Collagen Peptides –
Innovative technologies for innovative ideas!
What are collagen peptides?

Collagen peptides are short chain protein building blocks produced by hydrolysis of native collagen. Depending on the applied enzymatic process, a characteristic pattern of collageneic fragments will be generated.

These peptides are defined and classified by their average molecular weight distribution and peptide profile. Independent from their molecular weight all collagen peptides are rapidly absorbed by the body by virtually 100% and provide high bioavailability. They are non–allergenic, easily digestible, and due to the fact they are classified as food, suitable for clean label products.

Collagen peptides are a pure source of protein that originates from collagen, a mammalian extracellular matrix protein. GELITA offers a versatile portfolio of different collagen peptides classified in Bioactive Collagen Peptides® which are optimized for a specific lifescience solution e.g. FORTIGEL® for Joint Health or FORTIBONE® for Bone Health and PEPTIPLUS® for protein enrichment and food technological purposes.

Due to their various chemical and physical properties GELITA® Collagen Peptides are ideal proteins to combine with other food ingredients for a variety of food applications.
Technological properties

- Excellent solubility
- Heat-stability
- Stable against food acids
- Brilliant clarity
- No precipitation or flocculation in liquid applications
- Low viscosity
- Neutral in taste and odor

GELITA’s portfolio also includes high molecular weight collagen peptides such as GELITA Collagel™ or GELITA Sol® DA, collagen peptides with high binding properties used for example as partial glucose replacer in cereal bars or for foam stabilization in smoothies.

GELITA® Collagen Peptides are tailor made proteins run through a safe and certified production process (ISO 9001, ISO 14001, ISO 50001 & FSSC 22000).

The key of this technology is the enzymatic step cutting the collagen into specific peptides.
Why to use GELITA® Collagen Peptides?

- Pure Food Protein (up to 98% protein in dry substance)
- Reg. (EC) No 853/2004
- Non Allergenic (Mammalian Source)
- Clean label
- Non GMO Products
- FDA GRAS status (Docket Number 77N-0232)
- KOSHER/HALAL (bovine origin)

GELITA® Collagen Peptides have a typical amino acid and nutritional profile and are free from fat, sugar, cholesterol, purines and additives (clean Nutritional Profile). They offer clean-label opportunities.

GELITA® Collagen Peptides have an excellent sensorial profile

Sensorial evaluation of PEPTIPLUS®, Whey and Soy on a scale of: 0 = not noticeable to 6 = strong

The powder and liquid form of collagen peptides show an excellent sensorial profile suitable for sophisticated applications like beverages or powder products.
What to know about collagen peptides?

Collagen peptides in powder form

Collagen peptides are delivered as agglomerated or fine powder. Both powder forms show excellent blending properties. Agglomerated powders offer the advantage of an improved solubility behavior.

Due to its coarse powder structure the agglomerated powders offer several advantages in food processing:

- Rapid dissolution
- No lump formation
- Dust-free handling
- Excellent flowability
- No cohesion or clogging
- High storage stability
- High batch-to-batch consistency

Excellent wettability and solubility of agglomerated powder.

Collagen peptides in liquids

In liquid applications collagen peptides are clear soluble compared to other proteins. They can be used over a wide range of concentrations and pH without loss of quality and performance.

At low protein concentrations all collagen peptides show almost the same low viscosity, independent from average molecular weight (or degree of hydrolysis). With increasing concentrations the viscosity increases, from watery to syrup like liquids. This allows them to be used as doctoring agent e.g. for protein bars and beverages.

With GELITA® Collagen Peptides it is possible to adapt individual mouthfeel and texture!
Due to their high buffer capacity collagen peptides in liquids guarantee pH stability when adding acidic or basic components.

The isoelectric point of collagen peptides ranges between 5 – 6. This is a typical value for proteins which means that collagen peptides can be combined with all other proteins in beverage applications.

Viscosity of different collagen peptides at 25°C.

The foaming of collagen peptides is dependent on the origin of the product. Bovine materials show a lower initial foam volume and foam stability compared to products processed from pig skin.

Buffer capacity of collagen peptides, pH after adding acid (HCL 0.1 mol/L) to the system.

Foam volume and stability (foam volume after 20 minutes) for different PEPTIPLUS® types with protein concentrations of 5%, 10% and 15%.
Collagen peptides are stable in food products and food supplements

There is no hydrolysis of collagen peptides over a longer period of time, over a pH range from pH = 3.8 to 7.0, common for most food products. Even at higher storage temperatures caused by climate conditions they are hydrolysis stable.

Due to these physicochemical properties GELITA® Collagen Peptides offer a wide spectrum to be used in food applications either in solid or liquid form. Even at high concentrations collagen peptides show hydrolysis stability and comparably high resistance against Maillard reactions.

Collagen peptides show excellent recovery rates in food products gone through the thermal and mechanical stress during the production process.
Collagen peptides powder can be combined with micronutrients like vitamins and minerals. In powder blends, long stability tests proved that all the ingredients are stable over at least a period of 3 years.

The diagram below shows there is no loss or degradation of the collagen peptide after going through the food production process.

Chromatographic profile of fruit gummy sample. GELITA® Collagen Peptides show no change in fruit gum applications compared to samples only with gelatine – neither in quantity nor in quality.
Beverage applications

Collagen peptides can be used for different beverage applications like near water drinks, carbonated drinks and drinkable yoghurt or whey beverages in concentrations up to 25%. In carbonated variants, carbondioxide concentrations were tested up to 5 g/l with protein concentrations up to 10%.

Bar applications

In bar manufacturing the GELITA® Collagen Peptides portfolio offers a wide range of possibilities to produce bars with different and special textures. For high protein, cereal or fruit bars – any of these applications are possible with collagen peptides.

GELITA® Collagen Peptides are used for:
- Protein fortification
- Water binding and texturizing effects
- Sugar reduction
  (low Glycemic Index, high protein)

Fermented products

In fermented products like yogurt or alcoholic beverages collagen peptides do not affect the fermentation process up to a concentration of 5%. The combination of collagen peptides with ferments is suitable and reveals excellent sensorial profile and texture of the food. Therefore collagen peptides can be added before or after the fermentation process as required by the production process.

5% GELITA® Collagen Peptides in milk was tested and fermented with a commercial available culture to yogurt. After 4h and 24h the pH was detected. Compared to the control (no added collagen peptide) the yogurt with collagen peptides showed similar fermentation times.

Also combinations with ingredients like polyphenols which are commonly used in healthy food mainly in juices fit with collagen peptides. Precipitation occurs when collagen peptides are used, but the reaction can be inhibited by adding a stabilizer.
**Comprimates and capsules**

Microencapsulation of vitamins or other water insoluble micronutrients is a well established technology possible in combination with collagen peptides.

Tableting of GELITA® Collagen Peptides performs well because of the powder structure and high bulk density. Tablets with 99% collagen peptides and 1% lubricant revealed very good dissolution and disintegration profiles.

- **Disintegration time in minutes**
  - PEP PLUS®
  - FORTIBONE®
  - FORTIGEL®
  - VERISOL®
  - TENDOFORTE®
  - MADYBALANCE®
  - GELITA® Collagel™
  - PEPTIPLUS®

Release profile – Disintegration of the tablet within 30 minutes in 0.2 N HCl, pH = 1.3; T = 37°C.

Long term stability tests of tablets revealed excellent dissolution profiles even after 3 years. Also no protein hydrolysis was detectable.

Collagen peptides are hydrolysis stable under the following conditions.

<table>
<thead>
<tr>
<th>Process</th>
<th>State</th>
<th>Collagen peptide concentration</th>
<th>Temperature/Time</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extrusion</td>
<td>Liquid (Aqueous)</td>
<td>up to 10%</td>
<td>174°C/1 s (pressure &gt; 1 bar)</td>
<td>≥ 3.8</td>
</tr>
<tr>
<td>UHT</td>
<td>Liquid (Aqueous)</td>
<td>up to 60%</td>
<td>140°C/3 s</td>
<td>≥ 3.8</td>
</tr>
<tr>
<td>Pasteurisation</td>
<td>Liquid (Aqueous)</td>
<td>up to 60%</td>
<td>70°C – 90°C/5 min</td>
<td>≥ 3.8</td>
</tr>
<tr>
<td>Heating</td>
<td>Solid (Powder)</td>
<td>90 - 100%</td>
<td>up to 80°C</td>
<td>5 – 6</td>
</tr>
<tr>
<td>Baking</td>
<td>Solid (Blend)</td>
<td>up to 10%</td>
<td>180°C/20 min</td>
<td>5 – 6</td>
</tr>
</tbody>
</table>
Make innovative product ideas a reality!

Profit from GELITA’s know-how and ask your service contact to provide you with the desired information.

GELITA offers a variety of basic recipes for innovative food technology solutions.

### Application

<table>
<thead>
<tr>
<th>Application</th>
<th>Use level*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein-Shots</td>
<td>30.0 - 45.0 %</td>
</tr>
<tr>
<td>Beverages – Powder Blends</td>
<td>0.5 - 50.0 %</td>
</tr>
<tr>
<td>RTD – Beverages – Carbonated</td>
<td>1.0 - 10.0 %</td>
</tr>
<tr>
<td>RTD – Beverages – Near Water</td>
<td>0.5 - 3.0 %</td>
</tr>
<tr>
<td>RTD – Beverages – Drinkable Yogurts/Whey</td>
<td>0.5 - 3.0 %</td>
</tr>
<tr>
<td>Smoothies</td>
<td>1.0 - 20.0 %</td>
</tr>
<tr>
<td>Squeeze</td>
<td>up to 50.0 %</td>
</tr>
<tr>
<td>Bars – Cereal</td>
<td>1.0 - 10.0 %</td>
</tr>
<tr>
<td>Bars – Protein</td>
<td>10.0 - 25.0 %</td>
</tr>
<tr>
<td>Powder</td>
<td>up to 100.0 %</td>
</tr>
<tr>
<td>Comprimates (e.g. Tablets, Lozenges)</td>
<td>50.0 - 99.0 %</td>
</tr>
<tr>
<td>Confectionary (Gummy Bears)</td>
<td>0.5 - 20.0 %</td>
</tr>
<tr>
<td>Yogurt</td>
<td>0.5 - 5.0 %</td>
</tr>
<tr>
<td>Desserts (Mousses, Puddings)</td>
<td>0.5 - 10.0 %</td>
</tr>
<tr>
<td>Ice Cream</td>
<td>0.5 - 10.0 %</td>
</tr>
<tr>
<td>Whipped Creams</td>
<td>0.5 - 5.0 %</td>
</tr>
<tr>
<td>Chocolate</td>
<td>5.0 - 10.0 %</td>
</tr>
<tr>
<td>Soups &amp; Sauces</td>
<td>0.5 - 10.0 %</td>
</tr>
<tr>
<td>Bakery (Muffins, Bread)</td>
<td>1.0 - 10.0 %</td>
</tr>
</tbody>
</table>

*Usage dependent on final product (e.g. desired texture, protein content)