Technical Data Report

for

PAU D'ARCO

Tabebuia impetiginosa

Sage Press

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Pau d'Arco

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Family: Bignoniaceae

Genus: *Tabebuia*

Species: *impetiginosa*

Synonyms: *Tabebuia avellanedae, T. ipe, T. altissima, T. nicaraguensis, T. palmeri, T. schunkeuigoi, T. serratifolia, Gelseminum avellanedae, Handroanthus avellanedae, H. impetiginosus, Tecoma adenophylla, T. avellanedae, T. eximia, T. impetiginosa, T. integra, T. ipe*

Common Names: Pau d'arco, ipê, ipê roxo, lapacho, tahuari, taheebo, trumpet tree, ipê-contra-sarna, tabebuia ipê, tajy

Parts Used: Bark, heartwood

Pau d'arco is a huge canopy tree native to the Amazon rainforest and other tropical parts of South and Latin America. It grows to 30 m high and the base of the tree can be 2–3 m in diameter. The *Tabebuia* genus includes about 100 species of large, flowering trees that are common to South American cities' landscapes for their beauty. The tree also is popular with timber loggers—its high-quality wood is some of the heaviest, most durable wood in the tropics. Pau d'arco wood is widely used in the construction of everything from houses and boats to farm tools. The common name *pau d'arco* (as well as its other main names of commerce, *ipê roxo* and *lapacho*) is used for several different species of *Tabebuia* trees that are used interchangeably in herbal medicine systems. *T. impetiginosa* is known for its attractive purple flowers and often is called "purple lapacho." It has been the preferred species employed in herbal medicine. It is often referred to by its other botanical name, *Tabebuia avellanedae*; both refer to the same tree. Other pau d'arco species produce pink (*T. heptaphylla*), yellow (*T. serratifolia* and *T. chrysantha*) or white (*T. bahamensis*) flowers. Though many of these species may have a similar phytochemical makeup, they are different species of trees.

Pau d'arco has a long and well-documented history of use by the indigenous peoples of the rainforest. Indications imply that its use may actually predate the Incas. Throughout South America, tribes living thousands of miles apart have employed it for the same medicinal purposes for hundreds of years. Several Indian tribes of the rainforest have used pau d'arco wood for centuries to make their hunting bows; their common names for the tree mean "bow stick" and "bow stem." The Guarani and Tupi Indians call the tree *tajy*, which means "to have strength and vigor." They use the bark to treat many different conditions and as a tonic for the same strength and vigor it puts into their bows. Pau d'arco is recorded to be used by forest inhabitants throughout the Amazon for malaria, anemia, colitis, respiratory problems, colds, cough, flu, fungal infections, fever, arthritis and rheumatism, snakebite, poor circulation, boils, syphilis, and cancer.

Pau d'arco also has a long history in herbal medicine around the world. In South American herbal medicine, it is considered to be astringent, anti-inflammatory, antibacterial, antifungal, and laxative; it is used to treat ulcers, syphilis, urinary tract infections, gastrointestinal problems, candidiasis, cancer, diabetes, prostatitis, constipation, and allergies. It is used in Brazilian herbal medicine for many conditions including cancer, leukemia, ulcers, diabetes, candida, rheumatism, arthritis, prostatitis, dysentery, stomatitis, and boils. In North American herbal medicine, pau d'arco is considered to be analgesic, antioxidant, antiparasitic, antimicrobial, antifungal, antiviral, antibacterial, anti-inflammatory, and laxative, as well as to have anticancerous properties. It is used for fevers, infections, colds, flu, syphilis, urinary tract infections, cancer, respiratory problems, skin ulcerations, boils, dysentery, gastrointestinal problems of all kinds, arthritis, prostatitis, and circulation disturbances. Pau d'arco also is employed in herbal medicine systems in the United States for lupus, diabetes, ulcers, leukemia, allergies, liver disease, Hodgkin's disease, osteomyelitis, Parkinson's disease, and psoriasis, and is a popular natural remedy for candida and

yeast infections. The recorded uses in European herbal medicine systems reveal that it is used in much the same way as in the United States, and for the same conditions.

The chemical constituents and active ingredients of pau d'arco have been well documented. Its use with (and reported cures for) various types of cancers fueled much of the early research in the early 1960s. The plant contains a large amount of chemicals known as *quinoids,* and a small quantity of benzenoids and flavonoids. These quinoids (and, chiefly, anthraquinones, furanonaphthoquinones, lapachones, and naphthoquinones) have shown the most documented biological activity and are seen to be the center of the plant's efficacy as an herbal remedy. In the 1960s, plant extracts of the heartwood and bark demonstrated marked antitumorous effects in animals, which drew the interest of the National Cancer Institute (NCI). Researchers decided that the most potent single chemical for this activity was a naphthoquinone named *lapachol* and they concentrated solely on this single chemical in their subsequent cancer research. In a 1968 study, lapachol demonstrated highly significant activity against cancerous tumors in rats.[1]

By 1970, NCI-backed research already was testing lapachol in human cancer patients. The institute reported, however, that their first Phase I study failed to produce a therapeutic effect without side-effects—and they discontinued further cancer research shortly thereafter.[2] These side-effects were nausea and vomiting (very common with chemotherapy drugs) and anti-vitamin K activity (the main concerns over which caused anemia and an anticoagulation effect). Interestingly, other chemicals in the whole plant extract (which, initially, showed positive antitumor effects and very low toxicity) demonstrated positive effects on vitamin K and, conceivably, compensated for lapachol's negative effect. Once again, instead of pursuing research on a complex combination of at least 20 active chemicals in a whole plant extract (several of which had antitumor effects and other positive biological activities), research focused on a single, patentable chemical—and it didn't work as well. Despite NCI's abandonment of the research, another group developed a lapachol analog (which was patentable) in 1975. One study reported that this lapachol analog increased the life span of mice inoculated with leukemic cells by over 80%.[3] In a small, uncontrolled, 1980 study of nine human patients with various cancers (liver, kidney, breast, prostate, and cervix), pure lapachol was reported to shrink tumors and reduce pain caused by them—and three of the patients realized complete remissions.[4]

The phytochemical database housed at the U.S. Department of Agriculture has documented lapachol as being antiabscess, anticarcinomic, antiedemic, anti-inflammatory, antimalarial, antiseptic, antitumorous, antiviral, bactericidal, fungicidal, insectifugal, pesticidal, protisticidal, respiradepressant, schistosomicidal, termiticidal, and viricidal.[5] It's not surprising that pau d'arco's beneficial effects were seen to stem from its lapachol content. But another chemical in pau d'arco, beta-lapachone, has been studied closely of late—and a number of recent patents have been filed on it. It has demonstrated in clinical research to have activities similar to lapachol (antimicrobial,[6] antifungal,[7] antiviral,[8] cytotoxic,[4] antileukemic, [9] and anti-inflammatory[10]), with few side-effects. In one of these studies on beta-lapachone and other quinones in pau d'arco, researchers reported: "Because of their potent activity against the growth of human keratinocytes, some lapachol-derived compounds appear to be promising as effective antipsoriatic agents."[10] In a recent (2002) U.S. patent, beta-lapachone was cited to have "significant antineoplastic activity against human cancer cell lines . . . [including] promyelocytic leukemia, prostate, malignant glioma, colon, hepatoma, breast, ovarian, pancreatic, multiple myeloma cell lines and drug-resistant cell lines."[11] In another U.S. patent, beta-lapachone was cited with the *in vivo* ability to inhibit the growth of prostate tumors.[9]

In addition to its reported antitumor activities, pau d'arco clearly has demonstrated broad clinical actions against a number of disease-causing microorganisms, which supports its wide array of uses in herbal medicine. Antimicrobial properties of many of pau d'arco's active phytochemicals were demonstrated in several clinical studies, in which they exhibited strong *in vitro* activity against various gram-positive and gram-negative bacteria, fungi, and yeast (including *Candida, Aspergillus, Staphylococcus, Streptococcus, Helicobacter pylori, Brucella*, tuberculosis, pneumonia, and dysentery).[12–17] In addition to its isolated chemicals, a hot water extract of pau d'arco demonstrated antibacterial actions against *Staphylococcus aureus*,[18] *Helicobacter pylori*[19] (the bacteria that

commonly causes stomach ulcers), and *Brucella*.[20] A water extract of pau d'arco was reported (in other *in vitro* clinical research) to have strong activity against 11 fungus and yeast strains.[21] Pau d'arco and its chemicals also have demonstrated *in vitro* antiviral properties against various viruses, including *Herpes* I and II, influenza, polio virus, and vesicular stomatitis virus.[22–24] Its antiparasitic actions against various parasites (including malaria, schistosoma, and trypanosoma) have been confirmed as well.[22,25,26] Finally, bark extracts of pau d'arco have demonstrated anti-inflammatory activity and have shown success against a wide range of induced inflammation in mice and rats.[27]

Pau d'arco is an important resource from the rainforest with many applications in herbal medicine. Unfortunately, its popularity and use have been controversial due to varying results obtained from its use. For the most part, these seem to have been caused by a lack of quality control—and confusion as to which part of the plant to use and how to prepare it. Many species of *Tabebuia*, as well as other completely unrelated tree species exported today from South America as "pau d'arco," have few to none of the active constituents of the true medicinal species. Pau d'arco lumber is in high demand in South America. The inner bark shavings commonly exported to the U.S. and Europe are actually by-products of the South American timber and lumber industries. At least 10 species of *Tabebuia* are logged commercially in South America for lumber purposes alone. When these logs arrive at lumber mills, the identifying leaves and flowers (which distinguish the tree species) are long gone—it's all just "pau d'arco." This may explain varying species of pau d'arco bark being sold as herbal products—and their resulting (diminished) quality. Even mahogany shavings from the same sawmill floors in Brazil are swept up and sold around the world as "pau d'arco" (due to the similarity in color and odor of the two woods).[28] In 1987, a chemical analysis of 12 commercially-available pau d'arco products revealed only one product containing lapachol—and only in trace amounts.[29] As lapachol concentration typically is 2–7% in true pau d'arco, the study surmised that the products were not truly pau d'arco, or that processing and transportation had damaged them. Additionally, most pau d'arco research has centered on the heartwood of the tree. Most of the commercially-available products, though, contain just the inner bark of the tree—which is stripped off at sawmills when the heartwood is milled into lumber for construction materials. Laboratory analysis has always confirmed that the lapachol content is in higher concentration in the heartwood than the bark. Finally, many consumers and practitioners are unaware that, for the best results when extracting these particular active chemicals (even after obtaining the correct species), the bark and/or wood must be boiled at least 10-15 minutes—rather than brewed as a simple tea or infusion (lapachol and the other quinoids are not very water soluble).

It is therefore not surprising that consumers and practitioners are experiencing spotty results with commercially-available pau d'arco products. With its many effective applications, however, it would behoove consumers to take the time to learn about the available products and suppliers, and find a reliable source for this important medicinal plant from the rainforest. Relatively new in the marketplace are standardized extracts of pau d'arco (that guarantee the amount of lapachol and/or naphthoquinones). In such a product, it would be unclear if other active quinones and phytochemicals have been extracted (and to what extent) in these chemically-altered products. Although the natural wood and bark are quite effective when the correct species is used and prepared properly, the new standardized extracts may be the safer (although more expensive) purchase for most laypersons and general consumers concerned about quality but which don't have the time to research each product.

There have been no reports of human toxicity when a whole-bark decoction or tincture of pau d'arco is used. The oral LD50 (50% lethal dosage) for lapachol is reported to be 1.2–2.4 g/kg (body weight) in rats and 487–621 mg/kg in mice. Signs of toxicity in humans (vomiting/diarrhea) were reported at oral dosages of 1,500 mg daily (and higher) of pure lapachol. However, even at these dosages, no myleosuppression or hepatic or renal toxicity was noted. Good quality pau d'arco (*Tabebuia impetiginosa*) contains an average of 4% lapachol (or 40 mg of lapachol per gram of pau d'arco bark/wood).

Documented Properties and Actions: Analgesic, antibacterial, anticarcinomic, anticoagulant, antifungal, anti-inflammatory, antileukemic, antimicrobial, antimutagenic, antioxidant, antiparasitic, antirheumatic, antitumor, antiviral, astringent, cytotoxic, immunostimulant, laxative

Main Phytochemicals: Acetaldehydes, alpha-lapachone, ajugols, anisic acid, anthraquinones, benzoic acids, benzenes, beta-lapachone, carboxaldehydes, chromium, chrysanthemin, dehydro-alpha-lapachone, dehydroisolapachone, deoxylapachol, flavonoids,furanonaphthoquinones, hydrochlorolapachol, 2-hydroxy-3-methyl-quinone, 6-hydroxy-mellein, iso-8-hydroxy-lariciresinol, kigelinone, lapachenol, lapachenole, lapachol, lapachones, menaquinones, 4-methoxyphenol, naphthoquinones, paeonidin-3-cinnamyl-sophoroside, phthiolol, quercetin, tabebuin, tectoquinone, vanillic acid, vanillin, veratric acid, veratric aldehyde, xyloidone

Traditional Remedy: One-half to one cup bark and/or heartwood decoction taken orally 2–4 times daily. (Do not prepare an infusion/tea for this plant—it will not be as effective.) This decoction also is employed traditionally as a douche for yeast infections and is used topically on the skin.

Contraindications: There have been no reports in the literature of contraindications when a whole-bark decoction or tincture is used. However, at least one isolated phytochemical in pau d'arco, lapachol, has demonstrated abortifacient properties and retarded fetal growth in animal studies. As there are no studies confirming the safety of traditional bark decoctions used by pregnant women (nor is there documentation in traditional medicine systems of women using this plant during pregnancy), the use of pau d'arco during pregnancy is not recommended.

Large single dosages of pau d'arco decoctions (more than one cup) may cause gastrointestinal upset and/or nausea. Do not use in high doses unless under the advice of a qualified health practitioner; reduce dosage if nausea occurs.

Drug Interactions: None reported.

WORLDWIDE ETHNOBOTANICAL USES

Country	Uses
Amazonia	Colds, cough, fever, flu, leishmaniasis, sores, urinary tract infections
Argentina	Diarrhea, respiratory infections, urinary tract infections
Bahamas	Backache, dysuria, enuresis, gonorrhea, incontinence, toothache
Brazil	Allergy, analgesic, anticoagulant, antifungal, antimicrobial, antimutagenic, anus, arthritis, asthma, astringent, athlete's foot, bed-wetting, blood builder, boils, bursitis, cancer, cancer pain, candida, cicatrizant, circulation (poor), colds, colitis, constipation, cystitis, diabetes, diuretic, dysentery, eczema, fever, flu, gastritis, gingivitis, gonorrhea, hernia, hemorrhoid, hemorrhage, herpes, Hodgkin's disease, immunity, impetigo, inflammation, itch, leishmaniasis, leucorrhea, leukemia, liver, malaria, ophthalmic, parasites, prostatitis, respiratory, rheumatism, ringworm, scabies, skin, snakebite, sore throat, stomatitis, stomach, syphilis, throat, tendonitis, tonic, ulcers, urinary tract infections, uterus, vagina,varicose veins, warts, wounds
Costa Rica	Cancer, colds, fever, headache, snakebite
Guatemala	Rabies
Mexico	Anemia, fever

Country	Uses
South America	Allergies, anemia, antibacterial, antifungal, anti-inflammatory, arthritis, astringent, boils, cancer, candidiasis, chlorosis, circulation (poor), colitis, colds, constipation, cough, cystitis, diabetes, diarrhea, dysentery, enuresis, fever, flu, gastritis, gastrointestinal, infections, laxative, malaria, pharyngitis, prostatitis, respiratory disease, snakebite, syphilis, ulcers, wound
United States	Allergies, analgesic, antibacterial, antifungal, anti-inflammatory, antimicrobial, antimutagenic, antioxidant, antiparasitic, antiviral, arthritis, boils, cancer, candida, circulation disturbances, cold, diabetes, dysentery, fevers, flu, fungal infections, gastrointestinal, Hodgkin's disease, infections, laxative, leukemia, liver disease, lupus, osteomyelitis, Parkinson's disease, prostatitis, psoriasis, respiratory problems, skin ulcerations, syphilis, ulcers, urinary tract infections, warts

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Ethnomedical Information on Pau d'Arco (Tabebuia impetiginosa)

Plant Part / Location	Documented Ethnic Use	Type Extract / Route	Used For	Ref #
Bark South America	Used for boils, chlorosis, colitis, diarrhea, dysentery, enuresis, fever, pharyngitis, snakebites, syphilis, wounds, cancer, ulcers, respiratory problems, arthritis, cystitis, constipation, prostatitis and poor circulation.	Not Stated	Human Adult	AU1005
Flower Amazonia	Used for colds, cough and flu.	Decoction Oral	Human Adult	L04137
Bark Amazonia	Used on leishmaniasis sores.	Poultice	Human Adult	L04137
Bark Amazonia	Used for fever.	Not Stated	Human Adult	L04137
Bark Argentina	Used against diarrhea and to treat respiratory and urinary tract infections.	Decoction Oral	Human Adult	K17523
Leaf Bahamas	Used for backache, dysuria, gonorrhea and toothache. Used as an aphrodisiac in combination with other plants.	Decoction Oral	Human Adult	ZZ1049
Bark Bahamas	Used for enuresis and incontinence.	Decoction Oral	Human Adult	ZZ1049
Bark Bolivia	Used as a cancer remedy. Most sources in the lay press and many letters of inquiry (1982–1983) have made reference to this plant as *Tabebuia avellanidae* and *Tabebuia rosea,* but these are incorrect. The true identity of "taheebo bark" is *Tabebuia impetiginosa* (Mart. ex DC.) StandI.	Hot H2O Ext Oral	Human Adult	N13344
Culture of Callus Tissue Brazil	Used as a diuretic. Used as an astringent.	Infusion Oral Infusion External	Human Adult	K28241
Leaf Brazil	Used for gastric illness. Used for ophthalmic illnesses. Used against cancer.	Not Stated Oral Not Stated Ophthalmic Decoction Oral	Human Adult	L05437
Leaf Brazil	Used as an astringent and mucilaginous for syphilitic ulcers. Used for gonorrhea.	Decoction Oral	Human Adult	ZZ1099
Leaf Brazil	Used for blennorrhagia.	Juice Oral	Human Adult	ZZ1088
Bark Brazil	Used for cancer, ulcers, diabetes and rheumatism, respiratory problems, colitis, arthritis, poor circulation, prostatitis, cystitis and constipation.	Decoction Oral	Human Adult	ZZ1070

Plant Part / Location	Documented Ethnic Use	Type Extract / Route	Used For	Ref #
Bark Brazil	Used for rheumatism, arthritic inflammation, prostatitis, cystitis, fungus and yeast overgrowth, stomatitis, ulcers in the throat, gastric ulcers, syphilitic chancres, itchiness, wounds, eczema and boils. Used to prevent tumor formation, eliminate cancer pain and multiply the number of red blood cells, eliminate toxins and purify the blood.	Not Stated	Human Adult	ZZ1014
Bark Brazil	Used for candida, athlete's foot, cancer, parasitic infection, diabetes and for digestion.	Infusion Oral	Human Adult	ZZ1061
Bark Brazil	Used as an astringent and for impetigo.	Decoction Oral	Human Adult	ZZ1096
Bark Brazil	Used for affections of the skin, impetigo, itch, scabies, inflammation of the mouth, stomatitis, gastric ulcers, leucorrhea and diabetes. Used as an anti-inflammatory, antiallergic, antimicrobial, anticarcinogenic, antimalarial and antihemorrhagic.	Decoction Oral	Human Adult	ZZ1092
Bark Brazil	Used for scabies, ringworm and cancer.	Infusion Oral Salve External	Human Adult	ZZ1099
Bark Brazil	Used as an astringent and mucilaginous for syphilitic ulcers.	Decoction Oral	Human Adult	ZZ1099
Bark Brazil	Used for veins, hemorrhoids, varicose ulcers, as a depurgative after syphilis, for eczema, rheumatism, wounds, affections of the mouth, stomatitis and herpes of the lips. Used as an immunostimulant, antitumoral, antineoplastic, anticoagulant, antimalarial and analgesic.	Decoction Oral	Human Adult	ZZ1081
Bark Brazil	Used for leukemia, diabetes and cancer. Used for boils, chlorosis, syphilis, external wounds and Candida infection.	Not Stated	Human Adult	AU1004
Bark Brazil	Used for adenocarcinoma (pancreas), cancer of the esophagus, head, intestines, lung, prostate and tongue, Hodgkin's disease, leukemia and lupus. Said to be alexiteric, analgesic, anodyne, antidotal, diuretic and fungicidal.	Infusion Oral	Human Adult	ZZ1049
Bark Brazil	Used for boils, colitis, dysentery, bedwetting, fever, sore throat, snake bite, wounds, cancers (of the esophagus, head, intestine, lung, prostate, tongue), ulcers, respiratory problems, arthritis, cystitis, constipation, prostatitis and poor circulation.	Not Stated Oral	Human Adult	ZZ1064
Bark Brazil	Used as an astringent, mucilaginous and bitter. Used for impetigo, arthritic inflammation, leucorrhea, mucus in the urethra, gastritis, throat wounds, syphilis.	Decoction Oral	Human Adult	

Plant Part / Location	Documented Ethnic Use	Type Extract / Route	Used For	Ref #
Bark Brazil	Used for stomatitis, cancer, gastric ulcers and syphilis.	Decoction Oral	Human Adult	ZZ1002
Bark + Wood Brazil	Used inflammations of the mucosa such as gingivitis, throat, vagina, uterus and anus.	ETOH Ext Local Use	Human Adult	ZZ1078
Root + Bark Brazil	Used as an antitumoral, anti-inflammatory, anticarcinogenic, to protect against carcinogenic substances and AIDS and as an antioxidant and immune stimulant. Used for prostate cancer, malignant tumors, to reduce pain due to cancer, for hormonal cancers and colon cancer.	Decoction Oral	Human Adult	ZZ1076
Not Stated Brazil	Used for leukemia, malignant tumors of the liver, breast, cervix and prostate, and as a cancer analgesic. Said to stimulate the production of red blood cells in the bone marrow.	Not Stated	Human Adult	AU1002
Not Stated Brazil	Used as an antirheumatic, antisyphilitic and against leishmaniasis.	Not Stated	Human Adult	ZZ1099
Bark Costa Rica	Used for cancer.	Decoction Oral	Human Adult	H16341
Bark Costa Rica	Used for colds, fever and headache.	Decoction Oral	Human Adult	ZZ1049
Flower + Leaf + Shoot Costa Rica	Used for snakebite.	Not Stated	Human Adult	ZZ1049
Bark Guatemala	Used for rabies.	Decoction Oral	Dog	ZZ1049
Root Mexico	Used for anemia.	Decoction Oral	Human Adult	ZZ1049
Leaf + Bark Mexico	Used for fever.	Decoction Oral	Human Adult	ZZ1049
Not Stated Colombia	Used for cancer.	Not Stated	Human Adult	ZZ1049
Not Stated USA	Used for fungal infection.	Decoction Oral Decoction External	Human Adult	ZZ1049
Bark Not Stated	Used as a cancer remedy, for diarrhea, boils, leprosy, chlorosis, dysentery, eneuresis, fever, pharyngitis, snakebite, syphilis and wounds. Use to aid the health of the immune system, as an antitumor, antimicrobial, analgesic, anodyne, diuretic, fungicidal, antifever, anticandida, anticancer, anti-inflammatory, antihemorrhagic and antileukemic.	Decoction Oral Tincture Oral	Human Adult	ZZ1011
Bark Not Stated	Used for cancer, osteomyelitis, ringworm, bronchitis, gastritis, colitis, cystitis, prostatitis, lupus, Hodgkin's disease and any type of pain. Used for parasitic penetration and schistosomiasis.	Infusion Oral	Human Adult	ZZ1053

Plant Part / Location	Documented Ethnic Use	Type Extract / Route	Used For	Ref #
Bark Not Stated	Used for leukemia, cancer, candida infections and arthritis.	Not Stated	Human Adult	ZZ1062
Not Stated	Used as an antiparasitic.	Not Stated	Human Adult	AU1003
Not Stated	Used for boils, chlorosis, diarrhea, dysentery, enuresis, fever, pharyngitis, snakebite, syphilis and wounds.	Not Stated	Human Adult	ZZ1049
Not Stated	Used for fevers, anemia (with *Yerba mate*), infections, colds, flu, syphilis, cancer, respiratory problems, skin ulcerations, boils, dysentery, gastrointestinal problems, arthritis, prostatitis, circulation disturbances, lupus, diabetes, Hodgkin's disease, osteomyelitis, Parkinson's disease, ulcers, venereal disease, rheumatism, eczema, herpes, mange and psoriasis. Used to relieve pain, kill germs, increase the flow of urine and as an antidote to poisons.	Not Stated	Human Adult	ZZ1062

Biological Activities of Pau d'Arco (Tabebuia impetiginosa)

Part – Origin	Activity Tested for	Type Extract	Test Model	Dosage	Result	Notes/Organism Tested	Ref #
Bark Argentina	Anticoagulant Activity	Decoction	Agar Plate	Not Stated	Inactive	*Pseudomonas aeruginosa.*	K17523
Not Stated Brazil	Mutagenic Activity	Infusion	Agar Plate	50.0 mg/Plate	Equiv.	*Salmonella typhimurium* TA98. Metabolic activation required to obtain positive results vs. 2-amino-3,7,8-trimethylimidazo[4,4-f]quinoxaline-induced mutagenesis.	K26457
Not Stated Brazil	Mutagenic Activity	Infusion	Agar Plate	50.0 mg/Plate	Weak Activity	*Salmonella typhimurium* TA98. Metabolic activation required to obtain positive results vs. 2-amino-3,4,7,8-tetramethyl-3h-imidazo-[4,5-f]quinoxaline-inoxaline-induced mutagenesis.	K26457
Not Stated Brazil	Antimutagenic Activity	Infusion	Agar Plate	50.0 mg/Plate	Weak Activity	*Salmonella typhimurium* TA98. Metabolic activation required to obtain positive results vs. 2-amino-3-methyl-imidazo[4,5-f]-quinoline2-amino-1-methyl-6-phenylimidazo[4limidazo[4,5-b]-pyridine- and 3-amino-1,4-dimethyl-5h-pyrido[4,3-b] indole(TRP-P-1)-induced mutagenesis.	K26457
Bark Argentina	Antibacterial Activity	Decoction	Agar Plate	Not Stated	Inactive	*Pseudomonas aeruginosa.*	K17523
Bark Argentina	Antibacterial Activity	Hot H2O Ext Hot H2O Ext	Agar Plate	62.5 mg/ml 62.5 mg/ml	Active Inactive	*Staphylococcus aureus.* *Escherichia coli.*	K14683 K14683
Bark Argentina	Antibacterial Activity	H2O Ext	Agar Plate	1.0 mg/ml LC50 = 10.3 mcg/ml	Inactive Active	*Salmonella typhi.*	J11153
Bark Not Stated	Antibacterial Activity	Not Stated	Agar Plate	Not Stated	Active	*Helicobacter pylori.* Zone of inhibition = 32.	AU1008
Wood Brazil	Antibacterial Activity	Not Stated	Not Stated	Not Stated	Active	*Brucella.*	AU1016
Bark Argentina	Antifungal Activity	Hot H2O Ext	Agar Plate	62.5 mg/ml	Inactive	*Aspergillus niger*.	K14683

Part – Origin	Activity Tested for	Type Extract	Test Model	Dosage	Result	Notes/Organism Tested	Ref #
Not Stated Spain	Antifungal Activity	H2O Ext MEOH Ext CH2Cl2 Ext	Not Stated	Not Stated	Strong Activity Strong Activity Active	11 fungal strains comprising several filamentous fungi and yeasts.	AU1024
Bark Brazil	Anti-inflammatory Activity	H2O Ext	Oral Rat	200 mg/kg 400 mg/kg	Active Active	Reduced formalin induced edema by 49.3% (200 mg/kg) and 53.7% (400 mg/kg).	AU1021
Bark Brazil	Anti-inflammatory Activity	Not Stated	Not Stated / Rat	Not Stated	Active	vs. formalin-induced pedal edema.	A12697
Bark Brazil	Anti-inflammatory Activity	H2O Ext	Oral Rat	100 mg/kg 200 mg/kg 400 mg/kg	Weak Activity Active Weak Activity	Reduced the nociception produced by acetic acid by 49.9% (100 mg/ kg), 63.7% (200 mg/kg) and 43.8% (400 mg/kg).	AU1021
Bark Brazil	Anti-inflammatory Activity	H2O Ext	Oral Rat	200 mg/kg	Active	Inhibited edema by 12.9% vs. rat paw edema model.	AU1021
Bark Brazil	Anti-inflammatory Activity	H2O Ext	Rat	Not Stated	Active	vs. paw edema test induced by carrageenan.	AU1021
Bark Brazil	Immunologic Effects (Unspecified)	Naphthoquinone Fraction	Not Stated	Variable	Active	Data incomplete—derived from an abstract.	T11808
Bark Brazil	Antitumor Activity	H2O Ext	IG Rat Oral Rat Oral Rat	150.0 mg/kg 200.0 mg/kg 400.0 mg/kg	Active Active Active	Sarcoma (Yoshida ASC). 85% TWD dosing for 9 days. Sarcoma—WM256 (IM). 44% TWD dosing for 9 days. Sarcoma (Yoshida ASC). 52% TWD dosing for 9 days.	A03256
Bark Brazil	Cytotoxic Activity	MeOH (75%) Ext	Cell Culture	IC50 = 1 mg/ml	Inactive	In vero cells.	L05437
Bark Brazil	Smooth Muscle Relaxant Activity	H2O Ext	Not Stated / Guinea Pig Not Stated / Rat	Not Stated Not Stated	Inactive Inactive	Ileum. Ileum.	A03256
Bark Brazil	Smooth Muscle Stimulant Activity	H2O Ext	Not Stated / Rat	Not Stated	Inactive	Ileum.	A03256
Bark Korea	Antioxidant Activity	Hot H2O Ext	Not Stated	1000 g/ml 5 g/ml	Active Active	Inhibited the formation of conjugated diene hydroperoxides. Inhibited the oxidation of hexanal.	AU1023

Biological Activities for Compounds in Pau d'Arco (Tabebuia impetiginosa)

(Please note: The following is just a representation of some of the published research on compounds in pau d'arco. Over 200 clinical studies have been published on various phytochemicals naturally found in pau d'arco, including those compounds shown below.)

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism Tested	Ref #
Lapachol compounds	Toxicity (general)	Cell Culture	IC50 = 0.35-0.7 mcM	Active	Caused damage to keratinocyte cell membrane.	AU1025
Lapachol	Toxicity (general)	Oral Rat	100 mg/kg	Active	Fetotoxic, leading to fetal growth retardation. Non-toxic to mothers.	AU1050
Lapachol	Toxicity (general)	Not Stated Monkey	130 mg/l	Active	Acute cardiac toxicity.	AU1012
Lapachol	Toxicity (general)	Not Stated	Blood levels > 20 mcg/ml	Active	Mild effects of nausea, vomiting and anticoagulant effects due to anti-vitamin K activity.	J04271
Lapachol	Toxicity (general)	Not Stated Mice Not Stated Rat Not Stated Dog Not Stated Monkey	LD50 = 0.621 g/kg LD50 = >2.4 g/kg 0.25–2 g/kg 0.0625–1 g/kg	Active	Signs of toxicosis = anemia, reticulocytosis, normoblastosis, pallor of mucous membranes, bilirubiniuria, and proteinuria.	AU1036
Lapachol	Toxicity (general)	Not Stated Monkey	250 mg/kg	Active	Reversible anemia, reticulocytosis, proteinuria, and bilirubinuria.	AU1037
Lapachol	Toxicity (general)	Not Stated Dog Not Stated Monkey	0.25–2 mg/kg 0.25 g/kg 0.5 g/kg 1 g/kg	Inactive Active Active Active Active	No lethal effect. Anemia, reticulocytosis, normoblastosis, thrombocytosis, and transient leukocytosis. Emesis, anorexia, paleness of mucus membranes, reversible anemia, reticulocytosis, proteinuria, bilirubinuria and red-brown urine discoloration seen. Death. Death.	AU1038
Beta-lapachone	Toxicity (general)	Oral Dog Oral Rat Not Stated Mice Not Stated Chicken	100 mg/kg 200 mg/kg Not Stated Not Stated	Inactive Weak Activity Inactive Inactive	Higher doses caused gastric ulceration and loss of erythrocytes but with no signs of bone marrow suppression.	AU1007
Lapachol	Abortifacient Activity	Not Stated Rat	10 mg in 0.5 ml Hydroalcoholic Ext	Active	Fetal mortality (99.2%). Mothers unaffected.	AU1052
Lapachol	Coagulation Activity	In Vitro Not Stated Dog	0.02–0.6 mg/ml IV 7–20 mg/kg	Active Inactive	Coagulation time increased. No effect seen.	AU1034

GI = Gastric Intubation IG = Intragastric NG = Nasogastric IP = Intraperitoneally IV = Intravenously SC = Subcutaneously IM = Intramuscular

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism Tested	Ref #
Lapachol	Anticoagulant Activity	Not Stated Rat Not Stated Human	Not Stated Not Stated	Active Active		AU1039
Naphthoquinones	Antibacterial Activity	In Vitro	Not Stated	Active Strong Activity	*Staphylococcus aureus.* Penicillin-resistant strains.	AU1041
Kigelinone + Dehydro-alpha-lapachone + Lapachol	Antibacterial Activity	Agar Plate	Not Stated	Active		AU1053
Lapachone	Antibacterial Activity	Agar Plate	Not Stated Not Stated Not Stated	Active Active Active	*Bacillus subtilis.* *Staphylococcus aureus.* *Brucella.*	AU1017
Xiloidone	Antibacterial Activity	Not Stated	Not Stated	Active	*Brucella* sp.	AU1031
Furanonaphthoquinones	Antibacterial Activity	Agar Plate	MIC = 1.56–25 mcg/ml	Active Active Weak Activity	Gram-positive bacteria. Methicillin-resistant *Staphylococcus aureus*. Methicillin-sensitive *S. aureus*.	AU1028
Furanonaphthoquinones	Antibacterial Activity	Agar Plate	MIC = 3.13 mcg/ml MIC = 6.25 mcg/ml MIC = 6.25 mcg/ml MIC = 25 mcg/ml MIC = 6.25 mcg/ml MIC = 25 mcg/ml MIC = 25 mcg/ml MIC = 25 mcg/ml MIC = 1.56 mcg/ml MIC = 25 mcg/ml MIC = 0.78 mcg/ml MIC = 0.78 mcg/ml MIC = 1.25 mcg/ml MIC = 0.05 mcg/ml MIC = 0.1 mcg/ml	Active	*Staphylococcus aureus.* *Staphylococcus epidermidis.* *Streptococcus pneumoniae.* *Streptococcus pyogenes.* *Streptococcus mutans.* *Streptococcus salivarius.* *Enterococcus faecium.* *Enterococcus faecalis.* *Bacillus subtilis.* *Clostridium perfringens.* *Escherichia coli.* *Citrobacter freundii.* *Enterobacter cloacae.* *Serratia marcescens.* *Klebsiella pneumoniae.*	AU1028
Lapachol	Antimicrobial Activity	In Vitro	MIC = 20–100 mcg/ml	Active	*Brucella* sp. *Neisseria catarrhalis.*	AU1032

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism Tested	Ref #
Lapachol	Antimicrobial Activity	Agar Plate	MIC = 60–80 mcg/ml MIC = 40–60 mcg/ml MIC = 40–60 mcg/ml MIC = 60–80 mcg/ml MIC = 40–60 mcg/ml MIC = > 100 mcg/ml MIC = 80–100 mcg/ml MIC = 80–100 mcg/ml MIC = 60–80 mcg/ml MIC = > 100 mcg/ml MIC = 40–60 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = 15–20 mcg/ml MIC = 15–20 mcg/ml MIC = 10–15 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml	Active	*Bacillus subtilus.* *B. mycoides.* *B. anthracis.* *Staphylococcus aureus.* *Sar. lutea.* *Streptococcus hemolyticus.* *M. tub. hom.* *M. smegmatis.* *M. phisi.* *N. asteroides.* *N. catarrhalis.* *E. coli.* *K. pneumonia.* *S. typhosa.* *Br. suis.* *Br. abortus.* *Br. melirensis.* *C. albicans.* *C. kruzei.* *C. neoformans.*	ZZ1064
Alpha-lapachone	Antimicrobial Activity	Agar Plate	MIC = 40–50 mcg/ml MIC = 40–50 mcg/ml MIC = 40–50 mcg/ml MIC = 30–40 mcg/ml MIC = 30–40 mcg/ml MIC = 60–80 mcg/ml MIC = 30–50 mcg/ml MIC = 30–50 mcg/ml MIC = 20–30 mcg/ml MIC = 60–80 mcg/ml MIC = 80–100 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = 20–30 mcg/ml MIC = 30–40 mcg/ml MIC = 30–40 mcg/ml MIC = 80–100 mcg/ml MIC = 80–100 mcg/ml MIC = 50–80 mcg/ml	Active	*Bacillus subtilus.* *B. mycoides.* *B. anthracis.* *Staphylococcus aureus.* *Sar. lutea.* *Streptococcus hemolyticus.* *M. tub. hom.* *M. smegmatis.* *M. phisi.* *N. asteroides.* *N. catarrhalis.* *E. coli.* *K. pneumonia.* *S. typhosa.* *Br. suis.* *Br. abortus.* *Br. melirensis.* *C. albicans.* *C. kruzei.* *C. neoformans.*	ZZ1064

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism Tested	Ref #
Furanonaphthoquinones	Antibacterial Activity	Agar Plate	MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml MIC = > 100 mcg/ml	Inactive Inactive Inactive Inactive Inactive Inactive Inactive Inactive Inactive Inactive Inactive	*Klebsiella oxytoca.* *Proteus vulgaris.* *Morganella morganii.* *Acinetobacter calcoaceticus.* *Pseudomonas aeruginosa.* *Neisseria gonorrhoeae.* *Haemophilus influenzae.* *Moraxella catarrhalis.* *Campylobacter jejuni.* *Helicobacter felis.* *Helicobacter pylori.*	AU1028
Furanonaphthoquinones	Antifungal Activity	Agar Plate	MIC = 4 mcg/ml MIC = > 8 mcg/ml MIC = 4 mcg/ml MIC = > 8 mcg/ml MIC = 2 mcg/ml MIC = 0.5 mcg/ml MIC = 2 mcg/ml MIC = 1 mcg/ml MIC = 4 mcg/ml MIC = 6 mcg/ml MIC = 6 mcg/ml	Active	*Candida albicans.* *Candida tropicalis.* *Candida glabrata.* *Candida krusei.* *Candida utilis.* *Cryptococcus neoformans.* *Saccharomyces cerevisiae.* *Aspergillus fumigatus.* *Aspergillus niger.* *Trichophyton mentagrophytes.* *Trichophyton rubrum.*	AU1028
Beta-lapachone	Antifungal Activity	Agar Plate	Not Stated	Active	*Candida albicans.* *C. ropicalis.* *Tricophyton mentagrophytes.* *T. glabrata.*	AU1029
Lapachol	Antifungal Activity	Agar Plate	Not Stated	Weak Activity	*Candida albicans.* *C. ropicalis.* *Tricophyton mentagrophytes.* *T. glabrata.*	AU1029
Lapachol	Antiviral Activity	Cell Culture Chick embryos	Not Stated	Not Stated Not Stated Not Stated Active Active Not Stated Not Stated Active	*Adenovirus* type 5. *Herpes simplex* type 1. Western equine encephalomyelitis virus. *Vesicular stomatitis* virus Brazil. *Poliovirus* type 1. *Echovirus* type 19. *Coxsackievirus* B4. *Influenza* virus.	AU1033
Beta-lapachone	Antiviral Activity	In Vitro	Not Stated	Active	HIV-1 replication.	AU1058

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism Tested	Ref #
2-methylnaphtho(2,3-b)furan-4,9-dione	Antiviral Activity	In Vitro	3 mcg/ml	Active	Japanese encephalitis virus. Expression of viral proteins and replication of virus inhibited.	AU1049
Naphthoquinones Lapachol	Antimalarial Activity	Cell Culture	20 mcM 20 mcM	Active Weak Activity	*Plasmodium falciparum,* including drug resistant strains. *Plasmodium falciparum* (20% inhibition).	AU1019
Lapachol	Antiparasitic Activity	Not Stated Mice	Not Stated	Active	Complete protection against *Schistosoma mansoni* infection.	AU1030
1,4-napthoquinone	Antiparasitic Activity	Not Stated Mice	Not Stated	Weak Activity	Partial protection against *Schistosoma mansoni* infection.	AU1030
Naphthoquinones	Antiparasitic Activity	In Vitro	IC50 = 0.12 mcM IC50 = 0.045 mcM	Active Active	*Trypanosoma brucei brucei.* *Trypanosoma brucei rhodesiense.*	AU1048
Beta-lapachone	Anti-trypansomal Activity	In Vitro	Not Stated	Active	Trypansoma cruzi.	AU1013
Lapachol	Molluscicidal Activity	Not Stated Snails	LC90 = < 7 ppm LC90 = < 3 ppm	Active Active	Adult snail. Snail egg masses.	AU1051
Lapachol	Antineoplastic Activity	Cell Culture	Not Stated Not Stated	Active Active	Sarcoma 180. Ehrlich carcinoma.	AU1035
Beta-lapachone	Antineoplastic Activity	Cell Culture	IC50 = 1–10 mcM	Active	Human cancer cell lines.	AU1006
2,8-dihydroxy-1, 4-naphthoquinone	Antiproliferative Activity	Cell Culture	IC50 = 0.35 mcM	Active	Inhibited keratinocyte growth.	AU1025
Beta-lapachone	Cytotoxic Activity	Cell Culture	Not Stated	Active Inactive	Promyelocytic leukemia, malignant glioma, hepatoma, prostate, colon, breast, ovarian, pancreatic cancer, and multiple myeloma cell lines including drug-resistant lines. Normal or proliferating human PBMC.	AU1006
Beta-lapachone	Cytotoxic Activity	Cell Culture	IC100 = 4-8 mcM Not Stated IC100 = 16 mcM IC100 = 16 mcM IC100 = 128 mcM IC100 = > 32 mcM	Active Active Active Active Inactive Inactive	Androgen independent human prostate tumor cells PC-3 & DU145. LNCaP cells. 21MT (human breast carcinoma). AD2780s (human ovary carcinoma). SW116 (human colon adenocarcinoma). H596, H520 (human lung carcinoma), 293 (human kidney epithelial cell line).	AU1007

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism Tested	Ref #
Beta-lapachone	Cytotoxic Activity	Cell Culture	4 mcM	Active	Enhanced the lethality of x-rays against human laryngeal epidermoid carcinoma (Hep-2) cells.	AU1018
Beta-lapachone	Cytotoxic Activity	Cell Culture	Not Stated	Active	Enhanced the cytotoxic effects of DNA-damaging agents that induce DNA strand incisions (x-rays) against radioresistant human malignant melanoma (U1-Mel).	AU1018
Beta-lapachone	Cytotoxic Activity	Not Stated	Not Stated	Active	Yoshida tumor and Walker 256 carcinosarcoma.	AU1027
Beta-lapachone	Cytotoxic Activity	Not Stated	Not Stated	Active	Inhibits DNA synthesis, topoisomerases I and II and poly(ADP-ribose) polymerase.	AU1027
Beta-lapachone	Cytotoxic Activity	Not Stated	Not Stated	Active	Epidermoid laringeal cancer, prostate, colon, ovary and breast cancer and various leukemia cells.	AU1027
Beta-lapachone	Cytotoxic Activity	Cell Culture	Not Stated	Active Inactive	Induced apoptosis of human prostate cancer cells PC-3 (in 62% cells by 24 hrs.), DU145 and LNCaP (in 68% of cells by 24 hrs.). Apoptosis not seen in 21-MT (human breast epithelial cell line), H520 (human lung carcinoma cell lines), SW1116 (human colon adenocarcinoma), A2780s (human ovary carcinoma).	AU1007
Beta-lapachone	Cytotoxic Activity	Cell Culture Implanted Into Mice	Not Stated	Active	Enhanced lethality of x-rays and alkylating agents to tumor cells; inhibition of DNA lesion repair.	AU1054
Beta-lapachone	Cytotoxic Activity	IP Rat	50 mg/ml	Active Active	Rat prostate adenocarcinoma Dunning R-3327. Malignant & metastatic prostate adenocarci-noma RT-3.1.	AU1007
Lapachol	Cytotoxic Activity	Not Stated Human Adult	20–30 mg/kg	Active	Tumors shrunk and feelings of pain reduced. Adenocarcinoma of the liver, kidney, breast, prostate, and squamous cell carcinoma of the palate and uterine cervix.	AU1009
Lapachol	Cytotoxic Activity	Cell Culture	Not Stated	Active	Melanoma (4 cell lines) and renal cell carcinoma line (Caki-2).	AU1020
Lapachol	Cytotoxic Activity	Not Stated Mice Not Stated Rat	Not Stated	Inactive Active	Sarcoma 180. Yoshida sarcoma and Walker 256 carcinosarcoma.	AU1032

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism Tested	Ref #
Saponins	Cytotoxic Activity	IP Mouse	250 mg/kg	Active	In mice with sarcoma-180 the saponins prolonged survival by 27.8%.	K22244
Naphthoquinones	Cytotoxic Activity	Cell Culture	Not Stated	Active Active Active	A-549 human lung adeno-carcinoma. MCF-7 human breast carcinoma. HT-29 human colon carcinoma.	AU1026
Naphthoquinones	Cytotoxic Activity	Cell Culture	IC50 = 1.1–10.8 mcM IC50 = 2.5 – >32 mcM	Active Active	MCF7. HT29 human colon, A549 human lung, CEM leukemia, and AT3.1 rat prostate cancer cells.	AU1057
Anthraquinones	Cytotoxic Activity	Cell Culture	0.02 mcM 0.05 mcM	Active Active	Rat gioma C6 cells and human hepatoma G2 cells.	AU1047
Beta-lapachone	Necrotic Activity	Cell Culture	Not Stated	Active	Human osteocarcinoma cells. Necrosis rather than apoptosis induced.	AU1055
Lapachol	Antitumor Activity	Oral Not Stated IP Not Stated SC Not Stated IM Not Stated	45–60 mg/kg	Active	Walker 256 carcinosarcoma.	AU1040
Furanonaphthoquinones	Antitumor Activity	Cell Culture	IC50 = 10.4–14.1	Active Inactive	Human cervical cancer, lung adenocarcinoma, uterine endocervical, tracheal, and bronchiolar epithelial cells and fibroblasts. Prostate, cholangio, colon, laryngeal, and tongue carcinoma cell lines and two osteosarcoma cell lines. Normal cells.	AU1042
2-methylnaphtho (2,3-b)furan-4,9-dione	Antitumor Activity	Cell Culture	3–5 mcg/ml 20 mcg/ml	Active Inactive Active	HeLa human cervical cells. Normal cells. Normal cells.	AU1043
Lapachol	Antileukemic Activity	Not Stated Mice	Not Stated	Active	Increased life span by over 80% in mice inoculated with leukemic cells.	AU1010
Beta-lapachone	Antileukemic Activity	Cell Culture	Not Stated	Active	Induced apoptosis of human leukemia cell line HL-60.	AU1007
1-(1-hydroxyethyl)furonaphthoquinone	Antileukemic Activity	Cell Culture	IC50 = 0.8 mcg/ml	Active	Mouse leukemia cell L-5178Y.	K09729
Lapachol	Antileukemic Activity	Not Stated Mice	Not Stated	Active	Mouse lymphocytic leukemia P-388. Life span increased 80% over controls.	AU1010

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism Tested	Ref #
Beta-lapachone	Cytostatic Activity	IP Rat	50 mg/kg	Active	Prostate weight in rats treated was 203 g compared to controls at 345 g.	AU1007
Beta-lapachone	Cytostatic Activity	Not Stated Rat	500 mg/kg 250 mg/kg	Strong Activity Active	Human prostate adenocarcinoma PC-3. Human prostate adenocarcinoma PC-3.	AU1007
Furanonaphthoquinones	Immunomodulating Activity	Not Stated	Not Stated	Active	Human granulocytes and lymphocytes.	ZZ1099
Naphthoquinones	Immunostimulating Activity	In Vitro	10 ng–10 fg/ml	Active		AU1044
Naphthoquinones	Immunosuppressive Activity	In Vitro	100 mcg–10 ng/ml	Active		AU1044
Lapachol	Anti-ulcer Activity	Oral Rat Not Stated Guinea Pig	10 mg/kg	Active	Gastric and duodenal ulcers. Reversed aspirin-induced changes in peptic activity, protein and sialic acid.	AU1015
Cyclopentene dialdehydes	Anti-inflammatory Activity	Not Stated	Not Stated	Active		H26004
Beta-lapachone	Anti-inflammatory Activity	Cell Culture	1–4.5 mcM	Active	Inhibited LPS-induced nitric oxide synthase in rat alveolar macrophages and aortic rings.	AU1056
Beta-lapachone	Anti-psoriatic Activity	Cell Culture	IC50 = 0.7 mcM	Active	Antiproliferative to the human keratinocyte cell line HaCaT with antipsoiatic activity comparable to the drug anthralin.	AU1025
Naphthoquinones	Electron Transport Inhibitors	Cell Culture	IC50 = 15-82.5 mcM	Active	Rat liver mitochondria.	AU1026

Presence of Compounds in Pau d'Arco (Tabebuia impetiginosa)

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #
Ajugol, 6-o-(3-4-dimethoxy-benzoyl)-	Iridoid Monoterpene	Bark	Brazil	00.02%	H11723
Ajugol, 6-o-(para-hydroxy-benzoyl)-	Iridoid Monoterpene	Bark	Brazil	00.0356%	H11723
Ajugol, 6-o-(para-methoxy-benzoyl)-	Iridoid Monoterpene	Bark	Brazil	00.14%	H11723
Anisaldehyde	Benzenoid	Stembark	Argentina		H05276
Anisic acid	Benzenoid	Stembark	Argentina	Not Stated	H05276
Anthraquinone, 1-hydroxy-	Quinoid	Heartwood Heartwood	SouthAmerica Not Stated	00.00160%	L19377 A12233
Anthraquinone ,1-methoxy-	Quinoid	Heartwood Heartwood	Not Stated South America	00.00036%	A12233 L19377
Anthraquinone, 2-acetoxy-methyl-	Quinoid	Heartwood	Not Stated	00.00400%	A12233
Anthraquinone, 2-hydroxy-3-methyl-	Quinoid	Heartwood	Not Stated	00.00620%	A12233
Anthraquinone, 2-hydroxy-methyl-	Quinoid	Heartwood	Not Stated	00.00240%	A12233
Anthraquinone, 2-methyl-	Quinoid	Heartwood	South America		L19377
Anthraquinone, methyl- 2-acetoxy-	Quinoid	Heartwood	South America		L19377
Anthraquinone, methyl- 2-hydroxy-	Quinoid	Heartwood	South America		L19377
Anthraquinone-2-aldehyde	Quinoid	Heartwood	Not Stated	00.00320%	A12233
Anthraquinone-2-carboxylic acid	Quinoid	Heartwood Heartwood	Not Stated South America	00.00360%	A12233 L19377
Benzoic acid, 3-4-5-trimethoxy-	Benzenoid	Stembark	Argentina		H05276
Benzoic acid, 3-4-dimethoxy-	Benzenoid	Bark	Brazil		H26004
Benzoic acid, 4-hydroxy-	Benzenoid	Stembark Heartwood	Argentina Not Stated	00.01960%	H05276 A12233
Benzoic acid, o-hydroxy-	Benzenoid	Heartwood	Not Stated		ZZ1064

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #
Benzoic acid, p-hydroxy-	Benzenoid	Heartwood	Not Stated		ZZ1064
Benzoic acid, 4-methoxy-	Benzenoid	Bark	Brazil		H26004
Benzoic acid, ortho-hydroxy-	Benzenoid	Heartwood	Not Stated	00.00820%	A12233
Benzo[b]furan-6-carboxaldehyde	Oxygen Heterocycle	Stembark	Argentina	00.0005%	H05276
Benzene, 5-allyl-1,2,3-trimethoxy-		Inner Bark	Korea		AU1023
Benzene, 1-methoxy-4-(1E)-1-propenyl-		Inner Bark	Korea		AU1023
Benzyl, 4-methoxy alcohol		Inner Bark	Korea		AU1023
Carboxaldehyde, benzo(*b*)furan-6-	Quinoid	Stembark	Germany		H05276
Chromium	Inorganic	Not Stated	Brazil		M29199
Chrysanthemin	Flavonoid	Flowers	USA (Cult)		M14652
Cyanidin-3-o-beta-d-rutinoside	Flavonoid	Flowers	USA (Cult)		M14652
Cyclopent-2-ene-1-acetaldehyde, 2-formyl-5-(3'-4'-Dimethoxy-benzoyl-oxy)-3-methyl-	Alicyclic	Bark	Brazil	00.0000445%	H26004
Cyclopent-2-ene-1-acetaldehyde, 2-formyl-5-(4'-methoxy-benzoyl-oxy)-3-methyl-	Alicyclic	Bark	Brazil	00.000044%	H26004
Furanonaphthoquinone, 2-3-dihydro-2-(2-methyl-ethenyl)-	Quinoid	Bark	South America		L19377
Furanonaphthoquinone, 2-acetyl quinoid	Bark	Not Stated	South America		L19377
Furanonaphthoquinone, 2	Quinoid	Bark	South America		L19377
Furanonaphthoquinone, 2-hydroxy-ethyl-	Quinoid	Bark	South America		L19377
Furanonaphthoquinone, 2-iso-propyl-	Quinoid	Bark	South America		L19377
Furanonaphthoquinone, 8-hydroxy-2-acetyl-	Quinoid	Bark	South America		L19377
Furanonaphthoquinone, 8-hydroxy-2-hydroxy-ethyl-	Quinoid	Bark	South America		L19377
Furonaphthoquinone, 1-(1-hydroxy-ethyl	Quinoid	Bark	Brazil		K09729
Kigelinone	Quinoid	Callus Tissue Bark	Brazil Brazil	00.05% 00.00028%	K28241 M28769

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #
Lapachenol	Oxygen Heterocycle	Heartwood	South America		L19377
Lapachenole	Oxygen Heterocycle	Bark Heartwood	Costa Rica Not Stated	00.015% 00.02000%	H16341 A12233
Lapachol	Quinoid	Bark Heartwood Bark Heartwood Wood Callus Tissue Bark Bark Stembark Bark	Brazil South America Costa Rica Not Stated Not Stated Brazil South America South America Argentina Not Stated	 00.14% 04.12400% 15.9% 2-7%	A03256 L19377 H16341 A12233 J04271 K28241 L02894 L19377 H05276 ZZ1064
Lapachol, hydrochloro-	Quinoid	Not Stated	Brazil		AU1017
Lapachol methyl ether	Quinoid	Heartwood Heartwood	South America Not Stated	 00.00260%	L19377 A12233
Lapachol, deoxy-	Quinoid	Heartwood Heartwood	South America Not Stated	 00.00280%	L19377 A12233
Lapachone, alpha-	Quinoid	Heartwood Bark Heartwood Heartwood Bark Bark Bark Stembark Heartwood	South America Brazil Not Stated South America Costa Rica South America South America Argentina Not Stated	 00.00440% 00.035% 00.00620% 	L19377 A03256 A12233 L19377 H16341 L02894 L19377 H05276 A12233
Lapachone, alpha-iso-	Quinoid	Bark	Costa Rica	00.02%	H16341
Lapachone, alpha-iso-dehydro-(-)-	Quinoid	Stembark	Argentina		H05276
Lapachone, alpha-dehydro	Quinoid	Not Stated	Not Stated		ZZ1064
Lapachone, alpha-iso-dehydro-5-hydroxy-	Quinoid	Stembark	Argentina	00.00012%	H05276

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #
Lapachone, beta-	Quinoid	Bark Heartwood Heartwood	Brazil South America Not Stated	00.01520%	A03256 L19377 A12233
Lariciresinol, iso-8'-Hydroxy-	Lignan	Bark	Costa Rica	00.03%	H16341
Mellein, 6-hydroxy-(-)-	Coumarin	Stembark	Argentina		H05276
Menaquinone	Quinoid	Heartwood Heartwood	South America Not Stated	00.00100%	L19377 A12233
Menaquinone-1	Quinoid	Not Stated	Not Stated		ZZ1064 A12233
Naphtho(2,3-b)-furan-4-9-dione, 2-acetyl-	Quinoid	Bark	Brazil		M28769
Naphtho(2,3-b)-furan-4-9-dione, 2-ethyl-	Quinoid	Bark	Brazil		M28769
Naphtho(2,3-b)-furan-4-9-dione, 5-hydroxy-2-(1-hydroxy-ethyl)-	Quinoid	Bark	Brazil	00.00028%	M28769
Naphtho(2-3-b)-furan-4-9-dione, 2-(1 '-Hydroxy-ethyl)-(+)-	Quinoid	Stembark	Argentina		H05276
Naphtho(2-3-b)-furan-4-9-dione, 2-(1-hydroxy-ethyl)-	Quinoid	Bark	Peru		M20404
Naphtho(2-3-b)-furan-4-9-dione, 2-acetyl-5-hydroxy-	Quinoid	Stembark	Argentina	00.00037%	H05276
Naphtho(2-3-b)-furan-4-9-dione, 2-acetyl-8-hydroxy-	Quinoid	Stembark	Argentina	00.00043%	H05276
Naphtho(2-3-b)-furan-4-9-dione, 2-acetyl-	Quinoid	Bark Stembark	Peru Argentina		M20404 H05276
Naphtho(2-3-b)-furan-4-9-dione, 5-hydroxy-2-(1'-Hydroxy-ethyl)-(-)-	Quinoid	Stembark	Argentina	00.001%	H05276
Naphtho(2-3-b)-furan-4-9-dione, 8-hydroxy-2-(1'-Hydroxy-ethyl)-(rs)-	Quinoid	Stembark	Argentina	00.00037%	H05276
Naphtho[2,2]b]-furan-4-9-dione, 8-hydroxy-2-hydroxy-ethyl-	Quinoid	Bark	South America		L02894
Naphtho[2,3-b]-furan-4-9-dione, 2-acetyl-	Quinoid	Bark	Brazil		L13573
Naphtho[2,3-b]-furan-4-9-dione, 2-(1-hydroxy-ethyl)-	Quinoid	Bark Bark	Brazil Peru		L13573 K19905

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #
Naphtho[2,3-b]-furan-4-9-dione, 2-3-dihydro-2-(1-methyl-ethenyl)-	Quinoid	Bark	South America		L02894
Naphtho[2,3-b]-furan-4-9-dione, 2-acetyl-	Quinoid	Bark	Peru		K19905
Naphtho[2,3-b]-furan-4-9-dione, 2-ethyl-	Quinoid	Bark	Brazil		L13573
Naphtho[2,3-b]-furan-4-9-dione, 2-hydroxy-ethyl-	Quinoid	Bark	South America		L02894
Naphtho[2,3-b]-furan-4-9-dione, 2-methyl-	Quinoid	Bark	Brazil		L13573
Naphtho[2,3-b]-furan-4-9-dione, 5-hydroxy-2-(1-hydroxy-ethyl)-	Quinoid	Bark	Brazil		L13573
Naphtho[2,3-b]-furan-4-9-dione, 7-8-dihydroxy-	Quinoid	Bark	Brazil		L13573
Naphtho[2,3-b]-furan-4-9-dione, 8-hydroxy-2-(1-hydroxy-ethyl)-	Quinoid	Bark	Brazil		L13573
Naphtho[2,3-b]-furan-4-9-dione, 8-hydroxy-2-methyl-	Quinoid	Bark	Brazil		L13573
Naphtho[2,3-b]furan-4-9-dione, 2-acetyl-5-hydroxy-	Quinoid	Callus Tissue	Brazil	00.005%	K28241
Naphtho[2-3-b]furan-4-9-dione, 5-hydroxy-2-(hydroxy-ethyl)-	Quinoid	Bark	Brazil	00.00007%	H26004
Naphtho[2-3-b]furan-4-9-dione, 8-hydroxy-2-(hydroxy-ethyl)-	Quinoid	Bark	Brazil		H26004
Naphthoquinone, 1-4-, 2-3-dimethyl-	Quinoid	Heartwood	Not Stated	00.00320%	A12233
Naphthoquinone, 1-4, alpha-ethylfurano-	Quinoid	Wood	France		AU1014
Paeonidin-3-cinnamyl-sophoroside	Flavonoid	Flowers	Brazil		H16202
Phenol, 4-methoxy		Inner Bark	Korea		AU1023
Phthiolol	Quinoid	Heartwood	Not Stated	00.00180%	A12233
Quercetin	Flavonol	Heartwood	Not Stated		A12233
Quinone, 2-hydroxy-3-methyl-	Anthraquinone	Not Stated	Not Stated		ZZ1064
Tabebuin	Quinoid	Heartwood	Not Stated	00.00200%	A12233
Tectoquinone	Quinoid	Heartwood	Not Stated	00.01500%	A12233
Vanillic acid	Benzenoid	Stembark	Argentina		H05276
Vanillin	Benzenoid	Stembark	Argentina		H05276

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #
Veratric acid	Benzenoid	Stembark	Argentina		H05276
Veratric aldehyde	Benzenoid	Stembark	Argentina		H05276
Xyloidone	Quinoid	Bark	Brazil		A03256

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AU1019	IN VITRO ACTIVITY OF NATURAL AND SYNTHETIC NAPHTHOQUINONES AGAINST ERYTHROCYTIC STAGES OF PLASMODIUM FALCIPARUM. CARVALHO,LH: ROCHA,EM: RASLAN,DS: OLIVEIRA,AB: KRETTLI,AU: BRAZ J MED BIOL RES 21 3: 485-7 (1988) (DEPARTAMENTO DE PARASITOLOGIA, ICB, UNIVERSIDADE FEDERAL DE MINAS, BRASIL)
AU1020	ACTIVITY OF EXTRACTS OF KIGELIA PINNATA AGAINST MELANOMA AND RENAL CARCINOMA CELL LINES. HOUGHTON,PJ: PHOTIOU,A: UDDIN,S: SHAH,P: BROWNING,M: JACKSON,SJ: RETSAS,S: PLANTA MED. 60 5: 430-3 (1994) (PHARMACOGNOSY RESEARCH LABORATORIES, DEPT OF PHARMACY, KING'S COLLEGE LONDON, UK)
AU1021	ANTINOCICEPTIVE AND ANTIEDEMATOGENIC PROPERTIES AND ACUTE TOXICITY OF TABEBUIA AVELLANEDAE LOR. EX GRISEB. INNER BARK AQUEOUS EXTRACT. FABIO GUILHERME GONCALVES DE MIRANDA: JEANE CARVALHO VILAR: IVANA ANDREA NUNES ALVES: SOCRATES CABRAL DE HOLANDA CAVALCANTI: ANGELO ROBERTO ANTONIOLLI: BMC PHARMACOLOGY: 1 6: 1471-2210 (2001) (DEPARTAMENTO DE FISIOLOGIA, CCBS, UNIVERSIDADE FEDERAL DE SERGIPE, SAO CRISTOVAO, SERGIPE, BRAZIL)
AU1022	THE SEARCH FOR NOVEL ANTICANCER AGENTS: A DIFFERENTIATION-BASED ASSAY AND ANALYSIS OF A FOLKLORE PRODUCT. DINNEN,RD: EBISUZAKI,K: ANTICANCER RES 17(2A): 1027-33 (1997) (DEPT OF MICROBIOLOGY AND IMMUNOLOGY, UNIVERSITY OF WESTERN ONTARIO, LONDON, CANADA)
AU1023	ANTIOXIDANT ACTIVITY AND CHARACTERIZATION OF VOLATILE CONSTITUENTS OF TAHEEBO (TABEBUIA IMPETIGINOSA MARTIUS EX DC) PARK, BS; LEE, KG: SHIBAMOTO,T: LEE,SE: TAKEOKA,GR: J AGRIC FOOD CHEM 51 1: 295-300 (2003) (WESTERN REGIONAL RESEARCH CENTER, US DEPT OF AGRICULTURE, ALBANY, CALIFORNIA)
AU1024	ANTIFUNGAL ACTIVITY OF PARAGUAYAN PLANTS USED IN TRADITIONAL MEDICINE. PORTILLO,A: VILA,R: FREIXA,B: ADZET,T: CANIGUERAL,S: J ETHNOPHARMACOL 76 1: 93-8 (2001) (UNITAT DE FARMACOLOGIA I FARMACOGNOSIA, FACULTAT DE FARMACIA, AVENIDA DIAGONAL, BARCELONA, SPAIN)
AU1025	POTENTIAL ANTIPSORIATIC AGENTS: LAPACHO COMPOUNDS AS POTENT INHIBITORS OF HACAT CELL GROWTH. MULLER,K: SELLMER,A: WIEGREBE,W: J NAT PROD 62 8: 1134-6 (1999) (INSTITUT FUR PHARMAZEUTISCHE CHEMIE, WESTFALISCHE WILHELMS-UNIVERSITAT MUNSTER, HITTORFSTRASSE, MUNSTER, GERMANY)

AU1026	BIOACTIVE FURONAPHTOQUINONES FROM TABEBUIA BARBATA(BIGNONIACEAE). COLMAN DE SAIZARBITORIA T: ANDERSON, JE: ALFONSO,D: MCLAUGHLIN,JL: ACTA CIENT VENEZ 48 1: 42-6 (1997) (FACULTAD DE FARMACIA, UNIVERSIDAD CENTRAL DE VENEZUELA, CARACAS, VENEZULA)
AU1027	CYTOTOXICITY OF BETA-LAPACHONE, AN NAPHTHOQUINONE WITH POSSIBLE THERAPEUTIC USE. DUBIN,M: FERNANDEZ VILLAMIL,SH: STOPPANI,AO: MEDICINA (B AIRES). 61 3: 343-50 (2001) (CENTRO DE INVESTIGACIONES BIOENERGETICAS, FACULTAD DE MEDICINA, UNIVERSIDAD DE BUENOS AIRES)
AU1028	ANTIMICROBIAL ACTIVITY OF NOVEL FURANONAPHTHOQUINONE ANALOGS. NAGATA,K: HIRAI,KI: KOYAMA,J: WADA,Y: TAMURA,T: ANTIMICROBIAL AGENTS CHEMOTHER 42 3: 700-2 (1998) (DEPT OF BACTERIOLOGY, HYOGO COLLEGE OF MEDICINE, NISHINOMIYA, JAPAN)
AU1029	COMPARISON OF ANTIBACTERIAL AND ANTIFUNGAL ACTIVITIES OF LAPACHOL AND B-LAPACHONE. . GIURAUD,P: STEIMAN,R, ET AL: PLANTA MED 60: 373-4 (1994)
AU1030	SCHISTOSOMIASIS. PROTECTION AGAINST INFECTION BY TERPENOIDS. GILBERT,B: DE SOUZA,FP: FASCIO,M: KITAGAWA,M: NASCIMENTO,SSC: FORTES,CC: SEABRA,A.DO PRADO: PELLEGRINO,J: AN. ACAD. BRASIL. CIENC. 42 (SUPL) 397-400 (1970) (FAC. FARM, UNIV. FED. RIO DE JANEIRO, RIO DE JANEIRO, BRAZIL)
AU1031	ANTIBIOTIC SUBSTANCES FROM HIGHER PLANTS. XXV. ISOLATION OF XILOIDONE (DEHYDROLAPACHONE) BY THE CONVERSION OF LAPACHOL IN THE PRESENCE OF PYRIDINE). O. GONCALVES DE LIMA: IVAN L. D'ALBUQUERQUE; MANOEL,A. PEREIRA BORBA: JOSE FRANCISCO DE MELLO: REV INST ANTIBIOT, UNIV. RECIFE. 6 ½: 23-34 (1966)
AU1032	ANTIMICROBIAL COMPOUNDS FROM HIGHER PLANTS. XXXV. ANTIMICROBIAL AND ANTITUMOR ACTIVITY OF LAWSONE (2-HYDROXY-1,4-NAPHTHOQUINONE) COMPARED WITH THAT OF LAPACHOL (2-HYDROXY-3-(3-METHYL-2-BUTENYL)-1,4-NAPHTHOQUINONE). GONCALVES DE LIMA, OSWALDO: COELHO, JOSE S DE B: LEONCIO D'ALBUQUERQUE, IVAN: FRANCISCO DE MELLO, JOSE: MARTINS, DINA G: LACERDA, ARI L: DE MORAES E SOUZA, MARIA A: REV. INST. ANTIBIOT, UNIV. FED. PERNAMBUCO, RECIFE 11 1: 21-6 (1971)
AU1033	ANTIVIRAL ACTIVITY OF LAPACHOL. LAGROTA, MARIA HELENA DO CARMO: WIGG, MARCIA DUTRA: PEREIRA, LUIZ OCTAVIO BARROSO: FONSECA, MARIA EVANGELINA FERREIRA: PEREIRA, NUNO ALVAREZ: GUIMARAES, JOAO CIRIBELLI. REV. MICROBIOL. 14 1; 21-6 (1983) (INST. MICROBIOL, RIO DE JANEIRO, BRAZIL)
AU1034	IN VIVO EFFECT OF LAPACHOL, 2-HYDROXY-3-(3-METHYL-2-BUTENYL)-1,4-NAPHTHOQUINONE, ON BLOOD COAGULATION IN DOGS. MAGALHAES, J REINALDO: BLUMEN, MARIA: PINTO,CA. FERREIRA: MIYAMOTO GL: AN. ACAD. BRASIL. CIENC. 42(SUPL) 263-6 (1970) (FAC. CIENC. MED. SANTA CASA SAO PAULO, SAO PAULO, BRAZIL)
AU1035	IN VITRO STUDY OF THE ANTINEOPLASTIC ACTION OF SUBSTANCES OF MICROBIAL AND PLANT ORIGIN AGAINST EHRLICH AND SARCOMA 180 CARCINOMAS. MOREIRA, LAURINETE C: FERREIRA DE SANTANA, CLECIO: NUNES DA SILVA, ITAMAR: REV. INST. ANTIBIOT, UNIV. FED. PERNAMBUCO, RECIFE. 13 1-2: 77-84 (1973) (INST. ANTIBIOT, UNIV. FED. PERNAMBUCO, RECIFE, BRAZIL)
AU1036	ORAL TOXICOLOGY STUDIES WITH LAPACHOL. MORRISON, ROBERT K: BROWN, DONALD EMERSON: OLESON, JEROME J: TOXICOL. APPL. PHARMACOL. 17 1: 1-11 (1970) (JOHN L. SMITH MEM. FOR CANCER RES, CHAS. PFIZER AND CO, INC, MAYWOOD NJ)

AU1037	SUPPLEMENTARY TOXICOLOGIC SSTUDIES WITH LAPACHOL IN MONKEYS. MORRISON, ROBERT K: OLESON, JJ: BROWN, DE: TIMMENS, EK: TASSINI R: US CLEARINGHOUSE FED. SCI. TECH INFORM. FROM US GOVT. RES. DEVELOP. REP. 69 7: 48-9 (1969) (CHAS. PFIZER AND CO, INC, MAYWOOD, NJ)
AU1038	TOXICOLOGIC AND PHARMACOLOGIC STUDIES WITH LAPACHOL. OLESON, JJ: MORRISON, RK: BROWN, DE: TIMMENS, EK: TASSINI, RA: US CLEARINGHOUSE FED SCI TECH INFORM. PP119 (1966) (CHAS. PFIZER & CO, INC, MAYWOOD, NJ)
AU1039	LAPACHOL INHIBITION OF VITAMIN K EPOXIDE REDUCTASE AND VITAMIN K QUINONE REDUCTASE. PREUSCH, PC: SUTTIE, JW: ARCH. BIOCHEM. BIOPHYS. 234 2: 405-12 (1984) (COLL. AGRIC. LIFE SCI, UNIV WISCONSIN, MADISON, WI)
AU1040	RECOGNITION AND EVALUATION OF LAPACHOL AS AN ANTI-TUMOR AGENT. RAO, KV: MCBRIDE, TJ: OLESON, JJ: CANCER RES. 28 10: 1952-4 (1968) (JOHN L. SMITH MEM. CANCER RES, CHAS. PFIZER AND CO, INC, MAYWOOD, NJ)
AU1041	BACTERIOSTATIC ACTION OF QUINONES ON NORMAL AND RESISTANT STRAINS OF STAPHYLOCOCCUS AUREUS. DI MARCO, A: BIFFI, G: ZAVAGLIO V: SPERIMENTALE 100: 481-92 (1951) (LAB. FARMITAL, MILAN, ITALY)
AU1042	FURANONAPHTHOQUINONE ANALOGS POSSESSING PREFERENTIAL ANTITUMOR ACTIVITY COMPARED TO NORMAL CELLS. HIRAI, KI: KOYAMA, J: PAN,J SIMAMURA, E: SHIMADA, H: YAMORI,T: SATO,S: TAGAHARA,K: TSURUO,T: CANCER DETECT PREV 23 6: 539-50 (1999) (DEPT OF ANATOMY, KANAZAWA MEDICAL UNIVERSITY, UCHINADA, ISHIKAWA, JAPAN)
AU1043	MITOCHONDRIAL DAMAGE BY A NEW ANTITUMOUR AGENT FURANONAPHTHOQUINONE DERIVATIVE IN HUMAN CERVICAL CANCER HELA CELLS. PAN,J: HIRAI,KI: SIMAMURA,E: KOYAMA,J: SHIMADA,H: KUWABARA,S: J ELECTRON MICROSC (TOKYO) 46 2: 181-7 (1997) (DEPT OF ANATOMY, KANAZAWA MEDICAL UNIVERSITY, UCHINADA, ISHIKAWA, JAPAN)
AU1044	IN VITRO STIMULATION OF HUMAN GRANULOCYTES AND LYMPHOCYTES BY PICO- AND FEMTOGRAM QUANTITIES OF CYTOSTATIC AGENTS. WAGNER,H: KREHER,B: JURCIC,K: ARZNEIMITTELFORSCHUNG 38 2: 273-5 (1988) (INSTITUTE OF PHARMACEUTICAL BIOLOGY, UNIVERSITY OF MUNICH, FED. REP. OF GERMANY)
AU1045	FUNGITOXICITY OF 1,4-NAPHTHOQUINONES TO CANDIDA ALBICANS AND TRICHOPHYTON MENTAGROPHYTES. GERSHON,H: SHANKS,L: CAN J MICROBIOL 21 9: 1317-21 (1975)
AU1046	SCHISTOSOMIASIS MANSONI: BLOCKAGE OF CERCARIAL SKIN PENETRATION BY CHEMICAL AGENTS: I. NAPTHOQUINONES AND DERIVATIVES. PINTO,AV: PINTO,MD: GILBERT,B: PELLEGRINO,J: MELLO,RT: TRANS R SOC TROP MED HYG 71 2: 133-5 (1977)
AU1047	SYNTHESIS OF SYMMETRICAL 1,5-BIS-THIO-SUBSTITUTED ANTHRAQUINONES FOR CYTOTOXICITY IN CULTURED TUMOR CELLS AND LIPID PEROXIDATION. HUANG,HS: CHIOU,JF: CHIU,HF: HWANG,JM: LIN,PY: TAO,CW: YEH,PF: JENG,WR: CHEM PHARM BULL (TOKYO) 50 11: 1491-4 (2002) (SCHOOL OF PHARMACY, NATIONAL DEFENSE MEDICAL CENTER, TAIPEI, TAIWAN, ROC)
AU1048	ACTIVITY OF EXTRACTS AND NAPHTHOQUINONES FROM KIGELIA PINNATA AGAINST TRYPANOSOMA BRUCEI BRUCEI AND TRYPANOSOMA BRUCEI RHODESIENSE. MOIDEEN,SV: HOUGHTON, PJ: ROCK,RP: CROFT,SL: ABOAGYE-NYAME,F: PLANTA MED 65 6: 536-40 (1999) (NATIONAL PHARMACEUTICAL CONTROL BUREAU, JALAN UNIVERSITY, PETALING JAYA, MALAYSIA)
AU1049	INHIBITORY EFFECT OF FURANONAPHTHOQUINONE DERIVATIVES ON THE REPLICATION OF JAPANESE ENCEPHALITIS VIRUS. TAKEGAMI, T: SIMAMURA, E: HIRAI, K: KOYAMA, J: ANTIVIRAL RES 37 1: 37-45 (1998) (MEDICAL RESEARCH INSTITUTE KANAZAWA MEDICAL UNIVERSITY, UCHINADA, ISHIKAWA, JAPAN)

AU1050	FETAL GROWTH IN RATS TREATED WITH LAPACHOL. FELICIO, AC: CHANG, CV: BRANDAO, MA: PETERS, VM: GUERRA MDE O: CONTRACEPTION 66 4: 289-93 (2002) (CENTRO DE BIOLOGIA DA REPRODUCAO, UNIVERSIDADE FEDERAL, DE JUIZ DE FORA, BRAZIL)
AU1051	TOXICITY OF LAPACHOL AND ISOLAPACHOL AND THEIR POTASSIUM SALTS AGAINST BIOMPHALARIA GLABRATA, SCHISTOSOMA MANSONI CERCARIAE, ARTEMIA SALINA AND TILAPIA NILOTICA. LIMA, NM: DOS SANTOS, AF: PORFIRO, Z: GOULAR MO: SANT'ANA, AE: ACTA TROP 83 1: 43-7 (2002) (DEPARTAMENTO DE QUIMICA/CCEN CAMPUS AC SIMOES, UNIVERSIDADE FEDERAL DE ALAGOAS, TABULEIRO DOS MARTINS MACEIO, ALAGOAS, BRAZIL)
AU1052	TOXICOLOGY OF LAPACHOL IN RATS: EMBRYOLETHALITY. GUERRA MDE O: MAZONI, AS: BRANDAO, MA: PETERS, VM: BRAZ J BIOL 61 1: 171-4 (2001) (CENTRO DE BIOLOGIA DA REPRODUCAO, UNIVERSIDADE FEDERAL DE JUIZ DE FORA, CP, JUIZ DE FORA, MINAS GERAIS, BRAZIL)
AU1053	ANTIBACTERIAL AND ANTIFUNGAL COMPOUNDS FROM KIGELIA PINNATA. BINUTU, OA: ADESOGAN, KE: OKOGUN, JI: PLANTA MED 62 4: 352-3 (1996)
AU1054	CANCER THERAPY WITH BETA-LAPACHONE. PARDEE, AB: LI,YZ: LI,CJ: CURR CANCER DRUG TARGETS. 2 3: 227-42 (2002) (DANA-FARBER CANCER INSTITUTE, 44 BINNEY ST, BOSTON, MA, USA)
AU1055	INHIBITION OF POLY(ADP-RIBOSE) POLYMERASE ACTIVATION ATTENUATES BETA-LAPACHONE-INDUCED NECROTIC CELL DEATH IN HUMAN OSTEOSARCOMA CELLS. LIU,TJ: LIN, SY: CHAU, YP: TOXICOL APPL PHARMACOL 182 2: 116-25 (2002) (DEPT OF PHYSICAL MEDICINE AND REHABILITATION, COLLEGE OF MEDICINE, NATIONAL YANG-MING UNIVERSITY, TAIPEI, TAIWAN, REPUBLIC OF CHINA)
AU1056	INHIBITION OF INDUCIBLE NITRIC OXIDE SYNTHASE BY BETA-LAPACHONE IN RAT ALVEOLAR MACROPHAGES AND AORTA. LIU,SH: TZENG, HP: KUO,ML: LIN-SHIAU, SY: BR J PHARMACOL 126 3: 746-50 (1999) (INSTITUTE OF TOXICOLOGY, COLLEGE OF MEDICINE, NATIONAL TAIWAN UNIVERSITY, TAIPEI)
AU1057	EFFECTS OF 1,2-NAPHTHOQUINONES ON HUMAN TUMOR CELL GROWTH AND LACK OF CROSS-RESISTANCE WITH OTHER ANTICANCER AGENTS. DOLAN, ME: FRYDMAN, B: THOMPSON, CB: DIAMOND, AM: GARBIRAS, BJ: SAFA, AR: BECK, WT: MARTON, LJ: ANTICANCER DRUGS 9 5: 437-48 (1998) (DEPT OF MEDICINE AND CANCER RES CENTER, UNIVERSITY OF CHICAGO, IL, USA)
AU1058	THREE INHIBITORS OF TYPE 1 HUMAN IMMUNODEFICIENCY VIRUS LONG TERMINAL REPEAT-DIRECTED GENE EXPRESSION AND VIRUS REPLICATION. LI,CJ: ZHANG, LJ: DEZUBE, BJ: CRUMPACKER, CS: PARDEE, AB: PROC NAT'L ACAD SCI USA 90 5: 1839-42 (1993) (DANA-FARBER CANCER INSTITUTE, DEPT OF BIOLOGICAL CHEMISTRY AND MOLECULAR PHARMACOLOGY, HARVARD MEDICAL SCHOOL, BOSTON, MA)