

## Hydrolyzed Oat

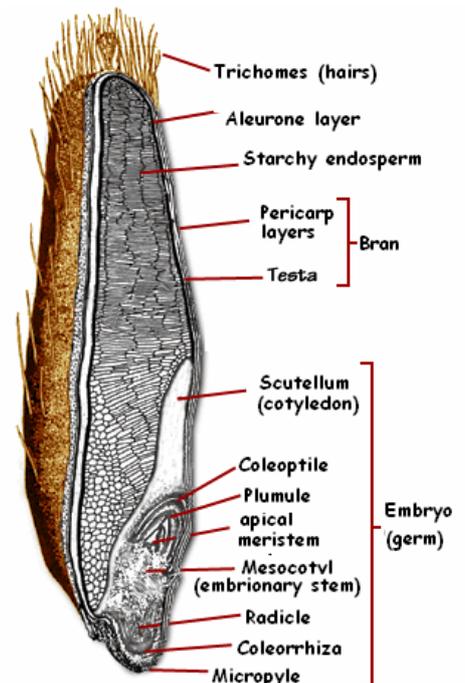


### BOTANY

*Avena sativa* L. Commonly known as oat. This annual herb – member of the Poaceae (Gramineae) family – typically grows 0.70-1.25m tall; leaves are alternate, lineal-lanceolate, plain, rough, 0.4-1cm wide, 15-30cm long. Short ligules with inflorescences, which are 15-25cm long terminal panicles, with 2cm long spikelets with 2 flowers each. Differently from other Poaceae plants, oat has pedunculated spikelets, which form branched, often bent inflorescences.

The fruit is a brown caryopsis, composed of the following parts:

- The hull, made of two structures called lemma and palea. It can be removed by milling the grains.
- The pericarp is the outermost layer that envelops the caryopsis. It is a thin layer, welded to the seed. Beneath the pericarp, there is the integument, or seed coat.
- The endosperm (nutritious tissue) and the embryo. The endosperm consists of the starchy endosperm and the aleurone layer. The embryo is attached to the endosperm by means of the scutellum; it bears the leaves and roots primordia (plumule and radicle).



Oat is native to southern Europe and Asia, although some have proposed that this plant is native to Sicily. It probably derives from the wild oat *Avena fatua* or from hybrids between the later and *Avena sterilis*. Nowadays, oat is cultivated in almost every temperate region in the world, especially in northern latitudes (lat. 45-65). Oat plants can be often found in the wild, coming from cultivation. It grows wild in Chile and Argentina. This plant is adapted to mountain regions, growing up to 1800m altitude in the Alps. About 25 different oat cultivars are known.

Hydrolyzed oat is obtained by controlled enzymatic hydrolysis from Oat protein.

## CHEMISTRY

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Hydrolyzed oat is especially rich in proteins.

The proteins in oat kernels include a globulin (avenalin), a prolamin (glutin), a glutelin (avenin), myosin, free amino acids (especially sulfur-containing ones) and a number of enzymes.

Table 1 shows the amino acids composition of total proteins in oat flour.

	<b>Amino acid</b>
Asx	4.9
Thr	3.8
Ser	6.0
Glx	24.8
Pro	14.3
Gly	6.0
Ala	5.1
Cys	1.5
Val	6.1
Met	1.6
Ile	3.7
Leu	6.8
Tyr	2.7
Phe	4.3
His	1.8
Lys	2.6
Arg	3.3
Trp	0.7
Amide groups	26.1

Table 1. Amino acid composition (% mol) of total proteins in oat flour (Belitz, HD. & Grosch, W., 1997).

In 1907, T.B Osborne separated the proteins in a wheat-flour sample into four fractions on the basis of their solubility, successively extracting: albumin with water, globulin with saline solution, and prolamin with 70% ethanol in water.

Table 2 shows the proportions of the Osborne fractions in oat proteins:

<b>Fraction</b>	<b>%<sup>a</sup></b>
Albumin	20.2
Globulin	11.9
Prolamin	14.0
Glutelín <sup>c</sup>	53.9

Table 2. Osborne fractions<sup>b</sup> in oat proteins (Belitz, HD. & Grosch, W., 1997).

<sup>a</sup>Calculated from amino acid analysis.

<sup>b</sup>Ash content in flour (calculated as % dry product): 1.0

<sup>c</sup>Protein residue after extraction of prolamin.

All of the vegetable proteins in the market are available as hydrolyzates with higher or lower average molecular weight. The “molecular weight” parameter must be defined as “average molecular weight” since the hydrolysis process never produces uniform peptides but a mixture of different peptides, whose molecular weights show a Gaussian distribution.

## TRADITIONAL USES

Archeological findings revealed oat grains in pile houses built during the Bronze Age. The seeds of *Avena fatua* (from which *Avena sativa* possibly derives) used to be harvested in the Nile. German peoples introduced it into Europe. Neither Romans, nor Egyptians nor Greeks knew this cereal. In China, oat was not cultivated until 1000 B.C. In the Formulary by Dujardin-Beaumont (1899) dehulled oat seeds were recommended as an excellent food for children’s healthy growth and vitality.

External applications of oat seeds have a helpful emollient effect in cases of skin irritation, seborrhea and different types of pruritus. Oat flour has long been used in cosmetics as an ingredient of face masks and as an additive of soaps to relieve irritation and itching. It has been claimed that the topical use of oat was discovered by chance, as a group of railway workers, who had been walking among dense bushes and abundant nettles, applied oat flour poultices on the rash they had on their hands. Oat flour preparations were also believed to leave a protective film on the skin.

## COSMETIC PROPERTIES

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### **Skin conditioning activity**

This activity is due to oat's proteins content.

Because of their polar nature, proteins easily bind water molecules through hydrogen bonds. When superficial moisturizing is involved, this action is almost not influenced by the molecular weight; however, if penetration and moisturizing of deeper skin layers is required, short-chain peptides – with lower molecular weights – are more effective.

Challoner, NI et al. (1997) evaluated the moisturizing effect of different proteins, including vegetable proteins and derivatives. In a first assay, they evaluated the moisturizing effects of an O/W emulsion containing 1% protein hydrolyzate. The results showed that the protein hydrolyzate-containing emulsion significantly increased skin immediate extensibility (Ei).

They also evaluated the lifting effects of two high molecular weight proteins in aqueous solution. The results showed that incorporating proteins into an aqueous formulation significantly decreased Ei during the treatment period. This finding could be explained by the capacity of proteins to form a coating film on the skin surface, which resulted in a lifting effect.

Thus, low molecular weight proteins are good moisturizers for deep skin layers and high molecular weight proteins – because of their filmogenic action – are good moisturizers for the skin surface, as well as good firming and soothing agents.

Additionally, regardless the molecular weight, all protein hydrolyzates and their derivatives improve the compatibility between tensioactive substances and skin/mucosa, thus reducing tensioactive-induced irritation (Griesbach et al., 1998).

Therefore, hydrolyzed oat is recommendable to formulate skin conditioning cosmetic products.

### **Hair conditioning activity**

Conditioning agents are expected to provide smoothness and shine to the hair, facilitate combing and reduce static electricity. A number of ingredients may be used to formulate hair conditioners including protein hydrolyzates (Dureja, H. et al., 2005).

Proteins protect the hair from environmental damage, repair and condition it, increase elasticity and reduce the risk of breakage (Griesbach U. et al., 1998).

Substantivity is a measure of a molecule's ability to establish bonds with the skin or the hair. Several studies have demonstrated the substantivity of protein hydrolyzates on the hair surface (Chahal, S.P., et al., 1999).

Proteins are polymer chains with hydrophilic groups (hydroxyl, carboxyl and amine groups), which easily bind water molecules. Protein hydrolysis generates more carboxyl- and amine-terminal groups, thus increasing water-retention under high relative humidity conditions.

Thus, because of their hydrophilic nature, protein hydrolyzates can retain water; the more hydrolyzed the protein, the higher the water-retention. Qualitative data have demonstrated higher water-retention and better regulation of water-absorption and release for protein hydrolyzate-treated hair (Chahal, S.P., 1999).

Low molecular weight proteins can penetrate to the hair-shaft cortex, thus repairing, strengthening and protecting it from the inside. High molecular weight proteins are good hair soothing and protecting agents, because of their ability to coat the hair-shaft surface (Huetter, I., 2003).

Therefore, hydrolyzed oat is recommended to formulate cosmetic products with hair conditioning and repairing activity.

## COSMETIC APPLICATIONS

Action	Active	Cosmetic Application
Skin conditioning	Proteins	-Skin conditioner
		-Moisturizer
		-Lifting effect
		-Filmogenic effect
Hair conditioning	Proteins	-Hair conditioner
		-Hair moisturizer
		-Hair repair

## RECOMMENDED DOSE

The recommended dose is between 0.5% and 5.0%.

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Web sites:

[www.fitoterapia.net](http://www.fitoterapia.net) [accessed June 2006].