



REFERENCE SUBSTANCES FOR HERBAL PRODUCTS

As one of the leading manufacturers internationally, PhytoLab offers over 1,500 extensively documented herbal reference substances of all classes of natural compounds. Our portfolio includes various reference substances applied in the analysis and quality control of ginkgo leaves, extracts and finished products.

Genus *Ginkgo*

The genus *Ginkgo* (family: *Ginkgoaceae*) is composed of only one species, *Ginkgo biloba* L. The ginkgo tree, a „living fossil“ originally occurred throughout the world, but survived as an endemic species only in Southeast China. In the early 18th century it was introduced to Europe. Today, ginkgo is widely cultivated as an ornamental tree in Asia, Europe and North America, not only because of its general beauty but also due to its strong resistance to pollution, insects and plant diseases in general. Ginkgo trees can become well over 1000 years old.

Medicinal use

Cooked or roasted ginkgo seeds, or more precisely the gametophytes, are a traditional part of the Asian cuisine. Seeds are also used in traditional Chinese medicine. Ginkgo leaves can be consumed as a tea, but usually powdered leaves or special extracts are applied in medicinal products. The European Union herbal monograph on *Ginkgo biloba* L. leaves describes the well-established use of a dry extract, prepared with 60% aqueous acetone, for the purpose of improvement of (age-associated) cognitive impairment and of quality of life in mild dementia. The traditional use of powdered ginkgo leaves is described for the relief of heaviness of legs and sensation of cold hands and feet associated with minor circulatory disorders, after serious conditions have been excluded by a medical doctor.

phyproof® reference substances for the analysis and quality control of *Ginkgo biloba* L.

Reference Substance	Product #
Sesquiterpenes and Diterpenes	
(-)-Bilobalide	89167
Ginkgolide A	89204
Ginkgolide B	89205
Ginkgolide C	89206
Ginkgolide J	89329
Ginkgolic acids	
Ginkgolic acid C13:0	89678
Ginkgolic acid C15:1	89522
Ginkgolic acid C17:1	89207
Ginkgolic acids RN (mix of the three individual ginkgolic acids)	89480
Flavonoids	
Isorhamnetin	89314
Kaempferol	89235
Quercetin (dihydrate)	89262 (89263)
Pyridoxine derivative	
Ginkgotoxin hydrochloride	82638
TLC markers	
Chlorogenic acid	89175
Rutin	89270



Chemical composition

Ginkgo contains some **unique terpene lactones**, i.e. bilobalide and ginkgolides A, B, C and J. Other typical constituents are various **flavonol mono- and diglycosides**, e.g. the 3-glucosides and the 3-rutinosides of quercetin, kaempferol and isorhamnetin. Due to their complex mixture the flavonol glycosides are usually analyzed only after hydrolysis, which results in a more simple HPLC profile dominated by the respective flavonols. Ginkgo also contains various **alkylphenols**, i.e. ginkgolic acids (6-alkylsalicylic acids) and **urushiols** (3-alkylcatechols) which have a known allergenic potential. Ginkgotoxin is a toxic vitamin B₆ analogue. Biflavonoids with diverse biological properties have been reported as well e.g. **Ginkgetin, Isoginkgetin and Bilobetin**.

Pharmacopoeias

In **European Pharmacopoeia**, a specification for flavonoids, expressed as flavone glycosides, is given in the **monograph on Ginkgo leaf**. Chlorogenic acid and rutin are used in the TLC identification test. In the assay, the sum of the peaks due to quercetin, kaempferol and

isorhamnetin (and other peaks eluting between those compounds) is determined by HPLC. The **monograph on Ginkgo dry extract, refined and quantified** additionally defines a content for bilobalide and ginkgolides A, B and C and a maximum content is set for ginkgolic acids.

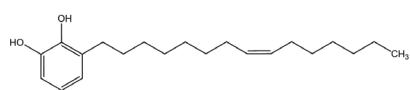
In **United States Pharmacopoeia**, the dietary supplements **monograph on Ginkgo** specifies a minimum content for flavonoids, calculated as flavonol glycosides, and for terpene lactones, calculated as the sum of bilobalide and ginkgolides A, B and C. Unlike in EP, only the signals due to quercetin, kaempferol and isorhamnetin are considered in the calculation of total flavonoids. Terpene lactones are quantified by HPLC with ELS detector. In the HPTLC identification test, zones due to rutin, quercetin, chlorogenic acid, bilobalide and all four ginkgolides are described. Similar to EP, the **monograph on powdered Ginkgo extract** additionally defines a content for bilobalide and ginkgolides A, B and C and a certain ratio of the flavonol peaks is demanded in HPLC analysis.

Reference Substances

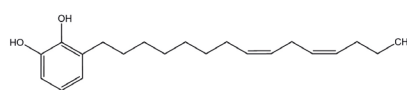
For a reliable quantitative analysis and quality control of ginkgo products well characterized reference substances are essential. **PhytoLab offers all reference substances described in EP and USP. All of them are characterized as primary reference substances** and supplied together with a comprehensive certificate of analysis. Many other natural products that have been described to occur in ginkgo are available as well. For a full listing and up-to-date information on prices and specifications please contact us or visit our webshop at phyproof.phytolab.com.

Selection of other available phyproof® Reference Substances related to Ginkgo Biloba

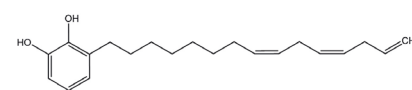
Potential allergens (Urushiols)



Urushiol (15:1), (product # 80180)

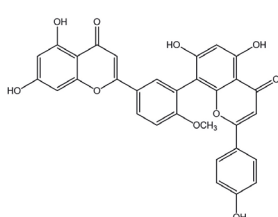


Urushiol (15:2), (product # 80181)

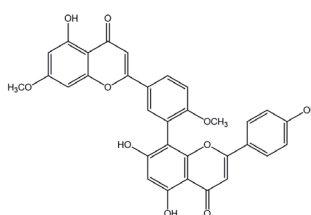


Urushiol (15:3), (product # 80182)

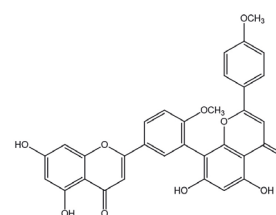
Biflavonoids



Bilobetin, (product # 83840)



Ginkgetin, (product # 83501)



Isoginkgetin, (product # 83513)

