TECHNICAL NOTE

SUMMARY

- Demand grows for collagen food ingredients that support joint, skin and bone health
- *COLLinstant active*® collagen peptide hydrolysate is produced with an advanced technology that regulates peptide length, particle size and morphology to optimize solubility
- A proprietary drying technology yields a low-dust, high-wettability formula for clean and easy dosing and flexible food processing



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ADVANCED PRODUCTION ENSURES OPTIMAL FOOD PROCESSING & PRODUCT FEATURES OF *COLLINSTANT ACTIVE*® COLLAGEN PEPTIDES

Key parameters control peptide size, cold-water solubility, low dust properties, taste & digestibility

As an abundant extracellular matrix protein that supports cell attachment, function and survival, collagen plays an important role in the maintenance of healthy cartilage, bones and resilient skin. A loss of the protein due to advanced age, inflammatory processes, or overstress due to high sportive exertion or overweight can lead to joint pain with reduced mobility, brittle bones and dry skin with increased wrinkle formation. However, collagen production in the body can be enhanced by food supplementation with collagen peptides.

HIGH DEMAND FOR EASY-TO-USE AND EASY-TO-PROCESS COLLAGEN HYDROLYSATE

Collagen peptides as supplements in drinks or food are becoming increasingly popular in an aging global population. Health- and beauty-conscious consumers want to promote joint and bone function and to counteract the effects of skin aging. As a daily supplement in drinks or smoothies, a pleasant taste, good digestibility and easy preparation is obligatory. For the latter, rapid solubility of the peptide hydrolysate is key for customers' convenience. To deliver optimal products, manufacturer of protein-enriched foods require collagen peptides that are universally usable for all taste- and texture-compositions: a hydrolysate with optimal processing properties with regard to solubility, dispersing and dosing.

This technical note provides a brief overview over Viscofan's advanced production process of the *COLLinstant active*® collagen hydrolysate.

PROPRIETARY EXTRACTION OF PURE TYPE I PEPTIDES FROM PREMIUM RAW MATERIAL

Viscofan produces collagen products at industrial scale for more than 90 years and has established an advanced technology for the production of its premium collagen peptide hydrolysate *COLLinstant active*® (FIG. 1). It starts with raw material of highest quality – bovine skin from traceable sources – that is split to obtain the collagen-rich dermal layer. In a proprietary process, very pure collagen type I fibers are extracted, thereby preserving their natural structure.

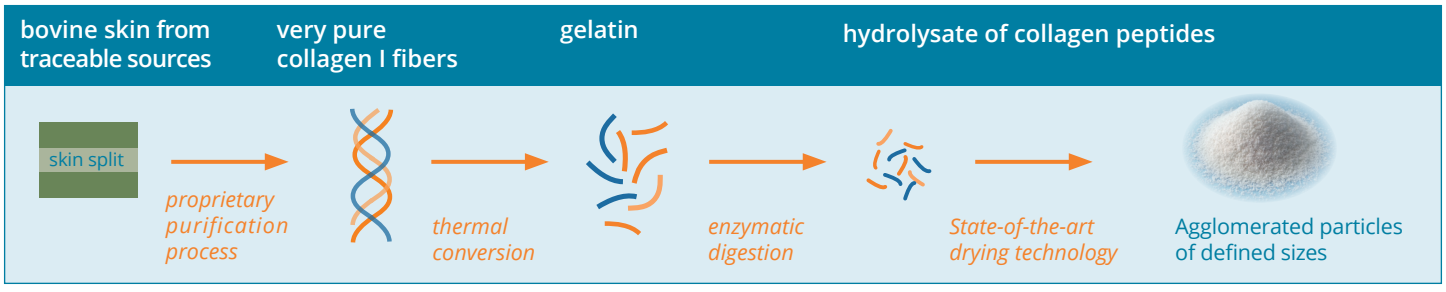


FIG 1: *Advanced technology for the production of premium collagen peptides*

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By gentle thermal conversion, collagen fibers are opened up and processed to shorter protein subunits called gelatin. Enzymatic digestion of gelatin generates hydrolyzed small peptides – the readily bioavailable source of collagen-specific building bricks for the body. The last production step employs a state-of-the-art drying technology that yields agglomerated collagen peptide particles of defined size.

The resulting collagen peptide hydrolysate *COLLinstant active*® is highly soluble even in cold water, exhibits neutral taste, is easily digestible and ensures best processability properties, such as clean, easy dosing and free-flowing & low-dust properties.

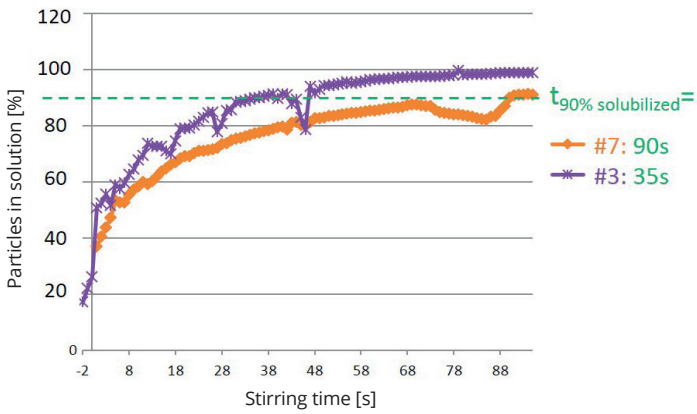
INFLUENCES ON SOLUBILITY KINETICS: PEPTIDE LENGTH & PARTICLE SIZE

The solubility of peptide powders can be enhanced by decreasing peptide length (FIG. 2). This can be controlled by the type of hydrolyzating enzymes, their concentration and residence time. Short peptides are also advantageous for digestibility. However, a peptide length below a molecular weight of 1000 Da (approx. 11 amino acids) should be avoided, since these short peptides confer a bitter taste.



FIG 2: *Inverse correlation of collagen peptide length and solubility.*

Peptides can be preserved for years as a dried powder with particle size having a great impact on solubility kinetics. To compare the solubility of powder particles with different sizes (FIG. 3 right), solubility kinetics were analyzed in real-time and the time until 90% of total solubility (t90% solubilized) is reached was determined (FIG. 3 left). The solubility profiles show that small granulated particles (#3) need less time to reach 90% solubility (35 s) than large granulated particles (#7, approx. 85 s). Due to their higher surface area small particels are more susceptible to water molecules and therefore exhibit higher solubility kinetics.



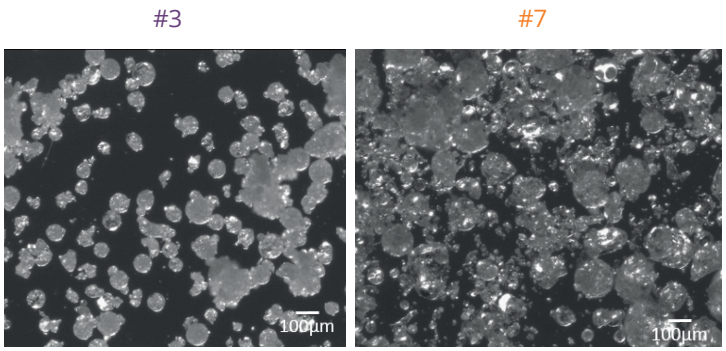


FIG 3: *Left graph: Solubility kinetics under standard conditions, measured in real time. Right panels: Microscopic analysis of a competitor product composed of small (#3) or large (#7) granulated particles.*

INFLUENCES ON SOLUBILITY KINETICS: PARTICLE MORPHOLOGY

However, small granulated particles tend to exhibit low wettability (FIG. 4) which counteracts rapid solubility. Additionally, they develop a lot of dust and show low free-flowing properties. This can lead to problems in downstream processing such as inaccurate dosing, elaborate sachet sealing, need for extra packaging material and for frequent cleaning intervals. All these challenges slow down production and increase waste.

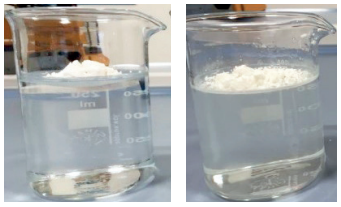


FIG 4: *Fine powder of small granulated particles exhibits low wettability and thus stays on the surface (left) even after stirring (right).*

THE ART OF AGGLOMERATION

Viscofan uses a state-of-the-art drying technology to solve the problem of low wettability and dust: During the last step, small granulated particles are assembled to blackberry-like agglomerates. Under well controlled conditions in hot air, collagen particles are mixed with sprayed small drops of a binder solution which builds small, stable connections between the particles (FIG. 5). These agglomerated particles are highly soluble due to the open structure, the small volume and the large surface area of their subunits. At the same time, the free flowing, stable aggregates sink quickly in aqueous solutions and provide an optimal powder density that enables low dust processing.

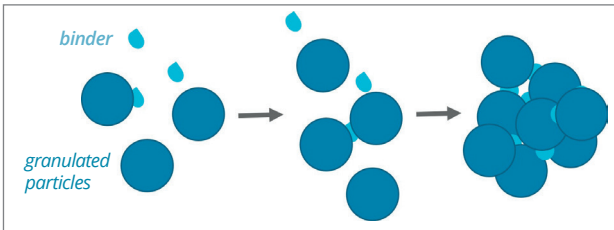


***FIG 5**: Agglomeration process. Granulated particles of collagen peptides are mixed with drops of a binder solution in hot air.*

The speed of the drying process is critical: if it is too fast or slightly too slow, the particles don't have time to meet or break apart again, respectively. As a result, the binder dries on the particles, increasing particle size and thus decreasing solubility (FIG. 6, left side). If the drying process is too slow, binder and particles simply accumulate at the bottom of the reactor in a slurry (FIG. 6, right side).

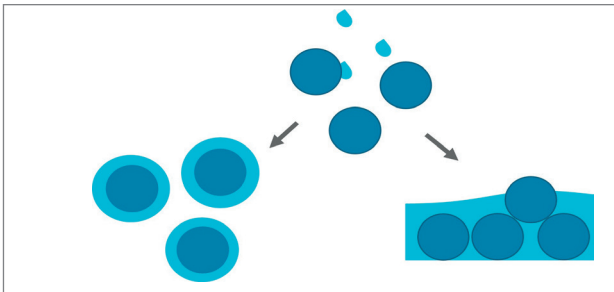


***FIG 6**: Non-successful agglomeration. Left: Drying process too fast or slightly too slow – binder dries on particles without establishing stable inter-particle connections. Right: Drying too slowly – binder solution and particles accumulate at bottom.*

Microscopic appearance and dissolving kinetics of different collagen hydrolysates were compared (FIG. 7). In two competitor products, large round particles (yellow arrows) are visible, generated presumably by accumulation of binder solution (as depicted in FIG. 6, left). Also, a mix of smaller particles and irregular aggregates can be observed (FIG. 7A and B). In product #4, a large amount of small-sized debris is visible, presumably generated by disruption of larger units. These particle properties lead to a 2- to 3-fold slower solubility kinetics of the competitor products compared to *COLLinstant active*® (FIG. 7D), which has a high degree of agglomeration efficiency and exhibits virtually no debris in microscopic analysis (FIG. 7C).

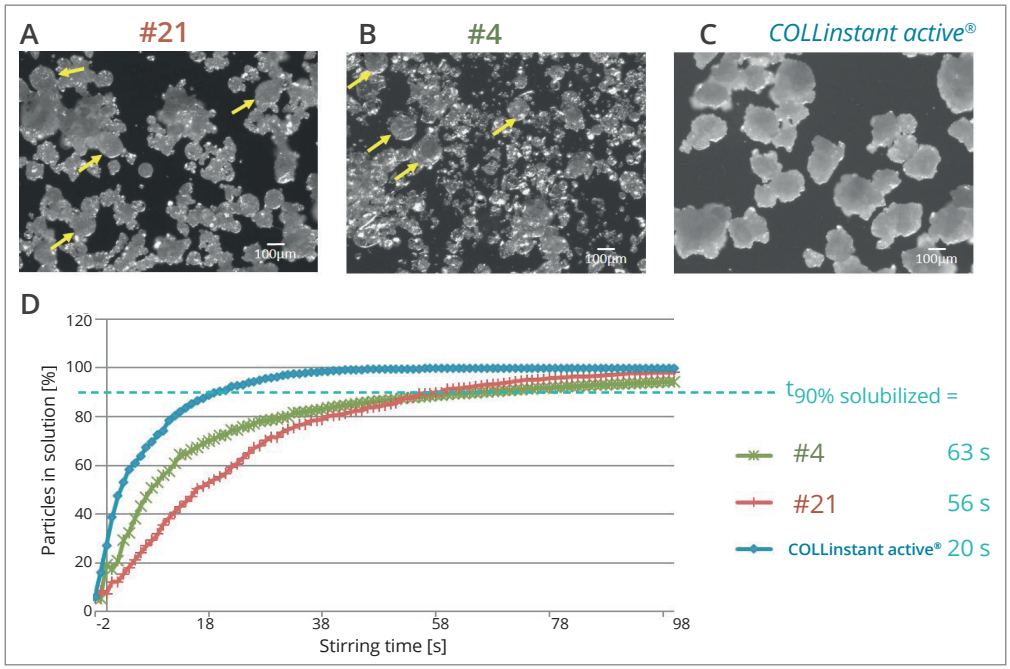


***FIG 7**: Microscopic analysis of competitor collagen hydrolysate agglomerated powders (A, B) and COLLinstant active® (C).*

Yellow arrows indicate large round particles formed by too fast or slightly too slow binding reactions during drying process.

C: High ratio of successfully agglomerated particles due to optimal binding kinetics.

D: Assessment of solubility kinetics of competitor collagen hydrolysate powder #21, #4 or COLLinstant active® with COLLinstant active® exhibiting the fastest solubility kinetics.

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QUICKLY DISSOLVING COLLAGEN HYDROLYSATE FOR EASY PROCESSING

Viscofan's advanced drying technology generates an agglomerated homogenous hydrolysate powder without granulates or debris that features excellent wettability, free-flowing properties and is quickly soluble – even in cold water (FIG. 8).

In comparison to other collagen hydrolysates, the low-dust formula of *COLLinstant active®* stands out with its optimized quality for clean and easy dosing as well as flexible processing.



FIG 8: *Image series demonstrating the optimized wettability & solubility of the agglomerated COLLinstant active® collagen hydrolysate.*

KEYWORDS
Collagen hydrolysate, collagen peptides, protein-enriched foods, food manufacturing, collagen foods, collagen supplements

COLLinstant active® Premium collagen peptides

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