

Essential Oils & The Skin

The Complete Skin Series

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Photosensitization



- ▶ Phototoxicity
- ▶ Risk factors
- ▶ Furanocoumarins
- ▶ Phototoxic limits
- ▶ Photoallergy
- ▶ Pigmented contact dermatitis

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Phototoxicity

A phototoxic substance causes an adverse skin reaction in the presence of ultra-violet light

Latency period: 1-24 hours after UV exposure

Phase I: Inflammation with possible edema & blisters for 3-7 days

Phase II: Hyperpigmentation lasting for months



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Fig leaves

Ficusin, methoxsalen

Age	Days in hospital	Complications
13	14	2nd degree burns over 40% of body
25	11	Extensive blistering, mild anemia
36	10	2nd degree burns, severe anemia
35	6	1st - 2nd degree burns, itchy erythema
39	8	2nd degree burns over 12% of body, itchy erythema

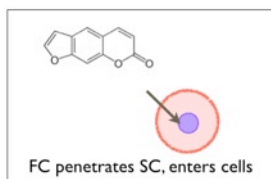
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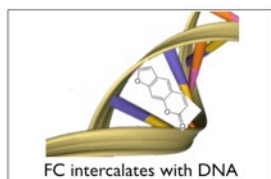
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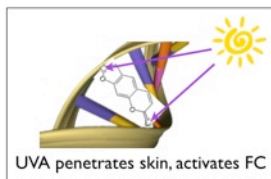
Phototoxicity mechanism



FC penetrates SC, enters cells



FC intercalates with DNA



UVA penetrates skin, activates FC

Free radicals generate inflammation
Keratinocyte cell death
Melanocyte population doubles or triples within a few days

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Risk factors

FC content
Skin contact
UV radiation
Time elapsed
Skin phototype

<http://dermnetnz.org/reactions/drug-photosensitivity.html>



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Skin phototypes

Phototype	Typical features	Tanning ability
I	Pale white skin, blond or red hair	Always burns, does not tan
II	Fair skin, blue eyes	Burns easily, tans poorly
III	Darker white skin	Tans after initial burn
IV	Light brown skin	Burns minimally, tans easily
V	Brown skin	Rarely burns, tans darkly easily
VI	Dark brown or black skin	Never burns, always tans darkly

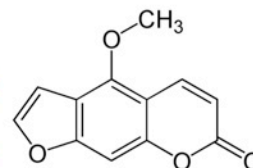
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Furanocoumarins



Citrus bergamia
0.2% bergapten



Bergapten



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FCs in bergamot oil

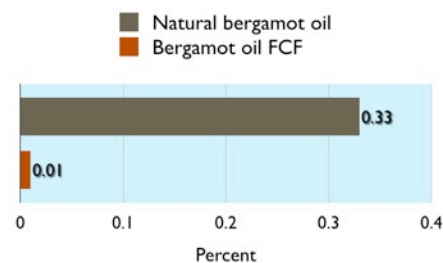
FC	Average %	Potency
Bergamottin	1.7	negligible
5-Geranyloxy-7-methoxycoumarin	0.4	not known
Citropten	0.2	moderate
→ Bergapten	0.2	strong
Bergaptol	0.1	not known
7-Methoxy-5-geranoxycoumarin	0.1	not known
Psoralen	0.001	strong

II

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Bergapten in bergamot



II

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Phototoxic limits

Threshold
15 ppm
0.0015%

Essential oil	Safe concentration
Fig leaf ABS	none
Lemon verbena EO	none
Taget EO or ABS	0.01%
Rue EO	0.15%
Mandarin leaf EO	0.17%
Bergamot EO	0.4%
Cumin EO	0.4%
Lime EO (expressed)	0.7%
Angelica root EO	0.8%
Bitter orange EO (expressed)	1.25%
Lemon EO (expressed)	2%
Grapefruit EO (expressed)	4%

http://www.ifraorg.org/en-us/standards-library/s/phototoxicity#.UgRJVIxkVW_4

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Safe citrus

Bergamot FCF	Neroli (orange blossom)
Grapefruit (distilled)	Orange (sweet or blood)
Kaffir lime leaf (combava)	Petitgrain (orange leaf)
Lemon (distilled)	Satsuma
Lemon leaf	Tangelo
Lime (distilled)	Tangerine
Mandarin (fruit)	Yuzu

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Possibly phototoxic

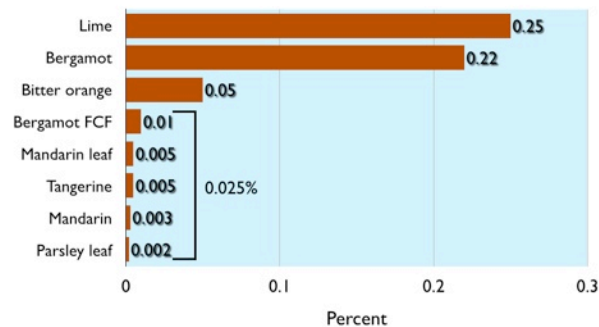
Essential oils	Absolutes / CO2 extracts
Celery leaf	Angelica root
Clementine fruit	Celery seed
Combava fruit	Cumin seed
Khella	
Lovage leaf	
Parsnip	

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Typical bergapten %



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No concern

Non-phototoxic	Negligible phototoxicity
Cassia	Bergamot FCF
Cedarwood Atlas	Ginger
Cedarwood Virginian	Mandarin
Cinnamon bark	Parsley herb
Lavandin	Patchouli
Lavender	Tangerine



Deterpenated (folded) oils: check with supplier



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Botanical source

Apiaceae	Rutaceae
Angelica	Bergamot
Celery	Fig
Cumin	Grapefruit
Khella	Lemon
Lovage	Lime
Parsnip	Mandarin
	Orange
	Rue



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Combining phototoxic oils



Essential oil	Safe
Bergamot oil	0.4%
Cumin oil	0.4%
Both oils	0.2% each



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Simple guideline



Maximum

4 drops total citrus fruit EO
per 30 mL (1 oz) excipient



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Photoallergy



Extremely uncommon.
An allergic reaction to UV light
Induced by a 'photoallergen'
No pigmentation.

Applied a mixture of amyris, patchouli, frankincense, lime,
ylang-ylang, Hawaiian sandalwood &
Roman chamomile, undiluted.
The rash only appeared after sun exposure.

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Potential photoallergens



Oakmoss

Essential oils

Bergamot
Costus
Garlic
Lavender
Oakmoss ABS
Sandalwood

Constituents

Cinnamaldehyde
Eugenol

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Pigmented contact dermatitis

What it is

Skin hyperpigmentation
not caused by UV light
May be due to melanin passing into
the upper dermis or lower
epidermis

Incidence

Relatively rare
Usually on the face
More common in women
& people with darker skin

Possible causes

Fragrance
Cosmetics
Azo dyes
Rubber

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Possible triggers



Santalum album

Essential oils

Cananga
Jasmine ABS
Lemon
Sandalwood
Ylang-ylang

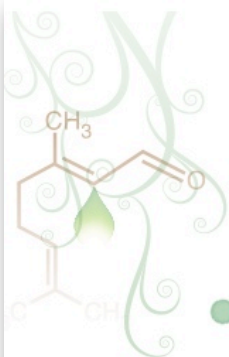
Constituents

Benzyl salicylate
Geraniol
Santalol

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Summary points

- Photosensitization from plants is known as phytophotodermatitis.
- Typically, there are both acute and chronic phases.
- Acute phototoxic reactions can be severe.
- Patchy pigmentation may persist for months or years.
- Phototoxicity is only a risk with leave-on products or fresh plants.
- Some citrus fruit oils are phototoxic, some are not.
- There are safe levels for most phototoxic essential oils.
- Photoallergy is very rare.
- Pigmented contact dermatitis is rare outside of Japan.



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CITATIONS

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IMAGE CREDITS

Acute phase (slide 6): Cather et al (2000) Baylor University Medical Center Proceedings
Chronic reaction (slide 10): (c) Diepgen TL, Yihune G et al. *Dermatology Online Atlas* (www.dermis.net). Reproduced with permission.
Yuzu steam distillation (slide 27): Chizu Kumagai, with permission
Oakmoss (slide 41): Tomas Čekanavičius

LINKS

Slide 13: <http://telemedicine.org/botanica/bot5.htm>
Slide 16: <http://dermnetnz.org/reactions/drug-photosensitivity.html>
Slide 17: <http://www.ifraorg.org>
Slide 29: <http://www.ifraorg.org/en-us/standards-library#.VDhBAiTF91Y>

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