Oil-Soluble Active Ingredients for Effective Skincare

White Paper

Powered by Synthetic Biology – A New Era of Oil-Based Skincare

—— Gebiotide®Patented Oil-Soluble Technology Series White Paper

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Foreword

Background and Purpose

The global market for effective skincare is going through big changes. People now want more than just basic cleaning, moisturizing, and sun protection. They look for deep repair, science-based anti-aging, and safe, powerful solutions. In this context, oil-soluble active ingredients have clear benefits. They work well with the skin's natural oil layer (sebum). They also absorb better through the skin. Plus, they fit the trends of water-free formulas and clean beauty. All of this makes them a key way for brands to stand out.

However, traditional active ingredients have many problems. They are **not very stable**, **do not absorb well**, and **do not work nicely with many oil-based formulas**. High amounts may also cause irritation. So the industry needs new technology to turn classic active ingredients into effective, stable, and safe oil-soluble solutions.

Zhuhai Gene-Biocon Biological Technology Co., Ltd.. (short for Gene-Biocon) is a national high-tech company. With more than 30 years of bio-pharma and synthetic biology experience, we developed a patented reverse micelle oil-soluble technology and a synthetic biology platform. We now offer the Gebiotide® patented oil-soluble series. This includes peptides, Recombinant Collagen, PDRN, Caffeine, Pro-xylane, Niacinamide, and more. We help global brands from raw materials to final formulas.

This white paper explains the technical trends and market opportunities for oil-soluble active ingredients. It also shows Gene-Biocon's R&D strength, product matrix, and scientific data – to help Chinese and international customers build a strong position in the oil-based skincare market.

Scope of the White Paper

For:

- **Chinese Brand Owners**
- **Overseas Buyers of Cosmetic Ingredients**
- **ODM/OEM Companies**
- **Formulators**
- **Product Managers**

It covers the technology, product range, application ideas, and cooperation models for oil-soluble active ingredients.

1. Industry Insight: The Opportunity for Oil-Soluble Skincare

1.1 Global Effective Skincare Market Overview

The global market for organic personal care ingredients is growing. According to Global Growth Insights, in 2025 the market was USD 6.66 billion. It is expected to reach USD 9.22 billion by 2035, with a yearly growth rate of 3.3% (see Fig.1). The natural solubilizer market was about USD 1.527 billion in 2025 and may reach USD 2.189 billion by 2034, growing at about 5.4% (Fig.2). Effective skincare is moving from just marketing to deep tech. This creates a good chance for suppliers with strong core technology.

Figure 1: Organic personal care ingredient market growth (Global Growth Insights) – placeholder

(Unit: US $100 million)

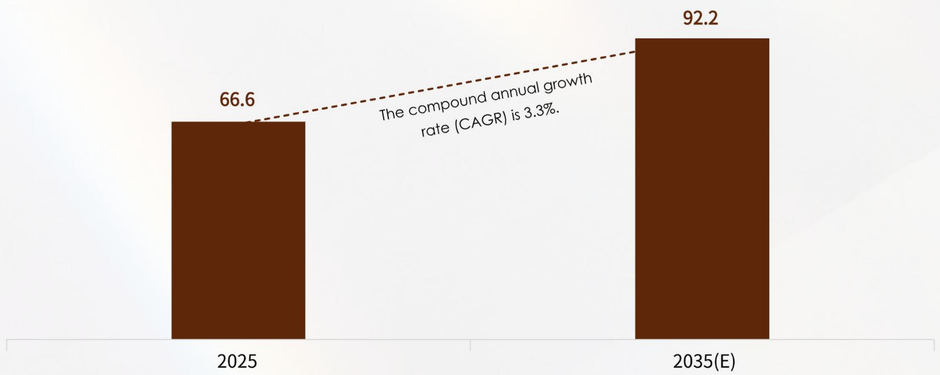
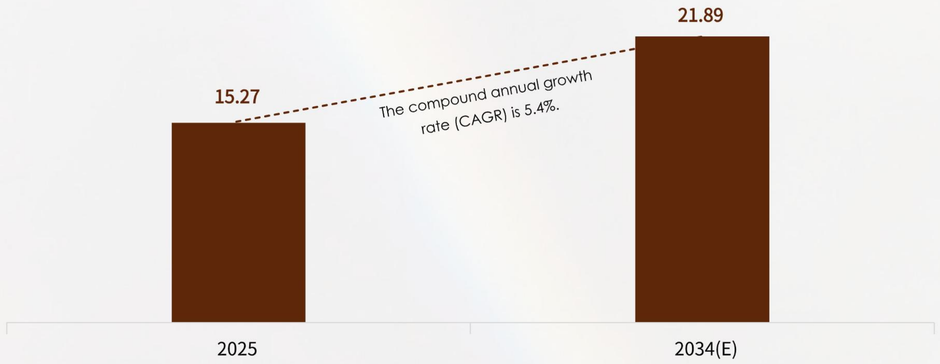


Figure 2: Natural solubilizer market outlook – placeholder

(Unit: US $100 million)

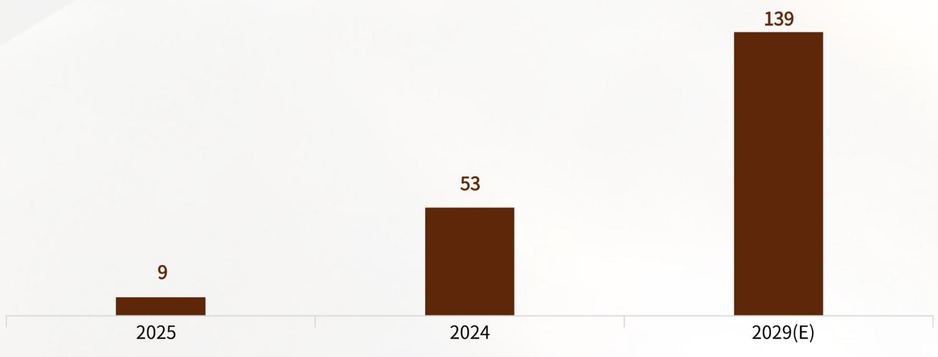


1.2 "Using Oils to Nourish the Skin" Trend

According to a 2025 report by UserTalk, the online facial oil market in China exceeded RMB 9.5 billion, with Douyin platform growth of 54.91% year on year. A report from Industrial Securities shows that China's facial oil market grew from RMB 0.9 billion in 2019 to RMB 5.3 billion in 2024, a yearly growth of 42.8%. It is expected to reach RMB 13.9 billion by 2029. Facial oils use plant or synthetic oils as a base, plus oil-soluble actives. They match the skin's oil barrier. Moisturizing and anti-wrinkle together make up nearly half of the market. Oil-based skincare is also expanding in Europe and America.

Figure: Facial oil market growth trend – placeholder

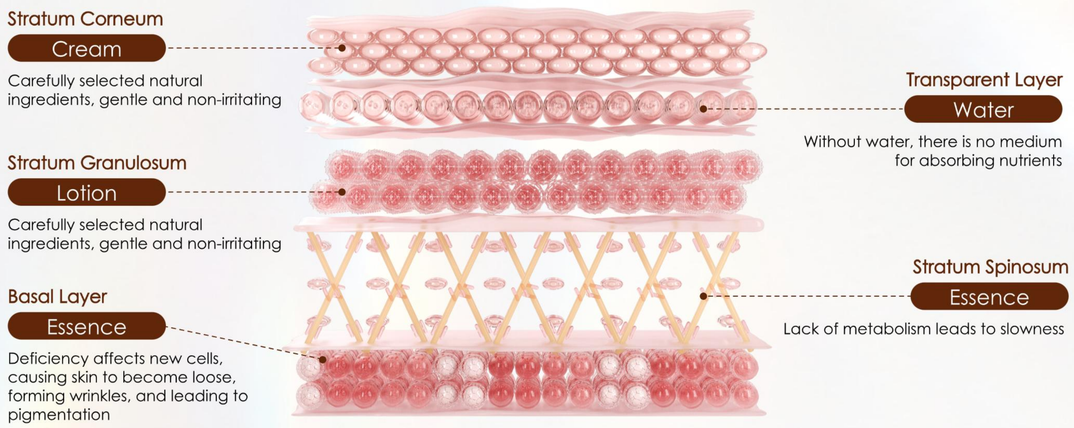
(Unit: RMB 100 million)



1.3 The Core Value of Oil-Soluble Active Ingredients

The skin's outer layer (stratum corneum) has a brick-and-mortar structure. This means that fat-loving (lipophilic) ingredients go through it more easily. Oil-soluble active ingredients are very similar to the skin's own oil film. They also meet the needs for water-free formulas and slow release, which fits the global clean beauty trend.

Figure: Skin barrier illustration – placeholder



1.4 Industry Problems and Gene-Biocon's Solution

1.4.1 Main problems with traditional oil-soluble active ingredients

As "oil skincare" becomes popular worldwide, water-free formulas and oil-based products (facial oils, balms, oil gels) are growing fast. But putting traditional water-soluble actives into oil-based systems has been hard for a long time:

Poor solubility and cloudy formulas

Most active ingredients are water-loving. When added directly to plant or synthetic oils, they don't dissolve and cause sediments or cloudy mixtures. This hurts how the product looks and how people accept it.

Bad stability and loss of activity

Water-soluble ingredients in oil without protection tend to clump, crystallize, oxidize, or lose their effect. Traditional oil systems are not very stable, so they separate during storage or shipping, and shelf life is short.

Low absorption through skin

Even though oil itself is good for penetration, water-soluble actives that are not spread well or form large particles cannot get through the skin barrier. This lowers the real effect.

Low loading capacity, less freedom in formulas

Old methods need many solubilizers or helpers, but they still don't work well. The effective amount of active is often below 5%, so it's hard to make strong products. Also, solubilizers may feel sticky or cause irritation.

Hard production and high energy use

Traditional ways rely on high-pressure mixing, high heat, or organic solvents. They need large equipment and a lot of energy, and may leave solvent residues, which does not fit clean beauty.

These problems limit how effective oil-based skincare can be. This is the main difficulty the industry needs to solve.

2. Gene-Biocon's Solution: Patented Reverse Micelle Nano-Encapsulation Technology

To solve these industry problems, Gene-Biocon created a reverse micelle encapsulation technology (national invention patent: ZL201910584254.5). This is not just simple mixing. It is a change at the molecular level that redefines how water and oil work together.

- Patent certificate information: A stable oil-soluble peptide composition and its preparation method – patent number ZL201910584254.5

2.1 Synthetic Biology Technology Platform

We have a "design-build-test-produce" closed loop. We ensure high purity and high activity of our ingredients.

Five Technology Platforms

- High-expression genetic engineering technology platform
- High-density biological fermentation technology platform
- High-activity protein tool enzyme technology platform
- High-performance nucleic acid drug tool enzyme technology platform
- Transdermal absorption nanotechnology platform

2.2 Reverse Micelle Oil-Soluble Technology (Patent No. ZL201910584254.5)

2.2.1 Technology Overview

Gene-Biocon's patented oil-soluble reverse micelle technology puts specific surfactants into an oil phase. They spontaneously form tiny "water pool" nano-structures. The outside is oil-friendly (hydrophobic), and the inside is water-friendly (hydrophilic). Then we load water-soluble active ingredients into that inner water pool. This results in a clear, stable nano-sized reverse micelle system in oil. It is a stable dispersion that carries hydrophilic actives inside oil carriers.

2.2.2 Core Benefits

Wider Use

Compared to regular water-soluble actives, our oil-soluble encapsulated ingredients can be used not only in emulsions and creams but also in pure oil or wax-based formulas like facial oils and lip balms.

Better Skin Penetration

The total absorption through skin is up to 3.5 times higher than traditional water-soluble actives. This improves how well the active ingredients work.

Slow Release

Instead of releasing everything at once, our oil-soluble encapsulation slowly releases the actives layer by layer on the skin. This reduces irritation and makes the effect last longer.

2.2.3 Delivery Mechanism

Our oil-soluble actives have a special structure – many nano-sized microspheres, each with an oil shell around a water-soluble active core. When you add them to serums, creams, lotions, or wax products, they stay stable as nano-sized spheres. When applied to the skin, the product breaks and releases the spheres. Because the skin likes oil, the spheres pass easily through the outer skin layer. Then they invert from reverse micelles into normal micelles and release the water-soluble actives. These free molecules go through the water-loving channels in the skin to reach the lower layers and work.

▸ Three-step Molecular Assembly

Step	Process	Result
Self-assembly	In the oil phase, surfactants arrange into reverse micelles with tails out and heads in	Creates a "molecular container" for water-soluble actives
Encapsulation	Water-soluble active solution is added slowly; active molecules get locked inside the reverse micelle's water core	The active gets nano-sized physical protection
Stable Dispersion	The reverse micelle-active complexes spread evenly in the oil phase.	Long-term stability without settling, no separation, high activity retention

Key parameters: particle size 5–100 nm (PDI < 0.2), optically clear, thermodynamically stable – no extra solubilizers needed.

2.3 Core Reverse Micelle Technology Solves Traditional Problems

Comparison Aspect	Traditional Oil-Soluble Method	Gene-Biocon Reverse Micelle Technology
Appearance	Cloudy, milky, or separates – poor look	High transparency, clear like oil – great texture
System Stability	Meta-stable, easy to break or settle	Thermodynamically stable, no settling, long shelf life
Active Protection	Weak protection, easy to degrade	Nano water core protects against enzymes and oxidation
Loading Capacity	Usually <5% – hard for high potency	Loading up to 5% ~ 20%*
Formulation Freedom	Many restrictions, needs extra solubilizers	Oil and water phases mix in any ratio – no extra solubilizers
Production Scale-up	Needs high-pressure homogenizing, high energy, high cost	Self-assembly, gentle process, low energy, easy to scale

*depending on ingredient

2.4 Gene-Biocon Oil-Soluble Technology Product Milestones

「2019」

Core Patent Foundation

National patent (ZL201910584254.5) for stable oil-soluble peptide composition

「2021」

First Products

Launched

- **Oil-soluble palmitoyl tripeptide-1**
- **Oil-soluble palmitoyl tetrapeptide-7**
- **Oil-soluble palmitoyl pentapeptide-4**

plus a soothing peptide blend

「2022-2023」

Deeper and More Specific

- **Oil-soluble nonapeptide-1** (2022)
- **Oil-soluble copper peptide** (2022)
- **Oil-soluble instant wrinkle-smoothing peptide** (2023)

「2024」

Recombinant Collagen & Advanced Blends

Oil-soluble recombinant type III small-molecule collagen, and compound products related to well-aging field

「2025」

Staring Redients Oil-solubilized

- **PureS-OilProX**
- **Oil-soluble niacinamide**
- **Oil-soluble recombinant SOD**
- **Oil-soluble acetyl hexapeptide-8**

「2026」

Forward —— Medical-Grade Actives

- **Oil-soluble PDRN**
- **Oil-soluble caffeine**

3. Product Matrix: Gebiotide® Patented Oil-soluble Series

3.1 Full Product Line

Category	Product Name	Core Benefit
Oil-soluble Actives	Gebiotide® Oil PDRN	Repair skin barrier, soothe inflammation, firm anti-wrinkle
	Gebiotide® Oil caffeine	Antioxidant, reduce puffiness, anti-inflammatory
	Gebiotide® Oleonic™ (Oil-soluble niacinamide)	Brightening, moisturizing, oil control
	Gebiotide® PureS-OilProX (Pro-xylane)	Anti-aging, moisturizing
Oil-soluble Proteins	Gebiotide® Oil-soluble recombinant type III small-molecule collagen	Anti-aging, soothing, repair, brightening
	Gebiotide® Oil-soluble recombinant human SOD	Anti-photoaging, antioxidant, free radical scavenging
Oil-soluble Peptides	Gebiotide® Oil-soluble acetyl hexapeptide-8	Long-lasting wrinkle smoothing
	Gebiotide® Oil Antiflamin peptide	Tighten and repair
	Gebiotide® Oil WrinkleAway peptide	Multi-target wrinkle care
	Gebiotide® Oil-soluble instant wrinkle peptide	Fast wrinkle smoothing
	Gebiotide® Oil-soluble palmitoyl tripeptide-1	Long-lasting firming
	Gebiotide® Oil-soluble palmitoyl tetrapeptide-7	Reduce inflammation, repair skin
	Gebiotide® Oil-soluble palmitoyl pentapeptide-4	Long-term anti-wrinkle
	Gebiotide® Oil-soluble nonapeptide-1	Fade spots, brighten
	Gebiotide® Oil-soluble copper peptide	Repair the skin barrier

More categories in development...

3.2 Key Product Details

Oil-soluble Peptides

Gebiotide® Oil Palmitoyl Tripeptide-1 —— boosts collagen

Gebiotide® Oil Palmitoyl Tetrapeptide-7 —— dual patent, lowers IL-6

Gebiotide® Oil-soluble Instant Wrinkle Peptide —— blocks nerve signals naturally

Gebiotide® Oil Antiflamin Peptide —— dual patent for sensitive skin

Oil-soluble Recombinant Proteins

Gebiotide® Oil-soluble Recombinant Type III Human Small Collagen —— 500-5000Da, skin penetration up to 1.41%, protects against natural aging

Gebiotide® Oil-soluble Recombinant SOD —— dual patent, protects against photoaging

Oil-soluble Actives

Gebiotide® Oil PDRN —— medical-grade repair

Gebiotide® Oil Caffeine —— targets eye puffiness and fat metabolism

Gebiotide® PureS-OilProX —— world's first transparent oil-soluble pro-xylane, 3.5x better penetration, alcohol-free

Gebiotide® Oleonic™ —— world's first oil-soluble niacinamide, 2-18x more absorption, stable at 90°C

3.3 Application Scenarios

- · Facial Oils
- · Lotions
- · Creams
- · Eye Creams
- · Balms
- · Body Care
- · Makeup (Lipstick, Eyeshadow)
- · Lip Care
- · Sunscreen
- · Clay Masks
- · Pet Care
- … …

4. Scientific Proof and Efficacy Data (Key Products as Examples)

4.1 Scientific Validation System

Third-party tests, in vitro cell studies, skin absorption tests, and human trials

4.2 Core Efficacy Data

Better Absorption

Oil-soluble peptides show **2x** absorption vs water-soluble peptides after **4** hours.

Transparent oil-soluble pro-xylane: **3.5x** higher than water-soluble version.

Oil-soluble niacinamide: **2 to 18x** more absorption

High Temperature Stability

Stable without separation at **90°C for 6 hours**, works with normal and hot filling processes

Take the HOT SALE products as an example

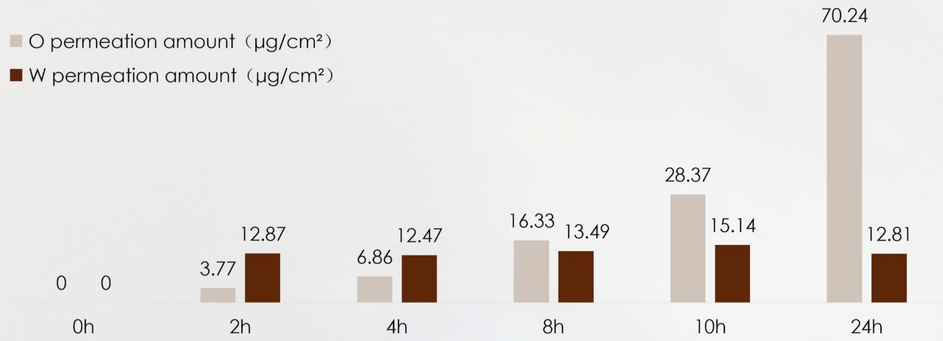
▶ Skin Retention

Reverse micelle encapsulated **Gebiotide® Recombinant Type III Small Molecule Collagen**:
5x higher amount in skin after 24h compared to free protein

Instruments: Vertical Franz diffusion cell system, high-performance liquid chromatography (HPLC)
Consumables: Porcine ear dorsal skin (skin thickness precisely controlled to 1.2 mm)

Formulations containing both water-soluble and oil-soluble recombinant type III small-molecule collagen at a concentration of 2000 ppm each were used as the test objects. Equal amounts of the test samples were added to the donor compartment, while the receptor compartment was filled with HEPES buffer. The system was maintained in a constant-temperature water bath at 37 ± 2 °C. Seven sampling time points were set during the experiment: 0 h, 2 h, 4 h, 6 h, 8 h, 10 h, and 24 h.

Comparison of permeation amounts of different Gebiotide® recombinant type III small molecule collagen formulations

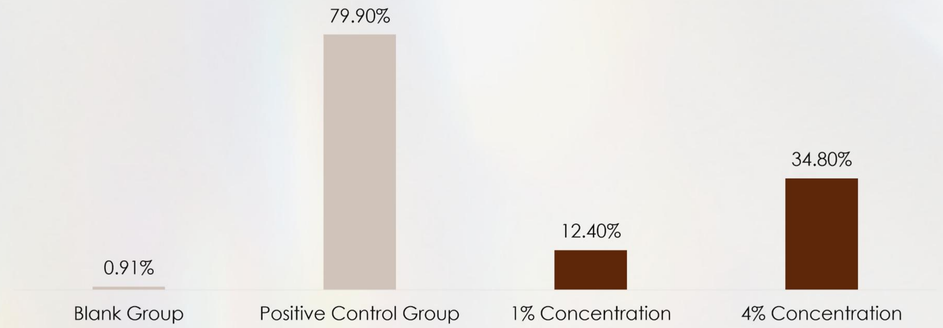


▶ Collagen Boosting

1% **Gebiotide® Oil WrinkleAway Peptide**: 12.4% elastase inhibition

To evaluate the anti-wrinkle efficacy of Gebiotide® Oil-Soluble Reverse-Time Peptide as an anti-wrinkle cosmetic product in slowing down the occurrence of skin wrinkles or making wrinkles less noticeable; the anti-wrinkle efficacy of the substance is assessed primarily by measuring its inhibition rate on elastase.

Inhibition rates of different concentrations of Gebiotide® oil-soluble reverse-time peptide on elastase



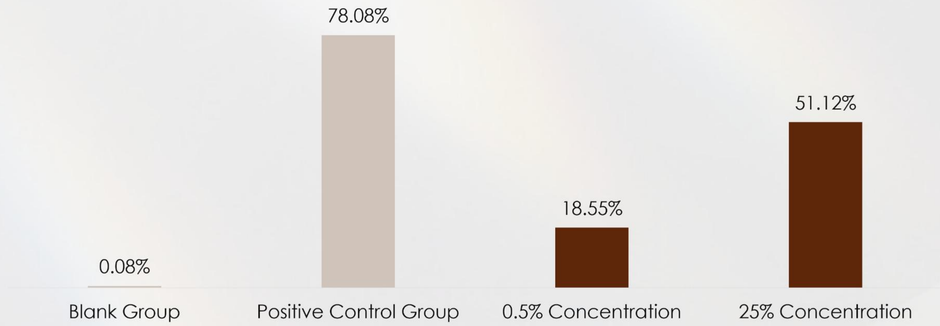
▸ Long-term stability

Gebiotide® PureS-OilProX is still active after **90°C for 6 hours** with **51.12% elastase inhibition**

Test sample: Gebiotide® PureS-OilProX
Test concentrations: 0.5% and 25%

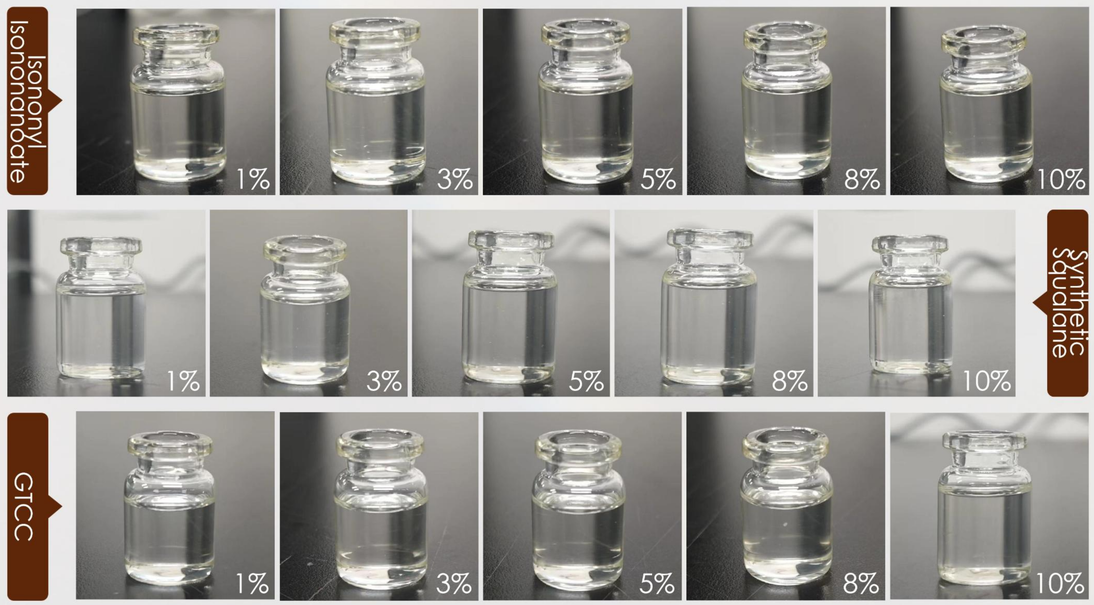
ake an appropriate amount of the transparent oil-soluble S-Pro-xylane, seal it separately, and place it in a constant-temperature water bath at 90 °C. Heat for 6 hours. From the sample heated at 90 °C for 6 hours, weigh an appropriate amount and add reagents step by step to allow the reaction to proceed to completion. Transfer an appropriate amount of the fully reacted mixture to a spectrophotometer to measure its absorbance. Record the data, and calculate the elastase inhibition rate and the significant difference value.

Inhibition rate of different concentrations of Gebiotide® PureS-OilProX on elastase



▸ Compatibility

Gebiotide® Oil Caffeine has strong compatibility with common oils and fats, with **no off-odor, no stratification, and no cloudiness**



4.3 Quality Assurance

Meets clean beauty standards

≥90%			0%	Animal-Free
High Purity	High Activity	Non-Allergenic	Preservative-free	Animal-Free

4.4 Differences Against Competitors

- **Patent Protection**
- **Better Penetration**
- **Wide Compatibility**
- **Heat Stability**
- **Good Value**

4.5 Summary: From Water-Soluble Limits to Oil-Soluble Freedom

Gene-Biocon's reverse micelle technology breaks the old limits. It lets classic active ingredients (peptides, collagen, PDRN, caffeine pro-xylane, niacinamide) work beautifully in oil – clear looking, physically and chemically stable, and with much better absorption. This lets brands upgrade oil-based skincare from basic moisture to serious anti-aging and deep repair.

5. Brand Power: Gene-Biocon's Value Proposition

5.1 Brand Positioning

「High-activity bio-based ingredient manufacturer」

—— using original innovation to boost downstream growth.

5.2 Core Brand Values

Science-driven, quality first, win-win with customers, green and sustainable.

5.3 Brand Milestones

Zhuhai Gene-Biocon Biological Technology Co., Ltd.. (hereinafter referred to as "Gene-Biocon") was established in 2015, headquartered in Jinwan District, Zhuhai City, the core innovation hub of the Guangdong Hong Kong Macao Greater Bay Area. It is a national high-tech enterprise driven by synthetic biology, focusing on the research and industrialization of highly active biological raw materials and high-end bio-pharmaceuticals.

The company has a production and research and development base that meets international GMP standards, and has built a full chain technology platform from genetic engineering strain construction, high-density fermentation, green purification to innovative formulation development. Gene-Biocon empowers the efficacy skincare industry with "pharmaceutical grade quality standards", extending the strict quality concept in the bio-pharmaceutical field to the efficacy skincare raw material field, and is committed to providing high-purity, high activity, and high safety bioactive molecule solutions for global customers.

As a pioneer in the industrialization of synthetic biology, Gene-Biocon has established two core technology matrices in the fields of biological beauty and medical beauty:

Recombinant Protein and Peptide Technology Platform

Relying on the efficient expression system of *E.coli/Pichia pastoris*, using the AI algorithm in cooperation with the Department of Chemistry at the University of Florida, we have achieved green biomanufacturing of daily skincare recombinant collagen and raw material for class II medical devices brand recombinant type I/II/XVII collagen, which has been highly praised and recommended by Nobel laureate *Roald Hoffmann*;

Patent Reverse Micelle Oil Solubility Technology (ZL201910584254.5)

A globally leading water-soluble active ingredient oil solubility platform, completely breaking through the bottleneck of oil-based formula efficacy, achieving precise targeting and long-term sustained release of active ingredients.

The company's sales network covers over 50 countries and regions worldwide, and is the designated raw material supplier for more than 200 domestic and foreign OEM/ODM enterprises and brand merchants. Gene-Biocon not only provides standardized Gebiotide ® The patented oil soluble series products, relying on strong research and development capabilities, provide customers with one-stop technical empowerment services from raw material customization, formula development to efficacy verification.

Based on biotechnology, leading the new era of oil soluble skincare. Gene-Biocon ignites the downstream high-quality development engine with source innovation, continuously providing irreplaceable technological value and product strength for the global efficacy skincare market.

6. Customer Support and Solutions

6.1 One-Stop Service

From raw material to formula: CDMO/ODM, custom options, technical support.

6.2 Brand Support

Three core tech pillars, targeted solutions, science-based marketing materials.

6.3 International Support

Complete documentation, 3-5 day air shipping with temperature control, multilingual technical service.

6.4 Client Cases

Trusted by 200+ leading OEMs and well-known brands. Contact our sales team for details.

The business model as below:

Provide brand owners wth one-stop. personalized services throughout the entre chain lincluding exclusive raw material production customizafion, movative formula research and development testing. product concept and seling point sorting. etc), and help brands create diferenfiated products through diversified business collaboration

	TYPE	SPECIFIC CONTENT	MONETIZATION METHOD
Technical Service	Raw material development and customization	· Exclusive raw material creation · Stability/Security Testing	· Raw material salestpatent authorization
	Formula development and testing	· Customized formula design · Concept buying point sorting (technology narrative, data support)	· R&D service fee+formula buyout
Commercial Production	Customized production	· Customize products required by brand merchants according to their needs · Full dosage form coverage	· Collect OEM fees
	Intellectual Property Authorization	· Raw material patent authorization · Mature formula technology for sale	· Charging authorization fees/technology buyout · Product sales revenue sharing
Additional Services	Efficacy and compliance documents	· Raw material efficacy/safety documents · Global Regulatory Document Support (SCCS Compliance Assessment Service)	
	End-to-end empowerment	· Insight into the cosmetics market and incubation of new concepts · Green production integration (helping brands reduce their carbon footprint and promote sustainable development)	· Additional value-added · services

7. Conclusion & Call to Action

Gene-Biocon uses synthetic biology as a root and patented oil-soluble technology as an engine. We provide high-purity, highly active, safe, and stable oil-soluble active solutions for global skincare brands. We invite brands, R&D teams, and buyers to contact us for free samples, technical advice, and custom development.

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Found us @Gene-Biocon

Appendix

Appendix 1: Summary of Third-Party Test Reports

Full reports on skin penetration, high-temperature stability, skin irritation, and efficacy available upon request.

Appendix 2: References

1. Global Growth Insights, 2025 Organic Personal Care Ingredient Market Report
2. 24Chemical Research, 2026 Natural Solubilizer Outlook
3. QYResearch, 2025 Global Cosmetic Liposome Report
4. Industrial Securities, "Domestic Brands Rise in Oil Skincare"
5. UserTalk, 2025 Online Facial Oil Consumption Trend Report
6. Gene-Biocon official website and technical documents