Fucus

**BOTANY**

*Fucus vesiculosus* L. Common name *fucus*. This seaweed belongs to the Fucaceae family. This brownish-green colored seaweed has a typical thin, branched and coriaceous thallus. Fucus is a member of the brown algae, Phaeophyceae, in which the green color of chlorophyll is masked by brown-colored pigments. The thallus is 1-1.5 cm wide and up to 1 m long; the woody fronds have thick midribs and are forked at the tips. Reproductive structures occur at the tips of the fronds. Wild fucus is widely spread in the shallow waters of the northeastern Atlantic rocky coasts, mainly in the English Channel, Baltic Sea, North Sea and Britain and also in the eastern coasts of the United States. This seaweed covers large surfaces of certain Atlantic regions known as the Sargasso Sea.

Fucus extract is produced from the seaweed *Fucus vesiculosus* L.

**CHEMISTRY**

**Mucilage**

Mainly alginic acid (alginate), which accounts for almost 40% total weight and can be found as calcium, magnesium or sodium salts.

Alginic acid is a lineal polymer composed of two uronic acids: D-manuronic and L-guluronic acid, whose monomers are linked by β-(1→4) bonds. These acids form homogeneous poly-M or poly-G blocks, separated by zones in which both alternate (G-M-G-M).

Fig.1. Structure of alginic acid.
Soluble glucosans
Up to 60% Laminarin and fucoidin (fucoidan). The former compound can be found in two different forms: soluble and non-soluble, both composed of 1-3 linked D-glucose units. Fucoidin is a water-soluble, viscous reserve carbohydrate, composed of L-fucose units with α-1-2 bonds and sulphur esters in C4.

Oligoelements and mineral salts
Mineral salts (13-23%) including iodine in the form of inorganic salts and bond to proteins and lipids. This plant also contains large proportions of sodium and potassium chloride as well as smaller proportions of chloride, bromine, magnesium, calcium, iron and silicon.

Other active principles
Carotenoids (β-carotene, zeaxanthin, fucoxanthin, neofucoxanthin, violaxanthin and lutein), vitamin C, vitamins of the B1 and B12 types, phenols (floroglucinol and derivatives), acrylic acid, lipids (β-sitosterol, fucosterol, δ-5-avenasterol), polyphenols, proteins, peptides, amino acids, volatile oil, etc.

TRADITIONAL USES
This plant has been used since ancient times. Plinius named it Quercus marina and used to prescribe it as an analgesic for painful joints. During the XVIII century it was much prized to treat cases of asthma. The species name vesiculosus refers to the typical air vesicles in the thallus of this seaweed.

Fucus is often used as a dietary supplement for obesity and endocrinopathy, to treat gastroesophageal reflux, hiatal hernia, gastritis, as an anticoagulant and diuretic agent, in anti-cellulite gels and mesotherapy creams, to relief rheumatic pain, scrofuloderma, and to heal wounds.

Sodium alginate is a highly stable colloid, often used as a suspension thickening and stabilizing agent in the pharmaceutical, food and textile industries, as well as to manufacture waxes and lubricants.

COSMETIC PROPERTIES
Moisturizing activity
Low concentrations of monovalent cation alginates and magnesium alginates can be dissolved in water to form viscous colloidal solutions with pseudoplastic behavior. Progressive addition of divalent cations (calcium) results in the formation of an elastic, non-thermo-reversible gel. Glucuronic segments with a folded conformation retain calcium ions by coordination, in co-operation with a parallel chain. Such egg-box like structure is periodically repeated, thus forming a three-dimensional net with organized zones linked by poly-M or poly (M-G) segments. The structure of this polymer is thus, the major factor in the rheological behavior of alginic acid gels; the proportion and the length of the poly-G blocks determine the formation and the strength of gels produced in the presence of calcium. Alginates are much prized in the cosmetic industry because of their filmogenic, soothing and moisturizing properties and because of their ability to yield preparations, which can be easily extended on the skin and have a pleasant feel (Bruneton, J., 2001).

Therefore, fucus extract is recommendable to formulate cosmetic products with moisturizing, filmogenic, soothing and anti-irritant actions.
Anti-inflammatory activity
The polysaccharides from fucus water extract showed bioadhesiveness effects in ex-vivo assays using porcine mouth membranes, which were equivalent to those of Calendula officinalis polysaccharides and higher than those of Althaea officinalis, Plantago lanceolada, Tilia cordata and Malva moschata. This finding supports the use of the muclage properties of hydrocolloidal polysaccharides, such as those extracted from fucus, on irritated or swollen mouth mucosa (Alonso, J., 2004).

Some studies have shown that fucoidan is able to inhibit the inflammatory cascade effects, which usually lead to allergy and tissue damage.

Therefore, fucus extract is recommendable to formulate cosmetic products with anti-irritant activity.

Anti-aging activity
Applications of a gel formulation that included 1% of fucus water extract to human cheek skin (twice daily for five weeks), was found to decrease skin thickness and improve skin elasticity. These results suggested that the extract possessed anti-aging activities beneficial for aged skin (Fujimura, T. et al., 2002).

Fucoidan was found to promote contraction and granulation in fibroblast-populated collagen gels. This result evidenced the epithelizing properties of this seaweed (Alonso, J., 2004).

Rupérez, P. et al (2002) studied the antioxidant capacity of F. vesiculosus. Their results showed that sulfated polysaccharides from this seaweed could be used as natural antioxidants.

Therefore, fucus extract is recommendable to formulate cosmetic products with anti-aging activity.

Anti-edema activity
The thallus of fucus contains organic iodine, which mobilizes retained fluids from some parts of the body, stimulates blood circulation and removes toxins (Soler, C., 2005).

Edema is one of the agents that cause cellulite; thus, active principles which reabsorb edemas are of great use to treat this condition (Benaiges, A., 2006).

Such decongestant and anti-edema actions of fucus support its use in the formulation of cosmetic products with anti-cellulite activity.

Anti-microbial activity
Lectin-like mucopolysaccharide compounds from F. vesiculosus have shown toxic effects on Escherichia coli and Neisseria meningitidis, as well as agglutinating effects on yeast cultures of Candida guilliermondii. Furthermore, a bacteria isolated from fucus has been found to produce antibiotic substances against Staphylococcus aureus, Pseudomonas aeruginosa and Escherichia coli cultures (Alonso, J., 2004).

Thus, fucus extract is of great use to formulate cosmetic products with purifying and antiseptic activity.
Finally, we would like to mention that the reference publication *Plants in cosmetics. Vol. I* (Council of Europe, 1994), includes a monograph on the dry hydroalcoholic extract and the glycolic extract of *Fucus vesiculosus* thallus, which attributes them the following cosmetic effects:

- calming, soothing, emollient
  up to 1% of the dry extract
  up to 10% of the glycolic extract in “slimming” products (both and shower gel, cream). Body massage cream.
- other possible effects: stimulating, anti-rheumatism, anti-arthritis, anti-obesity, emollient

**COSMETIC APPLICATIONS**

<table>
<thead>
<tr>
<th>Action</th>
<th>Active</th>
<th>Cosmetic Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisturizing</td>
<td>Mucilage (alginites)</td>
<td>-Moisturizing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Filmogenic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Soothing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Anti-irritant</td>
</tr>
<tr>
<td>Anti-inflammatory</td>
<td>Polysaccharides</td>
<td>-Anti-irritant</td>
</tr>
<tr>
<td>Anti-aging</td>
<td>Polysaccharides</td>
<td>-Anti-aging</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Epithelizing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Antioxidant</td>
</tr>
<tr>
<td>Anti-edema</td>
<td>Organic iodine</td>
<td>-Anti-cellulite</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Decongestant</td>
</tr>
<tr>
<td>Anti-microbial</td>
<td>Polysaccharides</td>
<td>-Purifying</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Antiseptic</td>
</tr>
</tbody>
</table>

**RECOMMENDED DOSE**

The recommended dose is between 0.5% and 5.0%.

**BIBLIOGRAPHY**


Web sites: