

A review on bioactive potential of Benzoin Resin

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Abstract

Styrax benzoin (benzoin resin) is a perennial tree belonging to the family (Styracaceae). It has been cultivated in the different regions of the world for thousands of year for incense and pharmaceutical preparations. *Styrax benzoin* usually contains benzaldehyde, benzoic acid, benzyl benzoate cinnamic acid and vanillin. Its chemical composition is influenced by the place of its origin, geographical, and climatic conditions. *Styrax benzoin* has been used traditionally for the treatment of skin diseases, arthritis, wounds, muscle pain, anxiety, and nervous disorders. Benzoin oil is widely used in the food, drinks and alcoholic beverage to give flavor, and for varnishing woods. The methods of production of resins are much traditional so there is a growing need to develop the new methods to maximize the production of resins.

Key words: Benzoin resin, dermatology, cinnamic acid, diuretic

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1. Botany

1.1. Introduction

Styrax Benzoin (benzoin resins) are perennial trees which belong to the family (Styracaceae). Styracaceae is native to subtropical or tropical regions, for example Mediterranean, North or South America and Asia. There are approximately 150 species of *Styrax* present which are used for the production of aromatic resin when they are burned. The *Styrax*, genus is different from all the members of the family Styracaceae due to the production of the resins which excrete from the trunks and barks of the plants after injured with sharps [1]. *Styrax* is self or cross pollinated and variability is present in flowers, fruits shape and colours and stem wood or chemical composition of resins due to cross pollination [2].

Styrax Benzoin is known by different names depending where you are in the world. The common names of the *Styrax Benzoin* are benzoin resins, benzoin trees, Sumatra benzoin. *Styrax* in Swedish is known as benzoin. In German, it is called as benzoebaum. In Spanish, it is well known as bálsamo de Benjuí and in French as arbre à benjoin. In Chinese it is known as xi xiang. The species of *Styrax* is divided into two groups 'Siam Benzoin' and 'Sumatra Benzoin'. *Styrax benzoin* and *Styrax paralleloneurm* are known as 'Saim benzoin' and '*Styrax tonkinensis*' is known as 'Sumatara benzoin'[3]. The plant can be shrub or tree with approximately 25m in length and has diameter 30cm with smooth and simple hairy dark green leaves and white flowers. The fragrance of the benzoin

resins is most familiar among the people since ancient times and used in every culture of the world as medicine or perfume.

The resin has great variability between the species and cultivars and is thought to be related to growing conditions, geographic origin, genetic factors, different chemo-types and differences in the nutritional status of the plants. In Indonesia, *Styrax benzoin* which is known as Sumatra benzoin is tapped to get the resin, after collection it is dried. This dried resin gave the fragrance when burned and it was believed that it has magical properties. In north Sumatra greater than 18,000 families are depending on the production of benzene resins [4]. A benzoin resin have vanilla like fragrance with reddish yellow to milky white colour in 'Siam benzoin' due to presence of benzoic acid while in 'Sumatra benzoin' its colour is dull reddish to greyish brown with storax like fragrance due to presence of cinnamic acid.

Benzoin resins have variability between the species and quality of benzoin resins depends on the practice of the farmers. There are two main varieties of benzoin resins; Sumatra benzoin and Saim benzoin which are present in the market. These two varieties grow in different geographical areas. Saim benzoin grows in Laos while Sumatra benzoin grows in Indonesia [5]. Due to distinct growing region, their chemical composition is also different. Sumatra benzoin is reported to contain more cinnamic acid and cinnamates than Siam benzoin [6]. It is not possible to give annual consumption of benzoin resins due to sufficient accuracy

worldwide. Sumatra benzoin mainly used in incense purpose while Saim benzoin is mainly used in pharmaceutical industries and its minor use in varnishes the town woods [7].

1.2 History/Origin

Styrax benzoin is native to the South-East or East Asia from tropical region to warm temperate of Northern Hemisphere. The name *Styrax* originates from the Greek word sturax and benzoin is derived from Arabic word luban jawi which means java incense. In Roman it was used approximately 2000 years ago.

In 15th and 16th centuries, England imported benzoin in powdered form with spices for perfume preparation which was used by Queen Elizabeth I. Benzoin was also used in religious ceremonies and drives away the evil spirits in the culture of ancient Malayan. *Styrax Benzoin* trees are most abundantly present in Indonesia especially in Sumatra therefore it is also known as Sumatra benzoin.

1.3 Demography/Location

Styrax benzoin grows in warm temperate to tropical regions. Some are found also across the equator in South America. Natural home of *Styrax benzoin* is Sumatra, Indonesia but it is also available in the Western countries from ancients. *Styrax* species other than *Styrax benzoin* grow in many countries such as China, Laos, Malaysia, Vietnam, Cambodia and Thailand. The plant grows in the rain forests of tropical region of Sumatra.

Singapore imports 5330 tons of benzoin, Malaysia 133 tons, China 77 tons, United Arab Emirates, 22tons, Kuwait 16 tons, India 70 tons, Pakistan 16 tons, Saudi Arabia 10 tons, Japan 25 tons, respectively. Singapore is the biggest importer of benzoin resins and then Europe imports benzoin resins for pharmaceuticals and other direct importers of Sumatra benzoin are Indian sub-continent, Japan and other countries of Middle East.

1.4 Botany, Morphology, Ecology

Styrax benzoin is a perennial tree of tropical areas which grow up to height of 15-25 meters. *Styrax benzoin* has tap roots which disappear laterally and tree also has shallow root system. Leaves are ovate and arranged alternately in the form of crown around the stem with hairy underside and smooth upper surface having length in the range of 6-10 cm and 3-5 cm wide. Flowers are bisexual and white in colour or bell shaped in the time of blooms in spring and has 5 petals which are arranged in the form of cluster along the branches. Fruits are closed in the hard and flat shell having the diameter approximately 2-3 cm. Seeds dormant after 6-7 months of fruit fall [8]. Resins of *Styrax benzoin* obtained from tapping of the bark which is produced after 15-20 years. *Styrax benzoin* resins are yellow in colour when obtained and later it becomes reddish-brown after hardening and thickening.

Styrax benzoin originated in rainforest that has medium to high altitude. Cultivation periods require 1300 millimetre rain per year or 3 to 6 dry months. Plants survive in extremely low or high temperatures ranging from -4 to

45°C. Soil having low base saturation and high acid content (pH below than 4.5) is required for best growth.

2. Chemistry

Styrax benzoin is acrid, impressively aromatic and have strong vanilla like smell [9]. Main components of *Styrax benzoin* are benzaldehyde, benzoic acid, benzyl benzoate, cinnamic acid and vanillin [6]. Vanilla like fragrance of plant is due to the presence of vanillin. Cinnamates present in the *Styrax benzoin* are used as flavouring agent and produce chocolate like flavor.

2.1. Chemical composition

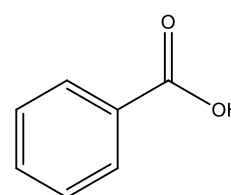
Styrax benzoin contains cinnamyl cinnamate 8-14 %, methyl cinnamate 10-17 %, cinnamic acid 4-7 %, benzyl cinnamate 2-4 % and little amount of vanillin, benzoic acid, phenylpropylic alcohol. Before the use of *Styrax benzoin*, a skin test must be taken as it causes allergy. *Styrax benzoin* is composed of 18% of benzoic acid, a little amount of volatile acids and 75 % of amorphous resins. Free benzoic and cinnamic acid and their corresponding esters such as coniferyl and p-coumaryl alcohol are present in different amounts and also some other higher molecular weight compounds like pinoresinol is also present [6].

2.2. Phyto-chemistry

Styrax benzoin has vanilla like odour due to the presence of vanilline. Trans-coniferyl alcohol benzoate or trans-p-coumaryl alcohol is obtained from the *Styrax benzoin* [10]. *Styrax benzoin* contains the cinnamic acid, benzoic acid, methyl cinnamate, coniferyl benzoate, cinnamyl cinamate, cinamic acid, phenylethylene, and vanillin. Figure 1 shows structures of important phytochemicals of *Styrax benzoin*. Due to difference in production region and varieties of benzoin such as Siam benzoin and Sumatra benzoin, it has significant differences in chemical composition [11].

Table.1. Compounds composition in the *styrax* species of *Styrax benzoin* and *Styrax paralleloneurm*

Compounds	<i>Styrax benzoin</i> (%)	<i>Styrax paralleloneurm</i> (%)
Benzoic acid	46.9	26
Cinnamic acid	40.4	26
Cinnamyl benzoate	0.5	0
Benzyl cinnamate	0	1.6
Cinnamyl cinnamate	0	1.9
p-Coumaryl benzoate	0	9.2
Coniferyl cinnamate	0	1.4
Pinoresinol	6.1	8.2
Benzoic acid ester	0.6	3.3
Triterpene	2.3	1.9
Cinnamic acid ester	0	5.4



Benzoic acid

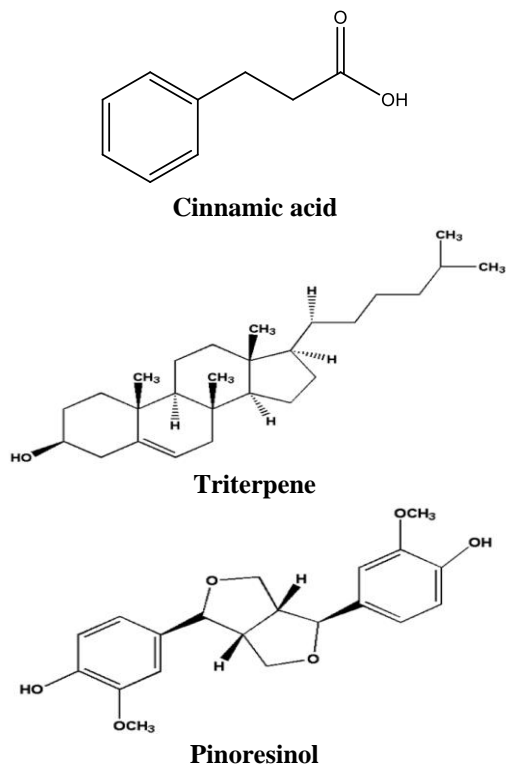


Figure 1. Structures of some bioactive compounds found in *Styrax benzoin*

4. Postharvest technology

Styrax benzoin resins are obtained by tapping of the trees. In order to obtain the resins in the form of tears having 5-6 cm length and 8-10 cm wide notches are made on the cambium of trunk and bark of tree is removed. The tapper makes a notch of 8-10 cm wide and 5-6 cm long into the cambium of the trunk and the bark is removed. Along the trunk of tree a number of notches are made after the interval of 20 to 30 cm and the first notch is made at a length of 30 cm above the ground level. After tapping exuded resins are lifted on the trunk of tree after approximately 4 to 5 months for hardening the resins. The process of tapping occurs during the first cold day of the winter and benzoin tear is obtained. In natural forests, first tapping of benzoin tree is done in the age of 3-5 years while in the regenerated forests; tapping is done in the age of 6 to 8 years. After the collection of resins, sorting and hard cleaning is carried out for the removal of bark pieces but extra care is required to retain the whole tear as such.

5. Value addition

A few local industries of Central Java produced cigarette known as Klembak menyan which is used to reduce stress. The components of this cigarette are tobacco, a large amount of benzoin resins and cloves [12]. According to the papyrus records, benzoin resins are grinded in powder form and mixed with cypress, galbanum, juniper and pine to make a cone that the Egyptian dancers used to place on their heads. Romans and Greeks used benzoin resins from ancients for incense purpose and in their traditional dishes; they use benzoin oil with black paper, juniper, berry, ginger, lavender, sweet marjoram and rosemary. The native people of Sumatra use Lubanja; a benzoin resins it is burnt with

coffee and gave vanilla like odour in their coffee ceremonies as relaxant.

Benzoin oil is also used in the treatment of skin diseases by mixing 10 ml of almond oil, 6 drops of benzoin oil and 2 drops of wheat germ oil and by applying on the affected area such as wounds, skin ulceration, burn and bad sores. Benzoin oil is used for the treatment of psoriasis and eczema with clay as taking 2 tbsp clay and by adding 3 drops of benzoin oil along with distilled water to make paste apply on affected areas and leave it for 20 minutes and then rinse off with water. Benzoin is useful with lemon juice for the treatment of brown marks on the face by adding 2 drops of lemon juice, 10 ml almond oil, 4 drops benzoin oil and 2 drops of wheat germ oil [13].

6. Uses

Styrax benzoin resin is widely used as an ingredient in the incense and is believed that it helps to drive out the evil spirits. Benzoin is also used as a preservative and fragrance compound in the perfumes, soaps, cosmetics and toiletries. Benzoin is also used as a flavouring agent in the food, alcoholic beverage and soft drinks. Benzoin resins act as powerful antioxidants and help to prevent the rancidity of fats. *Styrax benzoin* is also used in the healing of wounds [14].

6.1. General uses

Styrax benzoin is used as disinfectant and it is a good herbal remedy for the throat infection and for respiratory elements. *Styrax benzoin* tincture is used as a mouthwash for the treatment of cold sores. After the tooth extraction, dentists use benzoin resins tincture as an anti-inflammatory agent. Benzoin resins are familiar in the products which are used in the treatment of skin diseases like irritated or dry skin, wounds and inflamed skin. Benzoin resins are used as a herbal remedy for the muscle pain, poor circulation, gout and arthritis. Benzoin resins are used in the religious ceremonies in the many regions of the world. After burning, it produces a sweet smell that uplifts the mood and stimulates the nervous system. It stimulates the heart beat by giving the warm feelings and improves the circulation of blood [5]. Oil extracted from the aromatic plant is known as essential oil [15-18] which has various pharmacological uses [19-20] due to the presence of various bioactive components. Benzoin oil is used as sedative and relaxant and relieves the tension, stress, anxiety and nervousness. It brings out the neurotic or nervous system to normal. GC-MS analysis is generally used to find out bioactive components present in essential oils [18-21-22]. *Styrax benzoin* contains the compounds like benzoic acid, benzaldehyde and benzyl benzoate which are most effective bactericidal, germicidal, antiviral substances and fungicidal. If smoke of benzoin resin is spread then smoky zone become free of germs. Benzoin oil also has anti- flatulent and carminative properties.

7. Pharmacological uses

7.1. Phytotherapy in dermatology

Phytotherapy in dermatology is the process of reparation of medicines from plants and their uses in the treatment of skin. Benzoin is used in conditioning of the skin and also to toughen the skin [23]. Benzoin oils are also used for beauty of skin, making the skin fresh and youthful. It also has ability to heal the wounds and scars. Benzoin oil has healing properties that owe to benzoic acid, benzaldehyde and benzyl benzoate. Cinnamate present in the benzoin is also used in toughening of the skin but it is quite toxic and cause allergy [23].

7.2. Respiratory problems

There are a lot of respiratory problems such as chest infection, pneumonia, asthma, noisy breathing, obstructive sleep apnoea and aspiration [24]. Essential oil of benzoin is used to treat congestion, coughing and other respiratory problems. Benzoin is an excellent disinfectant and has expectorant qualities which help free mucus and ease breathing. As well as clearing up the respiratory system, its sedative properties can help clear the way to a good night's sleep. *Styrax benzoin* used in the pharmaceutical industries for the treatment of bronchitis, cough laryngitis and as an antiseptic for prevent the infections.

7.3. For digestion

In digestive issues like cramping and flatulence, then benzoin essential oil might provide relief. This wonderful essential oil has carminative properties as well as being able to relieve gas and inflammation in the intestines. It helps to relax the stomach muscles enabling excess wind to pass naturally, relieves pain related to gas. Benzoin essential oil also improves general digestion and helps improve your appetite. One of the health benefits of benzoin essential oil is preventing the acidity that occurs in the stomach and avoid many diseases are caused by gastric acidity. In cultivated region of *Styrax benzoin* people use it for the ache of stomach.

7.4. Diuretic

Diuretic is the disease which commonly characterized as the excess of extracellular fluid, the nephritic syndrome, kidney diseases, heart failure and cirrhosis [25]. Benzoin essential oil has natural diuretic properties, which essentially means that it helps to boost both urine production and frequency of urination. Diuretics are used to efficiently cleanse and remove toxins from the blood stream. These properties can have a positive effect on blood pressure and can even help you to lose weight caused by stubborn water retention [26]. *Styrax benzoin* has diuretic properties as it promotes and facilitates the quantity and frequency of urination and through urination it also helps to remove the toxic substances from the blood. It also helps to reduce weight, improving digestion and lowering of the blood pressure.

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