inflammatory. It is also used as a lotion or compress for wounds.

**Lust, John.:** The Herb Book – the most complete herb book ever published, 1974, 1<sup>st</sup> edition, Benedict Lust Publications. ISBN 0-87904-007-6.

**Lust, J.:** The Herb Book, 1986, 16th. impression, Bantam Publishing. ISBN 0-553-17273-5.

It is antihydrotic (reduces sweating/perspiration), antispasmodic and astringent. It reduces perspiration when taken as a tea, the action starts about 2 hours after drinking and can last for several days. It is also used in nervous conditions, trembling, depression, and vertigo. Used as an astringent in gastric cases, good gargle. Fresh leaves can be used on insect bites.

**British Herbal Pharmacopoeia, The:** 1983. ISBN 0-903032-07-4. British Herbal Manufacturers Association (B.H.M.A):

Confirms its value as a carminative, spasmolytic, antiseptic, astringent, antihydrotic,. It is used in a variety of complaints, the most relevant for this survey being inflammation of the mouth, tongue, and throat, as a gargle or mouthwash.

**Wren, R.C.:** Potter's New Cyclopaedia of Botanical Drugs and Preparations, 1985 8th impression, published C.W. Daniels. ISBN 0-85032-009-7.

Closely agrees with the reference above and confirms the use as an astringent and particularly in oral complaints, such as mouth ulcers and inflammations of the mouth and throat.

**Stuart, M.:** The Encyclopaedia of Herbs and Herbalism. 1986. Orbis ISBN 0-85613-700-6. signed edition.

**Stuart, Malcom:** Illustrated guide to Herbs. CPG (Cambridge Physic Garden) Edgerton International Ltd. 1994 (originally published 1979, see also B28). signed edition.

Gives some interesting folklore. It is an antifungal, antiseptic, anti-inflammatory, astringent, and

weakly hypoglycaemic. Useful in nervous conditions such as anxiety or depression. Useful in baths to treat skin problems.

**Winter-Griffith, H.:** The Vital Vitamin Fact File. 1988. Thorsons Publishing ISBN 0-7225-1693-2.

Lists the known effects as, depressing fever control centre in the brain, relieves spasm in the smooth skeletal muscle. It is speculated that it repels insects.

**Valnet, J.:** The Practice of Aromatherapy. 1986. C.W.Daniel Co. Ltd. ISBN 0-85207-143-4.

Gives the following external properties, astringent, healing (cicatrising), antiseptic, tonic, antirheumatic in baths, for atonic wounds, sores, ulcers, dermatosis (eczemas), alopecia, wasp stings, insect bites, domestic disinfectant, etc.

**Hoffmann, D.:** The Herb Users Guide. 1987 Thorsons Publishing. ISBN 0-7225-1288-0.

It is good for inflammations of the mouth, soothes the mucous membrane, good mouthwash, for inflamed and bleeding gums. Good for mouth ulcers. Reduces sweating when taken internally. Promotes the healing of wounds. AVOID DURING PREGNANCY SINCE IT STIMULATES THE MUSCLES OF THE UTERUS.

**Buchman, D.D.:** Herbal Medicine: The Natural way to get well and stay well. 1987. Century Hutchinson ISBN 0-09-153691-X.

It is good for depression, bad breath, fever, antiseptic (one of the herbs in the vinegar of the four thieves). Good for varicose veins and warts on the legs.

**Trattler, R.:** Better Health through Natural Healing. 1985 Thorsons Publishers. ISBN 0-7225-1382-8.

Recommends the use of sage for varicose veins and leg ulcers.

**Probert Jones, Christina:** Marks and Spencer: Extracts from Nature. 1989 Tigerprint. no ISBN No.

In Extracts from Nature we read that sage is very versatile, effective in a warm bath to ward off colds and coughs. It reduces sweating, alleviates nervous complaints, is antiseptic, astringent, diuretic and also has antifungal action.

**Weiss, R.F.:** Herbal Medicine. (translated from the 6th. German edition of Lehrbuch der Phytotherapie by A.R.Meuss). The Bath Press. 1986. ISBN 0-906584-19-1.

Sage will prevent a sweat if taken internally. It is one of our oldest medicinal plants, which originates from the Mediterranean. It contains bacteriacidal principles. Good results have been seen with peritonsillar abscesses as sage will give subjective relief and promote healing. (gargle needs to be hot and repeated every 2 hours)

**Leung, A.Y.:** Encyclopedia of Common Natural Ingredients used in food, drugs and

cosmetics. 1st. edition. John Wiley 1980 ISBN No. 0-471-04954-9.

Has a comprehensive quantitative analysis of the components present in sage. Antimicrobial properties are reported. Antispasmodic effects have been recorded. In folk medicine sage is used as a tonic, digestive, antiseptic, astringent, and antispasmodic. It is used to reduce perspiration, to stop the flow of milk, to treat nervous conditions, trembling, vertigo, sore throat, insect bites, etc. It has been reported in its use against cancer.

**Bunney, S.:** The Illustrated Book of Herbs. 1984. Octopus ISBN 0-7064-1489-6.

Sage is an antiseptic, antifungal, astringent, antispasmodic and has antidiaphoretic properties (reduces sweating). It has a wide range of medicinal uses. A tincture prepared from the fresh leaves is used in homoeopathy. **SAGE SHOULD NOT BE TAKEN IN LARGE DOSES FOR A LONG PERIOD BECAUSE OF THE THUJONE IT CONTAINS.**

**Level, C.F.:** Herbal Delights. 1987 Faber and Faber. ISBN 0-571-14850-6.

Sage is so wholesome that it is not surprising that at one time it was regarded as a panacea for every disease under the sun. Even the Chinese preferred its leaves to their own tea. They are strongly aromatic and the oils distilled from them are strongly antiseptic. Sage has a marked effect on the brain and the head. It strengthens the sinews and has been used with success in palsy.

**Ceres:** The Healing Power of Herbal Teas, 1984 Thorsons Publishers, ISBN 0-72251578-8.

This is another herb that has the reputation as one which wards off evil. It was thought to be efficacious against the biting of serpents and the dispelling of evil spirits. Externally sage was thought to help relieve a headache. A sage lotion made in large quantity can be used for a foot bath while it is still hot, for weary, sore and strained ankles and feet. Dabbed onto insect bites it takes away the sting and the itch.

**Grieve, Maud:** A Modern Herbal – the medicinal, culinary, cosmetic and economic properties, cultivation and folklore of herbs, grasses, fungi, shrubs and trees with all their modern scientific uses. 1998 Tiger Books International, London. ISBN No.1-85501-249-9.

She reports that it is a stimulant, astringent, tonic, and carminative. In the U.S. it is still an official medicine. It is an excellent oral antiseptic and very good for all affections of the mouth and throat. There are many other medical conditions covered in this section. It is also an excellent lotion for ulcers and to heal raw abrasions of the skin. It has also been popularly used to darken the hair when applied to the scalp. Good embrocation for use in cases of rheumatism. Full text below!

**Evans, M.:** A guide to herbal remedies. C.W.Daniel. 1990 ISBN No. 0 85207 221.

It is an astringent and antiseptic medicine, highly recommended for treating soreness and inflammation in the throat or mouth, both as a gargle and for internal use; **BUT AVOID INTERNALLY IN PREGNANCY.** Sage also has some value in relieving indigestion with gas or spasmodic pain. Used in sore throat and tonsillitis.

**Back, P.** The Illustrated Herbal. 1987. Hamlyn Publishers through Octopus Books printed in Hong Kong by Mandarin. ISBN No.0 600 553 361.

The botanical name given to sage comes from the Latin "salvare" meaning to be well and refers to the healing properties of the herb. Sage was widely used to steady the nerves and was said to sharpen the wit and the brain.

It helps the digestion, helps those going through the menopause and subject to hot flushes. It reduces and prevents excessive perspiration. A small glass of sage tea will help to soothe a nervous headache. A cup of sage milk can be very effective in helping to ward off a cold.

It is used in the form of an infusion as a mouth wash for infections and inflammations of the mouth, bleeding gums and to regulate the flow of saliva. As a gargle it is an effective remedy for a sore and inflamed throat, tonsillitis and laryngitis.

It is an instant remedy for insect bites, reducing the pain and irritation. Sage embrocation is helpful for easing muscular pain, for rheumatism, sciatica and for loosening stiff and painful joints. It will clear a stuffy head. Sage is a good hair tonic and the infusion, used as a hair lotion, can be rubbed on to the scalp every other day to ensure healthy shining hair.

It is particularly good for dark hair, strengthening the hair and deepening the natural colour.

For large pores, sage can be of benefit as a compress or infusion. It can be used for similar purpose as a face pack. Sage cream can be used for cold sores near the mouth.

**Schauenberg, P., Paris, F.:** Guide to Medicinal Plants. 1990 First paperback edition (Paris 1974). Lutterworth Press ISBN No. 0-7188-2820-8.

It has violet flowers. The whole plant produces 2% of an essential oil containing 30% thujone, 15% cineol, a camphor, tannin and bitter compounds (picrosalvine etc.). Sage's most remarkable property is its ability to stop perspiration. The action starts 2 hours after the dose is taken and can be prolonged for several days. Sage can also arrest lactation; it is carminative, spasmolytic, stimulating, antidiarrhoeic; it has oestrogenic properties. Infusions, extracts and tinctures are used. An infusion is recommended for nervous disorders, dizziness, trembling and depressive states. It is a useful disinfectant in the treatment of amenorrhagia, dysmenorrhoea and leucorrhoea. The leaves are used dried in the shade. Employed in ancient Egypt to increase the fertility of women.

**Genders, Roy:** Natural Beauty - the practical guide to Wildflower cosmetics. Webb and Bower. 1985. ISBN No. 0-86350-078-1.

It was given pride of place amongst all aromatic plants and there is a saying translated from an Anglo-Saxon manuscript which reads "why should man die when he has sage?" For this reason it took the Latin name meaning salvation. The common sage is one of the best plants for darkening and toning hair. An infusion of the fresh leaves or tops is used.

Tony **Balacs:** The International Journal of Aromatherapy, Spring 1992, Vol.4, No.1, p.14-15. Safety in pregnancy.

Sage (*Salvia officinalis*) contains between 1-2.8% essential oil, of which about half will be thujone (36-62%). The Essential Oil Safety Data Manual comments that unless sage oil contains an as yet unidentified substance which somehow reduces the toxicity of its thujone, which is not impossible but is not particularly likely either, sage must be assumed to be as toxic as tansy, wormwood and mugwort.

**Bianchini F., Corbetta F.,:** The Fruits of the Earth. Translated from the Italian by Mancinelli A. Bloomsbury Books, London. ISBN No. 1-870630-10-6.

It belongs to the mint family (Labiatae) and is considered to be a medicinal plant. The leaves of sage *Salvia officinalis* contain essential oil formed by various components: salviol, salvene, pinene, and borneol (camphol). These are bitter substances and resins, and they are said to have tonic-digestive, antispasmodic, antiseptic, resolvent, and healing properties, all of which justify the various popular uses of this herb; for example, the custom of rubbing teeth and gums with sage leaves, and of making compresses or simple rubbings of the leaves have been said to have a beneficial action on erythemas (rashes) or eczema.

### **The Lawrence Review of Natural Products.**

*Salvia officinalis* (Dalmation Sage), *Salvia lavandulaefolia* (Spanish Sage). Garden sage, true sage, scarlet sage, meadow sage. It has violet-blue flowers. It should not be confused with red sage or brush sage of the desert.

Dried sage leaf is used as a culinary spice and as a source of sage oil, which is obtained by steam distillation. Traditionally, sage and its oil have been used for the treatment of a wide range of illnesses; the name salvia derives from the Latin word meaning "healthy" or "to heal". Extracts and teas have been used to treat digestive disorders, as a tonic and antispasmodic. The plant has been employed topically as an antiseptic and astringent and has been used to manage excessive sweating. Sage has been used internally as a tea for the treatment of dysmenorrhoea, diarrhoea, gastritis and sore throat. The dried leaves have been smoked to treat asthma. Despite these varied uses, there is little evidence that the plant exerts any significant pharmacologic activity. The fragrance of the plant is said to suppress the odour of fish.

*Salvia officinalis* contains 1 to 2.8% of a volatile oil. The highly aromatic plant contains a wide variety of minor chemical constituents including picrosalvin, carnosol, salvin, and related ethers, flavonoids, phenolic acids and salviatannin (a tannin that undergoes degradation to phlobaphenes upon storage).

Sage oil contains  $\alpha$ - and  $\beta$ -thujones, which account for about half of the composition of the oil. The composition of Spanish sage oil differs somewhat, with variable amounts of camphor, cineol, limonene, camphene and pinene. Sage oil is often adulterated by the addition of thujone derived from the leaves of *Juniperus virginiana* (red cedar).

Sage extracts have been shown to have strong antioxidative activities, with labiatic acid and carnosic acid reported to be the active compounds.

The phenolic acid salvin and its monomethyl ether have antimicrobial activity, especially against *Staphylococcus aureus*.

Sage oil has antispasmodic effects in laboratory animals and this is likely related to its effect on gastrointestinal antispasmodic. There is some evidence that sage oil may exert a centrally mediated antisecretory action: the carminative effect is likely due to the irritating effects of the volatile oil.

Although sage oil contains thujone, the oil does not have a reputation for toxicity. The oil has been found to be non-irritating and non-sensitising when applied topically to human skin in diluted concentrations. Spanish sage oil was also non-phototoxic when applied to mice and pigs.

Cheilitis and stomatitis, however, have been reported in some cases following ingestion of sage tea. Others have reported that ingestion of large amounts of the plant extract may cause dry mouth or local irritation.

**In a file from Dr Stephen Greenburg** (Lipo Chemicals Inc.) entitled "Ethnic Botanical Literature) author anon.

The author mentions *Salvia officinalis* as garden sage. Elderly blacks living in Michigan have utilised crushed fresh sage leaves to get rid of warts on the face, neck, throat, hands and arms. An herbal wash of the same fresh leaves has been used to relieve bumps, sores, wounds, cuts and other skin injuries. A mixture of garden sage and rosemary has been used by some of the in the past to maintain the sheen of their dark, curly hair and to strengthen and stimulate further hair growth. (ref. Eddie L. Boyd, et al. Home remedies and the black elderly. Ann Arbor: Institute of Gerontology and College of Pharmacy, University of Michigan, 1984.)

New Orleans Blacks with either Cajun or Creole blood mixtures or both kinds in them, have used sage to reduce perspiration. Sage seems to have a calming effect on their sweat glands and effectively reduces outbreaks of sweat whether they occur in the underarm area, on hands, feet, or the entire body. A tea made of either the dried or fresh leaves and one cup of the same drunk each day in small doses quickly controls excessive sweating. (ref. Edward S. Ayensu. Medicinal Plants of the West Indies. Algonac, Michigan: Reference Publications Inc. 1981.)

Sage and rosemary are two herbs which some American Blacks in various Southern States consider to be "soul cosmetics" just as they regard different kinds of food as being "soul food". (ref. Watt, J.M. and M.G. Breyer-Brandwijk. The Medicinal and Poisonous Plants of Southern and Eastern Africa. London: E & S Livingstone Ltd, 1962.)

Another species of sage *Salvia serotina* is used in the form of either a tea or lotion for treating scratches, eczema, rash, itching, cuts, and burns on the skin by native blacks throughout the West Indies.

Various other species of sage - *Salvia repens*, *Salvia rugosa*, *Salvia runcinata*, and *Salvia sisymbriifolia* - have all been used at various times by different Southeastern African tribes for treating bed sores, herpes lesions, stinging nettle rash, and swellings due to insect or mosquito bites and wasp stings. They are all used as decoctions, teas or simple lotions. Sometimes milk would be used to steep the sage in, with excellent results.

Species of sage oil, especially garden and Spanish sages, are used as fragrance components in soaps, detergents, creams, lotions, and perfumes etc. Spanish sage oil is the more commonly used.

Sage contains strong antioxidative compounds such as labiatic acid and carnosic acid, plus phenolic acids like salvin and salvin monomethyl ether which have antimicrobial properties.

Species of sage also contain thujone (normally around 50%) as the main components of sage oil. These materials contribute to the healing properties of this plant in a variety of skin conditions.

### **The William Gardener Collection**

*Salvia officinalis* L., Lamiatae, Garden Sage, a small shrub or shrubby herb, rarely a herb, the lower part woody, the stems of the upper part square, and clothed with felted hairs.

Native to southern Europe, and growing wild there, the plant is widely cultivated for its culinary and medicinal values. It will grow in any temperate or warm temperate region, including mountain areas in low latitudes. Thus it is cultivated successfully in Kashmir (3), and in hill country in northern Yunnan (4), as well as in other parts of China, but in the deep tropics seem too near the equator for it. Burkill (2) mentions that when introduced into the hills near Penang it did not persist for long. Clayey and loamy soils are said to produce the best quality of sage, and hot dry climates to be unsuitable (3).

The species is very variable in cultivation, particularly in shape and colouration of the leaves.

Sage Oil, also known as Dalmation Sage Oil, a pale yellow, mobile liquid, is produced by steam distillation from the leaves in southern Europe, the Levant, the USSR, and Kashmir. Young plants which are not yet in flower are thought to be the most aromatic and to provide the most oil. The best quality is regarded as that produced from wild plants in Yugoslavia, while oil produced from cultivated plants in Kashmir is claimed to be the second best (3). The odour and the flavour are warm and aromatic, the odour being also fragrant, and the taste somewhat astringent, and a little bitter.

Properties and constituents of the oil can vary according to source. The wealth of India (3) records a European sample of the oil as containing  $\alpha$ -pinene, 3.3%;  $\beta$ -pinene, 5.6%; linalyl acetate, 14.8%; thujone, 51.0%; camphor, 8.2%; borneol, 6.6%; and borneol acetate, 1.7%; with large numbers of mono- and sesquiterpenes present, along with small amounts of triterpenoids and steroids, with ursolic and oleanolic acids, thujene, 3-carene and viridifloral among the constituents.

Another analysis, based on samples predominantly from southern Europe and the USSR, states (6) that the plant contains 1-2.8% of volatile oil (citing C.A. 87, 141106x, 1977), whose constituents include the bitter principles picrosalvin and carnosol (citing C.A. 71, 113102u, 1969); salvin, salvin monomethyl ether, and carnosic acid (citing C.A.86, 117603r, 1977); flavonoids including genkwanin, 6-methoxyleteolin, 6-methoxyluteolin-7-methyl ether, hispidulin, and salvigenin; phenolic acids (rosmarinic, labiatic, caffeic, and a trace of chlorogenic); a tanning, salviatannin, of the condensed catechin type which on storage undergoes degradation to phlobaphenes; and others. The main components are reported to be  $\alpha$ - and  $\beta$ -thujones, normally c. 50%.

The higher the thujone content, the better the quality attributed to the oil; and The Wealth of India (3) records the values of a sample of oil obtained by hydrodistillation of the dried herb

from Kashmir (yield (1.1%) as  $d_{20}^{20}$  0.9268  $n_D^{20}$ , 1.4633 [a], +0.2%, acid value, 1.1; and ester value after acetylation, 30.0. The constituents reported as present were:  $\alpha$ -pinene, 1.8%; cineole; linalyl acetate, 10.1%; thujone, 44.45%; borneol, bornyl acetate; farnesol; and camphor. The linalyl acetate content of the oil was regarded as too low for commercial exploitation of the oil for the ester.

Arctander (1) suggests that the use of infusions of the herb in effective mouth washes and gargles in household medicine indicates fairly good bactericidal value in the oil.

Antimicrobial properties have been reported as especially active against *Staphylococcus aureus*, and to be due to phenolic acids (e.g. salvin and salvin monomethyl ether) isolated from sage (6, citing C.A. 82 (1975), 167491r, and C.A. 86 (1977), 117603r).

In The Wealth of India (3) it is stated that the oils is used in insecticidal preparations. The volatile oil in this and other labiates is known to be obnoxious to insects and to reduce their presence in gardens, of the parts of gardens, where these herbs are planted (7: 370).

Large doses of the oil have been considered toxic to human beings, increasing the flow of blood to the abdominal organs, and possibly being harmful to the central nervous system (5). Lesser quantities would appear to have no adverse effects, in spite of the thujone content, given the considerable use as a flavouring material in vermouth and other bitters or aperitifs, and as a spice in sauces, sausages, pickles, etc. (1).

Knowledge and use of the species go back many centuries. Theophrastus (9) records two sages, one a spineless wild undershrub whose name he gives as Joakos (sphakos), the other resembling it, but cultivated, called (elelispakos). Pliny the Elder (8) says that this latter plant is called Salvia by the Romans, a mint-like, hoary and aromatic and also cultivated more than sphakos of Theophrastus, and used as a diuretic, for promoting menstruation, as a local anaesthetic (numbering the surface of the skin where it is applied), a styptic, and when taken in drink with wormwood, a treatment for dysentery. Monastery gardens in the time of the Carolingian empire of the early Middle Ages were cultivating the plant. Walafrid Strabao, in his Hortulus (10), describes it as having a sweet scent and being of proved value in many human ailments, and he goes back to the Greek root for the name he gives it, Lelifagus. By the time the Medical School of Salerno was established and famous, in the full flowering of the Middle Ages, this sage's name had reverted to Salvia, and a well-known distich became current, *Cur moriatur homo, cui salvia crescit in horto* - why should a man die, in whose garden Salvia is grown?.

There can be little doubt that, from the time of Theophrastus and Pliny on, the sage cultivated under these different names is *Salvia officinalis*.

The oil is anti-inflammatory, and astringent (5). Leung (6) states that in pharmacological action it is reported to have neurotropic effects against acetylcholine spasms in animals, and, citing Hartwell, J.L., 1969, Lloydia 32: 247, that it has been reported to have been used in cancers. It is also used as a convulsant, though it is less active in that capacity than wormwood oil (1). Mixed with rosemary, sage is said to maintain a dark sheen in the hair, strengthening it, and stimulating growth, activities attributable to the volatile oil in the plant (7:339).

In official medicine sage does not have the reputation it enjoyed in former days. In domestic or folk medicine it is still valued, however, especially in the form of an infusion, sometimes known

as mint tea. The properties ascribed to it are tonic, digestive, antiseptic, astringent, and anti-spasmodic. It is used to treat nervous conditions such as trembling, depression and vertigo, and in addition gastritis, dysmenorrhoea diarrhoea, and sore throats (6).

Indian use is much on these lines, and include the long-used gargle for sore throats that is derived from an infusion of the leaves. The hot infusion is said to be diuretic. Extracts from the leaves are reported to be antipyretic; and the dried leaves rubbed on the teeth are said to provide a good dentifrice. (3).

Use of the leaves, liquefied, to treat laryngitis, is mentioned in China (4).

In perfumery, the oil blends well with many other perfumes (1). It can form a component of the fragrance in soaps, detergents, and colognes and after-shave lotions (6).

In culinary use, the plant is well known as a standard spice, though in Roman times it is doubtful if it enjoyed the culinary popularity of other fragrant Mediterranean labiate herbs.

Sage and onion stuffing is no doubt also when used as a customary flavouring ingredient in sausages. It is among the most versatile of flavourings, and processed foods such as condiments and relishes, meat and meat products, and vegetables and soups, may all contain sage or sage oil, as can vermouth and bitters (6).

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**The Pharmaceutical Journal** Vol 255, Nov.25, 1995. p.708.

Onlooker: Sage against age. According to a report in New Scientist from 14th. October, workers at the Neurochemical Pathology Unit maintained by the MRC at Newcastle General Hospital have discovered evidence that Common Sage (*Salvia officinalis*) might prove useful in the struggle against Alzheimer's disease. The oil produced by this plant inhibits the activity of acetylcholinesterase, which may play a role in the loss of memory associated with the disease. In Alzheimer's disease the progressive deterioration of memory is associated with a fall in the brain concentration of acetylcholine. This may be brought about by excessive activity of esterase, and progressive memory loss can be slowed by some sufferers by administration of the antagonist tacrine.

They tested 15 herbs with the most promise.

It appears that sage was used in ancient Egypt and brought to our shores by the Romans. In medieval times a proverb said; "Who would live for aye must eat sage in May". Moreover, sage herb was chewed to improve the state of the teeth.

Gerard recorded: "Sage is singularly good for the head and the brain, it quickeneth the senses and memory, strengtheneth the sinews, restoreth health to those who have the palsy, and taketh away shaky tremblings of the members".

In France the herb was reputed to mitigate grief of body and mind, Perhaps this explains the note made by Samuel Pepys for April 26th, 1661, when travelling from Gosport to Southampton: "In our way....we observed a little churchyard, where the graves are accustomed to be strewn with sage."

*Salvia* contains a yellow volatile oil of penetrating odour, containing thujones, cineole, borneol, camphor, 2-methyl-3-methylene-5-heptene, diterpenes and flavonoids among its principal constituents. Its psychological activity is today rated as stimulant, astringent, tonic and carminative. The herb is used as the dried leaf for culinary purposes.

**Grieve**, Maud.: A Modern Herbal, 1984 Savvas Publishing. ISBN unknown.

**Grieve**, Maud: A Modern Herbal – the medicinal, culinary, cosmetic and economic properties, cultivation and folklore of herbs, grasses, fungi, shrubs and trees with all their modern scientific uses. 1998 Tiger Books International, London. ISBN No.1-85501-249-9.

### **Sages**

Sage, Common

Sage, Clary

Sage, Vervain

SAGE, COMMON

Botanical: *Salvia officinalis* (LINN.)

Family: N.O. Labiatae

Basic Description

Habitat

Cultivation

Description

Chemical Constituents

Medicinal Action and Uses

Culinary Recipes

Medicinal Recipes

Synonyms: (Old English) Sawge. Garden Sage. Red Sage. Broad-leaved White Sage. Narrow-leaved White Sage. *Salvia salvatrix*.

Parts Used: Leaves, whole herb.

The Common Sage, the familiar plant of the kitchen garden, is an evergreen undershrub, not a native of these islands, its natural habitat being the northern shores of the Mediterranean. It has been cultivated for culinary and medicinal purposes for many centuries in England, France and Germany, being sufficiently hardy to stand any ordinary winter outside. Gerard mentions it as being in 1597 a well-known herb in English gardens, several varieties growing in his own garden at Holborn.

Basic Description---Sage generally grows about a foot or more high, with wiry stems. The leaves are set in pairs on the stem and are 1 1/2 to 2 inches long, stalked, oblong, rounded at the ends, finely wrinkled by a strongly-marked network of veins on both sides, greyish-green in colour, softly hairy and beneath glandular. The flowers are in whorls, purplish and the corollas lipped. They blossom in August. All parts of the plant have a strong, scented odour and a warm, bitter, somewhat astringent taste, due to the volatile oil contained in the tissues.

Habitat: Sage is found in its natural wild condition from Spain along the Mediterranean coast up to and including the east side of the Adriatic; it grows in profusion on the mountains and hills in Croatia and Dalmatia, and on the islands of Veglia and Cherso in Quarnero Gulf, being found mostly where there is a limestone formation with very little soil. When wild it is much like the common garden Sage, though more shrubby in appearance and has a more penetrating odour, being more spicy and astringent than the cultivated plant. The best kind, it is stated, grows on the islands of Veglia and Cherso, near Fiume, where the surrounding district is known as the Sage region. The collection of Sage forms an important cottage industry in Dalmatia. During its blooming season, moreover, the bees gather the nectar and genuine Sage honey commands there the highest price, owing to its flavour.

In cultivation, Sage is a very variable species, and in gardens varieties may be found with narrower leaves, crisped, red, or variegated leaves and smaller or white flowers. The form of the calyx teeth also varies, and the tube of the corolla is sometimes much longer. The two usually absent upper stamens are sometimes present in very small-sterile hooks. The Red Sage and the Broad-leaved variety of the White (or Green) Sage - both of which are used and have been proved to be the best for medical purposes - and the narrow-leaved White Sage, which is best for culinary purposes as a seasoning, are classed merely as varieties of *Salvia officinalis*, not as separate species. There is a variety called Spanish, or Lavender-leaved Sage and another called

Wormwood Sage, which is very frequent.

A Spanish variety, called *S. candelabrum*, is a hardy perennial, the upper lip of its flower greenish yellow, the lower a rich violet, thus presenting a fine contrast.

*S. lyrata* and *S. urticifolia* are well known in North America.

*S. hians*, a native of Simla, is hardy, and also desirable on account of its showy violet-and-white flowers.

The name of the genus, *Salvia*, is derived from the Latin *salvere*, to be saved, in reference to the curative properties of the plant, which was in olden times celebrated as a medicinal herb. This name was corrupted popularly to *Sauja* and *Sauge* (the French form), in Old English, 'Sawge,' which has become our present-day name of Sage.

In the United States Pharmacopoeia, the leaves are still officially prescribed, as they were formerly in the London Pharmacopoeia, but in Europe generally, Sage is now neglected by the regular medical practitioner, though is still used in domestic medicine. Among the Ancients and throughout the Middle Ages it was in high repute: *Cur moriatur homo cui Salvia crescit in horto?* ('Why should a man die whilst sage grows in his garden?') has a corresponding English proverb:

'He that would live for aye,  
Must eat Sage in May.'

The herb is sometimes spoken of as *S. salvatrix* ('Sage the Saviour'). An old tradition recommends that Rue shall be planted among the Sage, so as to keep away noxious toads from the valued and cherished plants. It was held that this plant would thrive or wither, just as the owner's business prospered or failed, and in Bucks, another tradition maintained that the wife rules when Sage grows vigorously in the garden.

In the Jura district of France, in Franche-Comte, the herb is supposed to mitigate grief, mental and bodily, and Pepys in his Diary says: 'Between Gosport and Southampton we observed a little churchyard where it was customary to sow all the graves with Sage.'

The following is a translation of an old French saying:  
'Sage helps the nerves and by its powerful might  
Palsy is cured and fever put to flight,'

and Gerard says:

'Sage is singularly good for the head and brain, it quickeneth the senses and memory, strengtheneth the sinews, restoreth health to those that have the palsy, and taketh away shakey trembling of the members.'

He shared the popular belief that it was efficacious against the bitings of serpents, and says:

'No man need to doubt of the wholesomeness of Sage Ale, being brewed as it should be with Sage, Betony, Scabious, Spikenard, Squinnette (Squinancywort) and Fennel Seed.'

Many kinds of Sage have been used as substitutes for tea, the Chinese having been said to prefer Sage Tea to their own native product, at one time bartering for it with the Dutch and giving thrice the quantity of their choicest tea in exchange. It is recorded that George Whitfield, when at Oxford in 1733, lived wholesomely, if sparingly, on a diet of Sage Tea, sugar and coarse bread. Balsamic Sage, *S. grandiflora*, a broad-leaved Sage with many-flowered whorls of blossoms, used to be preferred to all others for making tea. An infusion of Speedwell (*Veronica officinalis*), Sage and Wood Betony is said to make an excellent beverage for breakfast, as a substitute for tea, Speedwell having somewhat the flavour of Chinese green tea. In Holland the leaves of *S. glutinosa*, the yellow-flowered Hardy Sage, both flowers and foliage of which exhale a pleasant odour, are used to give flavour to country wines, and a good wine is made by boiling with sugar, the leaves and flowers of another Sage, *S. sclarea*, the Garden Clary. The latter is known in France as 'Toute bonne' - for its medicinal virtues.

It was formerly thought that Sage used in the making of Cheese improved its flavour, and Gay refers to this in a poem:

'Marbled with Sage, the hardening cheese she pressed.'

Italian peasants eat Sage as a preservative of health, and many other country people eat the leaves with bread and butter, than which, it has been said, there is no better and more wholesome way of taking it.

A species of Sage, *S. pomifera*, the APPLEBEARING SAGE, of a very peculiar growth, is common on some of the Greek islands. It has firm, fleshy protuberances of about 3/4 inch thickness, swelling out from the branches of the plant and supposed to be produced in the same manner as oak apples, by the puncture of an insect of the *Cynips* genus. These excrescences are semi-transparent like jelly. They are called Sage Apples, and under that name are to be met with in the markets. They are candied with sugar and made into a kind of sweetmeat and conserve which is regarded by the Greeks as a great delicacy, and is said to possess healing and salutary qualities. It has an agreeable and astringent flavour. This plant is considerably larger than the common Sage of our gardens and its flavour and smell are much more powerful, being more like a mixture of Lavender and Sage. It grows very abundantly in Candia, Syros and Crete, where it attains to the size of a small shrub. The leaves are collected annually, dried and used medicinally as an infusion, the Greeks being particular as to the time and manner in which they are collected, the date being May 1, before sunrise. The infusion produces profuse perspiration, languor, and even faintness if used to excess. There is a smaller *Salvia* in Greece, the *S. Candica*, without excrescences.

Another south European species, an annual, *S. horminum*, the RED-TOPPED SAGE, has its whorls of flowers terminated by clusters of small purple or red leaves, being for this peculiarity often grown in gardens as an ornamental plant. The leaves and seed of this species, put into the vat, while fermenting, greatly increase the inebriating quality of the liquor. An infusion of the leaves has been considered a good gargle for sore gums, and powdered makes a good snuff.

Certain varieties of Sage seeds are mucilaginous and nutritive, and are used in Mexico by the Indians as food, under the name of Chia.

Cultivation: The Garden Sage succeeds best in a warm and rather dry border, but will grow well

almost anywhere in ordinary garden soil; it thrives in a situation somewhat shaded from sunshine, but not strictly under trees.

Description: It is a hardy plant, but though a perennial, does not last above three or four years without degenerating, so that the plantation should be renewed at least every four years. It is propagated occasionally by seed, but more frequently by cuttings. New plantations are readily made by pulling off the young shoots from three-year-old plants in spring, generally in the latter end of April, as soon as they attain a sufficiency of hardness to enable them to maintain themselves on the moisture of the ground and atmosphere, while the lower extremities are preparing roots. If advantage be taken of any showery weather that may occur, there is little trouble in obtaining any number of plants, which may either be struck in the bed where they are to grow, inserting a foot apart each way, or in some other shady spot whence they may be removed to permanent quarters when rooted. The latter plan is the best when the weather is too bright and sunny to expect Sage to strike well in its ordinary quarters. See the young plants do not suffer from want of water during their first summer, and hoe the rows regularly to induce a bushy growth, nipping off the growing tips if shooting up too tall. Treat the ground with soot and mulch in winter with old manure. Cuttings may also be taken in the autumn, as soon as the plants have ceased flowering.

Sage is also often propagated by layers, in the spring and autumn, the branches of old plants being pegged down on the ground and covered with 1/2 inch of earth. The plant, being like other of the woody-stemmed garden herbs, a 'stem rooter,' each of the stems thus covered will produce quantities of rootlets by just lying in contact with the ground, and can after a time be cut away from the old plant and transplanted to other quarters as a separate plant.

Red Sage is always propagated by layering or by cuttings, as the seed does not produce a red-leaved plant, but reverts back to the original green-leaved type, though efforts are being made to insure the production of a Red Sage that shall set seed and remain true and develop into the red-leaved plant.

Sages backed by late-flowering Orange Lilies go very well together, and being in flower at the same time make an effective grouping. The calyces of Sage flowers remain on the plants well into late summer and give a lovely haze of reddish spikes; the smell of these seeding spikes is very distinct from the smell of the leaves, and much more like that of the Lemon-scented Verbena, pungent, aromatic and most refreshing.

At the present day, by far the largest demand for Sage is for culinary use, and it should pay to grow it in quantity for this purpose as it is little trouble. For this, the White variety, with somewhat pale green leaves should be taken.

In Dalmatia, where the collection of Sage in its wild condition forms an important cottage industry, it is gathered before blooming, the leaves being harvested from May to September, those plucked in midsummer being considered the best. The general opinion is that it should be gathered before the bloom opens, but the Austrian Pharmacopoeia states that it is best when gathered during bloom.

Chemical Constituents: The chief constituent of Sage and its active principle is a yellow or greenish-yellow volatile oil (sp. gr. 0.910 to 0.930) with a penetrating odour. Tannin and resin are also present in the leaves, 0.5 to 1.0 per cent of the oil is yielded from the leaves and twigs

when fresh, and about three times this quantity when dry.

The Sage oil of commerce is obtained from the herb *S. officinalis*, and distilled to a considerable extent in Dalmatia and recently in Spain, but from a different species of *Salvia*. A certain amount of oil is also distilled in Germany. The oil distilled in Dalmatia and in Germany is of typically Sage odour, and is used for flavouring purposes. The botanical origin of Spanish Sage oil is now identified as *S. triloba*, closely allied to *S. officinalis*, though probably other species may also be employed. The odour of the Spanish oil more closely resembles that of Spike Lavender than the Sage oil distilled in Germany for flavouring purposes, and is as a rule derived from the wild Dalmatian herb, *S. officinalis*. The resemblance of the Spanish oil to Spike Lavender oil suggests the possibility of its use for adulterative purposes, and it is an open secret that admixture of the Spanish Sage oil with Spanish Spike Lavender oil does take place to a considerable extent, though this can be detected by chemical analysis. It is closer in character to the oil of *S. sclarea*, Clary oil, which has a decided lavender odour, although in the oil of *S. triloba*, the ester percentage does not appear to be as high as in the oil of the *S. sclarea* variety.

Pure Dalmatian or German Sage oil is soluble in two volumes of 80 per cent alcohol, Spanish Sage oil is soluble in six volumes of 70 per cent alcohol.

Sage oil contains a hydrocarbon called Salvene; pinene and cineol are probably present in small amount, together with borneol, a small quantity of esters, and the ketone thujone, the active principle which confers the power of resisting putrefaction in animal substances.

Dextro-camphor is also present in traces. A body has been isolated by certain chemists called Salviol, which is now known to be identical with Thujone.

English distilled Sage oil has been said to contain cedrene.

*S. cypria*, a native of the island of Cyprus, yields an essential oil, having a camphoraceous odour and containing about 75 per cent of Eucalyptol.

*S. mellifer* (syn. *Ramona stachyoides*) is a labiate plant found in South California, known as BLACK SAGE, with similar constituents, and also traces of formic acid.

Medicinal Action and Uses: Stimulant, astringent, tonic and carminative. Has been used in dyspepsia, but is now mostly employed as a condiment. In the United States, where it is still an official medicine, it is in some repute, especially in the form of an infusion, the principal and most valued application of which is as a wash for the cure of affections of the mouth and as a gargle in inflamed sore throat, being excellent for relaxed throat and tonsils, and also for ulcerated throat. The gargle is useful for bleeding gums and to prevent an excessive flow of saliva.

When a more stimulating effect to the throat is desirable, the gargle may be made of equal quantities of vinegar and water, 1/2 pint of hot malt vinegar being poured on 1 OZ. of leaves, adding 1/2 pint of cold water.

The infusion when made for internal use is termed Sage Tea, and can be made simply by pouring 1 pint of boiling water on to 1 OZ. of the dried herb, the dose being from a wineglassful to half a teacupful, as often as required, but the old-fashioned way of making it is more elaborate and the result is a pleasant drink, cooling in fevers, and also a cleanser and purifier of the blood. Half an

ounce of fresh Sage leaves, 1 OZ. of sugar, the juice of 1 lemon, or 1/4 OZ. of grated rind, are infused in a quart of boiling water and strained off after half an hour. (In Jamaica the negroes sweeten Sage Tea with lime-juice instead of lemon.)

Sage Tea or infusion of Sage is a valuable agent in the delirium of fevers and in the nervous excitement frequently accompanying brain and nervous diseases and has considerable reputation as a remedy, given in small and oft-repeated doses. It is highly serviceable as a stimulant tonic in debility of the stomach and nervous system and weakness of digestion generally. It was for this reason that the Chinese valued it, giving it the preference to their own tea. It is considered a useful medicine in typhoid fever and beneficial in biliousness and liver complaints, kidney troubles, haemorrhage from the lungs or stomach, for colds in the head as well as sore throat and quinsy and measles, for pains in the joints, lethargy and palsy. It will check excessive perspiration in phthisis cases, and is useful as an emmenagogue. A cup of the strong infusion will be found good to relieve nervous headache.

The infusion made strong, without the lemons and sugar, is an excellent lotion for ulcers and to heal raw abrasions of the skin. It has also been popularly used as an application to the scalp, to darken the hair.

The fresh leaves, rubbed on the teeth, will cleanse them and strengthen the gums. Sage is a common ingredient in tooth-powders.

The volatile oil is said to be a violent epileptiform convulsant, resembling the essential oils of absinthe and nutmeg. When smelt for some time it is said to cause a sort of intoxication and giddiness. It is sometimes prescribed in doses of 1 to 3 drops, and used for removing heavy collections of mucus from the respiratory organs. It is a useful ingredient in embrocations for rheumatism.

In cases where heat is required, Sage has been considered valuable when applied externally in bags, as a poultice and fomentation.

In Sussex, at one time, to munch Sage leaves on nine consecutive mornings, whilst fasting, was a country cure for ague, and the dried leaves have been smoked in pipes as a remedy for asthma.

In the region where Sage grows wild, its leaves are boiled in vinegar and used as a tonic.

Among many uses of the herb, Culpepper says that it is:

'Good for diseases of the liver and to make blood. A decoction of the leaves and branches of Sage made and drunk, saith Dioscorides, provokes urine and causeth the hair to become black. It stayeth the bleeding of wounds and cleaneth ulcers and sores. Three spoonful of the juice of Sage taken fasting with a little honey arrests spitting or vomiting of blood in consumption. It is profitable for all pains in the head coming of cold rheumatic humours, as also for all pains in the joints, whether inwardly or outwardly. The juice of Sage in warm water cureth hoarseness and cough. Pliny saith it cureth stinging and biting serpents. Sage is of excellent use to help the memory, warming and quickening the senses. The juice of Sage drunk with vinegar hath been of use in the time of the plague at all times. Gargles are made with Sage, Rosemary, Honeysuckles and Plantains, boiled in wine or water with some honey or alum put thereto, to wash sore mouths and throats, as need requireth. It is very good for stitch or pains in the sides coming of wind, if

the place be fomented warm with the decoction in wine and the herb also, after boiling, be laid warm thereto.'

## MEDICINAL RECIPES

### A Gargle for a Sore Throat

A small glass of port wine, a tablespoonful of Chile vinegar, 6 Sage leaves, and a dessertspoonful of honey; simmer together on the fire for 5 minutes.

### A Cure for Sprains

Bruise a handful of Sage leaves and boil them in a gill of vinegar for 5 minutes; apply this in a folded napkin as hot as it can be borne to the part affected.

**Then, M., Lemberkovics, E., Marczal, G.:** Salvia species in cosmetics and household chemicals. Poster presentation, proceedings International Conference of IFSCC and the 4th Hungarian Congress on Cosmetics and Household Chemicals. Budapest, 14-16 April 1997.

According to our knowledge the sage (*Salvia officinalis* L.) is used mainly in human phytotherapy and it is well-known as a spice. The Clary sage (*Salvia sclarea* L.) is used first in the perfumery, veterinary and wine industry. It is also a significant as a sclareol source.

The volatile oil is the most important ingredient of both Salvia species. In our research work we carried out the phytochemical evaluation of the two salvia species, further the total content, composition, and localisation of volatile oil in sage and clary sage were studied.

Our investigations were completed by microbiological evaluation regarding to the antibacterial and antiphlogistic activity of sage oil and sage extracts. The aqueous extracts (infusion and decoction) of sage have intensive astringent effect, therefore the sage is a favourite plant in oral hygiene as well.

The two Mediterranean plants are cultivated in Hungary. The leaf of *Salvia officinalis* and the oil are official in several Pharmacopoeias, the clary sage (*Salvia sclarea* L.) is official only in the Russian Pharmacopoeia (Ross.9/1961/)

Dosing of *Salvia officinalis* L is described in Erg.6.\* is the following:

4-6 g of leaf

0.1-0.3 g/day of volatile oil

2.5-7.5 g/day of alcoholic extract

1.8-3.0 g/day of fluid extract

\* Ergänzungsbuch zur 6. Ausgabe des Deutschen Arzneibuches.

The plant material originates from the Botanical and Economical Research Institute of the Hungarian Academy of Sciences, Vacratot.

The methods were described.

The Morphological results were discussed.

## *Phytochemical evaluation*

### Tannin content

The tannin content of *Salvia officinalis* leaf was higher than that of the *S. sclarea* leaf.

<i>Salvia officinalis</i>	leaf	8.75% tannin
	flowering shoot	2.29%
<i>Salvia sclarea</i>	leaf	5.42%
	flowering shoot	2.16%

Tannin and dried material content of ethanolic *Salvia* extracts. Extracts obtained by 20% ethanol were the richest in tannins (compared to 40% and 70% EtOH)

### Rosmarinic acid content

Rosmarinic acid content of *Salvia officinalis* extracts by densitometry

	area percentage of rosmarinic acid
20% EtOH	84
40% EtOH	72
70% EtOH	64

### Essential oil content

<i>Salvia officinalis</i>	leaf	0.17 ml/100g
	flowering shoot	0.64
<i>Salvia sclarea</i>	leaf	0.77
	flowering shoot	0.14

### Detection of sclareol-diterpene derivative in clary sage

Sclareol was detected by GC-MS in foliage leaf, upper leaf, calyx in hexanic extracts obtained from the fresh plant.

## **SUPPLIER DATA SHEETS**

### **In a data sheet from Rahn**

we learn that sage acts externally as an astringent and bactericide. It is also said to reduce sweating. It is recommended for inflammations of the throat and mouth mucosa, dandruff, loss of hair, fatty hair and skin, cellulitis.

### **In a data sheet from Active Organics**

we find that sage is an astringent, good for affections of the mouth and throat, heals raw abrasions of the skin and darkens hair. It is also used to reduce perspiration. Good for soothing bath products.

### **In a data sheet from Cosmetochem**

we see that sage is used as an antiperspirant, astringent, expectorant and bacteriocide. Used as a gargle and in liniment for purulent wounds.

### **In a data sheet from Plantextrakt (through Aston Chemicals)**

we read that it contains essential oil and flavonoids. It is antiphlogistic and antihydrotic.

### **In a data sheet from Exsymol (through Paroxite)**

we read that it contains 1-2% essential oil (thuyone, pinene, cineol, free and esterified borneol, camphor), triterpenes, a diterpenic bitter principle, picrosalvine, flavonoids, phenol acids, tannins etc.

It is a metabolic and superficial stimulant, has oestrogen activity, antiperspirant, dermo-purifier, astringent, healing, antiseptic, anti-inflammatory and antispasmodic.

### **In a data sheet from Dragoco**

we read that sage has constituents in its leaves which have a skin protective, inflammation reducing, slightly astringent and stimulating effects. Sage has been an important remedial plant since earliest times. Dioscorides, Pliny and Galen all recommend sage as a haemostatic, diuretic, tonic and emmenagogue. Pliny tells us that it is good for cleansing snakebite. Walafrius Strabo sings the praises of sage in his gardening book "Hortulus" and Charlemagne in the "Capitulare" decrees that sage must be cultivated on every farm. The highest commendation comes from the Salerno Medical School (11th and 12th centuries) when they said "Why should a Man die, if sage grows in his garden? - No garden medicament can prevail against the power of Death." The treatise closes with the words "Sage, thou healer, Nature's mediatrix"

The Latin name salvia comes from the Latin word Salvare meaning to save. Sage found a place in the "Four thieves Vinegar" which was used in 1630 by four robbers who went round plague victims' houses to loot them in Toulouse. They were untouched by the plague because of their secret recipe which they revealed in order to gain their freedom. It consisted of thyme, sage, lavender, rosemary and other herbs.

Germany has many proverbs about sage "for a ripe old age, in May you eat sage". Folklore also said that that sage would make women fertile and arouse love for a person. Country women would take sage to church with them, and if they got sleepy would have a sniff to wake them up!

Sage contains:- essential oils, saponin, tans, picrosalvin (bitters), resin, fumaric acid, ursolic acid, oleanic acid, and other oxytriterpenic acid, germanicol, chlorogenic and caffeic acids, pentosene, wax and nicotinic acid, additionally a diterpenediphenol carboxylic acid, n-triacontane have been identified. Sage extract contains six flavones and eight flavone glycosides. Interesting amongst them is a substance which has an effect on tuberculosis bacilli and an estrogenic constituent.

The essential oil contains thujone, borneol, p-cymene, 1,8-cineole, d-camphor, d- and l-alpha-pinene, salvene, dipentene, a sesquiterpene, linalool and picrosalvin.

Sage has an antiperspirant and anti-inflammatory effect and protects the skin. Used in compresses to help heal skin lesions which will not heal. Kneipp tells us that it will help heal old festering wounds.

Good in mouthwash to help strengthen gums.

Cited for use on boils, lesions, chilblains and treating sweaty feet. Good bath for those suffering from fatigue according to Maurice Messegue.

#### **In a data sheet from William Ransom**

we read that it is cleansing, astringent, stimulating. Tightens pores. For shampoos, tonics and conditioners. Adds sheen and strengthens hair. Darkens greying hair. Conditioner for most types of hair. In bath preparations it is stimulating, cleansing, antiperspirant. Deodorant foot bath. Medicinally, sage tea aids digestion and reduces sweating, soothes colds. Regulating hormonal problems in menopause. In ancient time the Egyptian women would drink the juice to increase their fertility. Sage in bloom placed in a room discourages flies. It is a herb of Mars.

#### **In a data sheet from Haarman and Reimer**

we read that Sage is *Salvia officinalis*, and that the leaf is used. It is grown in the Mediterranean region, and has astringent, antiphlogistic and spasmolytic properties.

It contains chlorogenic acid, caffeic acid, rosmarinic acid, syringic acid, cinnamic acid, anisic acid, carnosol, luteolin, hyperoside. Proline, asparagine, alanine, asparaginic acid, gamma-aminobutyric acid, glutamine and valine have been identified as the amino acids present.

#### **In a data sheet from Maruzen Pharmaceuticals (through K&K Greeff)**

we read that the leaves are used to make an extract that is antiphlogistic, promoting to the blood stream and also disinfectant.

#### **In a data sheet from Bio-Botanica**

we read that the dried leaves are used for extraction purposes. It contains volatile oil, (thujone, camphor salvene, pinene, cineol) resin, tannin and bitter principles.

An extract of sage is used to clean old ulcers and wounds. Massaged into the scalp it will control dandruff, falling hair or loss of hair if the papilla is dormant and not destroyed.

In Russian folk medicine it is claimed to be aromatic, astringent, antiseptic, carminative, disinfectant (against inflammations).

#### **In a botanical information sheet from A. Webster of English Grains**

we read that the leaves are used, which contain essential oil (thujon, cineol and other monoterpenes), tanning agents, di- and tri-terpenes, flavonoids.

The effect is antibacterial, fungistatic, virustatic, astringent, stimulating secretion, emphratic.

In external use, sage has proved to be effective in cases of inflammations of oral and pharyngeal mucosa, gingivitis, stomatitis as well as for the treatment of pressure sores due to prothesis. Internally: in cases of dyspeptic complaints, flatulence and inflammations of intestinal mucosa. Sage has antihydrotic effects, e.g. in case of night perspiration as well as excessive production of sweat and saliva due to psychosomatic disturbances.

The traditional medicine makes use of the inhibiting effect on the galactosis for ablactation. However, it has not been proved that sage stimulates the menstruation or lowers the blood sugar values. Its antihydrotic effect has been known for a long time.

PREGNANCY: No use of essential oils or alcoholic extracts.

In case of prolonged application the pure essential oil or alcoholic extract might promote epileptiform convulsions.

Dosage externally 2.5% max

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A soluble enzyme preparation from immature sage (*Salvia officinalis*) leaves has been shown to catalyze the cation-dependent cyclization of geranyl pyrophosphate to the isomeric monoterpene olefins (+/-)-alpha-pinene and (-)-beta-pinene and to lesser amounts of camphene and limonene (Gambliel, H., and Croteau, R. (1982) *J. Biol. Chem.* 257, 2335-2342). This preparation was fractionated by gel filtration on Sephadex G-150 to afford two regions of enzymic activity termed geranyl pyrophosphate:pinene cyclase I (Mr approximately equal to 96,000), which catalyzed the conversion of geranyl pyrophosphate to the bicyclic olefin (+)-alpha-pinene, and to smaller quantities of the rearranged olefin (+)-camphene and the monocyclic olefin (+)-limonene, and geranyl pyrophosphate:pinene cyclase II (Mr approximately equal to 55,000), which transformed the acyclic precursor to (-)-alpha-pinene and (-)-beta-pinene, as well as to (-)-camphene, (-)-limonene, and the acyclic olefin myrcene. The multiple olefin biosynthetic activities co-purified with pinene cyclase I on four subsequent chromatographic and electrophoretic steps, and the ability to cyclize geranyl pyrophosphate and the related allylic pyrophosphates neryl pyrophosphate and linalyl pyrophosphate was likewise coincident throughout purification. Fractionation of pinene cyclase II by an identical sequence showed that the activities for the synthesis of the stereochemically related (-)-olefins co-purified, as did the ability to utilize the three acyclic precursors. The general properties of cyclase I and cyclase II were determined, and a scheme for the biosynthesis of the pinenes and related monoterpene olefins was proposed.

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**Then M:** [Formation and localization of volatile oils in the seed leaf and primary foliage leaf of *Salvia* species]. Acta Pharm Hung (1974 Jun) 0(0):suppl 1:91-6. ISSN: 0001-6659. (Published in Hungarian). [No Abstract Available]

**Todorov S Philianos S Petkov V Harvala C Zamfirova R Olimpiou H:** Experimental pharmacological study of three species from genus *Salvia*. Acta Physiol Pharmacol Bulg (1984) 10(2):13-20. ISSN: 0323-9950

Fifteen extracts isolated from three species of genus *Salvia* were studied: two from *Salvia officinalis*, seven from *Salvia triloba* and six from *Salvia verbenaca*. Their effects on the blood pressure of cats and spontaneously hypertensive rats were examined. The smooth-muscle effects of the extracts were studied on isolated segments of guinea-pig ileum. The effects of some of the extracts on hexobarbital anaesthesia were investigated. Applied intravenously and duodenally, aqueous-alcohol extract of *Salvia officinalis* causes moderate but prolonged lowering of the blood pressure in cats. Decoction of *Salvia triloba* also possesses a similar effect (in experiments on spontaneously hypertensive rats). Most of the extracts isolated from *Salvia officinalis* and *Salvia triloba* inhibit to various degrees smooth-muscle contractions induced by acetylcholine, histamine, serotonin and BaCl<sub>2</sub>, whereas extracts of *Salvia verbenaca* usually potentiate them. Substances isolated from *Salvia triloba* prolong hexobarbital sleep. Future studies of substances isolated from *Salvia officinalis* and *Salvia triloba* are promising with a view to their spasmolytic and hypotensive actions. There exist marked interspecies differences in the pharmacological effects of biologically active substances isolated from genus *Salvia*.

**Funk C Koeppe AE Croteau R:** Catabolism of camphor in tissue cultures and leaf disks of common sage (*Salvia officinalis*). Arch Biochem Biophys (1992 Apr) 294(1):306-13 ISSN: 0003-9861

(+)-Camphor constitutes nearly 30% of the monoterpenes accumulated in the leaves of common sage (*Salvia officinalis*), and as the plant approaches maturity the content of this monoterpene ketone decreases by roughly half. Although the ability to catabolize camphor has been demonstrated previously in sage leaf disks, tissue cultures proved to be a more suitable system for examining the responsible degradative pathway. Cell suspension cultures were shown to convert (+)-[3-<sup>3</sup>H]camphor, in sequence, to 6-hydroxycamphor, 6-oxocamphor, alpha-campholonic acid, and 2-hydroxy-alpha-campholonic acid, and each intermediate of the pathway was identified by chromatographic and spectroscopic means. This oxidative ring opening sequence resembles the pathway for camphor degradation by the soil diphtheroid, *Mycobacterium rhodochrous*, that ultimately leads to isoketocamphoric as the last defined metabolite that contains all 10 carbons of the original bicyclic nucleus. Studies with both cell cultures and leaf disks also demonstrated that the catabolism of camphor via 1,2-campholide, a metabolite in sage leaves previously described, was a minor degradative pathway. The first step in the metabolism of camphor was demonstrated in cell-free extracts of the cultured sage cells, and several lines of evidence indicated that this microsomal (+)-camphor-6-exo-hydroxylase is a cytochrome P-450-dependent monooxygenase.

**Croteau R Gundy A:** Cyclization of farnesyl pyrophosphate to the sesquiterpene olefins humulene and caryophyllene by an enzyme system from sage (*Salvia officinalis*). Arch Biochem Biophys (1984 Sep) 233(2):838-41. ISSN: 0003-9861.

A soluble enzyme preparation obtained from sage (*Salvia officinalis*) leaves was shown to

catalyze the divalent metal-ion dependent cyclization of trans, trans-farnesyl pyrophosphate to the macrocyclic sesquiterpene olefins humulene and caryophyllene. The identities of the biosynthetic products were confirmed by radiochromatographic analysis and by preparation of crystalline derivatives, and the specificity of labeling in the cyclization reaction was established by chemical degradation of the olefins derived enzymatically from [1-3H<sub>2</sub>]farnesyl pyrophosphate. These results constitute the first report on the cyclization of farnesyl pyrophosphate to humulene and caryophyllene, two of the most common sesquiterpenes in nature, and the first description of a soluble sesquiterpene cyclase to be isolated from leaves of a higher plant.

**Croteau R Karp F:** Biosynthesis of monoterpenes: hydrolysis of bornyl pyrophosphate, an essential step in camphor biosynthesis, and hydrolysis of geranyl pyrophosphate, the acyclic precursor of camphor, by enzymes from sage (*Salvia officinalis*). Arch Biochem Biophys (1979 Dec) 198(2):523-32. ISSN: 0003-9861. [No Abstract Available].

**Croteau R Karp F:** Biosynthesis of monoterpenes: preliminary characterization of bornyl pyrophosphate synthetase from sage (*Salvia officinalis*) and demonstration that Geranyl pyrophosphate is the preferred substrate for cyclization. Arch Biochem Biophys (1979 Dec) 198(2):512-22. ISSN: 0003-9861. [No Abstract Available]

**Croteau R Hooper CL Felton M:** Biosynthesis of monoterpenes. Partial purification and characterization of a bicyclic monoterpene dehydrogenase from sage (*Salvia officinalis*). Arch Biochem Biophys (1978 May) 188(1):182-93. ISSN: 0003-9861. [No Abstract Available].

**Croteau R Karp F:** Biosynthesis of monoterpenes: partial purification and characterization of 1,8-cineole synthetase from *Salvia officinalis*. Arch Biochem Biophys (1977 Feb) 179(1):257-65. ISSN: 0003-9861. [No Abstract Available].

**Croteau R Karp F:** Biosynthesis of monoterpenes: enzymatic conversion of neryl pyrophosphate to 1,8-cineole, alpha-terpineol, and cyclic monoterpene hydrocarbons by a cell-free preparation from sage (*Salvia officinalis*). Arch Biochem Biophys (1976 Oct) 176(2):734-46. ISSN: 0003-9861. [No Abstract Available].

**Croteau R Purkett PT:** Geranyl pyrophosphate synthase: characterization of the enzyme and evidence that this chain-length specific prenyltransferase is associated with monoterpene biosynthesis in sage (*Salvia officinalis*). Arch Biochem Biophys (1989 Jun) 271(2):524-35. ISSN: 0003-9861

Cell-free homogenates from sage (*Salvia officinalis*) leaves convert dimethylallyl pyrophosphate and isopentenyl pyrophosphate to a mixture of geranyl pyrophosphate, farnesyl pyrophosphate, and geranylgeranyl pyrophosphate, with farnesyl pyrophosphate predominating. These prenyltransferase activities were localized primarily in the soluble enzyme fraction, and separation of this preparation on Sephadex G-150 revealed the presence of a partially resolved, labile geranyl pyrophosphate synthase activity. The product of the condensation reaction between [1-<sup>14</sup>C]dimethylallyl pyrophosphate and [1-<sup>3</sup>H]isopentenyl pyrophosphate was verified as [1<sup>4</sup>C,1-<sup>3</sup>H]geranyl pyrophosphate by TLC isolation, enzymatic hydrolysis to geraniol, degradative studies, and the preparation of the crystalline diphenylurethane. The cis-isomer, neryl pyrophosphate, was not a product of the enzymatic reaction. By employing a selective tissue extraction procedure, the geranyl pyrophosphate synthase activity was localized in the leaf

epidermal glands, the site of monoterpene biosynthesis, suggesting that the role of this enzyme is to supply the C10 precursor for the production of monoterpenes. Glandular extracts enriched in geranyl pyrophosphate synthase were partially purified by a combination of hydrophobic interaction chromatography on phenyl-Sepharose and gel permeation chromatography on Sephadex G-150. Substrate and product specificity studies confirmed the selective synthesis of geranyl pyrophosphate by this enzyme, which was also characterized with respect to molecular weight, pH optimum, cation requirement, inhibitors, and kinetic parameters, and shown to resemble other prenyltransferases.

**Dehal SS Croteau R:** Partial purification and characterization of two sesquiterpene cyclases from sage (*Salvia officinalis*) which catalyze the respective conversion of farnesyl pyrophosphate to humulene and caryophyllene. n: Arch Biochem Biophys (1988 Mar) 261(2):346-56. ISSN: 0003-9861

Humulene cyclase and caryophyllene cyclase, two enzymes which catalyze the cyclization of farnesyl pyrophosphate to the respective sesquiterpene olefins, have been partially purified from the supernatant fraction of a sage (*Salvia officinalis*) leaf epidermis extract and separated from each other by a combination of hydrophobic interaction, gel filtration, and ion-exchange chromatography. The molecular weight of both cyclases was estimated by gel filtration to be 57,000 and both cyclases exhibited a pH optimum of 6.5 and preferred Mg<sup>2+</sup> (K<sub>m</sub> approximately 1.5 mM) as the required divalent metal cation. Both enzymes possessed a K<sub>m</sub> of about 1.7 microM for farnesyl pyrophosphate, were strongly inhibited by p-hydroxymercuribenzoate, and exhibited comparable sensitivities to a variety of other potential inhibitors. The properties of the two sesquiterpene olefin cyclases, which are the first from a higher plant source to be examined in detail, were very similar to each other and to other monoterpene, sesquiterpene, and diterpene cyclases previously described.

**F Harris JL Croteau R:** Metabolism of monoterpenes: demonstration of the hydroxylation of (+)-sabinene to (+)-cis-sabinol by an enzyme preparation from sage (*Salvia officinalis*) leaves. Arch Biochem Biophys (1987 Jul) 256(1):179-93. ISSN: 0003-9861.

A microsomal preparation from the epidermis of *Salvia officinalis* leaves catalyzed the NADPH- and O<sub>2</sub>-dependent hydroxylation of the monoterpene olefin (+)-sabinene to (+)-cis-sabinol. The reaction catalyzed is a key step in the biosynthesis of C<sub>3</sub>-oxygenated thujane monoterpenes, and the hydroxylase is highly specific for (+)-sabinene as substrate. The hydroxylase from leaf homogenates was solubilized and characterized with regard to reaction conditions, inhibitors, and activators. Activity was partially inhibited by rabbit anti-rat cytochrome P-450 and by CO, and the latter inhibition was reversed by 450 nm light. A CO-difference spectrum and type I substrate binding spectrum were obtained. The hydroxylase meets most of the established criteria for a cytochrome P-450-dependent mixed function oxygenase and represents one of very few enzyme systems of this type to be isolated from leaves of a higher plant.

**Croteau R El-Bialy H El-Hindawi S:** Metabolism of monoterpenes: lactonization of (+)-camphor and conversion of the corresponding hydroxy acid to the glucoside-glucose ester in sage (*Salvia officinalis*). Arch Biochem Biophys (1984 Feb 1) 228(2):667-80. ISSN: 0003-9861

The bicyclic monoterpene ketone (+)-camphor is a major constituent (up to 26%) of the volatile oil of immature sage (*Salvia officinalis* L.) leaves; however, as the plant matures the content of this ketone declines in the fully expanded leaves (to about 65% of maximum) as does the overall

yield of oil (to roughly 60% of maximum). Examination of the metabolism of (+)-[G-3H]camphor in discs prepared from mature leaves of flowering sage plants revealed that this ketone was converted to a water-soluble metabolite which on chromatographic analysis proved to be considerably more polar than a simple monoterpenyl glycoside. Mass spectral analysis of several derivatives of the terpenoid moiety of the metabolite obtained from large-scale incubations allowed identification of the aglycone, while degradative studies and detailed radiochromatographic analyses indicated that the metabolite contained two glucose residues; one glycosidically linked and the other in ester linkage. All of the evidence was consistent with the initial lactonization of camphor to 1,2-campholide followed by conversion to the beta-D-glucoside-6-O-glucose ester of the corresponding hydroxy acid (1-carboxymethyl-3-hydroxy-2,2,3-trimethyl cyclopentane). Direct evidence for the intermediacy of 1,2-campholide was also obtained through isotopic dilution experiments and by direct testing of the labeled lactone. The lactonization of camphor in sage resembles a similar step in the catabolism of camphor by microorganisms, but appears to be the first report of this reaction type in higher plants.

**Pyun HJ Wagschal KC Jung DI Coates RM Croteau R:** Stereochemistry of the proton elimination in the formation of (+)- and (-)-alpha-pinene by monoterpene cyclases from sage (*Salvia officinalis*). *Arch Biochem Biophys* (1994 Feb 1) 308(2):488-96. ISSN: 0003-9861.

The three pinene synthases (cyclases) from common sage (*Salvia officinalis*) catalyze the conversion of geranyl pyrophosphate to the bicyclic olefins (+)-alpha-pinene and (+)-camphene (cyclase I), (-)-alpha-pinene, (-)-beta-pinene, and (-)-camphene (cyclase II), and (+)-alpha-pinene and (+)-beta-pinene (cyclase III), in addition to smaller amounts of monocyclic and acyclic monoterpene olefins. (1R)-4-2H1- and (1S)-4-2H1-labeled geranyl pyrophosphates were prepared and used to examine the stereochemistry of the C3-proton elimination from the pinyl cation intermediates in the formation of the alpha-pinene enantiomers. Mass spectrometric analysis of the biosynthetic products derived from the chirally deuterated substrates revealed that cyclase I and cyclase III removed the C4-proR-hydrogen of the substrate (C3 proton trans to the dimethyl bridge of the pinyl nucleus) with a stereoselectivity exceeding 94% in the formation of (+)-alpha-pinene. Similarly, cyclase II removed the C4-proS-hydrogen of the substrate (C3-trans proton of the corresponding pinyl cation) with a stereoselectivity exceeding 78% in the formation of (-)-alpha-pinene. The stereoselectivity of these C3-axial hydrogen eliminations is rationalized on the basis of a stereochemical model for the electrophilic isomerization-cyclization reaction sequence catalyzed by the pinene cyclases. The changes in the overall rates of olefin biosynthesis by these enzymes and in the product ratios resulting from deuterium substitution also permitted confirmation of isotopically sensitive branching in pinene biosynthesis and allowed the observation of primary kinetic isotope effects in isolation.

**Wagschal KC Pyun HJ Coates RM Croteau R:** Monoterpene biosynthesis: isotope effects associated with bicyclic olefin formation catalyzed by pinene synthases from sage (*Salvia officinalis*). *Arch Biochem Biophys* (1994 Feb 1) 308(2):477-87. ISSN: 0003-9861.

The three pinene synthases (cyclases) from common sage (*Salvia officinalis*) catalyze the conversion of geranyl pyrophosphate to the bicyclic olefins (+)-alpha-pinene and (+)-camphene (cyclase I), (-)-alpha-pinene, (-)-beta-pinene, and (-)-camphene (cyclase II), and (+)-alpha-pinene and (+)-beta-pinene (cyclase III), in addition to smaller amounts of monocyclic and acyclic monoterpene olefins. [1-3H,4-2H2]- and [10-2H2]-geranyl pyrophosphates were prepared and used in conjunction with 1-3H- and 1-3H,10-2H3-labeled geranyl precursors to examine the

isotope effects attending the C4- and C10-deprotonation steps in the enzymatic synthesis of the pinenes. The observation of isotopically sensitive branching within each set of stereochemically related bicyclic olefins confirmed that each product set was synthesized by the respective pinene synthase by partitioning of common carbocationic intermediates along different reaction channels at the active site. The changes in product distribution resulting from deuterium substitution at C4 and C10 of the substrate were used to determine kinetic isotope effects (KIEs) for the terminating deprotonations; these observed KIEs represent the lower limits of the intrinsic isotope effects. The intramolecular isotope effects for the methyl-methylene elimination in beta-pinene formation by cyclases II and III were also evaluated with [10-2H<sub>2</sub>]geranyl pyrophosphate as substrate and by MS analysis of the olefin products. The intramolecular KIEs (kH/kD = 3.0 and 3.5) were significantly higher than the observed KIEs determined from product ratios (kH/kD = 1.7 and 2.6) since the former involves considerably less masking of the intrinsic isotope effects.

**Briesskorn CH Biechle W:** [Flavones from *Salvia officinalis* L. 22. Components of *Salvia* off. L]. Arch Pharm Ber Dtsch Pharm Ges (1971 Aug) 304(8):557-61. (Published in German). [No Abstract Available].

**Briesskorn CH Melchior J:** [Quantitative change of terpenoids in germ-bud and leaf of *Salvia officinalis* L. under different conditions. 21. Contents of *Salvia* off. L] Arch Pharm Ber Dtsch Pharm Ges (1969 Dec) 302(12):921-31. (Published in German). [No Abstract Available].

**Croteau R Karp F:** Enzymatic synthesis of camphor from neryl pyrophosphate by a soluble preparation from sage (*Salvia officinalis*). Biochem Biophys Res Commun (1976 SEP 20) 72(2):440-7. ISSN: 0006-291X. [No Abstract Available].

**Daniela T:** [*Salvia officinalis* l. I. Botanic characteristics, composition, use and cultivation]. Cesk Farm (1993 Jun) 42(3):111-6. ISSN: 0009-0530 (Published in Slovak)

*Salvia officinalis* L. is an essential oil containing plant, which does not wildy grow in the territories of the Czech and Slovak Republics but it can be successfully cultivated. It is a perennial half-shrub, from which non-flowering herbaceous sprouts or leaves are collected for pharmaceutical purposes. After drying at a temperature not exceeding 35 degrees C they are the plant drugs Herba salviae or Folium salviae. In PhBs, Herba salviae is official. The drug contains mainly ethereal oil (1-2%), diterpenes, triterpenes and tannin. The pharmacopoeial criterion of quality is the content of essential oil, which is produced in an increased amount in the plant in warm summer months. Herba salviae and the extracts prepared from it are used as an antiseptic agent, an antiphlogistic agent, in the inflammations of the oral cavity and gingivitis and also as a stomachic and an antihydrotic agent. Its utilization in cosmetics and food industry is also of importance.

**Masterova I Misikova E Sirotkova L Vaverkova S Ubik K:** [Royleanones in the roots of *Salvia officinalis* L. of domestic provenance and their antimicrobial activity (published erratum appears in Ceska Slov Farm 1996 Nov;45(6):301)]. Ceska Slov Farm (1996 Sep) 45(5):242-5. ISSN: 1210-7816 (Published in Slovak).

The reported investigation of the constituents of the petroleum ether extract of the root of *Salvia officinalis* L. confirmed the presence of the following diterpene quinones: 12-hydroxy-8, 12-abietadiene-11, 14-dione (royleanone), 7 alpha, 12-dihydroxy-8.12-abistadiene-11-14-dione

(horminone) and 7 alpha-acetoxy-12-hydroxy-8, 12-abietadiene-11,14-dione (7-O-acetylhorminone). The compounds were identified on the basis of the interpretation of results of spectral analysis. Isolated royleanones show antimicrobial activity against gram-positive bacteria (*Staphylococcus aureus*). A study of abietate diterpenoids in the root of *Salvia officinalis* L. of Slovak provenance has been performed for the first time.

**Tucakov J Mihajlov M:** [Comparative pharmacognostic studies on sage officinalis (*Salvia officinalis* L.) of Pastrovici]. Glas Srp Akad Nauka [Med] (1977)(27):47-60. ISSN: 0081-3966 (Published in Serbo-Croatian, Cyrillic). [No Abstract Available]

**Tucakov J:** [Contribution to the pharmacognostic study of *Salvia officinalis* L. at Kalaverska strana in the mountains of Svrlijig]. Glas Srp Akad Nauka [Med] (1965)(18):21-38. ISSN: 0081-3966 (Published in Serbo-Croatian, Cyrillic). [No Abstract Available]

**Battersby AR Laing DG Ramage R:** Biosynthesis. XIX. Concerning the biosynthesis of (-)-camphor and (-)-borneol in *Salvia officinalis*. J Chem Soc [Perkin 1] (1972) 21:2743-8. ISSN: 0300-922X. [No Abstract Available]

**Aizenman BE Derbentseva NA Zelepukha SI Negrash AK Volosovets PS:** [Salvin, an antibiotic from *Salvia officinalis*]. Mikrobiol Zh (1982 May-Jun) 44(3):69-72. ISSN: 0201-8462 (Published in Russian). [No Abstract Available]

**Rutherford DM Nielsen MP Hansen SK Witt MR Bergendorff O Sterner O:** Isolation and identification from *Salvia officinalis* of two diterpenes which inhibit t-butylbicyclophosphoro [35S] thionate binding to chloride channel of rat cerebrocortical membranes in vitro. Neurosci Lett (1992 Feb 3) 135(2):224-6. ISSN: 0304-3940

Ethanollic extracts from dried leaves of sage (*Salvia officinalis*) showed inhibition of [35S]tertiary- butylbi-cyclophosphorothionate ([35S]TBPS) binding to rat brain membranes in vitro. This ligand is considered to bind to the chloride channel of the GABA/benzodiazepine receptor complex in brain tissue. Substances having inhibitory activity were purified and their chemical structure identified as the diterpenes carnosic acid and carnosol (IC<sub>50</sub> values of 33 +/- 3 microM and 57 +/- 4 microM, respectively). The two compounds did not affect binding of the ligands [3H]muscimol and [3H]diazepam to the GABA/benzodiazepine complex in vitro. Saturation experiments of [35S]TBPS binding indicated that carnosic acid decreases the binding affinity.

**Vaverkova S Holla M Tekel J:** The effect of herbicides on the qualitative properties of healing plants. Part 2: Content and composition of the essential oil from *Salvia officinalis* L. after application of Afalon 50 WP. Pharmazie (1995 Feb) 50(2):143-4. ISSN: 0031-7144

The aim of our work was to study the changes of the content and quality of volatile oil in *Salvia officinalis* L. being treated with Afalon 50 WP (the active substance linuron) in the major ontogenetic phases of the plant growth. The plants treatment with a herbicide in pre-emergence did not cause a dramatic change in the essential oil content or in the proportional representation of its individual components. During the investigation of the changes in quality of the essential oil after an application of Afalon during various plant growth phases there was found the same relationship when compared with those being untreated.

**Brieskorn CH Glasz J:** [Salvia glycoprotein, a water soluble protein material from the seeds of *Salvia officinalis* L. 19. On the contents of *Salvia officinalis* L.]. Pharmazie (1965 Jun) 20(6):382-4. ISSN: 0031-7144 (Published in German). [No Abstract Available]

**Murko D Ramic S Kekic M:** [Tannins of *Salvia officinalis* and their changes during storage (author's transl)]. Planta Med (1974 May) 25(3):295-300. ISSN: 0032-0943 (Published in German). [No Abstract Available].

**Schwarz K Ternes W:** Antioxidative constituents of *Rosmarinus officinalis* and *Salvia officinalis*. II. Isolation of carnosic acid and formation of other phenolic diterpenes. Z Lebensm Unters Forsch (1992 Aug) 195(2):99-103. ISSN: 0044-3026.

The phenolic diterpene carnosic acid appears to be the main substance for general oxidation leading to artifacts with gamma- or delta-lactone structure in extracts of *Rosmarinus officinalis* and *Salvia officinalis*. Until now it was only possible to prepare carnosic acid by hydrogenolysis of carnosol. A semipreparative HPLC method has been developed isolating carnosic acid among other phenolic diterpenes. The separated substances were identified by <sup>13</sup>C-nuclear magnetic resonance (NMR), <sup>1</sup>H-NMR, mass and IR spectroscopy. Conversion of carnosic acid and carnosol to other phenolic diterpenes was investigated by HPLC.

**Schwarz K Ternes W:** Antioxidative constituents of *Rosmarinus officinalis* and *Salvia officinalis*. I. Determination of phenolic diterpenes with antioxidative activity amongst tocochromanols using HPLC. Z Lebensm Unters Forsch (1992 Aug) 195(2):95-8. ISSN: 0044-3026

The strong antioxidative activity of *Rosmarinus officinalis* and *Salvia officinalis* is caused by phenolic diterpenes. Extracts of these herbs are used as additives to stabilize fat and fat-containing foodstuffs against oxidation. To determine the concentration of individual phenolic diterpenes in pure extracts and fats an HPLC method with electrochemical detection has been developed.

**Schwarz K Ternes W Schmauderer E:** Antioxidative constituents of *Rosmarinus officinalis* and *Salvia officinalis*. III. Stability of phenolic diterpenes of rosemary extracts under thermal stress as required for technological processes. Z Lebensm Unters Forsch (1992 Aug) 195(2):104-7. ISSN: 0044-3026.

The concentration of phenolic diterpenes in commercially available extracts of *Rosmarinus officinalis* (rosemary) determined by HPLC with electrochemical detection ranged from 2.8 to 22.5%. Antioxidant activity of extracts under simultaneous storage and thermal stress depended directly on the concentration of phenolic diterpenes. Differences in rates of degradation of individual phenolic diterpenes at different temperatures were obtained.

**Simon, J.E., A.F. Chadwick and L.E. Craker.** 1984. Herbs: An Indexed Bibliography. 1971-1980. The Scientific Literature on Selected Herbs, and Aromatic and Medicinal Plants of the Temperate Zone. Archon Books, 770 pp., Hamden, CT.

## **SAGE**

Family: Lamiaceae (Labiatae), *Salvia officinalis* L.

Sage, *Salvia officinalis* L., is a perennial shrub native to southern Europe and Asia Minor. Also known as common or garden sage, the growing herb reaches a height of 0.6 meters, has gray to silver-green leaves with a velvety texture, and white, blue, or purple flowers that bloom from late winter to early summer. The plant is cultivated and collected from the wild in Yugoslavia, Albania, Turkey, Italy, Greece, the United States, Spain, and Crete (11.1-128).

The reported life zone of sage is 5 to 26 degrees centigrade with an annual precipitation of 0.3 to 2.6 meters and a soil pH of 4.2 to 8.3 (4.1-31). The species is well suited to warm dry regions and grows best on a nitrogen-rich, clay loam soil located in the full sun. The plant is sensitive to extended dry periods with excessively high temperatures, and it will winter-kill when the temperature reaches about -100Cdeg;C.

For commercial cultivation, the plant can be established from seeds, by plant division, by layering, or from cuttings. Vegetative propagation is preferred for ensuring a rapid harvest and specific plant clones. The plantings last from two to six years, and the initial harvest is made in the first year. Generally, two or three harvests are taken just prior to bloom in subsequent years. Leaves and vegetative tops are harvested and dried in the shade or with low artificial heat to ensure retention of the color and the quality and content of the volatile oil (3.3-43, 14.1-8).

The essential oil, extracted by steam distillation, ranges from 1.2 to 2.5% of dry leaves. Constituents of sage oil include -thujone, camphor, linalool, 1,8-cineole, *cis*-ocimene, -thujone, sabinyl acetate and several other compounds (1.2-73, 6.4-102). The quality of the essential oil of sage differs by geographic region, but this may be attributable to the use of different sage species or types (2.9-116). The most common adulterant to sage oils is thujone, from the leaves of *Juniperus virginiana* L., red cedar. An oleoresin is obtained by organic solvent extraction.

The dried leaves and essential oil of sage are employed as seasonings for sausages, ground meats, stuffings, fish, honey, salads, soups, and stews. Sage is also used as a flavoring and antioxidant in cheeses, pickles, vegetables, processed foods, and beverages (6.4-104). The oil is used to extend the keeping quality of fats and meats (6.4-12). The plant is used in perfumes and cosmetics and as a natural insect repellent. Sage can be purchased as whole leaf, ground, rubbed, sliced, or cut.

As a medicinal plant, sage has traditionally been considered an antispasmodic, antiseptic, astringent, diaphoretic, expectorant, nervine, and tonic. The plant has also been used as a folk remedy against colds, diarrhea, enteritis, venereal disease, excessive perspiration, snake bites, sore throats, toothaches, and cancer (11.1-96, 14.1-16). The plant was thought to improve the memory. Sage has been reported to act as a bactericide and is used in mouthwashes and gargles (7.5-68, 11.1-128). The plant is also used as a convulsant and antisecretory agent, and as Salvin, a preparation of leaves used as an antimicrobial, anti-inflammatory agent in treating oral cavity disease (7.6-224, 14.1-8, 14.1-35). The name *Salvia* is from the Latin *salvere*, meaning "to heal," or "to be safe and unharmed" (11.1-128, 14.1-3).

Although five hundred species of *Salvia* and many varieties and chemotypes exist, only a few types of sage are commercially important. Dalmation sage, a type of *Salvia officinalis* L., serves as the standard sage to which others are compared, as it is considered to possess the finest and most characteristic sage aroma. *Salvia fruticosa* Mill., formerly known as *Salvia triloba* L. f., and native to some of the Mediterranean and Middle Eastern countries, may account for more than 50% of the culinary sage imported into the United States as common

sage (6.5-140). This species is commonly referred to as Greek, Mediterranean, or wild sage. *Salvia lavandulifolia* Vahl., Spanish sage, is a small shrub sold as sage but of minor commercial importance. *Salvia multiorrhiza* L. is used as a Chinese herbal medicine for treatment of menstrual irregularities, uterine bleeding, abdominal pain, neurasthenia, insomnia, hepatitis, mastitis, and hives (11.1-97). Leaves from *Salvia lyrata* L., wild sage or cancerweed, an herb native to the eastern section of the United States, are used as a folk remedy in the treatment of warts (11.1-101). *Salvia tomentosa* Mill., a native of the Mediterranean region, has been traditionally used to reduce abdominal pain and heal warts (7.1-63). Leaves of *Salvia divinorum*, Yerba de Maria, are used in some religious ceremonies because of their hallucinogenic properties (11.1-96).

*Salvia elegans* Vahl, formerly *Salvia rutilans* Carriere and known as pineapple sage, is a perennial shrub cultivated as an annual. Reaching heights of over one meter, the plant is characterized by decorative, fragrant leaves, which are employed in bouquets, and by scarlet flowers that bloom in autumn and are used in potpourris. *Salvia leucophylla* Greene, a perennial shrub native to the western United States, has been used as sage but is considered very inferior and not acceptable in commercial markets. Volatile monoterpenes emitted from the species are reported to have growth-inhibitory activity (1.8-93).

Indian and wild sage refers to *Eupatorium perfoliatum* L., a plant native to North America. Sage of Bethlehem actually refers to spearmint, *Mentha spicata* L. The sagebrush native to western portions of the United States and northern Mexico is of the *Artemisia* species.

Sage, as *Salvia officinalis* L. or *Salvia triloba* L., is generally recognized as safe for human consumption as a natural seasoning and as a plant extract/essential oil (21 CFR sections 182.10, 182.20 [1982]). Spanish sage is also recognized as safe for human consumption as a plant extract (21 CFR section 182.20 [1982]).

## INTERNET DATA

### SAGE

**Synonyms:** Broad-Leafed Sage, Dalmatian Sage, Garden Sage, Red Sage, Sawge, True Sage

**Family:** Labiatae or Lamiaceae

**Genus species:** *Salvia officinalis* var. *rubia*

**Type:** Perennial subshrub

**Part Used:** Leaves

**Location:** widely cultivated, southern Europe, U.S.

**Actions:** Antibiotic, anhidrotic, anthelmintic, antibacterial, antilactagogue, antihyperglycemic, anti-inflammatory, antimicrobial, antioxidant, antiphlogistic, antiseptic, antisialagogue, antispasmodic, antisudorific, astringent, carminative, condiment, deodorant, digestive, diuretic, emmenagogue, estrogenic activity, fungistatic, improves memory, nervine, peripheral vasodilator, resolvent, respiratory stimulant, spasmolytic, spice, stomachic, tonic, uterine stimulant, vermifuge, virostatic, vulnerary

**Indications:** Amenorrhea, cancer (mouth), common cold symptoms, cystitis, dandruff, dental abscess, diabetes mellitus, diarrhea, dyspepsia, excessive perspiration, failing memory, flatulent indigestion, galactorrhea, gastritis, gingivitis, glossitis, hair loss (hair rinse), halitosis, headache, hot flashes, hyperglycemia, hyperhidrosis, indigestion, inflammation, influenza, intestinal worms, night sweats, painful menstruation, quinsy, sore throat, stomatitis, stress, thrush, tonsillitis, uvulitis, warts, wen

**Chemicals & Nutrients:** Aluminum, beta-Sitosterol, Calcium, Carbohydrates (66%), Fats (14%), Fiber (9%), Iron, Magnesium, Niacin, Phosphorus, Potassium, Protein (12%), Sodium, Vitamin C, Zinc

**Preparation & Dosages:** (3x/day)

Dried herb, dose 1-4 g or by infusion

Liquid Extract: 1:1 in 45 % alcohol, dose 1-4 ml

**Warning:** Leaves contain 1-2.5% essential oil, with 35-60% of the oil being thujone. Thujone is toxic causing convulsions, epileptic fits, hallucination, cerebral depression and respiratory inhibition.

**Contraindications:** Pregnancy, pure essential oil and alcoholic extracts should not be taken during pregnancy.

**Side effects:** Prolonged use of alcoholic extracts and pure essential oil, epileptiform convulsions may occur.

**Safety:** GRAS.

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*Salvia officinalis*

Derived from the Latin word *salvere*, meaning “to save”, *Salvia officinalis*, otherwise known as Common or Dalmatian Sage, possesses numerous healing powers. Because *Salvia officinalis* possesses a wide range of curative properties, it has been used traditionally and recently to treat various ailments and diseases. From sore throats to constipation, *Salvia officinalis* has been traditionally used, but not officially accepted as an alternative to medicine. Even so, as research on *Salvia officinalis* continues, the medicinal properties are increasingly accepted.

*Salvia officinalis* is one particular species classified within an extremely large genus, *Salvia*. With the numerous different species of *Salvia*, different curative properties are relevant and typically used from centuries past. As *Salvia* was originally brought to America by Romans from ancient Egypt, it was “an important medicinal plant” (Dweck and Kintzios, 2000) that was used to ward off evils and increase fertility of women (Schauenberg and Paris, 1990). With increased utilization of *Salvia*, its recreational use has become increasingly intriguing as it produces an overall sedative effect unlike any other psychedelic. When creating positive effects, *Salvia* has been known to increase sensual appreciation, create euphoric emotions, and enhance insight of personal issues. In contrast, *Salvia* may also produce negative effects such as altered perceptions, panic attacks, and dissociation. *Salvia* contains an active component, Salvinorin A, and diterpene (Ulubelen, 2004), which can be extracted and released when fresh leaves of *Salvia* are chewed or crushed and added to a tea. In an attempt to achieve faster results or obtain a greater potency, *Salvia* is typically smoked or administered under the tongue when in liquid form. As it is difficult to achieve results, the chemical components of *Salvia* must be prepared intricately in order to produce an overall sedative effect. Interestingly, the dosage of *Salvia* necessary to produce effects is unknown as individuals react differently to different substances; therefore, as potency varies among different plants, caution is crucial. Even specific duration of *Salvia* effects is unknown as results may last anywhere from five minutes to three hours. Since *Salvia officinalis* has not been fully exploited and is even generally hard to obtain, it remains legal to grow, distribute, and consume in all countries excluding Australia, Denmark, Israel, and Norway.

Because *Salvia officinalis* possesses carminative, spasmolytic, antiseptic, bactericidal, and astringent properties, it has been used throughout history to relieve various skin conditions, muscular pain, and several nervous conditions. When the extracted oil from Common Sage is prepared as a lotion, compress, or bath solute, *Salvia officinalis* can be used to treat skin abrasions, cold sores, warts, cuts, and insect bites. When prepared for oral use, such as a mouthwash, Common Sage can be used to treat sore throats, mouth ulcers, bad breath, and bleeding gums. When prepared as a tea, *Salvia officinalis* can reduce perspiration and fever by depressing fever control centers in the brain and relieving spasms in the smooth skeletal muscle. Likewise, Common Sage has been found to ease rheumatism (inflammation of muscles and joints) as it reduces spasms and loosens tense joints. Interestingly, *Salvia officinalis* has additionally been used to treat certain nervous conditions such as depression, trembling, and vertigo (Dweck and Kintzios, 2000). Sage infusions applied to the scalp may even be used to treat alopecia and create darker, stronger hair. Additionally, *Salvia* may be

used to cease the flow of milk by nursing mothers. Overall, sage possesses numerous known and rumored medicinal properties.

As research continues to progress, *Salvia officinalis* demonstrates the ability to treat more acute mental conditions as it improves memory and decreases anxiety. One benefit of using herbal medicine as opposed to other medications is that herbal medications treat the whole disorder versus treatment of single symptoms. *Salvia officinalis* has been used to treat several central nervous system disorders for its “beneficial effects on memory disorders, depression, and cerebral ischemia” (Perry, Bollen, Perry, and Ballard, 2003). In addition, several *Salvia* species have antioxidant properties due to the ethanol extracts and the individual constituents of its essential oil. Moreover, *Salvia* contains many components such as carvacrol and alpha-pinene which have been shown to possess weak but overall significant anti-inflammatory properties (Perry et al, 2003). Despite the lack of further investigation, a dose-dependent oestrogenic activity has also been found within the ethanol extract of *Salvia*. Overall, the most significant activity found within studies is *Salvia*'s cholinesterase activity. Depending on the dosage, *Salvia* has been shown to reduce human brain AChE. In experiments where the *Salvia* essential oil was orally administered to rats, it was shown that the *Salvia* inhibited AChE in certain brain areas (Perry et al, 2003). As *Salvia* possesses antioxidant, anti-inflammatory, and oestrogenic properties, there have been experiments that have shown that it has several benefits for those who suffer from Alzheimer Disease. For example, a study performed in Tehran, Iran conducted an experiment on individuals with mild or moderate Alzheimer Disease ranging between the ages of 65 to 80 years. The individuals were administered either placebo or fixed dosages of *Salvia officinalis* extract for a sixteen week period. Prior to the experiment, the participants were tested and measured based upon the ADAS (Alzheimer Disease Assessment Scale) and at the conclusion of the experiment were tested again in order to compare the results. Studies showed that *Salvia officinalis* appeared to reduce agitation which as a result improved cognition scores. (Perry et al, 2003) With the results of the experiment, the essential oil has demonstrated the ability to increase cognition and improve memory. Moreover, results concluded that *Salvia* caused no adverse effects or withdrawal symptoms and in many cases *Salvia* provided a continued significant improvement on memory. Even so, it was documented that *Salvia* should not be given to those who have high blood pressure as it may increase blood pressure in people with preexisting hypertension.

As *Salvia officinalis* displays various curative properties, it is apparent that more studies are necessary in order for its medicinal properties to be officially accepted. Whether for recreational, medicinal, or even potential treatment for Alzheimer Disease, Common Sage proves to contain a wide variety of chemical components producing several different effects upon the human body with little or unknown side effects.

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Kintzios, Spiridon E. *Salvia The Genus Salvia*. Singapore: Overseas Publishers Association, 2000.

Perry N., Bollen C., Perry E., Ballard C., "Salvia for dementia therapy: review of pharmacological activity and pilot tolerability clinical trial." Pharmacology, Biochemistry and Behavior 75: (2003): 651-659.

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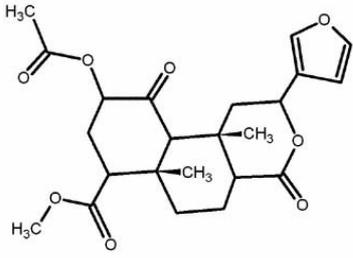
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### *Salvia officinalis*

Looking through your kitchen cabinet, you may find a container of an herb labeled as sage. Before including this herb in your Thanksgiving stuffing, it is worthwhile to know that common sage is among an enormous genus called *Salvia* and has many more uses other than enhancing certain tastes in foods. . Possessing a wide variety of curative properties and recreational uses, *Salvia officinalis* is a relatively unknown medicinal plant and with more studies, may prove to be a beneficial treatment for numerous illnesses including Alzheimer Disease.

*Salvia officinalis* is also known as Common or Dalmation Sage and is among the genus, *Salvia*, which is derived from the Latin word *salvere* meaning "to save". Different species can be found virtually all over the world and remarkably, each species contains its own healing powers. Justifying its name, *Salvia officinalis* may be used among various skin conditions such as reducing the size of pores, healing cold sores, eliminating warts, and relieving bumps, sores, cuts, and other skin afflictions. Additionally, Common Sage may also be administered in baths to treat sores, ulcers, and dermatitis. Sage can even moisturize, strengthen, and increase shininess when applied to dark-haired individuals. Conveniently, to achieve medicinal results, Common Sage may be variously prepared as either a mouthwash, compress, infusion, lotion, tea, or powder.

When used recreationally, *Salvia officinalis* produces an unpredictable psychedelic effect. As with all unknown substances, knowledge and responsibility are necessary in order to ensure one's safety when in an altered state of mind. With no exception, Common Sage leaves vary with potency; therefore, it is crucial to test tolerance first. As the fresh or dried leaves may be smoked for an immediate, but short-term effect, Common Sage leaves may also be chewed or concocted as a liquid and held under the tongue for absorption. Overall, most users report a euphoric, transcending state of mind resulting in episodes of further personal insight and dream-like visions. Even so, a few "experimenters" have complained about the difficulty of deriving results and in few cases, terror attacks have been endured. There are little or unknown side-effects and no death-related instances pertaining to *Salvia*; however, long-term effects are still under investigation. Since *Salvia officinalis* contains chemical constituents dissimilar to any controlled substance (figure below), it remains legal to purchase, consume, and cultivate within the United States and the majority of other countries, with the exception of Australia. Yet, as people become increasingly interested in medicinal plants and their various curative properties, exploitation is inevitable and as with all things, increased popularity results in consequences and ultimately legality issues.



Salvinorin A (C<sub>22</sub>H<sub>34</sub>O<sub>6</sub>)  
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