COLLAGEN

Raw material exclusively for cosmetics manufacturing

KOKEN

Middle-sized molecule collagen
based on a new concept*1
from the medical device manufacturer

Soluge

(Atelocollagen derived from tilapia)

Fourth-generation collagen

- Middle-sized molecule collagen
- Formulation-friendly*2
- Clean formulation
- Sustainable
- Preservative-free*3

Skincare

- Gradational moisturizing
- Firmness and elasticity
- Prevention of sagging
- Anti-wrinkle

Haircare

- Control of hair color fading
- Hair surface correction
- Improved ease of combing

*1. Middle-sized molecule collagen produced using technology to extract atelocollagen
*2. Product specifications facilitating formulation
*3. Tilapia Soluge 1% GPD

A collagen production technology that is applied for medical purposes is used in the manufacturing of this cosmetics raw material

Soluge

Soluge is a middle-sized molecule collagen manufactured using atelocollagen extraction technology, a method for manufacturing collagen for medical use. This is a fourth-generation collagen raw material based on a new concept, simultaneously achieving the characteristics of both soluble collagen (high molecular weight) and hydrolyzed collagen (low molecular weight).

History of the industrial use of collagen

- Fourth generation: Middle-sized molecule collagen (Soluge)
- Third generation: Atelocollagen (1960s) Ultra-low molecular/ modified collagen era
- Second generation: Peptide-like collagen (1930s)
- First generation: Gelatin (1700s)

Features of Soluge

01 Atelocollagen

A valuable type of collagen produced using an atelocollagen extraction technology that is also used in the medical field. Our technological capabilities that we have cultivated for over 45 years enable us to produce high-quality atelocollagen.

02 Middle-sized molecule collagen

Atelocollagen is made as a middle-sized molecule collagen made by converting collagen into low molecular-weight collagen using Koken's unique technology. The result is a middle-sized molecule collagen with the properties of both high molecular-weight collagen and low molecular-weight collagen.

03 Collagen with gradational sizing and moisturizing

Soluge contains collagen of different sizes and molecular weights, moisturizing the interior and exterior of the skin through gradational permeation.

04 Formulation-friendly collagen

This collagen facilitates the formulation of products, as it is highly compatible with hyaluronic acid and carbomers and its acidity is mild to neutral. The collagen is formulation-friendly because it is unlikely to cause such problems as aggregation and precipitation during formation.

Commitment to materials

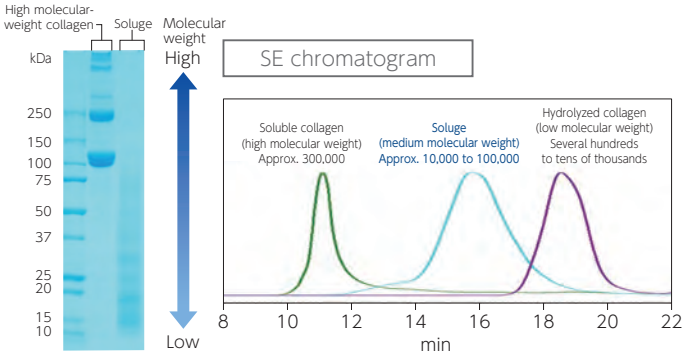
- SUSTAINABLE
- 100% NATURAL*
- PRESERVATIVE-FREE*
- CRUELTY FREE
- NON-CITES SPECIES
- NON-GMO

* Tilapia Soluge 1% GPD

Soluge is manufactured from the dermis of tilapia. Characteristically, the collagen of tilapia has is close to the amino acid composition of humans. It also excels in terms of handling. For this reason, it is a biomedical material that is expected to have applications in the medical field, such as the healing of injuries.
The collagen used to manufacture Soluge comes from the skin of tilapia which is a byproduct of food processing. Koken contributes to waste-free recycling consumption in cooperation with the food industry.

What is middle-sized molecule collagen?

Collagen as it exists in animal's bodies is a high molecular-weight substance with a molecular weight of around 300,000. In contrast, hydrolyzed collagen is a low molecular weight substance with a molecular weight in the range of hundreds to tens of thousands. It is frequently used for cosmetics. Soluge is a new middle-sized molecule collagen material that is an intermediate between them. Its molecular weight ranges widely from 10,000 to 100,000. The graded sizing enables Soluge to have new latent potential because it has the characteristics of both high and low molecular-weight collagen.



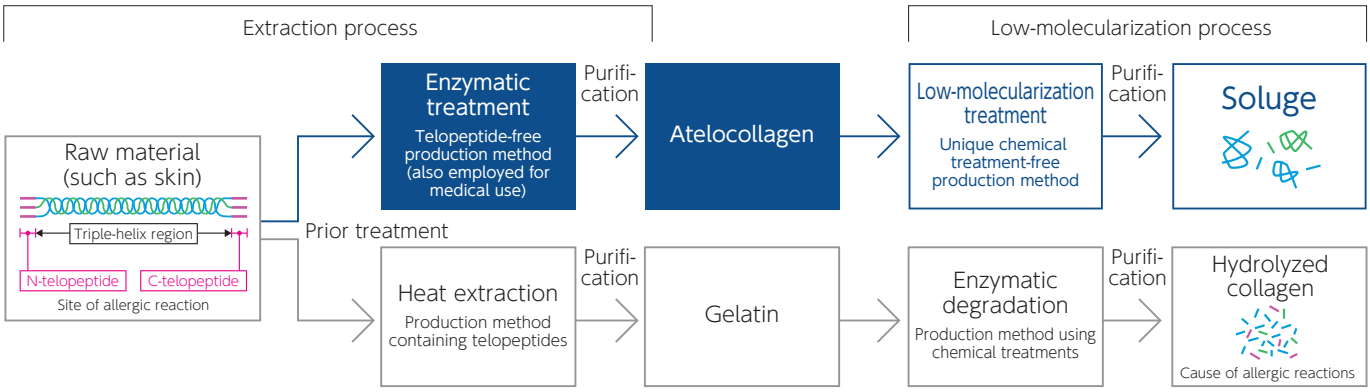
Based on in-house data

	Soluble collagen (high molecular weight)	Soluge (middle-sized molecule collagen)	Hydrolyzed collagen (low molecular weight)
Molecular weight	300,000	10,000 to 100,000	Several hundreds to tens of thousands
Advantage	• High moisturizing effect • Coats and protects the skin • Immediately feel the effects (moisturizing/firming)		• High permeability • High affinity with cells • Activates cells
Disadvantage	Impermeable		Effects take longer to feel

Soluge enables you to feel the benefits of both high- and low- molecular collagen.

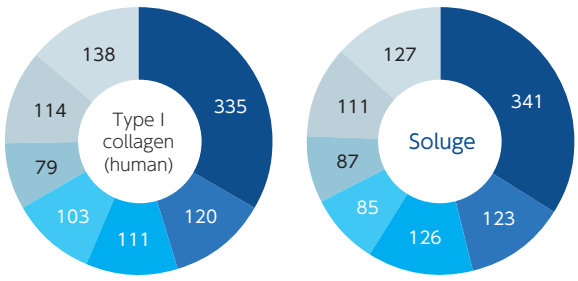
Koken's unique size control technology for achieving medium-sized molecules

Soluge is the result of the combination of the collagen manufacturing technology used in the medical field and a unique additive-free manufacturing technology that does not use chemicals.



Amino acid composition

The amino acid composition of Soluge is similar to that of human skin collagen. It is enriched with proline and hydroxyproline and has a high affinity with the skin and excellent moisture retention.



Based on in-house data

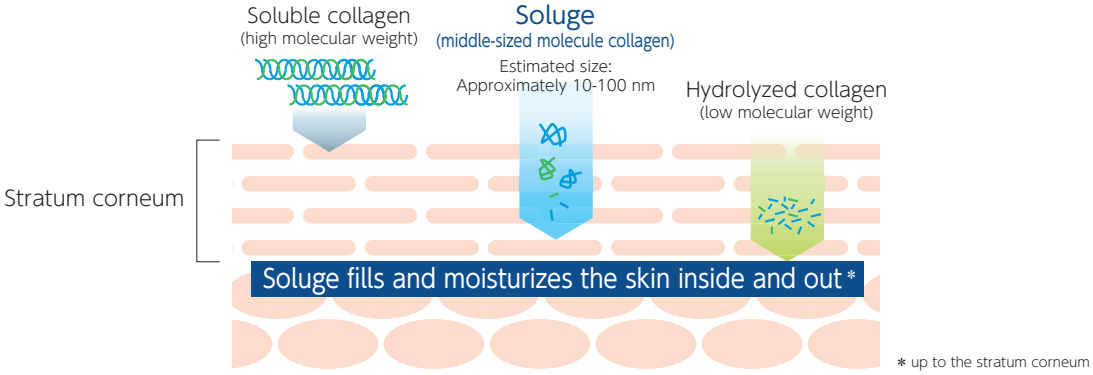
Functions for skincare products

Skincare theory

While conventional high-molecular-weight collagen focuses on moisturizing the skin's surface, Soluge features gradational moisturizing. Collagen in a wide range of sizes incrementally fills and moisturizes the skin inside and out.

- Size gradation
- High moisturizing capability
- High permeability

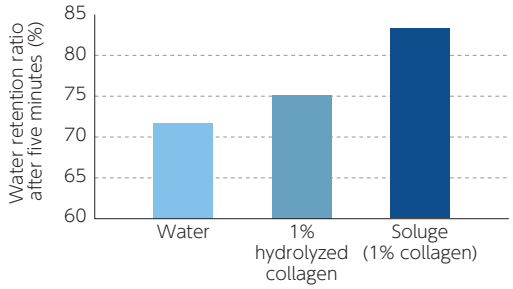
▶ New theory — Gradational moisturizing



* up to the stratum corneum

Water-retaining capability

Hydrolyzed collagen (Soluge) was dripped onto a piece of filter paper. After five minutes, the weight of the collagen was determined to calculate the moisture retention ratio.

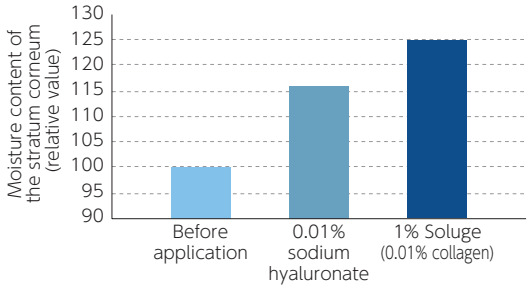


Based on in-house data

The water-retaining capability of Soluge is higher than that of hydrolyzed collagen

Moisturizing capability

The moisture content of the stratum corneum was determined 30 minutes after applying the sample to the test site.

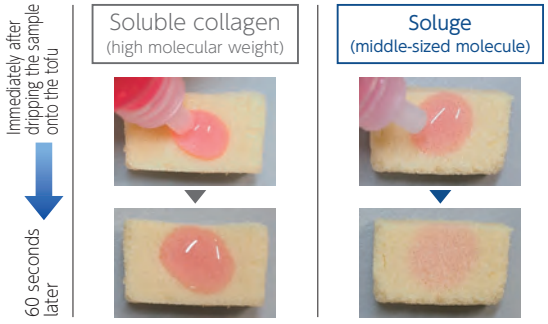


Based on in-house data

It was confirmed that the moisturizing effects of Soluge were higher than those of sodium hyaluronate (molecular weight: 1,200,000)

Permeability

Samples were dyed to enable the effects to be visible and dripped onto pieces of freeze-dried tofu. Permeation was observed over time (1% collagen).

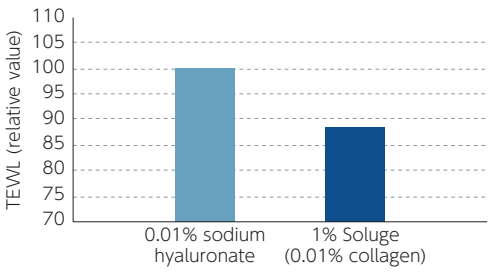


Based on in-house data

The permeation capability of Soluge appeared greater than soluble collagen (high molecular weight)

Skin barrier

After samples were applied to the skin, transepidermal water loss (TEWL) was determined to compare TEWL after four hours.

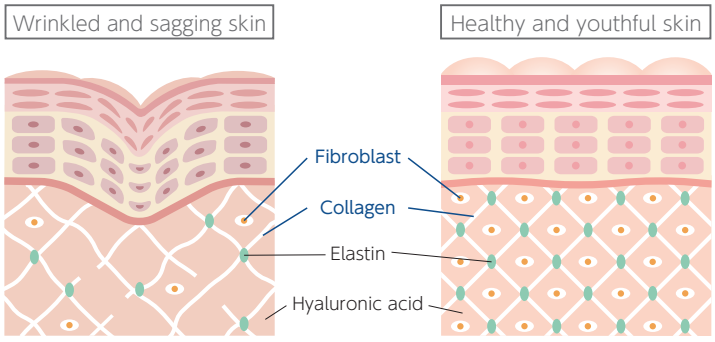


Based on in-house data

It was confirmed that Soluge suppressed TEWL (indicating an effect supporting the skin barrier) more effectively than sodium hyaluronate (molecular weight: 1,200,000).

Approach to cells

Diagrams of the skin



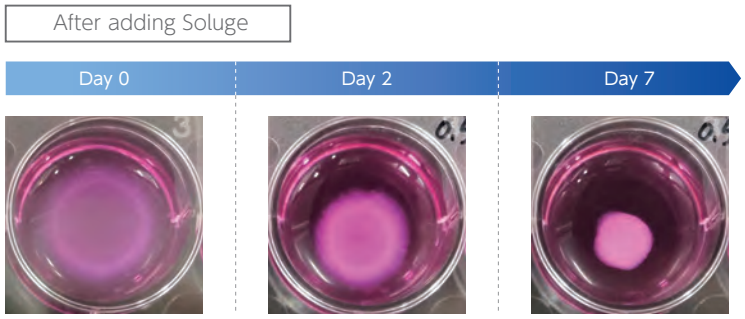
Sagging skin with low collagen density

Skin with high collagen density ensuring secure support like a corset

Reduced contractility of the dermal extracellular matrix is one cause of a decrease in firmness/elasticity and sagging related to aging.

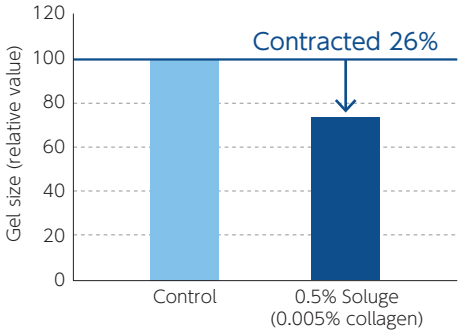
Prevention of sagging and loss of firmness and elasticity

A medium containing Soluge was added to a model simulating the dermis (collagen gel mixed with fibroblastic cells), the cells were cultured for seven days, and then the size of the model was measured.



Based on in-house data

The state of the collagen changed from sagging to firm

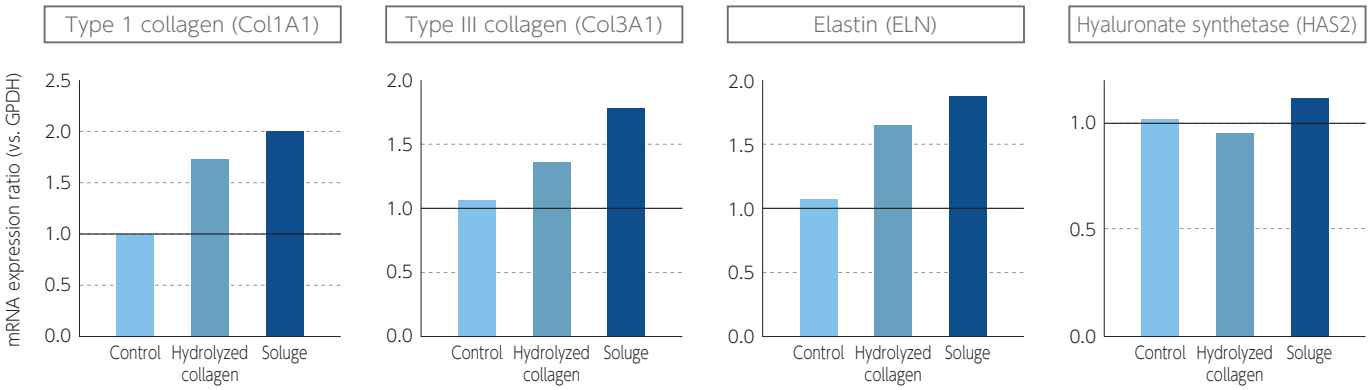


Based on in-house data

The contracting effect was confirmed using the model dermis

Anti-wrinkle

Samples were added to the fibroblastic cells, and the cells were cultured for 72 hours. Real-time PCR testing was used to determine the gene expression levels of type I collagen, type III collagen, elastin, and hyaluronate synthetase. Sample concentration: 0.01% (containing 1% Soluge)

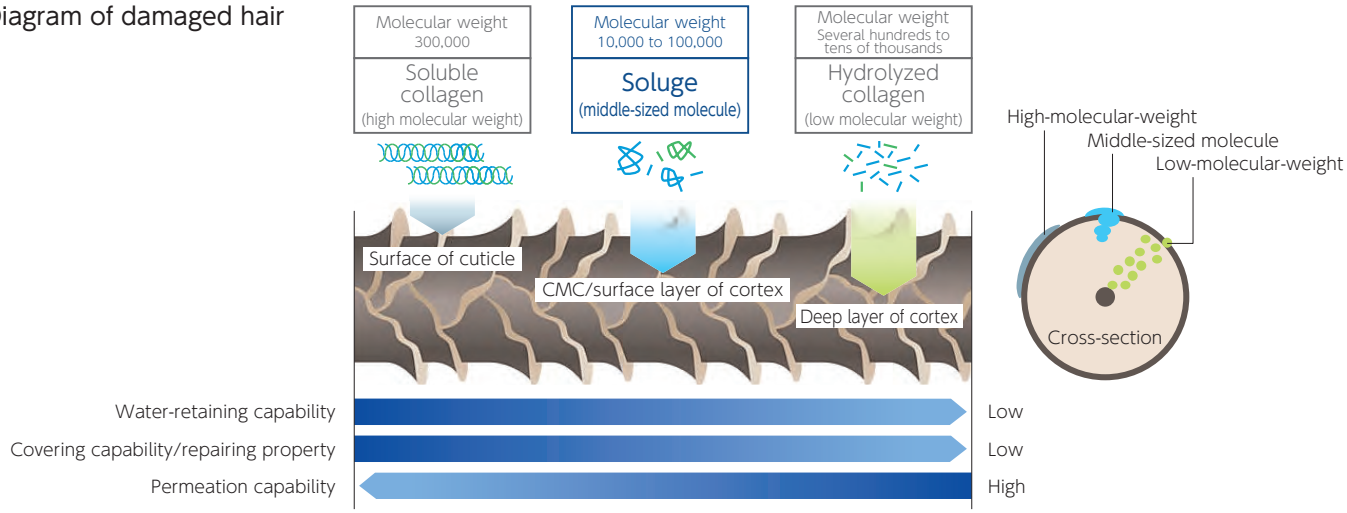


All based on in-house data

Soluge promotes the synthesis of dermal matrix components that give skin its elasticity (collagen, elastin, hyaluronic acid), making the skin elastic, firm and moisturized.

Approach to hair care

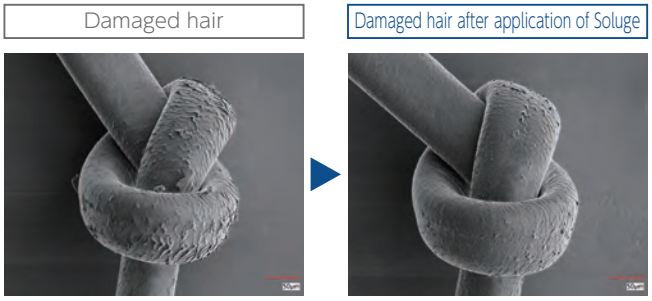
Diagram of damaged hair



Soluge middle-sized molecule collagen affects hair in various ways because it is an intermediate between high and low molecular-weight collagen.

Hair surface repair (cuticle protection)

Damaged hair was examined using a scanning electron microscope (SEM). The damaged hair was soaked in a 1% Soluge aqueous solution (0.01% collagen) for five minutes, the hair was dried overnight, and then the hair was examined again using a SEM.

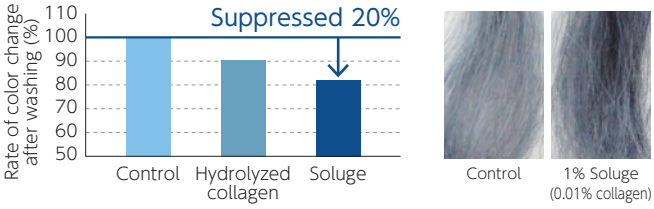


Based on in-house data

It was confirmed that Soluge-coated cuticles separated from the hair damage to condition hair

Prevention of hair dye fading

White hair was dyed with a hair color. Bundles of dyed hair were washed by shaking them in a cleaning solution containing 1% sample (1% SDS) and rinsed with running water. The water was removed, and hair was dried with a hair dryer. This procedure was repeated five times. Then, the changes in hair color before after rinsing were measured using a chronometer.

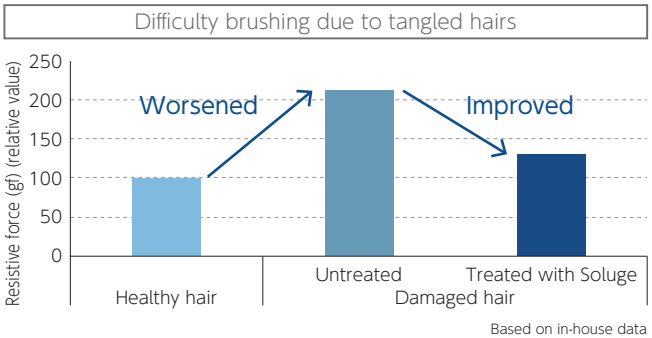


Soluge repaired the surface of the hair and prevented the outflow of dye to control hair color fading. Based on in-house data

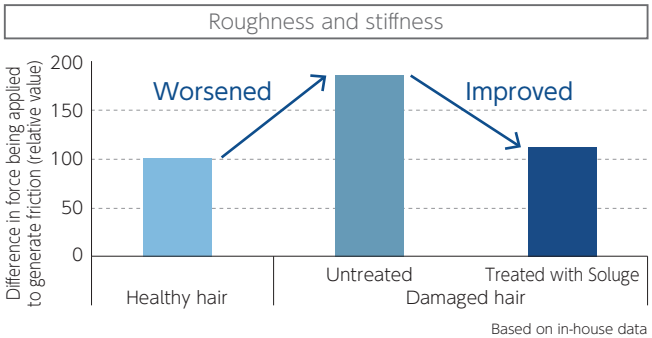
It was confirmed that Soluge controlled hair color fading.

Improved ease of combing

Healthy hair and damaged hair were examined using a tribometer to determine ease of combing. The damaged hair was then soaked in a 0.1% Soluge aqueous solution (0.001% collagen) and examined again using a tribometer.



Based on in-house data



Based on in-house data

Soluge addresses difficult hair brushing caused by hair damage to make the hair smooth and eliminate roughness and stiffness

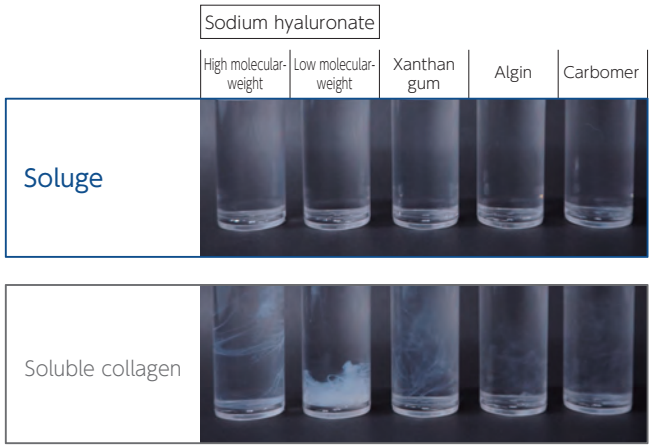
Basic physical properties

Compatibility with other raw materials

Soluge and various other cosmetics raw materials were mixed and left at 25 ℃. After four weeks of storage, appearance changes were observed.
(Concentration: 10% Soluge (0.1% collagen)).

Ingredients	Final concentration	Compatibility with Soluge
Sodium hyaluronate (high molecular weight)	0.25%	○
Sodium hyaluronate (low molecular weight)	0.25%	○
Xanthan gum	0.25%	○
Algin	0.25%	○
Carbomer	0.25%	○

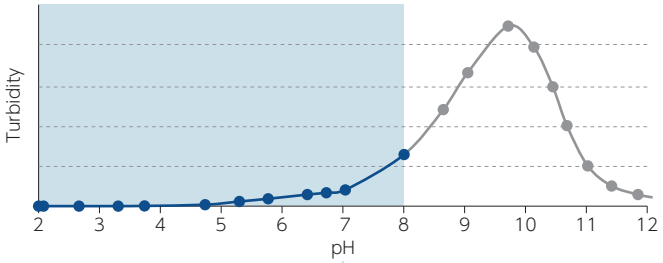
Soluge does not cause white turbidity, in contrast with soluble collagen which generates precipitates and causes turbidity.



Based on in-house data

pH stability

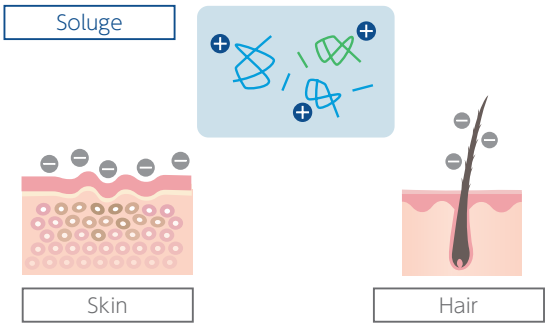
Collagen has a broad range of hydrogen ion concentrations. This facilitates the preparation of formulations from mildly acidic to neutral or alkaline at a pH of around 9.7.



	Acidic	Neutral	Alkaline
Soluge	◎	◎	○*
Soluble collagen	○	×	×

* Turbidity appeared at around pH 9.7 only

Based on in-house data



It is considered that Soluge has cationic properties when it' s pH is acidic to neutral.
It is likely to adhere to negatively charged skin and hair.

* The electrical charge of Soluge is simulated and presented for illustrative purposes on the premise that it is blended in cosmetics from acidic to neutral pH.

Clean formulation (preservative-free, buffer-free)

The simple product design facilitates blending for any formulation. It is a raw material that is ready to be used in clean formulations without a citric acid buffer or a phosphate buffer, which were previously blended into products to improve stability.

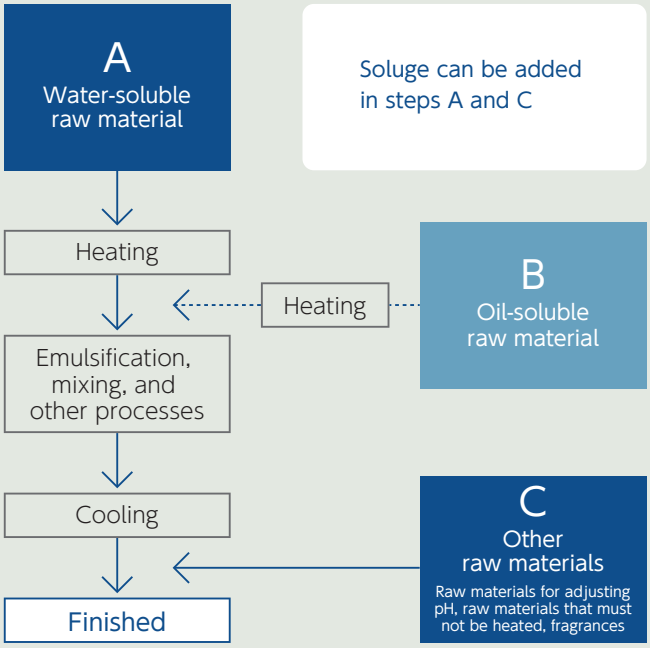
INCI Name: ATELOCOLLAGEN, WATER, PENTYLENE GLYCOL (OR PHENOXYETHANOL)

Tilapia Soluge 1% GPD is a raw material based on collagen that is free from even general preservatives.
When combined with other polyol products, it enables preservative-free formulations.

Ease of formulation

Flexible formulation design

Previously, soluble collagen was normally added in step C of the production process, as shown in the diagram. Generally, the blending rate was 0.1% or less in light of compatibility with other raw materials. However, Soluge can be added at any time during the production process because of its high formulation suitability. Additionally, its excellent compatibility with high-molecular-weight raw materials helps prevent formulation problems even if it is added at a concentration of several percent.



■ Emulsion containing highly adhesive collagen

		Raw material	Blending rate (%)
A Water-soluble raw material	A-1	Water	up to 100
		Carbomer dispersion liquid (1% aq.)	30
		Soluge	1
	A-2	Glycerin	3
		Butylene Glycol	3
		Phenoxyethanol	Appropriate amount
		Pentylene Glycol	Appropriate amount
		Xanthan Gum	0.05

		Raw material	Blending rate (%)
B Oil-soluble raw material	B	Polysorbate 60	2
		Glyceryl Stearate (SE)	5
		Squalane	5
		Cetyl Alcohol	4
		Ethylhexylglycerin	Appropriate amount

		Raw material	Blending rate (%)
C Other	C-1	Potassium Hydroxide (aq.)	Appropriate amount
	C-2	Fragrance	Appropriate amount

Production methods

❶ Agitate A-1.
❷ Add A-2 and agitate evenly.
❸ After agitating evenly, heat to achieve 80-85 ℃.
❹ Heat B to achieve 80-85 ℃ to dissolve evenly.
❺ Add ❹ to ❸ and emulsify it (with a homogenizing mixer, 6000 rpm, 5 minutes).
❻ Add C-1 and agitate evenly (pH 6-7).
❼ Cool it (at 30 ℃ or below).
❽ Cool C-2 and agitate evenly.

Example formulations of skincare and haircare products are also available for reference. For more information, please contact an our sales representative.

Recommended amount for blending: 0.1–1%
Safety evaluation Human repeated insult patch test (HRIPT): Conducted
Skin irritation alternative test (OECD TG439): Negative

Product No.	Product name	INCI name/中文名称	Other ingredients	Package	Sample
ATC-241	Tilapia Soluge 1% GPD	ATELOCOLLAGEN/缺端胶原	Water, Pentylene Glycol	1kg	100g
ATC-221	Tilapia Soluge 1% PE	ATELOCOLLAGEN/缺端胶原	Water, Phenoxyethanol	1kg	100g

Country of origin: Taiwan The last processing place: Yamagata Pref., Japan

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