Arnica oil

**BOTANY**

*Arnica montana L.* known also as arnica, is a member of the Compositae (Asteraceae) family. It is an aromatic herbaceous perennial. The leaves, arranged in a basal rosette, are alternate, large (5-17 x 2.5-5.5 cm), hairy, elliptic or obovate, with inconspicuous petioles, entire margins and acrodromous veins. The stem bears two small opposite leaves, and a large (5-8 cm diameter) solitary inflorescence, also called flower head. Occasionally, two or three flower heads grow clustered in a cyme. The inflorescence involucrum is composed of two rows of narrow lanceolate bracts. The flowers are yellow or orange. The fruit is a brown achene 6-10 mm long with a pappus of simple bristles. Flowers appear during the summer.

Arnica is native to the centre and south of Europe, central Asia and North America. It grows in sunny mountainous areas, especially in the Alps, on plains and peaty areas, preferentially on acidic, sandy and humus-rich soils. Wild arnica is harvested from Europe to Southern Russia. The main producers are Yugoslavia, Spain, Italy and Switzerland.

Arnica oil is an oily extract produced by maceration of *Arnica montana* flowers in sunflower oil (*Helianthus annuus*).

**QUIMICA**

**Sesquiterpene lactones**

The main components of arnica flowers are guaianolide-type sesquiterpene lactones (0.2-0.8%), especially helenalin, 11a,13-dihydro-helenalin, chamissonolid and their corresponding esters with short chain fatty acids (acetic, isobutyric, 2-methyl-butanoic, isovaleric, α- methacrylic and tiglic acids).

![Fig.1. Helenalin (left) and dihydrohelenalin (right).](image)

The terpene alcohols arnidiol and faradiol are also found in arnica.
Essential oil
Arnica flower heads also contain essential oil (0.2-0.4%), composed of 40-50% fatty acids, approximately 9% n-alkanes and thymol derivatives, as well as further monoterpenes and sesquiterpenes (including α-phellandrene, myrcene, humulene, α-cadinene and caryophyllene oxide).

TRADITIONAL USES
Arnica was extensively used in the German popular medicine, during the XVI century. In 1653, Nicholas Culpeper recommends arnica for skin wounds. Goethe (1749-1832) used to drink arnica infusion to treat his angina. In France, it was often employed as a sternutatory and to substitute tobacco. In Germany, it is still used to relief cardiac disease. However, in Great Britain and the United States, only external use is authorized.
Arnica is often used as an ointment to treat contusions, bruises and hematoma. Arnica may also be used internally as an abortive, lipid lowering substance, antifungal, hypertensive and cardiac stimulant. It produces a mild sedative antispasmodic effect on blood vessels, very helpful to treat coronary and vascular diseases.

COSMETIC PROPERTIES

Anti-inflammatory activity
This activity is mainly due to the sesquiterpene lactones and flavonoids content of arnica inflorescences.

It has been found that helenalin and dihydorhelenalin exerted anti-inflammatory effects on experimental animals, by inhibiting prostaglandin production through the blockade of the prostaglandin-synthase enzyme. Such anti-inflammatory effects were reinforced by carotenoids and flavonoids (Alonso J., 2004).

Helenalin, dihydrohelenalin, chamissonolide and their ester derivatives present in arnica flower heads influence several cell processes. Lyss G. et al. (1997) and Klaas C.A. et al. (2002) carried out studies that demonstrated that helenalin and, to a much lesser degree, dihydrohelenalin and chamissonolide, inhibit the activation of the FN-kappa-B and NF-AT transcription factors involved in the genesis of inflammatory processes.

A homeopathic product (Traumeel-S®) containing Arnica montana and other plant extracts and minerals, was tested on an rat models of inflammation. It was found that its main action mechanism was associated to a significant decrease of systemic interleukin-6 level. An open multi-centre clinical study revealed that 2 daily applications of an arnica-containing gel to 79 patients suffering knee-osteoarthritis, for a 3-6 weeks treatment, significantly reduced joint pain in most of the cases; the product was well tolerated in 87% of the cases (Alonso J., 2004).

Therefore, arnica oil is highly recommendable to formulate cosmetic products for sensitive and/or irritated skin.

Antimicrobial activity
Helenalin and five related sesquiterpene lactones (mexicanin-1, HO-helenalin acetate, chamissonolide, ivalin and isoalantolactone) showed in vitro inhibitory effects on Trypanosoma brucei and Trypanosoma cruzi. Helenalin was the most active one with IC₅₀=0.051 µM and IC₅₀=0.695 µM, respectively. A methanol extract of arnica flowers also showed in vitro inhibitory effects on aerobic and anaerobic periodontopathic bacteria with MIC equal to or less than 2048 mg/l (Alonso J., 2004).

This activity is strengthened by the essential oil content in arnica flower heads. All of the essential oils have antimicrobial activity to a greater or lesser degree. This activity can be measured by using the phenol coefficient, which rates the antimicrobial strength or weakness of a certain oil comparing it with that of pure phenol (coefficient = 1.0). Phenol – a component of essential oils – shares some characteristics of alcohol, which result in antimicrobial activity. The highest the phenol coefficient of a certain essential oil, the strongest its antimicrobial activity.
Different research studies have confirmed the antimicrobial properties of essential oils, especially on antibiotic-resistant bacteria, such as *Staphylococcus aureus*, which resists methicillin, or *Enterococcus faecium*, which resists vancomycin. The antimicrobial activity of essential oils is attributed to their main chemical components: citral (aldehyde), geraniol (primary alcohol), eugenol (phenol), menthol (secondary alcohol) and cinnamic aldehyde (aldehyde) (Hartman D. & Coetzee JC., 2002).

Essential oils show antiseptic effects against different pathogenic bacteria, even antibiotic-resistant strains. Some essential oils are also effective against the fungi and yeasts (*Candida*) that cause mycosis. The active doses are generally low. In general, the doses calculated for *in vitro* experiments may be used for external applications. Compounds such as linalol, citral, geraniol, or thymol are more antiseptic than phenol by 5, 5.2, 7.1 and 20 times respectively (Bruneton J., 2001).

The antimicrobial activity of arnica is strengthened by the antimicrobial activity of the sunflower oil.

Dilika F. et al. (2000) carried out studies, which revealed that linoleic acid inhibited the growth of the following Gram-positive bacteria: *Bacillus cereus*, *B. pumilus*, *B. subtilis*, *Micrococcus kristinae*, and *Staphylococcus aureus*. The minimum inhibitory concentration (MIC) was between 0.01 and 1.0 mg/ml. Oleic acid acted against the bacteria: *M. kristinae*, *S. aureus* and *Enterobacter cloacae* with a MIC of 1.0 mg/ml. A synergistic effect of both acids against *S. aureus* and *M. kristinae* was observed.

Rodrigues, KL. et al. (2004) conducted a study to evaluate the antimicrobial activity of the ozonised sunflower oil Bioperoxoil® against some pathological strains *in vitro* and against *Staphylococcus aureus* *in vivo*.

Bioperoxoil® was tested against *S. aureus*, *Pseudomonas aeroginosa*, *Candida albicans*, *S. typhimurium* and *Escherichia coli* using the agar diffusion method. *In vivo* experiments were carried out with Wistar rats through topical application of 3.5 mg/ml of the ozonised oil for 7 days after inoculation with *S. aureus*. Bioperoxoil® showed antimicrobial effects against all strains tested, with MIC values ranging from 2.0 to 3.5 mg/ml. Bioperoxoil® also demonstrated protective effects on skin connective tissue and stimulating effects on wound healing, as compared to a neomycin-clostebol complex used as a positive control. The results indicated significant antimicrobial, anti-inflammatory and wound-healing activities for Bioperoxoil® as compared to other commercially available antimicrobial agents.

Besides, sunflower oil has stimulating actions on the skin barrier function. This action is very useful to protect the skin from bacterial infections. Darmstadt GL et al (2004) tested the effectiveness of topical application of sunflower oil 3 times daily, to prevent infection in preterm infants. This treatment resulted in a significant improvement in skin condition and a highly reduction in the incidence of nosocomial infections compared with infants not receiving topical prophylaxis.

Therefore, arnica oil is highly recommendable to formulate cosmetic products with purifying and antiseptic activity.

**Inhibitory activity on cell mitosis**

Hair growth is due to the activity of the keratinocytes of the hair follicles. Hair growth rate can be either stimulated – by stimulating the cell proliferation and metabolism of the keratinocytes – or reduced – by reducing keratinocytes’ activity, which can be done by reducing the nutrient supply or by inducing free radicals-mediated lipid peroxidation.

Arnica flower heads contain sesquiterpene lactones that inhibit the keratinocytes mitosis thus inhibiting the growth and renewal of the cells of the hair follicle.

Therefore, arnica oil is recommendable to formulate cosmetic products that slow down the hair growth.
Finally, we would like to mention that the book *Plants preparations used as ingredients of cosmetics products* (Council of Europe Publishing, 1994) includes a monograph of the glycolic extract, oil tincture and hydroalcoholic tincture of arnica flowers, which mentions the following cosmetics effects and recommends the following maximum concentrations:

- tonic and stimulant
  - up to 10% hydroalcoholic tincture, oily tincture
  - up to 2% (maximum) glycolic extract, in stimulant products for scalp, oils and emulsions for massage, bath and showers after sport, products for body massage

- other possible effects: anti-edema, anti-ecchymosis, revulsive and antiseptic

### COSMETIC APPLICATIONS

<table>
<thead>
<tr>
<th>Action</th>
<th>Active</th>
<th>Cosmetic Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anti-inflammatory</strong></td>
<td>Sesquiterpene lactones, Essential fatty acids</td>
<td>-Anti-irritant</td>
</tr>
<tr>
<td><strong>Antimicrobial</strong></td>
<td>Sesquiterpene lactones, Essential oil</td>
<td>-Purifying, -Antiseptic</td>
</tr>
<tr>
<td><strong>Skin barrier repairing activity</strong></td>
<td>Essential fatty acids</td>
<td>-Moisturizing, -Emollient</td>
</tr>
<tr>
<td><strong>Cell mitosis inhibition</strong></td>
<td>Sesquiterpene lactones</td>
<td>-Slows down hair growth</td>
</tr>
</tbody>
</table>

**RECOMMENDED DOSE**

The recommended dose is between 0.5% and 5.0%.

**BIBLIOGRAPHY**

**Arnica**
Sunflower oil


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