



# Furocoumarins



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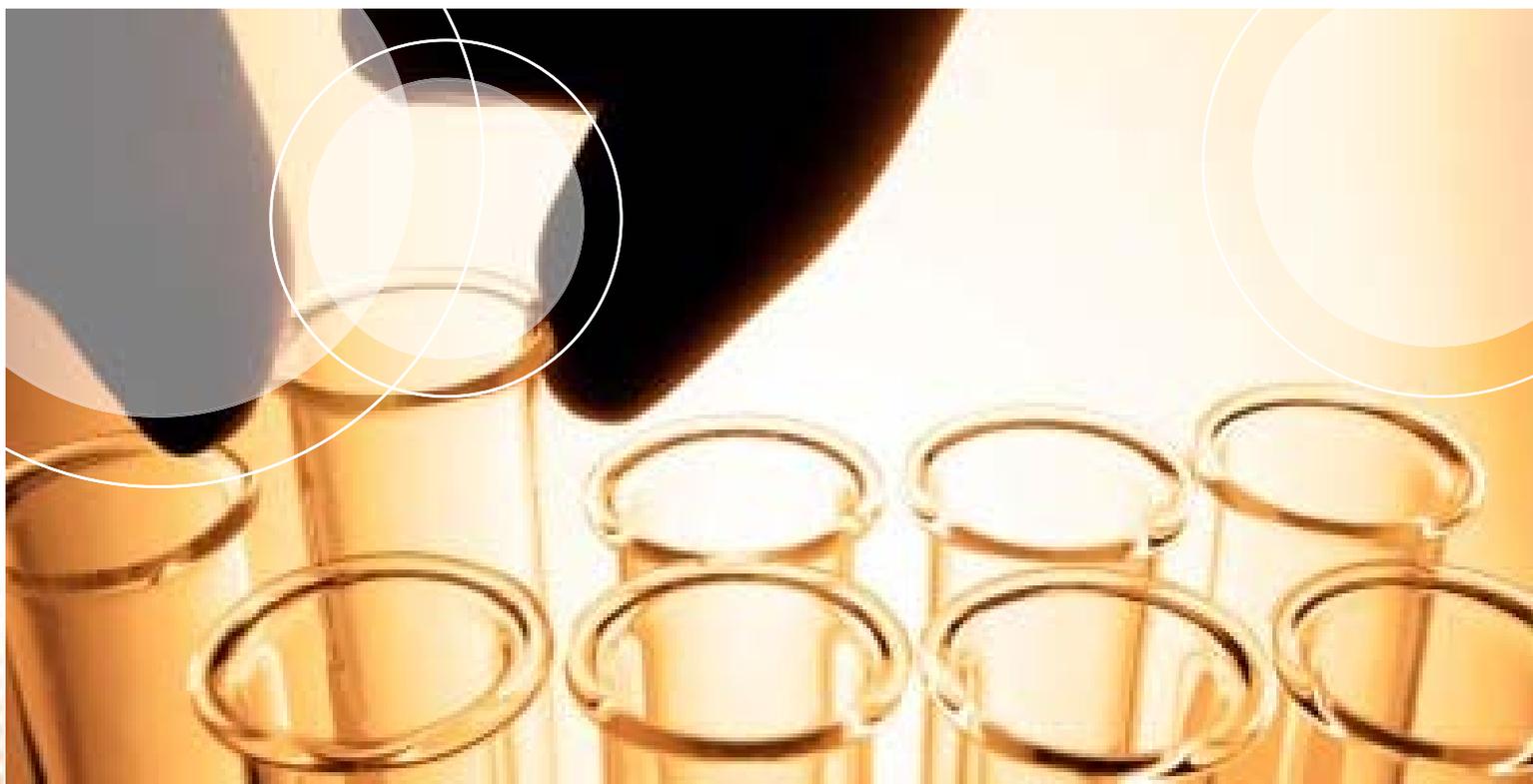
# Furocoumarins

**Furocoumarins**, or furanocoumarins, are a class of organic chemical compounds produced by a variety of plants. They are biosynthesized partly through the phenylpropanoid pathway and the mevalonate pathway, which is biosynthesized by a coupling of dimethylallyl pyrophosphate (DMAPP) and 7-hydroxycoumarin (umbelliferone).

The chemical structure of furocoumarins consists of a furan ring fused with coumarin. The furan may be fused in different ways producing several isomers. The compounds that form the core structure of the two most common isomers are psoralen and angelicin. Derivatives of these two core structures are referred to respectively as linear and angular furocoumarins.

Many furocoumarins are toxic and are produced by plants as a defense mechanism against various types of predators ranging from insects to mammals. This class of phytochemical is responsible for the phytophotodermatitis seen in exposure to the juices of the wild parsnip.

Furocoumarins have other biological effects as well. For example, in humans, bergamottin and dihydroxybergamottin are responsible for the "grapefruit juice effect", in which these furocoumarins affect the metabolism of certain pharmaceutical drugs.



## Government and Regulatory Actions Concerning Furocoumarins

EC Directive 95/34/EC of July 10, 1995 (adapting the European Cosmetics Directive 76/768/EEC for the 18th time) introduced a limit on the presence and use of furocoumarins in fragrances (and other cosmetic products). Entry 358 to Annex II bans directly added furocoumarins (e.g. 8-methoxypsoralen, 5-methoxypsoralen), except for contributions coming from natural essential oils. In sun protection and bronzing products the levels of furocoumarins should be below 1 ppm (1mg/kg). In its opinion SCCNFP/0392/00 of September 25, 2001, SCCP proposed to permit the use of furocoumarin-containing essential oils as long as “the total concentration of furocoumarin-like substances in the finished cosmetic product does not exceed 1 ppm”. The opinion is based on potential photomutagenic and photocarcinogenic effects. An industry IFRA Standard has existed for many years and recommends that, for essential oils in products applied to sun-exposed areas (except those that are washed off), the total level of bergapten (5-methoxypsoralen) in the finished product should not exceed 15 ppm. This Standard is based on phototoxic effects only, and is currently under review by the RIFM Expert Panel. Since the SCCP opinion of 2001 both IFRA and RIFM have engaged in a program of dialogue and testing. The dialogue sought to better define what materials the SCCP considered to be included in “all furocoumarin and furocoumarin-like substances”. Additionally, IFRA sought to gain acceptance of the restriction of only certain specific furocoumarins (i.e., those most readily identifiable and most predominant in natural products). RIFM sponsored a testing program, which investigated the photogenotoxicity potential of specific furocoumarins that are found in citrus oils and for which no photogenotoxicity data were available. The results of the RIFM testing program showed that the additional specific furocoumarins found in citrus oils were photogenotoxic. As such the fragrance industry has recommended these materials as specific furocoumarin markers in citrus oils.





**Bergamottin** is a natural furocoumarin found principally in grapefruit juice. It is also found in the oil of bergamot, from which it was first isolated and from which its name is derived. To a lesser extent, bergamottin is also present in the essential oils of other citrus fruits. Along with the chemically related compound 6',7'-dihydroxybergamottin, it is believed to be responsible for the grapefruit juice effect in which the consumption of the juice affects the metabolism of a variety of pharmaceutical drugs.

**Bergapten** (5-methoxypsoralen) is a psoralen (also known as furocoumarins) found in bergamot essential oil and many other citrus essential oils, and is the chemical in bergamot oil that causes phototoxicity.

**Imperatorin** is a furocoumarin and a phytochemical that has been isolated from *Urena lobata* L. (Malvaceae). It is biosynthesized from umbelliferone, a coumarin derivative. Psoralen (also called psoralene) is the parent compound in a family of natural products known as furocoumarins. It is structurally related to coumarin by the addition of a fused furan ring, and may be considered as a derivative of umbelliferone. Psoralen occurs naturally in the seeds of *Psoralea corylifolia*, as well as in the common fig, celery, parsley and West Indian satinwood. It is widely used in PUVA (=Psoralen +UVA) treatment for psoriasis, eczema, vitiligo, and Cutaneous T-cell Lymphoma. Although safe to mammals, it should be used with care since many furocoumarins are extremely toxic to fish, and some are indeed used in streams in Indonesia to catch fish.

**Xanthotoxin**, also known as Methoxsalen (marketed under the trade name Oxsoralen) is a drug used to treat psoriasis, eczema, vitiligo, and some cutaneous Lymphomas in conjunction with exposing the skin to sunlight. Methoxsalen modifies the way skin cells receive the UVA radiation, allegedly clearing up the disease. The dosage comes in 10mg tablets, which are taken in the amount of 30mg 75 minutes before a PUVA light treatment. The substance is also present in bergamot oil which is used in many perfumes and aromatherapy oils.



## Furocoumarins Products

Part#	Description	Grade	Size
ASB-00002210-005	BERGAMOTTIN	P	5mg
ASB-00002210-010	BERGAMOTTIN	P	10mg
ASB-00002210-025	BERGAMOTTIN	P	25mg
ASB-00002215-005	BERGAPTEN	P	5mg
ASB-00002215-010	BERGAPTEN	P	10mg
ASB-00002215-025	BERGAPTEN	P	25mg
ASB-00002530-001	BYAKANGELICIN	P	1mg
ASB-00002530-005	BYAKANGELICIN	P	5mg
ASB-00002533-001	BYAKANGELICOL	P	1mg
ASB-00002533-005	BYAKANGELICOL	P	5mg
ASB-00002533-010	BYAKANGELICOL	P	10mg
ASB-00005164-005	EPOXYBERGAMOTTIN	P	5mg
ASB-00005164-010	EPOXYBERGAMOTTIN	P	10mg
ASB-00005164-025	EPOXYBERGAMOTTIN	P	25mg
ASB-00007148-005	GERANYLOXYPSORALEN, 8-	P	5mg
ASB-00007148-010	GERANYLOXYPSORALEN, 8-	P	10mg
ASB-00008101-005	HERACLENIN	P	5mg
ASB-00008101-010	HERACLENIN	P	10mg

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## Furocoumarins Products

Part#	Description	Grade	Size
ASB-00009070-005	IMPERATORIN	P	5mg
ASB-00009070-010	IMPERATORIN	P	10mg
ASB-00009070-025	IMPERATORIN	P	25mg
ASB-00009256-005	ISOIMPERATORIN	P	5mg
ASB-00009256-010	ISOIMPERATORIN	P	10mg
ASB-00009256-025	ISOIMPERATORIN	P	25mg
ASB-00009174-005	ISOPIMPINELLIN	P	5mg
ASB-00009174-010	ISOPIMPINELLIN	P	10mg
ASB-00009174-025	ISOPIMPINELLIN	P	25mg
ASB-00015490-001	OXYPEUCEDANIN	P	1mg
ASB-00015490-005	OXYPEUCEDANIN	P	5mg
ASB-00015490-010	OXYPEUCEDANIN	P	10mg
ASB-00015495-005	OXYPEUCEDANIN HYDRATE	P	5mg
ASB-00015495-010	OXYPEUCEDANIN HYDRATE	P	10mg
ASB-00015495-025	OXYPEUCEDANIN HYDRATE	P	25mg
ASB-00016364-005	PSORALEN	P	5mg
ASB-00016364-010	PSORALEN	P	10mg
ASB-00016364-025	PSORALEN	P	25mg
ASB-00024300-010	XANTHOTOXIN	P	10mg
ASB-00024300-050	XANTHOTOXIN	P	50mg
ASB-00024300-250	XANTHOTOXIN	P	250mg

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