

Soap, Perfumery and Cosmetics: Botanical Detoxification. **72**, 10, 42-48 (1999).

DETOXIFYING MATERIALS FROM BOTANICALS

Introduction

Marketing strikes again! A new descriptor to challenge the legal borderline between medicines and toiletries legislation. It sounds extremely potent, but what does it mean? The answer was as follows [Penguin Hutchinson]:

detoxify vt

detoxify /dee'toksifie/ vt

1 to remove a poison (e.g. alcohol) or toxin from

2 to reduce the effect of (a poison or toxin), especially by chemical action to produce a less harmful substance - detoxification n

toxin n

toxin /'toksin/ n

an often extremely poisonous protein that is produced by a living organism (e.g. a bacterium), especially in the body of a host, and that typically stimulates the body to produce substances (antibodies) that counteract its action. [ISV tox- + -in]

toxin

any poison produced by another living organism (usually a bacterium) that can damage the living body. In vertebrates, toxins are broken down by enzyme action, mainly in the liver.

It might be argued from the description, that to detoxify is to protect the body by removing unwanted elements that have built up on the skin during the day. The simple act of washing will achieve these effects.

However, many of the finished products on sale today as detoxifying are more complicated than this and contain a whole array of specialist materials. This article will examine them and attempt to find some rationale for their use.

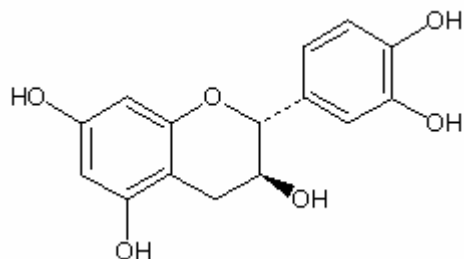
POLYPHENOLS

A group which contains useful detoxifying chemicals are the polyphenols, which can also include many of the tannins. There are numerous references to support the use of these materials

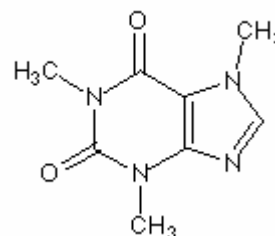
GREEN TEA (*Thea viridis*)

The best known polyphenols probably come from Green Tea or *Thea viridis*, a fast-growing additive in today's skin care repertoire.

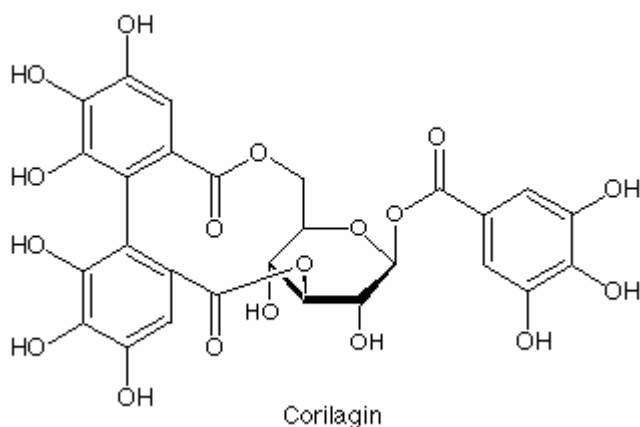
Tea contains caffeine, with small amounts of other xanthine alkaloids (e.g. theobromine and theophylline). It also contains high levels of tannins or phenolic materials (approx. 10-25%) which consist of catechin (flavanol) and gallic acid units. Flavonoids (quercetin, quercitrin, rutin etc.) and amino acids are also present.



Catechin

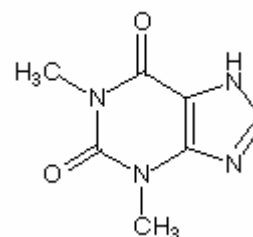


Caffeine

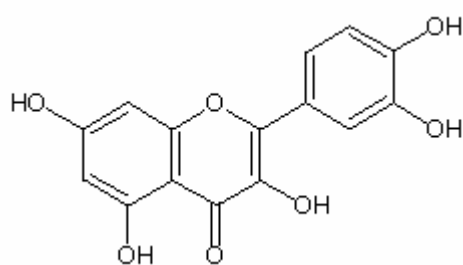


Corilagin

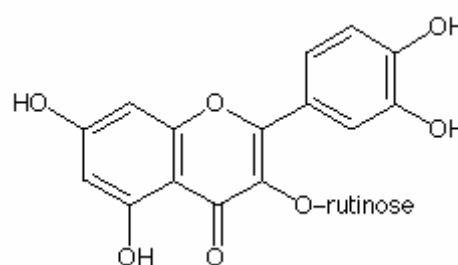
Tannin structure – corilagin



Theophylline



Quercetin (a flavonoid)



Rutin (a flavonoid)

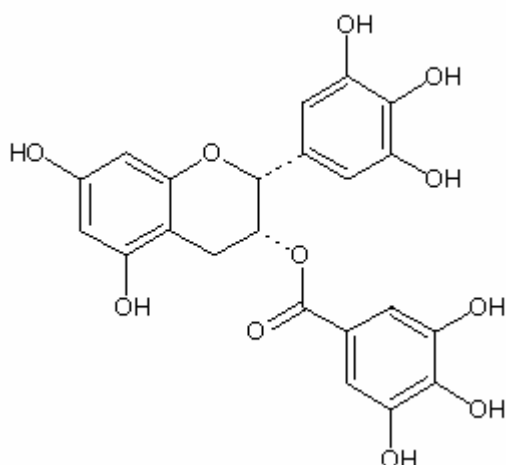
The pharmacological properties of tea are due primarily to its alkaloids (mostly caffeine) and tannins (polyphenolic compounds). Tannins have anti-cancer, carcinogenic and other activities. In folk medicine the common tea bag is used as a wash for sunburn, as a poultice for baggy eyes, and as a compress for headache or tired eyes. Tea has been used for millennia in Chinese medicine as a stimulant and anti-toxic [Leung].

Green tea infusion contains intact catechin polyphenols, which give rise to its bitterness and astringency. Six catechin polyphenols have been isolated from green tea;

(-)-epigallocatechin, (-)-epicatechin, (-)-epigallocatechin-3-O-gallate (EGCG), gallicocatechin-3-O-gallate (GCG), methyl-epigallocatechin-3-O-gallate, and (-)-epicatechin-3-O-gallate (ECG). These substances were tested for their antioxidant activity, and the gallic acid esters EGCG and EGC were found to be the strongest antioxidants, with EGCG being over 200 times more active than Vitamin E in an in vitro model. In another test, EGCG was more active against fat rancidity (lipid peroxidation) than Vitamin C or Vitamin E, and also exhibited synergistic action with those vitamins [Internet].

Following a congress in North America, results from a number of laboratories in the U.S., China and Japan point to the chemopreventive properties of green tea and other beverages, noting a beneficial effect for skin, lung, liver and other cancers in experimental mice [Anon]

Tea contains the polyphenol ECGC, or (-)-epigallocatechin gallate, as major components and it is these in which the researchers are interested. The polyphenols are powerful antioxidants capable of scavenging H_2O_2 and superoxide anions and thus preventing free radical damage to the body. This is a mechanism that has been associated with cancer and other disorders.



(-)-Epigallocatechin gallate

EGCG also has an astringent effect and may inhibit cell membrane phosphorylation. The researchers do not know whether the polyphenols inhibit the initiation or the promotion of tumours.

Tea also contains caffeine at a significant level (about 5%) and this has been shown to have a small tumour inhibiting effect. The proof is not confirmed, but the paper recommends the relaxing cup of tea anyway.

There are too many references to list them all, but certainly when taken as a dietary supplement, green tea seems to have many beneficial effects.

Following the oral feeding of a polyphenolic fraction isolated from green tea (GTP) in drinking water, an increase in the activities of antioxidant and phase II enzymes in skin, small bowel, liver, and lung of female SKH-1 hairless mice was observed [Khan et al.].

In this study the effects of green tea and its major components, (-)-epigallocatechin gallate (EGCG) and caffeine, on the tobacco-specific nitrosamine 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK)-induced lung tumorigenesis in A/J mice was examined. Inhibition by green tea and EGCG in NNK-induced lung tumorigenesis is due at least partly to their antioxidant properties [Xu et al.].

Clearly the polyphenols are acting as antioxidants and numerous researchers would bear out this fact. [Hara; Salah *et al.*; Zhao *et al.*; Xie *et al.*]

BIOFLAVONOIDS or FLAVONOIDS

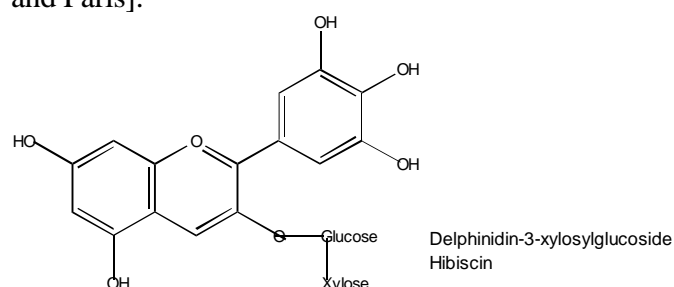
Clearly a flavonoid is identical to a bioflavonoid, furthermore, a flavonoid by definition is a polyphenol, since it contains more than one benzene ring in its structure. However, many would regard polyphenols as primarily referring to tannins.

As seen above, green tea has an abundance of flavonoids and flavonals as well as tannin. These compounds have been well characterised in the herb and numerous papers support their use as antioxidants or free radical scavengers.

Most of the studies relate to the ingestion of tea [Hertog *et al.*; Hirose *et al.*], where the antioxidant properties are well-proven.

GRAPE (*Vitis vinifera*)

Similar flavonals can be found in red grape skin, which contains xanthophyll, carotene, vitamins A, B1, B2 and C. In some country areas, the sap is collected. This contains the same substances as the grapes. It is used for eczema, and for intestinal haemorrhages accompanying dysentery. Drops of the sap are also used for eye infections [Schauenberg and Paris].

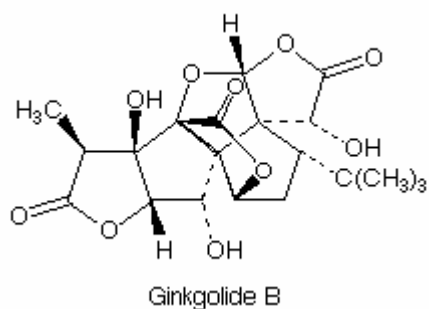


An anthocyanidin

The seeds contain another polyphenol sometimes referred to as “pycnogenol” (also found in pine bark extract), which is a proanthocyanidin. Pycnogenol is in fact a trade name! The other main compounds are quercetin, catechin and epicatechin, which have already been mentioned above.

GINKGO (*Ginkgo biloba*)

Chemical analysis has identified a number of terpenes, pro-anthocyanidines, heterosides, and bioflavones, the most common of which are sciaopitysin, ginkgetin, isoginkgetin, bilobetin and ginkgolic acid. There is a seasonal variation in the content of these compounds, with the highest amounts being present in the autumn. In man dietary supplementation with ginkgo extracts for 14 days indicated that the extract was slightly less effective than selenium but more effective than β -carotene and vitamin E as an oxidative scavenger. [Lawrence]



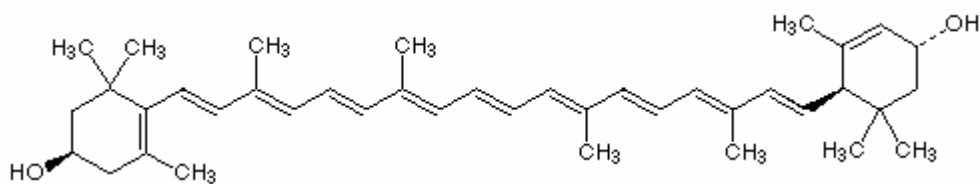
Ginkgolide has been cited for its treatment of severe sepsis and for its effect of PAF receptor binding. Ginkgo inhibits platelet activating factor (PAF), thereby preventing PAF-induced clot formation and promoting clot breakdowns. Similarly, ginkgo inhibits PAF-induced bronchospasm.

The anti-radical properties of Ginkgo biloba extract have been determined on several *in vitro* models. The product is as effective as uric acid, an anti-radical agent known to entrap the hydroxyl and diphenylpicrylhydrazyl radicals, such as adriamycyl, which escape uric acid activity. It also inhibits membrane lipid peroxidation and owing to its anti-radical activity exerts a stimulant effect on the biosynthesis of prostanoids [Pincemail *et al.*].

A reference that has not been substantiated says “because it improves circulation, it can help in cases where a man has circulation-related difficulties in getting an erection”. I doubt that this is true, but if the free radicals have got you, then it would be nice to think that this might be a pleasant side effect to the herb. However, large doses over a long period of time can result in irritability and headaches. No more than 3g daily should be taken in capsule or tincture form [Watson].

CAROTENOIDS

Vitis vinifera has yet another molecule that has valuable potential as a detoxifying agent and that is the presence of a carotenoid called xanthophyll.

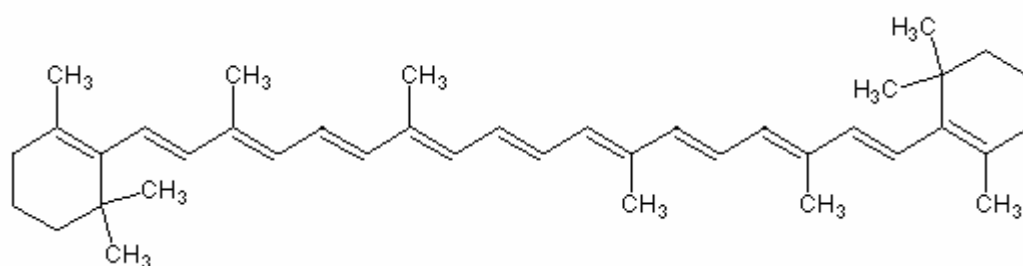


Xanthophyll

The presence and benefit of these materials has been known for generations, but it is only recently that the link between these compounds and free radical scavenging has been associated.

CARROT (*Daucus carota*)

The humble carrot is full of an orange substance called β -carotene. This material is also known as provitamin A and is often used in UV sunscreen preparations as a boost to the efficacy of the product. It has long been known that this material is also a powerful antioxidant.

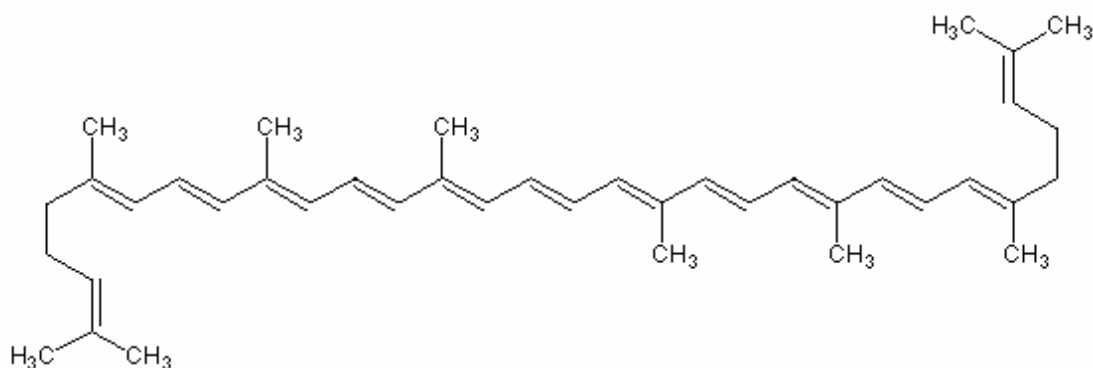


β -carotene

It is recommended as an emollient, lenitive, anti-irritant, refreshing, colouring matter. The pure juice in emollient preparations is used for irritated and dry skin. Up to 5% oil tincture in sun preparations, emollient products for sensitive skins. It has other possible effects, such as cheratoplastic, anti-irritant, and antimicrobial.

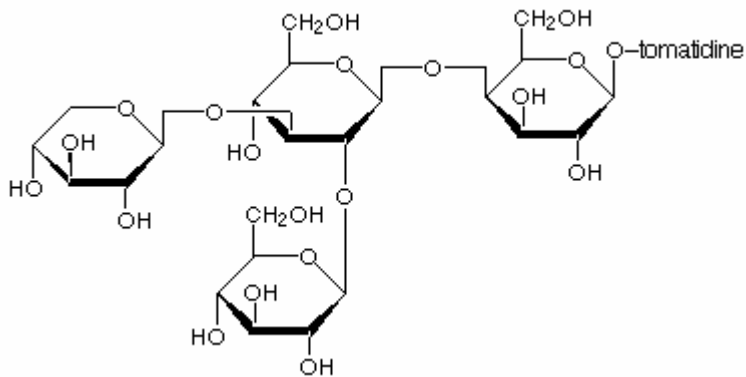
TOMATO (*Lycopersicon esculentum*)

Tomato, another 'red' plant contains carotenoids as well, however, in this case the active material lycopene is another carotenoid that is four times more powerful than α -carotene and ten times more potent than β -carotene. Besides the classical plant active principles like polyphenols and proteins, are also extracted, in a significant quantity, compounds having high bacteriostatic properties (tomatine).

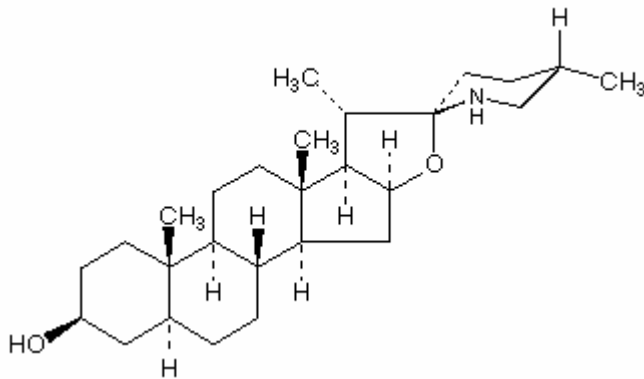


Lycopene

It also contains tomatine and tomatidine



Tomatine or lycopersicin

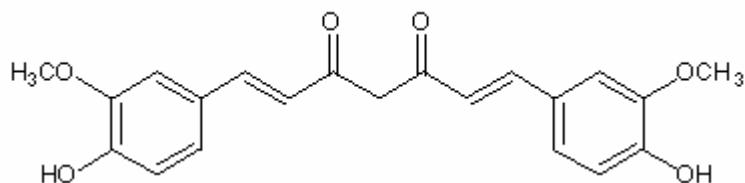


Tomatidine

These materials by the very nature of their structure would also be polyphenols!
Tomatine and tomatidine inhibit the growth of various fungi and bacteria [Merck].

TURMERIC (*Curcuma longa*)

A number of soluble fractions of turmeric, including curcumin, have been reported to have antioxidant properties. Turmeric inhibits the degradation of polyunsaturated fatty acids. Dietary administration of this compound at a level of 2% to mice reduced the incidence of experimentally-induced colonic hyperplasia, indicating that the antioxidant effects are active in vivo. The curcumins inhibit cancer at initiation, promotion and progression stages of development .



SULPHUR COMPOUNDS

GARLIC (*Allium sativum*)

The key detoxifying ingredient in garlic is S-allyl cysteine (SAC), which has been proven to protect against oxidation, free radicals, pollution, cancer and cardiovascular diseases.

Antioxidative effects. SAC demonstrated radical and hydrogen peroxide scavenging activities [Ide et al, 1996, 1] and in a later paper demonstrated a scavenging effect on hydrogen peroxide and also inhibited the chain oxidation induced by a hydrophilic radical initiator [Ide et al, 1996, 2]. Furthermore, S-allyl cysteine inhibited the emission of low level chemiluminescence and the early formation of TBA-RS (markers of oxidation caused by free radicals), whereas water extracts of raw and heat-treated garlic enhanced such emissions [Imai]. It was suggested that SAC has antioxidative efficacy. On the other hand, raw garlic and other preparations tend to stimulate oxidation.

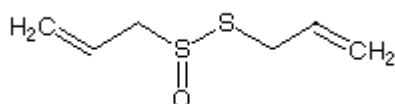
Two important facts emerge, firstly the importance of the condition of the herb and secondly, that being an antioxidant might qualify the description 'detoxifying'.

Melanoma cancer preventitive. Inhibited the Growth of Melanoma Cells

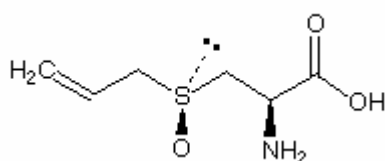
It was found that SAC derived from Aged Garlic Extract inhibited the proliferation of nine human melanoma cell lines and one murine melanoma cell line in a dose dependent manner. SAC inhibited cellular growth and proliferation and modulated major cell differentiation marker of melanoma [Takeyama et al.].

Whether this would be applicable topically is not clear, but clearly the idea that pollution and the environment can cause severe adverse effects on the skin is a concept that has been clearly implanted into the mind of the consumer.

The presence of these sulphur compounds abundant in garlic might also include alliin (S-allyl-L-cysteine sulphoxide) and allicin (diallyl thiosulphinate), which have potent antifungal and antibacterial properties [Dewick]. These properties would also fit the definition of detoxifying.



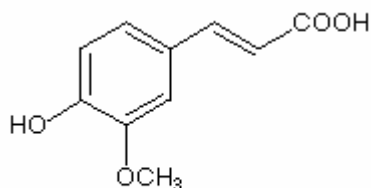
Allicin structure



Alliin structure

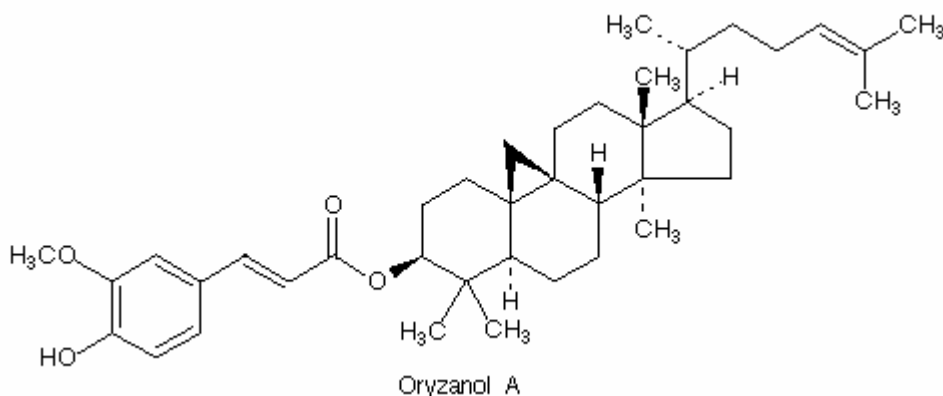
RICE (*Oryza sativa*)

Rice is full of many interesting ingredients, especially ferulic acid, *gamma*-oryzanol and phytic acid, which are found concentrated in the rice bran and its oil. Ferulic acid is used as a food preservative and so under the definition would satisfy the term detoxifying.



trans- Ferulic Acid

The *gamma*-oryzanol is believed to be the most active component responsible for rice bran's anti-oxidant effects



The presence of phytic acid, a strong chelating agent, will not only help to mop up unwanted metal ions, but will also help to attack the outer cell membrane of bacterial cells.

CONCLUSIONS

Whether one can believe that living in the town or city is going to affect the skin with high levels of pollution is very much a question of debate. The use of antioxidants and free-radical scavengers are clearly of advantage both internally and externally. The use of the term 'detoxifying' (though very powerful and emotive) probably falls within the scope of cleansing and protecting.

REFERENCES

Anon: Chemistry in Britain November 1991, p.994.

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

Hara Y: Antioxidative action of tea polyphenols: Part 1. Am Biotechnol Lab (1994 Jul) 12(8):48.

Hertog MG Feskens EJ Hollman PC Katan MB Kromhout D; Dietary antioxidant flavonoids and risk of coronary heart disease: the Zutphen Elderly Study. *Lancet* (1993 Oct 23) 342(8878):1007-11.

Hirose M Hoshiya T Akagi K Futakuchi M Ito N: Inhibition of mammary gland carcinogenesis by green tea catechins and other naturally occurring antioxidants in female Sprague-Dawley rats pretreated with 7,12-dimethylbenz[alpha]anthracene. *Cancer Lett* (1994 Aug 15) 83(1-2):149-56.

Ide, N. et al. 1996. Antioxidant and radical scavenging effects of Aged Garlic Extract and its constituents. 2nd International Congress on Phytomedicine. September 11-14, 1996. Munich, Germany

Ide, N. et al. 1996. Scavenging effects of Aged Garlic Extract and its constituents on active oxygen species. *Phytother. Res.* 10: 340-341.

Imai, J. et al. 1994. Antioxidant and Radical Scavenging Effects of Aged Garlic Extract and its constituents. *Planta Medica* 60:417-420.

Internet: http://www.thorne.com/thorne_abstracts.html

Khan SG Katiyar SK Agarwal R Mukhtar H: Enhancement of antioxidant and phase II enzymes by oral feeding of green tea polyphenols in drinking water to SKH-1 hairless mice: possible role in cancer chemoprevention. *Cancer Res* (1992 Jul 15) 52 (14):4050-2

Lawrence Review of Natural Products dated Feb. 1988, (updated Feb 1994). Copyright 1994 by Facts and Comparisons (ISSN 0734-4961). 111 West Port Plaza Suite 400, St. Louis, Missouri 63146-3098.

Leung, A.Y.: *Encyclopedia of Common Natural Ingredients used in food, drugs and cosmetics*. 1st. edition. John Wiley 1980 ISBN No. 0-471-04954-9.

The Merck Index. 12th edition. Merck & Co. Inc. 1996 Whitehouse Station, NJ, USA. ISBN No. 0911910-12-3.

Penguin Hutchinson Reference Library (CD ROM). 1996 Helicon Publishing and Penguin Books Ltd

Pincemail J., Deby C.: Anti-radical properties of Ginkgo biloba extract. article in French. *Presse Méd.*, 1986, 15, pp. 1475-1479.

Salah N Miller NJ Paganga G Tijburg L Bolwell GP Rice-Evans C: Polyphenolic flavanols as scavengers of aqueous phase radicals and as chain-breaking antioxidants. *Arch Biochem Biophys* (1995 Oct 1) 322(2):339-46

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

Takeyama, H. et al. , 1993. Growth Inhibition and Modulation of Cell Markers of Melanoma by S-allyl cysteine. *Oncology*, 50: 63-69.

Watson, Cynthia: Love Potions - a guide to aphrodisiacs. Optima Books. 1993. ISBN No. 0-356-21049-9

Xie B Shi H Chen Q Ho CT: Antioxidant properties of fractions and polyphenol constituents from green, oolong and black teas. Proc Natl Sci Counc Repub China B (1993 Apr) 17(2):77-84.

Xu Y Ho CT Amin SG Han C Chung FL: Inhibition of tobacco-specific nitrosamine-induced lung tumorigenesis in A/J mice by green tea and its major polyphenol as antioxidants. Cancer Res (1992 Jul 15) 52(14):3875-9

Zhao BL Li XJ He RG Cheng SJ Xin WJ: Scavenging effect of extracts of green tea and natural antioxidants on active oxygen radicals. Cell Biophys (1989 Apr) 14(2):175-85

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