IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

An Extensive review on; *Biancaea Sappan* of its phytochemical and Pharmacological activities.

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Abstract:

Cancer is crucial disorder in present scenario and influencing decrease national economic status. The several numbers of chemotherapeutic agents were available and existing in the market, where as these synthetic analogues exhibits more hazard effects rather than clinical benefits. The treatment schedule of the concept is any chemotherapeutic analogues exhibits more clinical values rather than adverse effects. With this respect the bio compounds were safe, cheap and easily administrable with minimum side effects. The Leguminosae family consists of the well-known medicinal plant *Caesalpinia sappan L.* which is grown and sold across Southeast Asia, Africa, and America. The secondary metabolites like flavonoids, anthraquinones are founds in maximum concentrations in the *Biancaea Sappan* by considering all these facts the present review is focused of *Biancaea Sappan* of its phytochemical and Pharmacological activities.

Keywords: *Biancaea Sappan*, Anticancer, Antioxidant, PANCE-1, HEPG-2.

Introduction:[13,14]

India is an emporium of medicinal plants. The majority of rural residents rely on traditional and herbal medicine to treat a variety of afflictions and diseases. India has 15000-18000 species of flowering plants, 2500 algae species, 23000 fungi species, 1600 types of lynches, 1800 different types of bryophytes, and 30 million microbes. Of these, about 15000-20000 plants have good medicinal value and are used in traditional, folkloric and herbal medicines. *Sappan* wood is used in the traditional medicines of various Asiatic countries. Modern research has identified various medically active compounds in the plant, particularly brazilin, which is found in the heartwood. Brazilin has been shown to have a positive effect on the immune functions plus a

hypoglycaemic action and increased glucose metabolism. A decoction of the wood has shown antibiotic activity against Staphylococcus, Salmonella typhi, Shigella flexneri, Shigella dysenteriae and Bacillus subtilis. An extract of *Caesalpinia sappan* was found to be a potent agent for inactivating human sperm *in vitro* about 2.5 mg/ml is required to reduce motility to 50%. A decoction or infusion of the heartwood is generally considered a strong emmenagogue and astringent. It is also used to cure wounds (also with a plaster of macerated leaves and bark), tuberculosis, diarrhoea and dysentery and is reported as having antioxidant, anti-inflammatory, hepatoprotective, cytotoxic, hypoglycaemic and xanthine oxidase-inhibitory activities. The seeds serve as a sedative.[1]

This review provides a summary of the *Caesalpinia sappan L*. plant.

Stem

Flowers

Fruits

Seeds

Bark

Plant profile:[13]

Caesalpinia sappan L. is a well-known medicinal plant belonging to the Leguminosae family, distributed and cultivated in Southeast Asia as well as in Africa and America. It is a small to medium size, shrubby tree, 4-8 m tall, trunk up to 14 cm in diameter, bark with distinct ridges and many prickles and greyish brown.

Taxonomical classification:

- Kingdom : Plantae-planta
- Subkingdom : Viridiplantae-green plants
- Infrakingdom : Streptophyta-land plants
- Super division : Embryophyta
- Division : Tracheophyta-Vascular plants
- Subdivision : Spermatophyte
- Class : Magnoliopsida
- Superorder : Rosanae
- Order : Fabales
- Family : Fabaceae-Peas, legumes
- Genus : Caesalpinia L-nicker, Caesalpinia, poinciana
- Species : *Caesalpinia sappan* L – *Sappan* wood

VERNACULAR NAMES:

- Kannada : Sappanga
- Sanskrit : Patrangah, Patangah
- Hindi : Patamg, Bakam
- Malayalam : Chappannam, Sappannam
- Marathi : Patang, pathang
- Tamil : Sappamgu, Patamgam
- Telugu : Bakaruchakka
- Common name : *Sappan* Wood, Brazil woo Caesalpinia *Caesalpinia sappan* L.

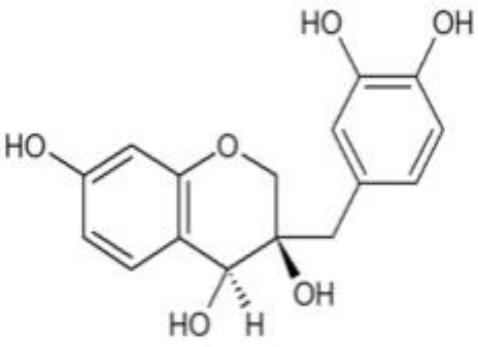
Geographical Distribution:

Caesalpinia sappan L. is found in India, Peru, Malaya, etc. It grows wildly in mountains and is cultivated in the gardens for its large panicles of yellow flowers. In India the tree is distributed in Tamilnadu, Kerala, Karnataka, Andhra Pradesh and West Bengal.

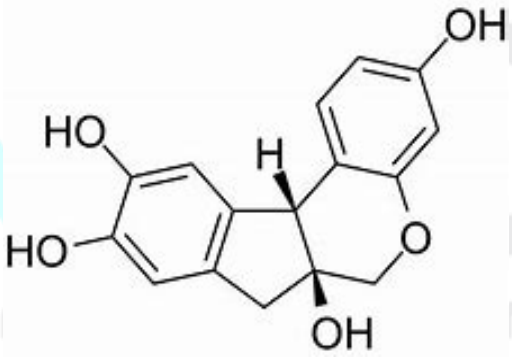
PHYTOCONSTITUENTS:[11,14]

Phytoconstituents are the constituents that are originated from plants. Brazilein is one among the main chemical constituents of *Caesalpinia sappan*. It has diverse pharmacological activities. The plant even contains sapanone-A and sappanol as major chemical constituents. The chemical constituents have anticancer, anti-inflammatory, antibacterial, antioxidant, immunomodulatory, and other pharmacological effects, according to modern pharmacological investigations. Other than these mentioned the plant even contains (3R,4S)-3-(3′,4′-hydroxybenzyl)-3,4-dihydro-2″,3″-dimethyl-3H-[1,3]dioxolo[4,5 c]chromen-7-ol, brazilin, protosappanin A, protosappanin C, protosappanin B, caesalpin J, sappanone B, and sappanchalcone as known chemical constituents. As main constituents the plant contains 3-deoxysappanone, sappanone, 3-deoxysappanone, sappanol, episappanol, 3'-O-methyl brazillin, brazilin derivatives, ombuin, calsalpin, octacosanol, taraxerol.

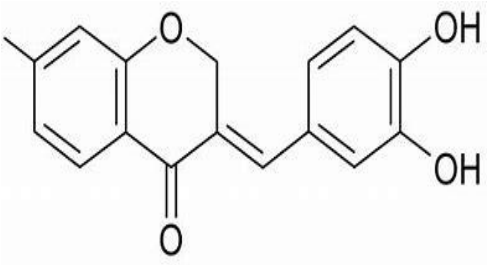
Chemical Structures:[9]



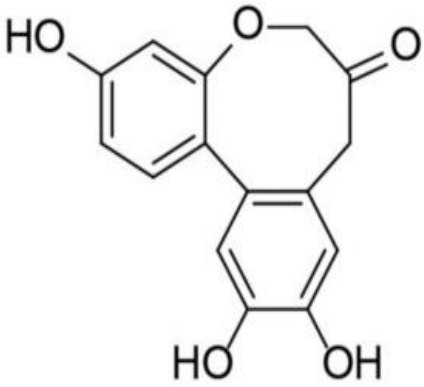
Sappanol



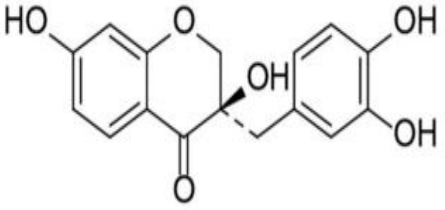
Brazilin



Protosappanin-A



Sappanone-A



Sappanone-B

Pharmacological Activities:

1. **Anti-inflammatory activity**:[15,16]

   Anti-inflammatory activity of BRE (0.1–5 mg/mL) was evaluated as anti-denaturation activity using bovine serum albumin as a substrate. On the basis of b-carotene bleaching assay, BRE showed antioxidant activity with an EC50 value of 60.5 mg/mL, which was almost equal to that of pure brazilin (52.1 mg/mL). Gram-positive bacteria were more sensitive to all tested samples than Gram negative bacteria. BRE possessed higher antibacterial activities than CSE, but lower than brazilin. MIC/MBC values of 62.5–125/125 and 250–500/250–500 mg/mL were obtained for BRE against Gram-positive and Gram-negative bacteria, respectively. A low concentration (0.1 mg/mL) of brazilin, BRE, and CSE showed anti-inflammatory activity by inhibiting protein denaturation up to 46.8, 54.1, and 61.9%, respectively.

2. **Antibacterial activity:**[7]

All bacteria were incubated in BHA at 37˚C for 24 h. Inoculate were prepared by mixing a few bacteria colonies with sterile ringer solution (0.85% NaCl) and comparing the turbidity with the standard 0.5 McFarland solution, which were equivalent to 108 CFU/ml. The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were determined by the broth microdilution assay. Ampicillin

and DMSO were used as positive and negative controls, respectively. The MIC was defined as the lowest concentration of the compound to inhibit the growth of microorganisms and the MBC was defined as the lowest concentration of the compound required to kill the microorganisms.

3. Protective effect on DNA damage-induced by hydroxyl radical:[6]

The heartwood of C. sappan was extracted with 95% ethanol and concentrated under reduced pressure. The extract was studied for free radical scavenging activity on ABTS+, superoxide anion, nitric oxide and total phenolic content. In addition, the extract was studied on protective effect on DNA damage-induced by hydroxyl radical. *C. sappan* extract exerted strong scavenging activity on ABTS+ with the VCEAC = 0.5782± 0.0042-gram L-ascorbic acid/gram extract and TEAC = 0.9159±0.0055-gram Trolox/gram extract. *C. sappan* extract also exhibited high scavenging activity on superoxide anion with an EC_{50} value of 7.73±0.06 µg/ml, which was comparable to the activity of L-ascorbic acid and rutin (EC_{50} value of 6.65±0.07 and 7.83±0.13 µg/ml, respectively). Furthermore, it exerted the strong activity on nitric oxide scavenging activity with an EC_{50} value of 4.24±0.14 µg/ml. This activity was comparable to curcumin with an EC_{50} value of 5.70±0.08 µg/ml. It also contained high amount of phenolic content with the gallic acid equivalent = 0.5540±0.0192 mg gallic acid/mg extract. *C. sappan* extract also showed the protective effect on DNA damage-induced by hydroxyl radical. According to the strong activity on free radical scavenging in vitro and protective effect on DNA damage-induced by hydroxyl radical, *C. sappan* has the potential for chemopreventive study.

4. Anticonvulsant activity of *Caesalpinia sappan* L:[4]

80% Aqueous MeOH extracts from the wood of *Caesalpinia sappan*, which showed remarkable anticonvulsant activity, were fractionated using EtOAc, n-BuOH, and I-t20. Among them, the EtOAc fraction significantly inhibited the activities of two GABA degradative enzymes, succinic semialdehyde dehydrogenase (SSADH) and succinic semialdehyde reductase (SSAR). Repeated column chromatographies for the fraction guided by activity test led to the isolation of the two active principal components. Their chemical structures were determined to be sappanchalcone and brazilin based on spectral data. The pure compounds, sappanchalcone and brazilin, inactivated the SSAR activities in a dose dependent manner, whereas SSADH was inhibited partially by sappanchalcone and not by brazilin.

5. *In-vitro* anthelmintic activity:[2]

In vitro anthelmintic activity of crude aqueous methanolic extract (AME) of both the plants was determined using mature Haemonchus contortus and their eggs in adult motility assay and egg hatch test, respectively. In vivo anthelmintic activity was evaluated in sheep naturally infected with mixed species of gastrointestinal nematodes by administering crude powder (CP) and AME in increasing doses (1.0–3.0

g/kg). Both plants exhibited dose- and time-dependent anthelmintic effects by causing mortality of worms and inhibition of egg hatching. Caesalpinia crista (LC_{50} = 0.134 mg/mL) was found to be more potent than Chenopodium album (LC_{50} = 0.449 mg/mL) in egg hatch test. In vivo, maximum reduction in eggs per gram (EPG) of faeces was recorded as 93.9 and 82.2% with Caesalpinia crista and Chenopodium album AME at 3.0 g/kg on day 13 and 5 post-treatment, respectively. Levamisole (7.5 mg/kg), a standard anthelmintic agent, showed 95.1–95.6% reduction in EPG.

6. *In-vitro* Anti-Influenza Viral Activities:[8,12]

NA activity assay:

A standard fluorimetry assay was used to measure influenza virus NA activity. The substrate MUNANA is cleaved by NA to yield a fluorescent product, which can be quantified. The reaction mixture containing the test compounds and NA enzyme or a virus suspension in 32.5 mM MES buffer with 4 mM calcium chloride (pH 6.5) was incubated for 40 min at 37 °C. After incubation, the reaction was terminated by the addition of 34 mM NaOH. The fluorescence was quantified at an excitation wavelength of 360 nm and emission wavelength of 450 nm. The 50% inhibitory concentration (IC_{50}) was defined as the concentration of NA inhibitor necessary to reduce the NA activity by 50% relative to that in a reaction mixture containing virus but no inhibitor.

CPE reduction assay:

The antiviral activities of the chemical constituents isolated from C. sappan were measured with the CPE inhibition assay. Viral suspension (200 TCID50/mL, 100 µL) was added to each well of a 96-well plate containing a confluent cell monolayer. After incubation at 37 °C for 2 h, the virus solution was removed, and 100 µL of consecutive threefold serial dilutions of the test constituents and reference compounds were added to each well, using the MNCC as the highest concentration. An infection control without constituents was also included. The plates were incubated at 37 °C in a humidified CO_2 atmosphere (5% CO_2) for 24 h, after which the CPE was assessed. The virus-induced CPE was scored as follows: 0 = no CPE, 1 = 0–25% CPE, 2 = 25%–50% CPE, 3 = 50%–75% CPE, and 4 = 75%–100% CPE. The reduction in virus multiplication was calculated as a percentage of the virus control (% virus control = CPEexp/CPEvirus control × 100). The IC_{50} of the CPE with respect to the virus control was estimated using the Reed–Muench method and is expressed in µg/mL. The selective index (SI) was calculated as the ratio CC_{50}/IC_{50}.

7. Hepatoprotective activity:[15,1]

The best-characterized system of xenobiotic-induced hepatotoxicity is liver damage caused by CCl_4, and medication hepatoprotective properties are frequently based on this system. The alterations brought on by CCl_4-induced liver damage are comparable to those brought on by acute viral hepatitis. Since most hepatic damage are caused by free radicals, medicinal plant extracts with strong antioxidant activity may also have strong hepatoprotective effects.

Table No. 1 Summery of actions of *Caesalpinia sappan L.*
1. Anti-inflammatory activity.
2. Antibacterial activity.
3. Protective effect on DNA damage-induced by hydroxyl radical.
4. Anticonvulsant Compounds from the Wood of *Caesalpinia sappan L.*
5. In-vitro anthelmintic activity.
6. In-vitro Anti-Influenza Viral Activities.

Table No. 2 Therapeutic activities of *Caesalpinia sappan L.*
1. Thrombosis
2. Contusion
3. Rheumatism
4. Hemorrhages
5. Cancer therapy
6. Anti-bacterial
7. Anti-fungal
8. Anti-diarrheal

Conclusion and discussion:

The Present review on plant demonstrates that antioxidant property is effective from the extraction of the bark. *Caesalpinia sappan L.* includes an abundance of antibacterial components that have great therapeutic effects.

The leaves of *Caesalpinia sappan* L. have the acute and chronic toxicity effect. These findings may indicate that *Caesalpinia sappan* L. is a viable drug with therapeutic benefits. These results of this study shows that *Caesalpinia sappan* L. may be regarded antimicrobial and laxative properties. Other unidentified components yet to be revel.

Caesalpinia sappan L. traditional medical uses for treating these ailments need to be supported by thorough in vitro and in vivo studies due to the high degree of unanimity for these diseases that has been seen. The pharmacological activities of the species, which include antibacterial, antifungal, anti-diabetic, anti-inflammatory, antioxidant, laxative, and ulcer-protective effects, have confirmed some of the ethnomedical uses of *Caesalpinia sappan* L. Because of this, the pharmacological and phytochemical actions of *Caesalpinia sappan L.* support the traditional medical uses of the species against a variety of ailments, necessitating the need for thorough

in vitro and *in vivo* studies. To determine the interaction between the separated chemicals and common antibiotics, more research is being done.

Acknowledgment:

The authors express their gratitude to the principal of Bapuji Pharmacy College in Davanagere, Karnataka, India, for providing the facilities needed for this work. We are also grateful to pharmacology PG students Mujeebulla R H, Sharat Hegde, Dhanush C R, Renukaradhya, Chandana M, Kavya K. (2022-23) for their suggestions and advices while writing the manuscript.

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