

Collagen Peptides –  
Innovative technologies  
for innovative ideas!



**GELITA**  
Improving Quality of Life

# What are Collagen Peptides?

Collagen Peptides are functional short chains of amino acids produced by the simple hydrolysis of collagen protein. Depending on the applied enzymatic process, Collagen Peptides will deliver excellent solutions for food applications and specific health benefits.

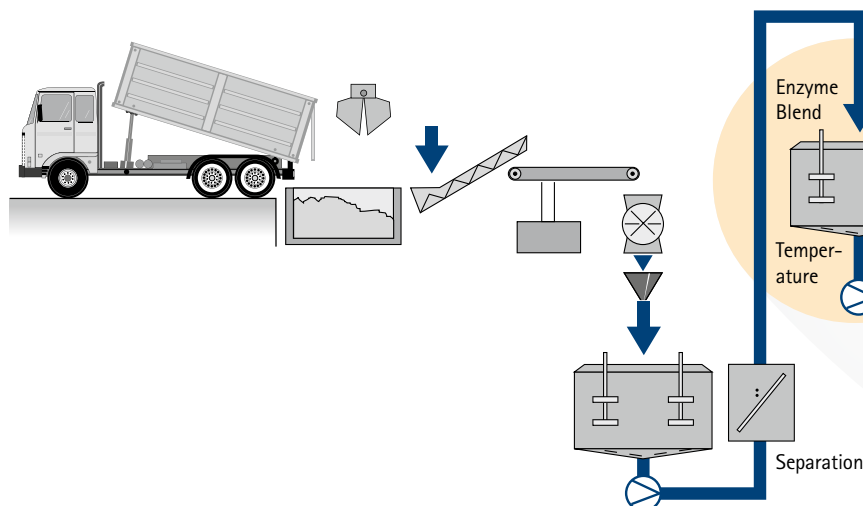
Collagen Peptides are characterized by their particular molecular weight distribution profile and high bioavailability. They are pure sources of collagen protein amino acids that are rapidly

digested and fully utilized by the body. Collagen Peptides are also non-allergenic and suitable for clean label products.

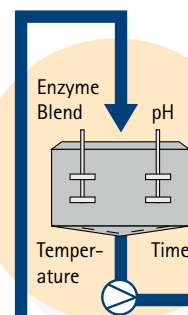
GELITA offers a versatile portfolio of different Collagen Peptides, including specific Bioactive Collagen Peptides®, which are optimized for targeted health benefits e.g. FORTIBONE® for Bone Health or VERISOL® for Beauty from within and TENDOFORTE® for Ligaments & Tendons. Collagen Peptides are a pure source of protein that originates from collagen, a mammalian extracellular matrix protein.

Due to their unique functionality GELITA® Collagen Peptides are ideal protein solutions to combine with other food ingredients for a variety of food and health & nutrition applications.

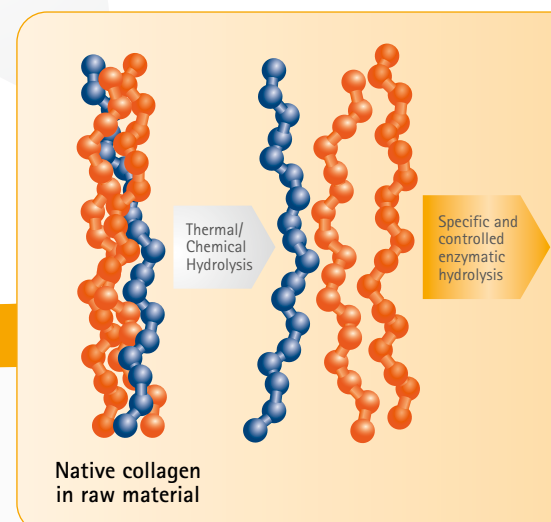
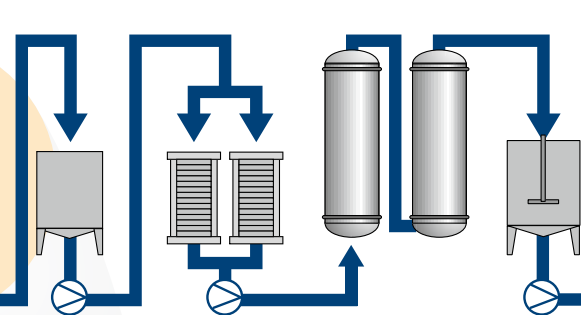
## Pretreatment of the Raw Material



## Enzymatic Process (Hydrolysis of collagen into specific peptides)



## Purification (Filtration, Demineralization)



### Advantages in food applications

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

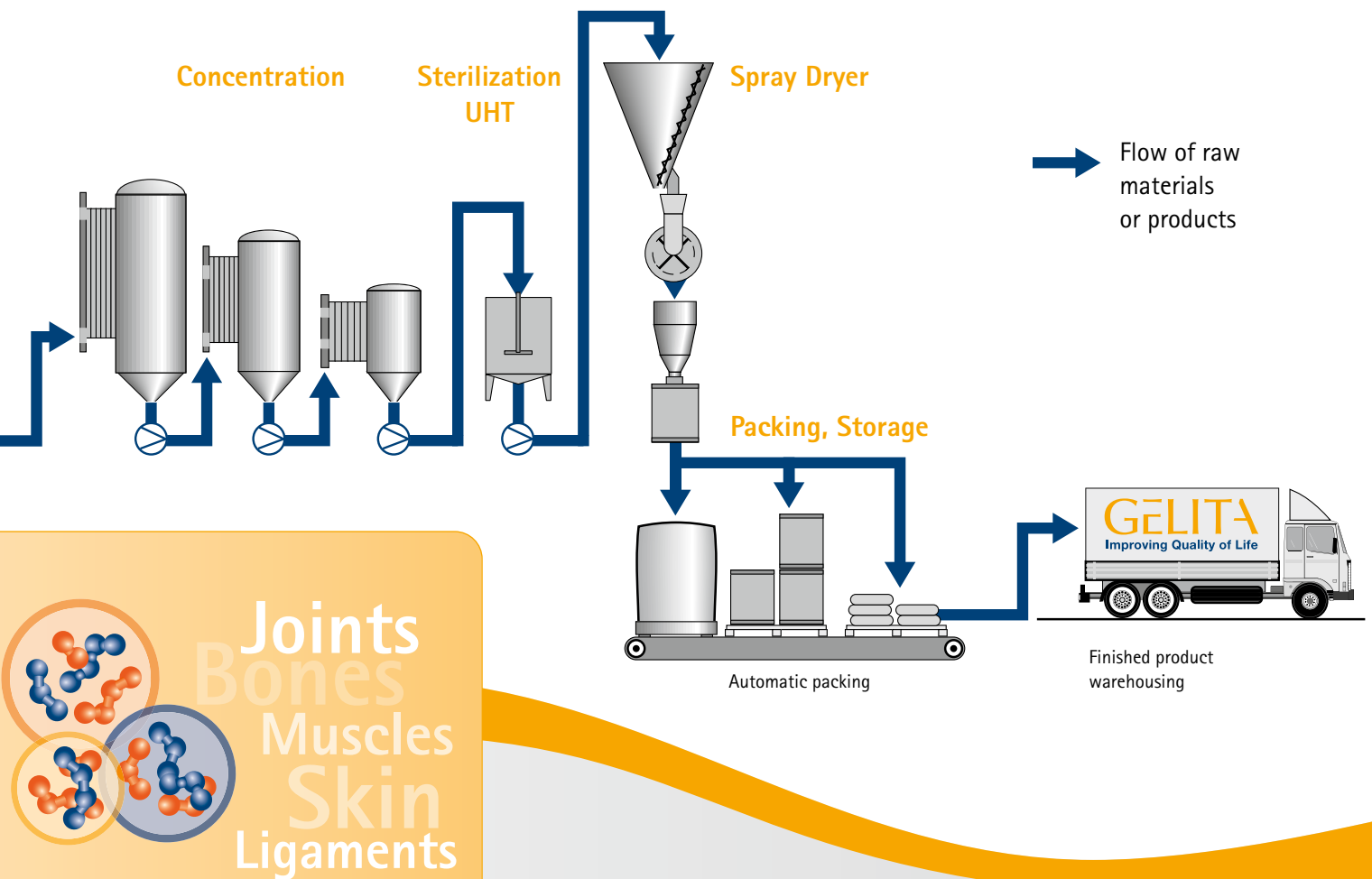
GELITA® Collagen Peptides are tailor made proteins fashioned by a safe and certified production process (ISO 9001, ISO 14001, ISO 50001 & FSSC 22000).

The key of this technology is the enzymatic step cutting the collagen into specific peptides.

### GELITA® Collagen Peptide Portfolio

|                     |       |                                           |
|---------------------|-------|-------------------------------------------|
| Beauty from Within  |       | VERISOL®<br>Beauty from Within            |
| Joint Health        | Human | FORTIGEL®<br>The Joint Health Revolution  |
|                     | Pet   | PETAGILE®<br>Feeding Mobility             |
| Bone Health         |       | FORTIBONE®<br>Collagen Matrix Stimulation |
| Ligaments & Tendons |       | TENDOFORTE®<br>For Connective Strength    |
| Body Toning         |       | BODYBALANCE®<br>Always in Shape           |
| Endurance           |       | PeptENDURE®<br>Performance Peptides       |
| Protein Enrichment  |       | PEPTIPLUS®<br>Collagen Protein            |

GELITA's portfolio also includes PEPTIPLUS®, a family of Collagen Peptide products, specialized for protein enrichment and technical food applications.



# Why to use GELITA® Collagen Peptides?

Collagen is a major component of the human body – making up about 30 % of our total body protein. Collagen is crucial for mobile joints, stable bones, healthy muscles, strong ligaments and tendons, smooth skin, glossy hair and healthy finger nails. It is one of the primary structural proteins of connective tissues and also abundant in blood vessels, intervertebral discs, the blood-brain barrier, the cornea, dentin and the intestinal wall – a vital component of our whole body.

## Bioactive Collagen Peptides® stimulate collagen metabolism

GELITA Bioactive Collagen Peptides® (BCPs) include a range of specific peptides optimized for targeted health benefits. They directly stimulate the metabolism of target connective tissue cells involved in collagen biosynthesis. Furthermore, as all GELITA® Collagen Peptides they provide a number of physiological and technical benefits making them the perfect supplement to realize innovative product ideas in the fields of health, beauty and sports nutrition.



## Bioactive Collagen Peptides®

|                       |                                       |              |
|-----------------------|---------------------------------------|--------------|
| Skin Health           | Fibroblasts                           | VERISOL®     |
| Joint Health          | Chondrocytes                          | FORTIGEL®    |
| Bone Health           | Osteoblasts/<br>Osteoclasts           | FORTIBONE®   |
| Ligaments/<br>Tendons | Ligamentocytes/<br>Tenocytes          | TENDOFORTE®  |
| Body Toning           | Muscle cells<br>resistance exercise   | BODYBALANCE® |
| Endurance             | Muscle cells<br>endurance performance | PeptENDURE®  |

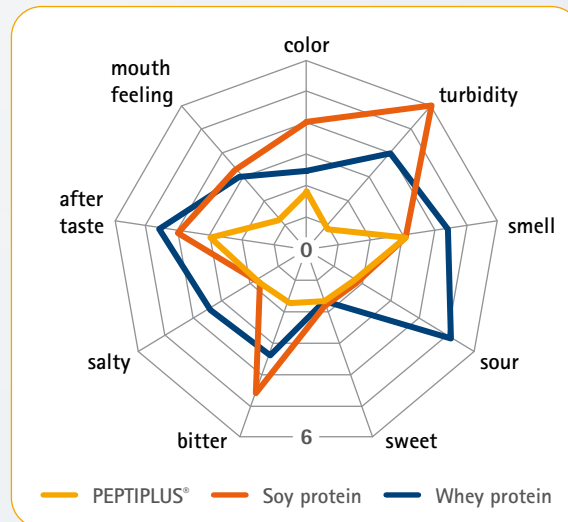


# Which benefits provide GELITA® Collagen Peptides?

- Pure Food Protein (up to 98 % protein in dry matter)
- Safe according to 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 consistent typical amino acid and nutritional profile and are free from fat, sugar, cholesterol, purines and additives. 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.

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## Technical Product Data

### PEPTIPLUS® XB aggl.

Comprising PEPTIPLUS® XB aggl., PEPTIPLUS® XB (SA) aggl., PEPTIPLUS® XB (US) aggl., PEPTIPLUS® XB (NL) aggl.

**Product description:**  
PEPTIPLUS® XB aggl. are highly purified Collagen Peptides from bovine skin. The average molecular weight is between 2,500 – 4,000 g/mol.

**Characteristics:**  
Light colored, agglomerated powder with a bulk density between 270 – 400 g/L. Specifically neutral in taste and odor, excellently soluble in cold and warm water. PEPTIPLUS® XB aggl. is pure collagen protein with an extremely low mineral content and is free of fat, cholesterol, carbohydrates, and dietary fibers.

**Application and Service:**  
PEPTIPLUS® XB aggl. is suitable for protein enrichment in food such as bars, gums and beverages.

**Shelf life:**  
Under dry and odorless conditions PEPTIPLUS® XB aggl. can be stored in the original unopened packaging at ambient temperatures (< 30°C) for 5 years without loss of quality.

**Packaging:**  
Multi-ply paper bags with PE-liner containing 15 kg net.

## PEPTIPLUS® Collagen Protein

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**Nutritional profile (per 100g):**

| Parameter              | Typical value      |
|------------------------|--------------------|
| Moisture               | 1.550 g            |
| Energy value (average) | 1550 kJ (369 kcal) |
| Protein                | 91.0 g             |
| Carbohydrates          | 0.0 g              |
| Fat                    | 0.0 g              |
| Cholesterol            | 0.0 g              |
| Sodium                 | 0.0 g              |
| Calcium                | 0.0 g              |
| Phosphorus             | 0.0 g              |
| Iron                   | 0.0 g              |
| Copper                 | 0.0 g              |
| Zinc                   | 0.0 g              |
| Chromium               | 0.0 g              |
| Manganese              | 0.0 g              |
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| Chlorine               |                    |

# Why use GELITA® Collagen Peptides as a protein source?

PEPTIPLUS® is used in finished products for optimal texture and taste, it also adds extra collagen protein as a rich source of the key amino acids building blocks of collagen in the body.

## The human body requires an appropriate amino acid balance

The body requires a balance of different amino acids to maintain optimal function, structure and health. A well-balanced, high quality protein diet can meet the basic needs for all the essential amino acids. But, as people today live a dynamic and more active lifestyle, also aspiring to live longer and in good health, extra demands are put on the body, notably on the structure of the connective tissue.

These extra demands may increase the needs for collagen amino acids to amounts that are above the normal intakes through today's diets, and beyond the body's capacity to produce such conditionally essential amino acids at the rates required.

## PEPTIPLUS® – a source of conditionally essential amino acids

PEPTIPLUS® is particularly rich in the conditionally essential amino acids Proline and Glycine. These are not found in abundance in any other protein source, but are very important building blocks of the body's own collagens.

A regular supply of proline and glycine plays a largely neglected role in maintaining the integrity of the body's collagens and in offsetting the high physical and metabolic demands posed on the connective tissue, daily. Dietary supply of collagen amino acids is also important to stop the extra stress put on the body to produce these amino acids itself.

However, people are increasingly adopting a diet that is low in collagen. For example, collagen can be completely absent from the diet of vegetarians and vegans, or significantly reduced in diets that allow only for the lean cuts of meat, creating a real need for alternative ways to consume collagen amino acids naturally, such as in high protein bars, shakes or drinks.

## Reaching daily amino acid balance with PEPTIPLUS®

| PEPTIPLUS® is a natural source of conditionally essential amino acids, rich in proline and glycine |                                                        |                                                                                                                                           |
|----------------------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Amino acids                                                                                        | PROLINE                                                | GLYCINE                                                                                                                                   |
| % in PEPTIPLUS®                                                                                    | 25 %                                                   | 30 %                                                                                                                                      |
| Average % in a range of protein sources                                                            | 4.5 %                                                  | 7.5 %                                                                                                                                     |
| Benefits                                                                                           | Maintains a healthy turn-over of whole body collagens. | Versatile amino acid that protects all tissues from wear and tear. Important for reaching adequate glycine-to-methionine dietary balance. |

## Reaching perfect protein balance with GELITA® Collagen Peptides

Enriching the diet with Collagen Peptides at up to 36 % of the total daily protein intake, contributes to a better nutritional balance of the 20 dietary amino acids, while maintaining the high protein quality score of the diet (PDCAAS = 1.0) (Paul *et al.*, 2019).

Finished products rich in protein often provide 10 to 30 g of protein per portion. Replacing about 30 % of the total protein by GELITA® Collagen Peptides results in an amino acid profile that is more balanced and varied than each single protein source alone. Such improved protein combinations can better prepare the body for today's dynamic and active lifestyles.

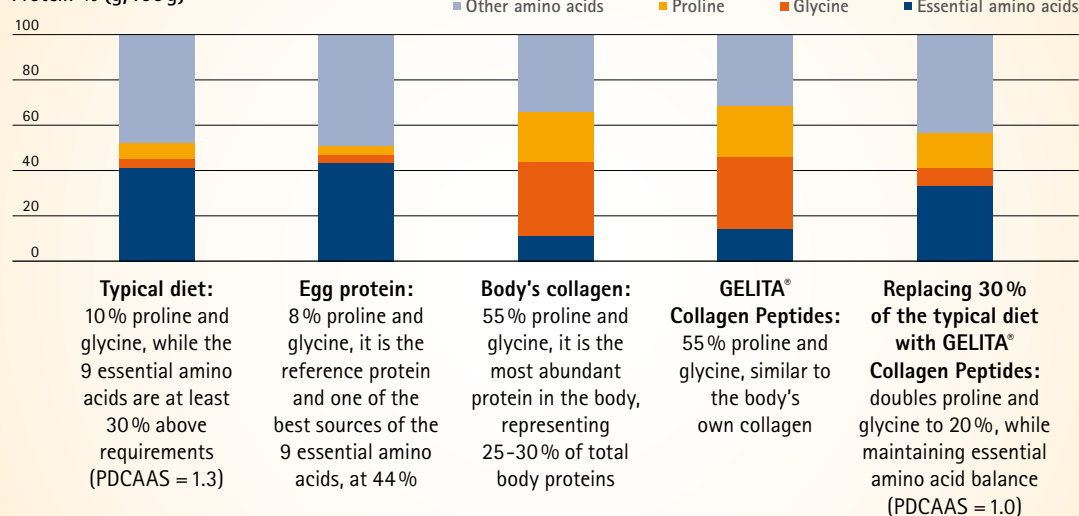
Enriching with about 30 % GELITA® Collagen Peptides for optimal amino acid balance (PDCAAS = 1.0)

| Total protein per portion | Of which GELITA® Collagen Peptides |
|---------------------------|------------------------------------|
| 10 g                      | 3 g                                |
| 15 g                      | 5 g                                |
| 20 g                      | 6 g                                |
| 25 g                      | 8 g                                |
| 30 g                      | 10 g                               |



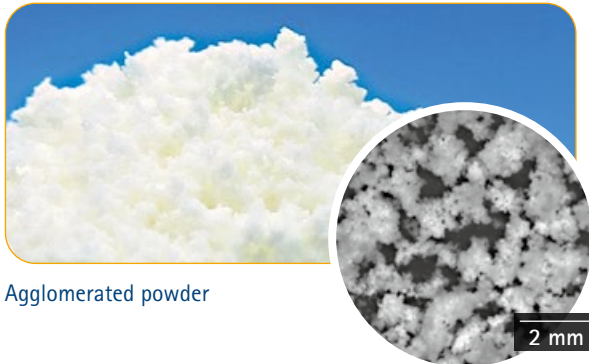
## ! Collagen Peptides contributes to better amino acid balance

Protein % (g/100 g)



Adapted from Paul *et al.* (2019). Significant amounts of functional Collagen Peptides can be incorporated in the diet while maintaining indispensable amino acid balance. *Nutrients*, 11(5).

# What to know about Collagen Peptides?



Agglomerated powder



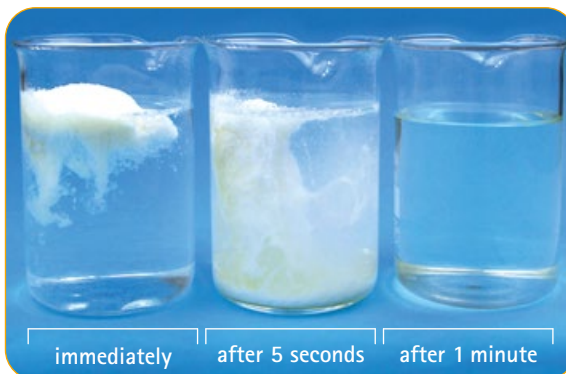
Fine powder

## Collagen Peptides in powder form

Collagen Peptides are delivered as agglomerated or fine powder. Both powder forms show excellent blending properties.

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 and soluble in concentrations up to 40 %. They can be used over a wide range of concentrations and pH without loss of quality and performance.

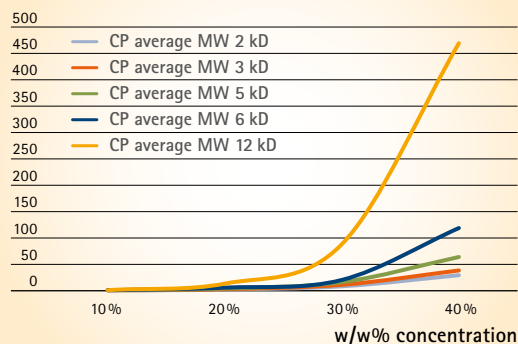
At low protein concentrations all Collagen Peptides show almost the same low viscosity, independent from average molecular weight (or degree of hydrolysis). With increasing concentrations the viscosity increases, from watery to syrup like liquids. This allows them to be used as a flexible tool to adapt mouthfeel and texture e.g. for protein bars and beverages.

With GELITA® Collagen Peptides it is possible to adapt individual mouthfeel and texture!



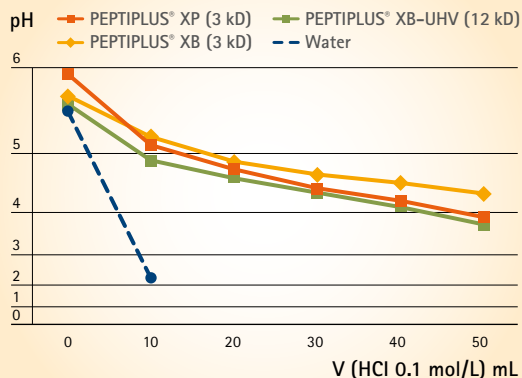


Viscosity [mPas]



Viscosity of different Collagen Peptides at 25°C.

Due to their high buffer capacity Collagen Peptides in liquids guarantee pH stability when adding acidic or basic components.

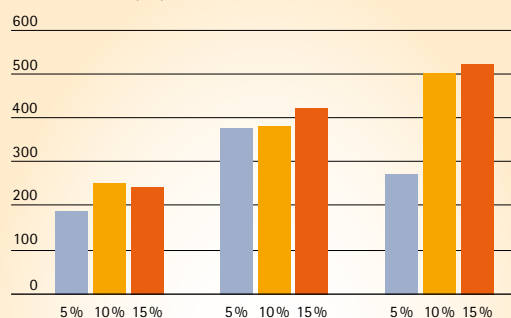


Buffer capacity of Collagen Peptides. pH after adding acid (HCL 0.1 mol/L) to the system.

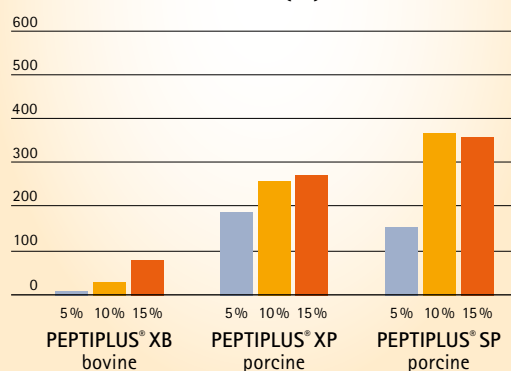
The isoelectric point of Collagen Peptides ranges between 5 – 7. This is a typical value for proteins which means that Collagen Peptides can be combined with all other proteins in beverage applications.

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.

Foam volume (ml)



Foam volume after 20 minutes (ml)

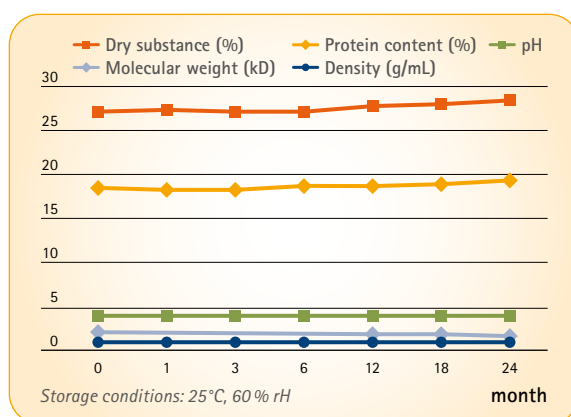


Foam volume and stability (foam volume after 20 minutes) for different PEPTIPLUS® types with protein concentrations of 5%, 10% and 15%.



## Collagen Peptides are stable in food products and food supplements

There is no hydrolysis of Collagen Peptides over a longer period of time, across 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 stable.

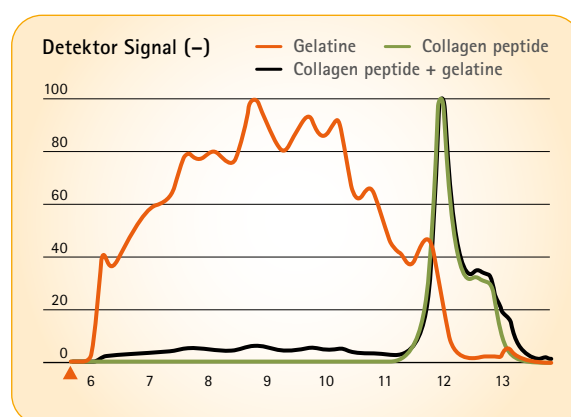


Stability test over a period of 24 months of a market product (concentrated beverage shot) with 25% VERISOL® and other ingredients like sucrose, tartaric acid, citric acid, beta-carotene, potassium sorbate, sodium benzoate, flavor, zinc citrate, retinyl acetate, biotin, sodium selenite.

Due to these physicochemical properties GELITA® Collagen Peptides offer a wide spectrum to be used in food and health & nutrition 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 passing the thermal and mechanical stress during the production process.

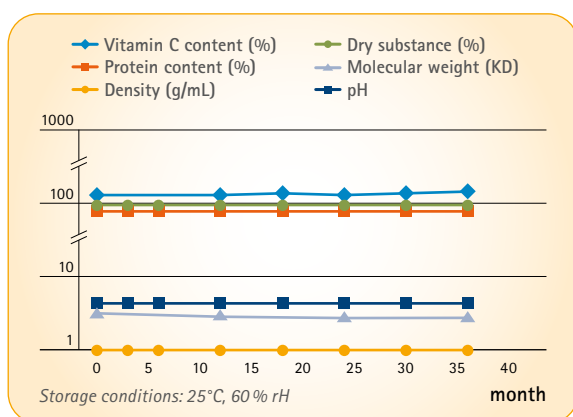
In various food applications e.g. soups, extruded products or gummy bears fortified with GELITA® Collagen Peptides, the protein was tested for degradation and was found to be stable both qualitatively and quantitatively.



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.

Collagen Peptides powder can be combined with micro-nutrients 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.





Long term stability test of a powder blend with vitamin C (market product). Ingredients: 90 % FORTIGEL®, flavor + beta-carotene, citric acid, orange flavor, ascorbic acid, sucralose.

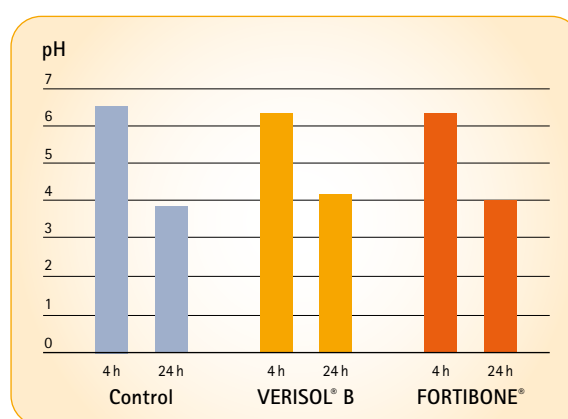
## Beverage applications

Collagen Peptides can be used for different beverage applications like near water drinks, carbonated drinks and drinkable yogurt 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 %.



## Fermented products

GELITA® Collagen Peptides will not affect the fermentation process of products like yogurt or alcoholic beverages when used 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 manufacturing process.



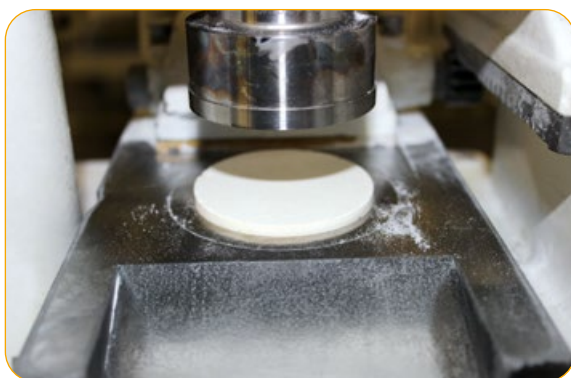
A milk fortified with 5 % GELITA® Collagen Peptides, fermented with a commercially available culture to yogurt, showed similar fermentation times to a milk-only control, as indicated by similar pH values after 4 h and 24 h.

GELITA® Collagen Peptides can be used in synergy with a broad range of healthy food ingredients and across a number of different food applications. In combination with some juices containing polyphenols precipitation might occur which can be overcome by adding a stabilizer.

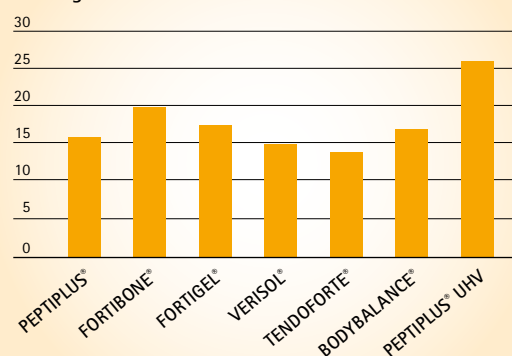


## Comprimates and capsules

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



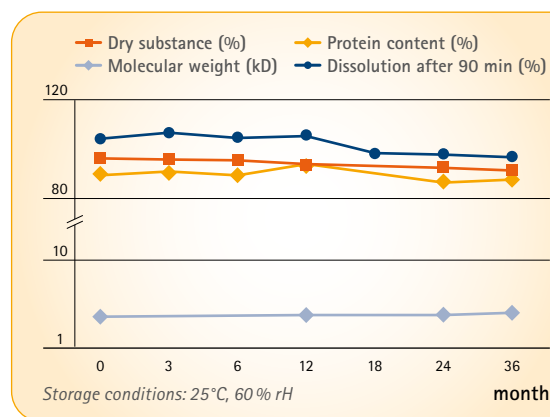
Disintegration time in minutes



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.

Tableting of GELITA® Collagen Peptides performs well offering multiple formats. Tablets with 99 % Collagen Peptides and 1 % lubricant revealed very good dissolution and disintegration profiles.



Long term stability test of a market product (tablet).  
Ingredients core: 90 % VERISOL®, 1 % Magnesium Stearate;  
coating: coating agent pink-red, Hydroxypropyl-methyl-cellulose, water, colour.

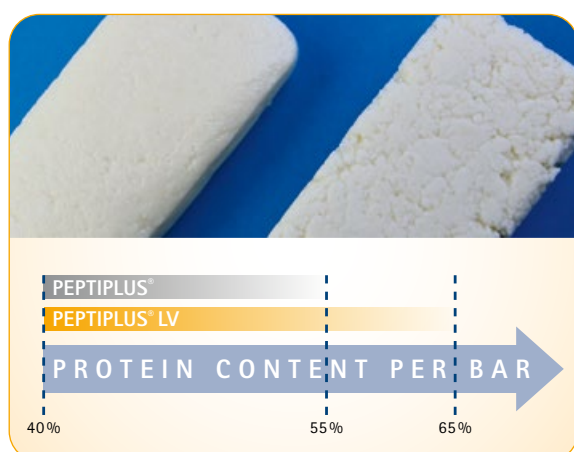




## Bar applications

For bar manufacturing the GELITA® Collagen Peptides portfolio offers a wide range of possibilities to produce bars with different and special textures.

In addition to the well-known PEPTIPLUS® we can offer specialized variants such as PEPTIPLUS® LV (low viscosity), PEPTIPLUS® HV (high viscosity) and PEPTIPLUS® UHV (ultra high viscosity). These can easily be used as softener for high protein bars and to reduce sugar in cereal and granola bars, respectively.




PEPTIPLUS® LV has been developed both to enable superior protein bar textures and to lift the protein content of the bars over 60 %. The selection of PEPTIPLUS® and variants from the portfolio depends on the formulation, ingredients and protein content.

Great tasting protein and cereals bars might be given an extra benefit by adding GELITA Bioactive Collagen Peptides®.

To replace glucose in cereal, granola or nut-bars and thus to exchange conceptionally carbohydrates against proteins to achieve protein enrichment and/or carbohydrate reduced products, PEPTIPLUS® can be used as well. This "binding" or "glue" property of Collagen Peptides is best achieved by using the high and ultra-high variances of PEPTIPLUS® (PEPTIPLUS® HV & UHV).



## Stability Overview

 Collagen Peptides are resistant to hydrolysis under the following conditions

| Process        | State            | Collagen peptide concentration | Temperature/Time             | pH    |
|----------------|------------------|--------------------------------|------------------------------|-------|
| Extrusion      | Liquid (Aqueous) | up to 10 %                     | 174°C/1 s (pressure > 1 bar) | ≥ 3.8 |
| UHT            | Liquid (Aqueous) | up to 60 %                     | 140°C/3 s                    | ≥ 3.8 |
| Pasteurisation | Liquid (Aqueous) | up to 60 %                     | 70°C – 90°C/5 min            | ≥ 3.8 |
| Heating        | Solid (Powder)   | 90 – 100 %                     | up to 80°C                   | 5 – 6 |
| Baking         | Solid (Blend)    | up to 10 %                     | 180°C/20 min                 | 5 – 6 |



# Excellent Quality and Leading Expertise

As the leader in the collagen peptide market GELITA's mission is to provide highest and consistent quality for products and services on a global basis in close customer proximity. Our comprehensive peptides portfolio and technological know-how provides a broad spectrum of technological and physiological opportunities for successful products.

## High sensorial characteristics

Globally renowned for consistently neutral taste and odor, all GELITA® Collagen Peptides are consistently reliable performers. Rest assured of the cleanest, most neutral impact on your finished products.

## Religious Certifications

GELITA recognizes the value and the necessity of offering uniquely certified Collagen Peptides to meet the world's diverse ethnic and religious demands. Collagen Peptides from GELITA are available with these leading global certifications:

- OU Kosher
- KO Kosher
- IFANCA
- CDIAL
- and many more



Islamic Food and  
Nutrition Council  
of America

## Animal Raising

Grass-fed and Pasture-Raised cattle e.g. from the vast free-range grasslands of South America or lush pastures of North America are the basis for a variety of GELITA® Collagen Peptides.

## Varied Options

With a robust portfolio of uniquely different Collagen Peptides, GELITA offers Collagen Peptides for diverse needs for technical performance and protein enrichment. Each of GELITA's Collagen Peptides is specially produced for the desired results. Within the broad category of protein enrichment, the PEPTIPLUS® brand features numerous options to support diverse product formulations and to meet discriminating consumer preferences.

|                      |        | PEPTIPLUS® |           |          |       |
|----------------------|--------|------------|-----------|----------|-------|
|                      |        | bovine     |           | porcine  |       |
|                      |        | hide       | ossein    | skin     | mixed |
| Xtra<br>(Premium)    | aggl.  | XB aggl.   | XBB aggl. | XP aggl. | –     |
|                      | powder | XB         | XBB       | XP       | –     |
| Standard             | aggl.  | SB aggl.   | –         | SP aggl. | –     |
|                      | powder | SB         | –         | SP       | SM    |
| Low Viscosity        | aggl.  | B-LV       | –         | –        | –     |
| High Viscosity       | powder | B-HV       | –         | P-HV     | –     |
| Ultra-High Viscosity |        | B-UHV      | –         | P-UHV    | –     |

PEPTIPLUS® is the all-round collagen peptide from GELITA. Used in finished products for optimal texture and taste, it also adds extra collagen protein as a rich source of the key amino acids building blocks of collagen in the body.

## Global Network

With GELITA's network of global production, we ensure reliability and proximity of supply – important in reducing risks in your supply chain.

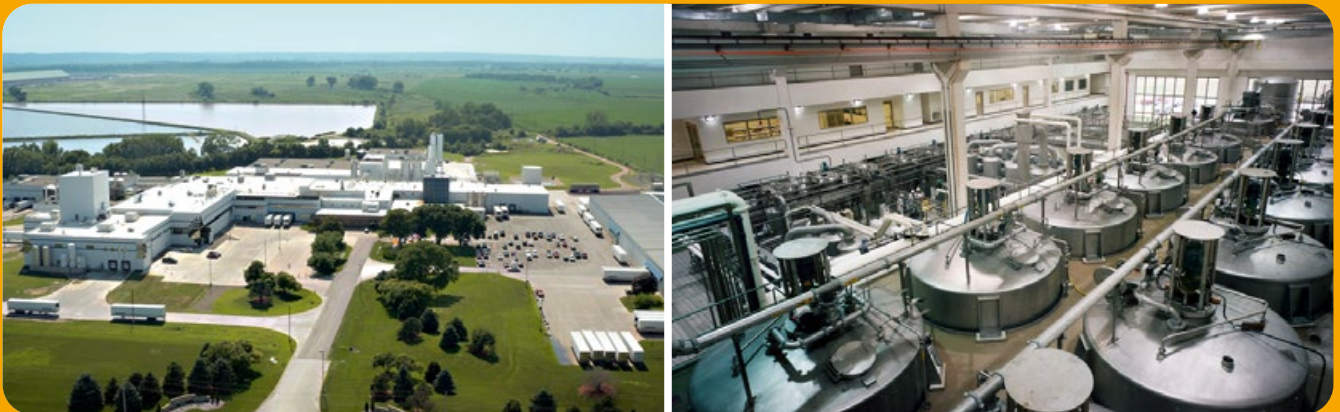
## Sustainability

Our goal is to find and to implement the best solution for people and the planet. The company therefore invests in state-of-the-art facilities in its plants, seeking innovative solutions to improve processes and thus reduce the impact of its business operations on the environment.

# Global Reach + Local Presence




Production plant Sioux City Iowa, USA, the biggest collagen plant in the world



Production plant Liaoyuan, China



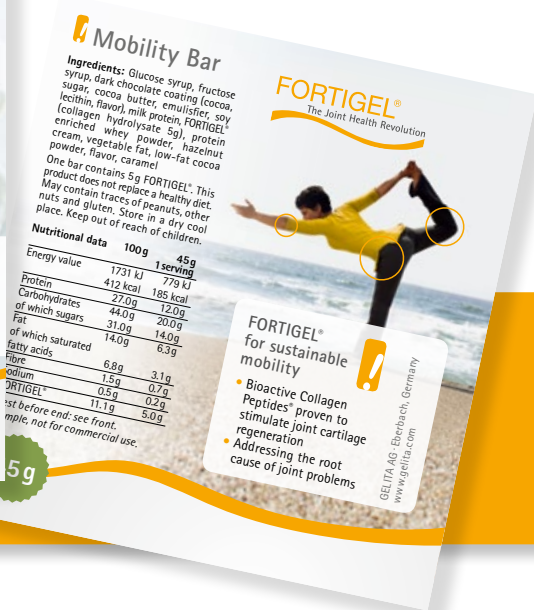
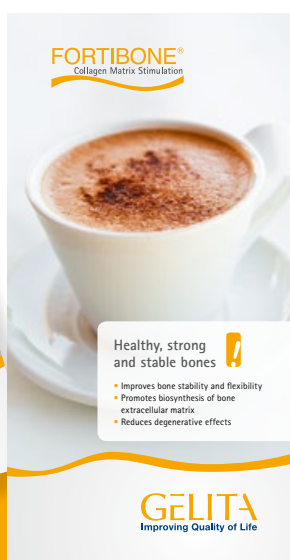
# Make innovative product ideas a reality!

 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 application solutions.

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

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



These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure or prevent any disease. The information contained herein is for business and informational purposes only. Although the information provided is, to the best of our knowledge, truthful and accurate, GELITA does not guarantee its accuracy. Companies desiring to incorporate any structure/function claim in product labeling or advertising must consult with appropriate legal counsel to ensure any such claim is lawful and substantiated for the specific product marketed. GELITA assumes no responsibility for buyer's product claims.

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**GELITA**  
Improving Quality of Life