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TECHNICAL INFORMATION

Catalog Number: 101815
Gluten, Wheat

Description: Wheat gluten is a water insoluble wheat protein concentrate that is prepared by removing starch from wheat flour and carefully drying the remaining high protein gluten in such a manner as to retain the native properties of the wheat gluten (vital wheat gluten).
The ability of wheat gluten to form a viscoelastic mass when fully hydrated sets it apart from all other commercially available vegetable proteins. Glutenin and gliadin, the two major protein components of wheat gluten, interact in an aqueous system to produce this viscoelastic property. Glutenin, the higher molecular weight protein fraction, contributes elasticity. Gliadin, of lower molecular weight, provides extensibility. These properties are summarized as follows:

Gliadin	**Glutenin**
Highly extensible	Less extensible
Less elastic	Highly elastic
Soluble in alcohols	Insoluble in alcohols
Low molecular weight (less than 100,000)	High molecular weight (greater than 100,000)
Intramolecular bonds	Intra & intermolecular bonds

The viscoelastic behavior of hydrated wheat gluten persists even in the presence of excess water because of the physico-chemical status of these molecular structures in aqueous systems. The dramatic difference in properties of wheat gluten in comparison with almost all other food proteins is largely due to the low level of polarity of the total amino acid structure. Polar grouping levels of 30-45% are normal for most food proteins and impart a net negative electrostatic charge. Wheat gluten, by contrast, has a polar group level of about 10%, with a resultant net positive charge.
The result of this reduced polarity is that excess water is repelled and the wheat gluten molecules associate closely together and resist dispersion.
The film forming property of hydrated wheat gluten is a direct outcome of its viscoelasticity. Whenever carbon dioxide or water vapor forms internally in a gluten mass with sufficient pressure to partially overcome the elasticity, the gluten expands to a spongy or cellular structure. In such structures, pockets or voids are created which are surrounded by a continuous protein phase to entrap and contain the gas or vapor.
This new shape and structure can then be rendered dimensionally stable by applying sufficient heat to cause the protein to denature or devitalize and set up irreversibly into a fixed moist gel structure or to a crisp fragile state, depending on final moisture content.
Wheat gluten heat coagulates at approximately 85°C.
Since wheat gluten is a complex of proteins it has no sharp isoelectric (minimum solubility and dissociation) point. There is thus no readily discernible point at which the positive and negative charges exactly balance. Because glutenin is essentially insoluble in water over normal pH ranges, wheat gluten tends to reflect the isoelectric behavior of gliadin in pH/solubility properties.
When gliadin is separately examined for pH/solubility criteria, it displays minimum solubility over the pH range 6.0-9.0. It is in this range that the cohesive, extensible network of wheat gluten is strongest. It is important to note that wheat gluten becomes more soluble in acid or alkaline dispersions.
Wheat gluten alone, when measured against the standard casein reference in rat bioassay, rates rather low on the Protein Efficiency Ratio (P.E.R.) scale. Values from 0.7 to 1.0 have been recorded, or 28% to 40% of the casein value. These values reflect a deficiency in the essential amino acid, lysine, a characteristic shared by most cereal grains. Addition of optimal amounts of lysine raises wheat gluten to a P.E.R. level of about 1.7, or nearly 70% of the casein value. Vegetable proteins in general rate low on the P.E.R. scale due to low contents of one or more essential amino acids. Blends of different vegetable proteins often result in higher P.E.R. values than the arithmetic average of the components. Such is the case with wheat gluten, low in lysine but high in methione and cystine, when blended with soy flour.
Soy flour, high in lysine but low in methionine, has a P.E.R. value of about 2.0. At a wheat gluten/soy flour protein ratio of 30:70, a P.E.R. value of 2.4 is achieved, or roughly three times the rating of wheat gluten alone. Similar effects are predictable for other food systems wherein excess lysine is available from meat, milk solids or other sources. Wheat gluten in combination with other proteins can have solid nutritional impact.

Typical Analysis:

Protein	75-80% (Dry Basis)
Moisture	5-8%
Fat (ether extract)	0.5 - 1.5% (Dry Basis)
Ash	0.8 - 1.2% (Dry Basis)

Water Absorption Capacity	150 - 200%
Total Nitrogen	12 - 13%
Fiber	< 1%

Typical Amino Acid Profile (g/100 g protein):

Arginine	3.01
Histidine	2.18
Isoleucine	4.13
Leucine	6.93
Lysine	1.42
Methionine/Cysteine	3.70
Phenylalanine/Tyrosine	8.85
Threonine	2.54
Tryptophan	1.01
Valine	4.26

Typical Vitamin Analysis:

Vitamin A	< 1 mg/100 g
Thiamin	< 1 mg/100 g
Riboflavin	< 1 mg/100 g
Niacin	< 1 mg/100 g
Vitamin C	< 1 mg/100 g

Reference:

The above description is an excerpt from Wheat Gluten: *A Natural Protein for the Future - Today* by the International Wheat Gluten Association, P.O. Box 8193, Shawnee Mission, Kansas 66208 (1981).