

## INDUSTRY OVERVIEW

*Certain information and statistics set out in this section have been extracted from various official government publications, market data providers and an Independent Third Party source, Frost & Sullivan<sup>(1)</sup>. The report (the “Frost & Sullivan Report”) prepared by Frost & Sullivan and cited in this document was commissioned by us. We believe that the sources of this information are appropriate sources for such information and have taken reasonable care in extracting and reproducing such information. We have no reason to believe that such information is false or misleading or that any fact has been omitted that would render such information false or misleading. The information from official government sources has not been independently verified by our Company, the Joint Sponsors, any of their respective directors, employees, agents or advisers or any other person or party involved in the [REDACTED], and no representation is given as to its accuracy, fairness and completeness. For a discussion of the risks relating to our industry, see “Risk Factors – Risks Relating to Our Business and Industry” in this document.*

### OVERVIEW OF BIOACTIVE INGREDIENTS USED IN THE BEAUTY AND HEALTH SECTORS

The term “bioactive ingredients” generally refers to substances which possess specific biofunctions and bioactivity, and can be found in nature or produced by biotechnologies, specifically synthetic biology techniques. Synthetic biology is at the frontier of biotechnologies in recent years. Synthetic biology is an interdisciplinary area that involves the application of engineering principles to biology, which aims at the design and fabrication of biological parts, devices and systems. Synthetic biology techniques not only can enhance the safety, stability and bioactivity in ingredients and raw materials, but also can customize such substances based on specific requirements, such as different skin types, skin problems, dietary habits and exposure to environments, so as to achieve precision in functions. Synthetic biology has the potential to produce ingredients for beauty and health products in a more sustainable way, at a larger scale and with improved stability, compared to certain traditional methods, namely extractions from petrochemicals, animal sources and plant-based sources. As such, synthetic biology has a broad spectrum of potential applications in cosmetics, food and medicine.

<sup>1</sup> We engaged Frost & Sullivan, an independent market research consultant, to conduct an analysis of China’s collagen-based product market, and to prepare a report on China’s collagen-based product market, professional skin treatment product market, skin rejuvenation application market, collagen-based biomedical material market and rare ginsenosides technology-based functional food market for use in this document, which was commissioned by us for a fee of RMB650,000.

In compiling and preparing the F&S Report, Frost & Sullivan adopted the following assumptions: (i) the social, economic and political conditions in China currently discussed will remain stable during the forecast period, (ii) government policies on China’s collagen-based product market, professional skin treatment product market, skin rejuvenation application market, collagen-based biomedical material market and rare ginsenosides technology-based functional food market will remain consistent during the forecast period, (iii) China’s collagen-based product market, professional skin treatment product market, skin rejuvenation application market, collagen-based biomedical material market and rare ginsenosides technology-based functional food market will be driven by the factors which are stated in the report in the forecast period.

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The key types of bioactive ingredients commonly used in the beauty and health sectors mainly include hyaluronic acid, collagen and ginsenosides. Compared with traditional non-bioactive ingredients used in beauty and health products such as glycerol, bioactive ingredients can actively engage with human tissues at a cellular level, and achieve improved safety and efficacy profile. The key features of hyaluronic acid are lubricating and moisturizing the skin. The key benefits of collagen are in skin repair and anti-aging. According to Frost & Sullivan, as an active ingredient extracted from ginseng, ginsenosides help boost the immunity system, reduce cholesterol and blood sugar levels, and contribute to inhibiting tumor growth. Given the aforementioned biological benefits, bioactive ingredients have a broad range of applications in beauty and health sectors, such as skincare, medical dressings, biomedical materials and functional foods. Given the wide range of potential applications, the use of bioactive ingredients in beauty and health sectors are expected to increase and such products will continue to gain popularity.

### **Key Trends of the China's Beauty and Health Sectors**

***Growing Popularity of Technology-based Products.*** Consumers in general are increasingly aware of the underlying science and technologies used in the development of various beauty or health products, leading to a surge in demand for such products. Consumers place greater emphasis on ingredients used in beauty and health products in terms of their efficacy and potential adverse reactions. In particular, they are paying increasing attention to ingredients that are closer to substances found in human tissues or have enhanced biological properties. Consumers are also becoming well versed in science and technology to make informed decision on products, given the abundance of information available both online and offline. In addition, increasingly affluent population in China with higher purchasing power are expected to drive the demand for technology-based products as their product positioning is generally more premium. According to Frost & Sullivan, from 2017 to 2021, the per capita disposable income in China increased from RMB26.0 thousand to RMB35.1 thousand at a CAGR of 7.8%. It is expected to further increase from RMB38.3 thousand in 2022 to RMB57.3 thousand in 2027 at a CAGR of 8.4%.

***Advancement in Technologies of Bioactive Ingredients.*** According to Frost & Sullivan, the advanced technologies in synthetic biology have enabled the mass production of many leading bioactive ingredients without compromising a high level of bioactivity for consumer applications, rendering bioactive ingredients more readily available, stable and affordable to customers. In addition, advancements in synthetic biology have made the production of certain bioactive ingredients possible and in more diverse forms, leading to the abundant possibilities to address specific needs of the consumers. Furthermore, the properties of bioactive ingredients have been increasingly supported by science, research and clinical data. Such advancement in technologies and availability of data also contribute to the feasibility of a clear regulatory framework.

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***Rise of Chinese Domestic Brands.*** Although international brands still dominate the beauty and health sectors in China, the proportion of Chinese domestic brands is expected to grow in the future. Chinese consumers are becoming increasingly sophisticated and focused on products’ value proposition with better and distinctive functionality and quality. Therefore, Chinese domestic players in the industry are now devoting more resources into R&D with a focus on product development. With the increased R&D investment by Chinese domestic brands, their relevant technologies and product quality are catching up to their international counterparts, and for certain technologies such as recombinant collagen and rare ginsenosides, Chinese domestic brands even have the leading edge over international brands. In addition, Chinese domestic brands are closer to Chinese consumers and market trends in China and are thus more nimble in tailoring their research, product development and marketing to address changing consumer preferences and market trends.

***Digital Transformation.*** Digital transformation impacts throughout the product lifecycle from product design, branding, marketing, distribution to consumer interaction and consumer education. Consumers are also influenced by digital transformation, from where they obtain product information, acquiring digital savviness, to behavioral changes in their ultimate choice of purchase. The e-commerce and social media platforms in China have become the frontier of consumer digital experience. The business models of companies, and the industry at large, have had to adapt to digital transformation and those that have done so successfully have thrived.

***Generation Z and the Millennials.*** Younger generations like Generation Z and the Millennials are becoming a significant group of consumers that transform the landscape of beauty and health sectors. As they are more digitally savvy and technology-focused, younger generations are more inclined towards purchasing products with proven technologies and brands with better digital focus, with less regards to whether such brands are international or domestic. They are ready to exchange knowledge and experience in online community and embrace the latest innovations in terms of products and ingredients used.

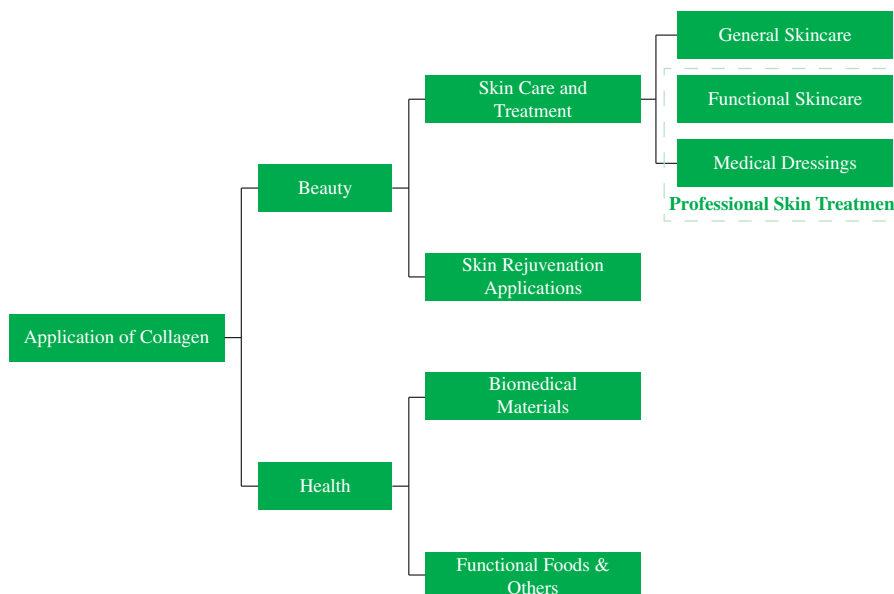
## OVERVIEW OF CHINA’S COLLAGEN-BASED PRODUCT MARKET

### Introduction of Collagen and its Major Applications

As the most abundant protein in human body, collagen is an ideal ingredient for skincare and skin treatment products, such as (i) functional skincare products, (ii) medical dressings, (iii) general skincare products and (iv) skin rejuvenation applications. Given its hemostatic and cell regenerative property, collagen also serves as an ideal biomedical material for medical and health products, such as implantable medical devices.

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### Major Applications of Collagen in the Beauty and Health Sectors



### Comparative Analysis between Recombinant Collagen and other Bioactive Ingredients

Among the bioactive ingredients used for beauty products, hyaluronic acid and collagen both enjoy the established popularity and wide acceptance. The key features of hyaluronic acid are skin lubrication and moisturization. In contrast, collagen in general possesses additional biological properties in providing structural support, promoting hemostasis and cell adhesion, stimulating cell regeneration and proliferation, repairing damaged skin barrier, and replenishing nutrients for aging and problematic skin. As a result, the fundamental advantage of collagen over hyaluronic acid is its efficacy in skin repair and anti-aging. Therefore, collagen has been gaining more market shares and the market share of collagen-based professional skin treatment products is expected to exceed that of products made of hyaluronic acid in 2026.

Collagen can be categorized into recombinant collagen and animal-derived collagen. Recombinant collagen is synthesized by genetic engineering, while animal-derived collagen is extracted from animal tissues. Historically, animal-derived collagen has been commonly used in beauty and health products, primarily due to its lower costs of production and simpler production process. However, recombinant collagen has inherent advantages, which include higher levels of bioactivity and biocompatibility, lower level of immunogenicity, lower risk of undetected pathogens, better water solubility, free from cytotoxicity and the ability to be further processed and optimized. Given the denaturation temperature of recombinant collagen at over 72°C is far above the that of animal-derived collagen at 40°C, recombinant collagen is easier for transportation and storage. With the significant advantages, recombinant collagen is comparably a safer and more suitable material for beauty and health products than animal-derived collagen. Moreover, leading market players including our Company, have propelled the technological advancements in mass production of recombinant collagen at a lower cost, which have increased its popularity and penetration rate.

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### Growth drivers for the increasing penetration rate of recombinant collagen

- *Better efficacy to address increase in problematic skin conditions.* The urban lifestyle, such as bedtime procrastination and prolonged exposure to blue light from electronic devices, has given rise to various problematic skin conditions, including skin sensitivity, premature skin aging, chronic eczema and allergies, which may lead to stinging, itching, burning redness, dryness, scaling, peeling, bumps, and hives. The increase in problematic skin conditions highlights the need for scientific skin treatment solutions that are effective and tailored to the specific skin conditions. Recombinant collagen possesses higher levels of bioactivity and biocompatibility, which promote cell growth and support a high cell adhesion performance, thus offering better efficacy in repairing damaged skin barriers and addressing such problematic skin conditions.
- *Heightened consumer awareness of technological background of recombinant collagen.* With enhanced skincare awareness education on online and offline media, consumers are increasingly aware of the ingredients, efficacies, safety, science and technology behind the product formulas. In recent years, there are more clinical data and scientific support for the biological properties and efficacies of recombinant collagen. As such, consumers are having a better understanding of biological advantages of recombinant collagen as well as its medical grade applications, which serves as a strong motivation for purchasing recombinant collagen-based products.
- *Development of online sales and marketing channels.* The development of online sales and marketing channels boosted retail sales value of skincare products and the proportion of e-commerce sales of skincare products in China increased rapidly from 44.7% in 2017 to 73.5% in 2021. More and more consumers are opting for e-commerce channels given the convenience, wide access of products and services and competitive pricing. Leveraging the increasing internet penetration and prevalent use of mobile devices in China, Chinese domestic businesses and brands often utilize new media and e-commerce platforms to capture target consumers, including the younger generations who are ready to accept innovative ingredients like recombinant collagen, consequently achieving high sales conversion. For example, content marketing via collaborations with influencers on live streams and brand promotion is one of the popular marketing tools.
- *Favorable policies and regulations.* China's National Medical Products Association (NMPA) has introduced the standards for recombinant collagen (both as raw materials and end-products) in the medical and pharmaceutical industry; and is in the process of preparing the technical standards for collagen raw materials for cosmetic products. The PRC Medical and Pharmaceutical Industry Standards, Recombinant Collagen (中華人民共和國醫藥行業標準《重組膠原蛋白》), is expected to become effective in August 2022. The implementation of industry-wide standards will further promote the commercial applications of recombinant collagen with clearer regulatory oversight on quality control, testing and raw materials.

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- *Technological advancement.* The advanced technologies in synthetic biology have enabled the mass production of recombinant collagen at a lower cost, without compromising a high level of bioactivity for consumer applications. A diverse range of recombinant collagen categories and a comprehensive expression system can achieve efficient synthesis across different types of recombinant collagen for different commercial applications.

### **Recombinant Collagen Application 1: Professional Skin Treatment (Functional Skincare and Medical Dressing)**

Professional skin treatment products are used to address skin issues, such as skin sensitivity, premature skin aging, chronic eczema and allergies, and can also be used for general purposes of consumers. To achieve the desired efficacies, professional skin treatment products contain ingredients such as collagen, hyaluronic acid and plant extracts. Professional skin treatment products include (i) functional skincare products and (ii) medical dressings.

#### *Introduction of China’s functional skincare market*

Functional skincare products are designed with mild formula and active ingredients such as collagen, hyaluronic acid, and plant extracts, which enhance skin health with proven benefits. Such skincare products help ensure results through high-performance ingredients that address a spectrum of skin conditions. Due to the unhealthy lifestyle, prolonged exposure to blue light from electronic devices, and increasing pollution, there is an increasing number of people with sensitive skin, premature skin aging, chronic eczema and allergies. Such skin conditions may cause symptoms, such as stinging, itching, burning redness, dryness, scaling, peeling, bumps, and hives. In 2021, the total number of people with sensitive skin reached over 0.4 billion, accounting for over 30% of the total population in China, which is a key demographic group behind the growth of the functional skincare market. More broadly, by providing customized solutions to improve skin conditions, functional skincare products have gained increasing popularity among many consumer groups beyond those with problematic skin conditions.

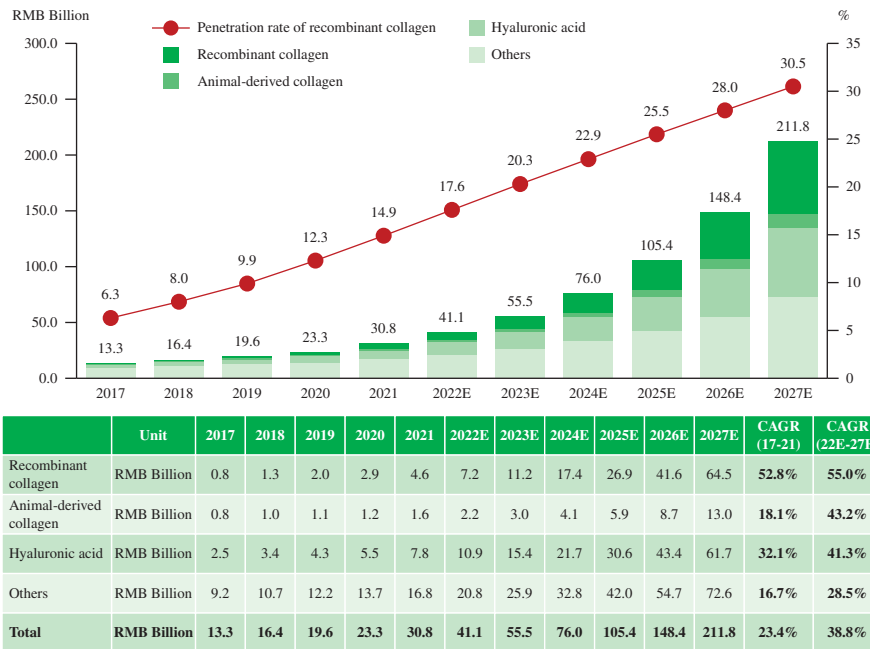
#### *Market size of China’s functional skincare market*

China’s functional skincare market has experienced rapid growth in the recent few years due to the emergence of bioactive ingredients. The market size in terms of retail sales values increased from RMB13.3 billion in 2017 to RMB30.8 billion in 2021 at a CAGR of 23.4%. It is projected to reach RMB211.8 billion in 2027 at a CAGR of 38.8% from 2022 to 2027. The collagen-based functional skincare product market has grown from RMB1.6 billion in 2017 to RMB6.2 billion in 2021 at a CAGR of 38.8%. It is expected to further grow from RMB9.4 billion in 2022 to RMB77.5 billion in 2027 at a CAGR of 52.6%, which is higher than that of hyaluronic acid-based products.

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In addition, in light of the significant advantages of recombinant collagen over animal-derived collagen, the penetration rate of recombinant collagen-based functional skincare products increased from 6.3% to 14.9% from 2017 to 2021. It is expected to further grow from 17.6% in 2022 to 30.5% in 2027. Furthermore, the market size of the recombinant collagen-based functional skincare products has grown from RMB839.8 million in 2017 to RMB4.6 billion in 2021 at a CAGR of 52.8%. It is expected to further grow from RMB7.2 billion in 2022 to RMB64.5 billion in 2027 at a CAGR of 55.0%.

### Market Size of Functional Skincare Product Market (by retail sales value), China, 2017-2027E



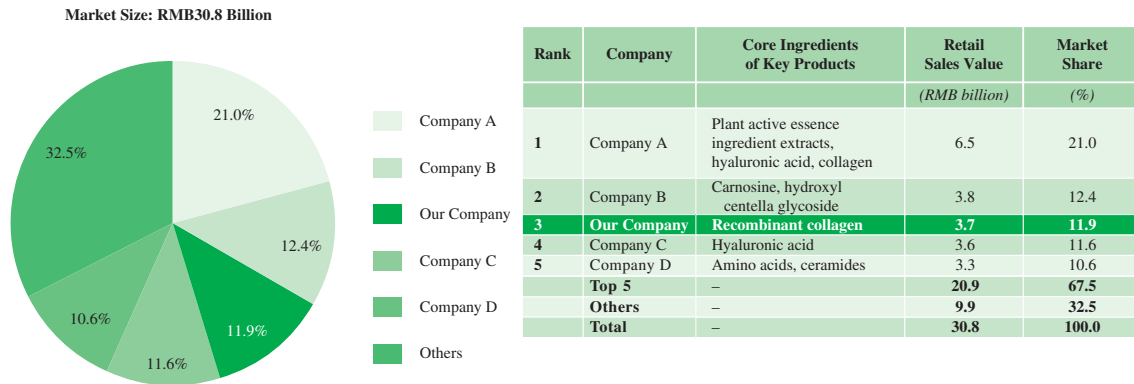
Source: Frost & Sullivan



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### Competitive landscape of China’s functional skincare market

The size of China’s functional skincare market reached RMB30.8 billion in terms of retail sales value in 2021, with the top five players accounting for 67.5% of the market share. Our Company ranked third in the functional skincare market and first in the collagen-based functional skincare market, with retail sales value of RMB3.7 billion in 2021. The following table sets forth the top five functional skincare companies in China by retail sales value in 2021:



Source: Frost & Sullivan

#### Notes:

- (1) Company A is a publicly listed leading skincare provider primarily engaged in the R&D, production, and sales of professional skin treatment products.
- (2) Company B is a publicly listed and a global well-established company primarily engaged in R&D, production and sales of personal care products, cosmetics, and professional skin treatment products.
- (3) Company C is a publicly listed biotechnology company primarily focusing on the R&D, production, and sales of hyaluronic acid-based products.
- (4) Company D is a publicly listed and a well-established company primarily engaged in R&D, production, and sales of personal care products and professional skin treatment products.

### Introduction of China’s medical dressing market

Medical dressings are adjuvant therapeutic products catered for the skin repair needs following medical procedures, injuries, chronic eczema and allergies and exclude medical consumables such as gauze. In the PRC, according to the Product Classification Catalog of Medical Devices (《醫療器械分類目錄》), they fall within the category of medical devices, which are further classified into three classes. Higher level in classification requires higher standards and involves prolonged administrative processes, thus creating entry barriers for new applicants. Given the superior properties of collagen and hyaluronic acid, they are commonly used in medical dressings.

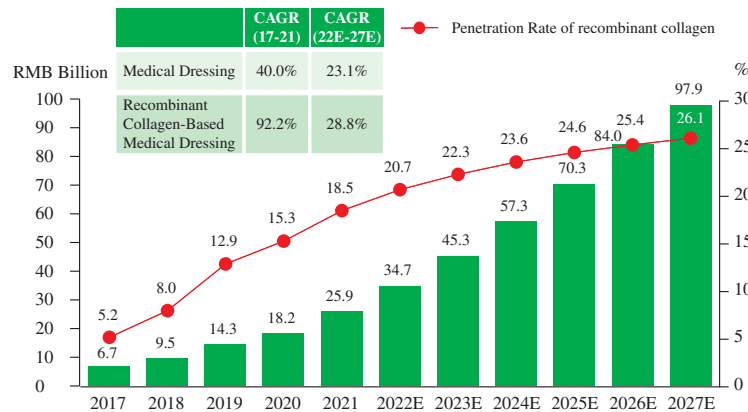


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### *Market size of China’s medical dressing market*

Driven by the increasing demand of skin repair needs, the market of medical dressings has witnessed a robust growth. The market size for medical dressings in China increased from RMB6.7 billion in 2017 to RMB25.9 billion in 2021 at a CAGR of 40.0%, and is expected to further increase from RMB34.7 billion in 2022 to RMB97.9 billion in 2027 at a CAGR of 23.1%. The penetration rate of recombinant collagen-based medical dressings in the overall medical dressing market increased from 5.2% in 2017 to 18.5% in 2021, and is expected to further increase to 26.1% in 2027. The market size of the recombinant collagen-based medical dressings increased from RMB351.6 million in 2017 to RMB4.8 billion in 2021 at a CAGR of 92.2%, and is projected to further grow from RMB7.2 billion in 2022 to RMB25.5 billion in 2027 at a CAGR of 28.8%.

**Market Size of Medical Dressing Market  
(by retail sales value), China, 2017-2027E**

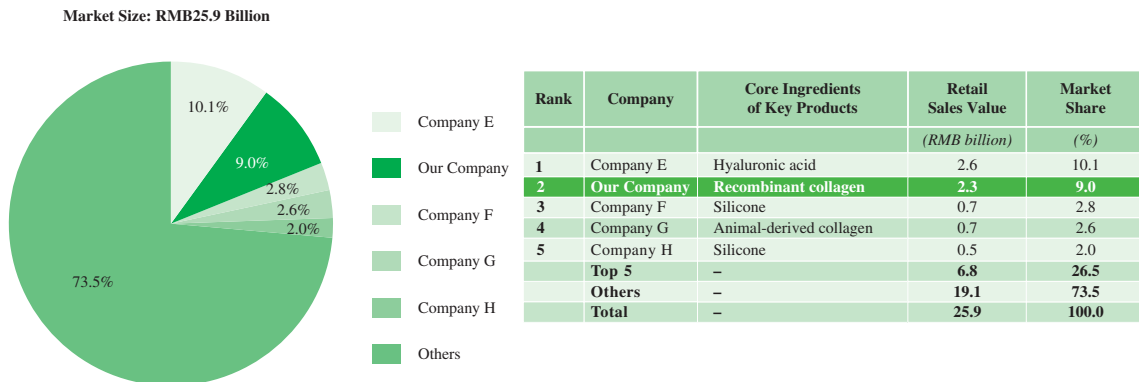


Source: Frost & Sullivan

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### Competitive landscape of China’s medical dressing market

The overall scale of China’s medical dressing market reached RMB25.9 billion in 2021 in terms of retail sales value. The top five players accounted 26.5% of market share in China’s medical dressing market, demonstrating fragmented competition. Our Company ranked second in the overall medical dressing market and first in collagen-based medical dressing market, with retail sales value of RMB2.3 billion generated in 2021. The following table sets forth the top five medical dressings companies in China by retail sales value in 2021:



Source: Frost & Sullivan

Notes:

- (1) Company E is a professional skin treatment company primarily engaged in R&D, production and sales of functional skincare and medical dressing products.
- (2) Company F is a publicly listed medical device manufacturer primarily engaged in the R&D, production, and sales of medical dressing products, medical products and sanitary products.
- (3) Company G is a publicly listed biotechnology company primarily engaged in the R&D, production and sales of professional skincare products based on animal-derived collagen.
- (4) Company H is a publicly listed medical device manufacturer for disposable wound-care and surgical products.

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### Summary of professional skin treatment product market size and competitive landscape in China

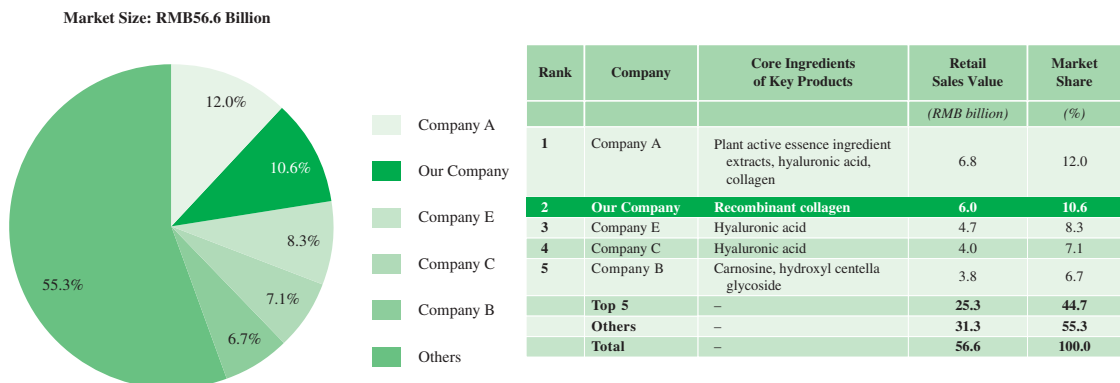
The following chart sets forth the breakdown of professional skin treatment product market by material:

**Market Size of Professional Skin Treatment Product Market (by retail sales value), China, 2017-2027E**



Source: Frost & Sullivan

China’s overall professional skin treatment product market was RMB56.6 billion in 2021, and China’s recombinant collagen-based professional skin treatment product market was RMB9.4 billion in 2021 in terms of retail sales value. In 2021, the top five players accounted for 44.7% of the market share in China’s professional skin treatment product market, implying a moderate concentration. The following table sets forth the top five professional skin treatment product companies in China by retail sales value in 2021:



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### Recombinant Collagen Application 2: Skin Rejuvenation Applications

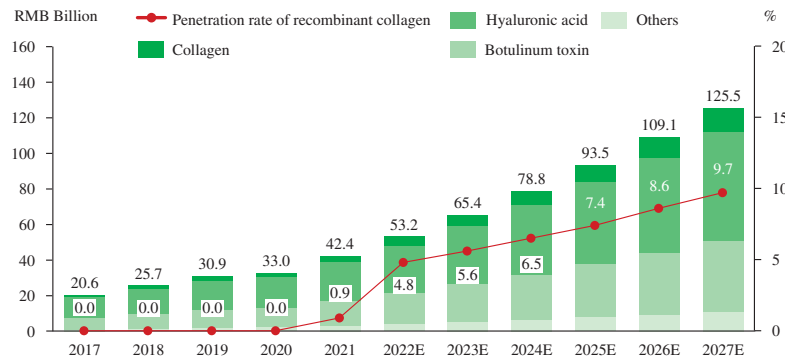
#### *Introduction of skin rejuvenation application market*

As a non-surgical procedure, skin rejuvenation applications are popular among consumers because of its safety, shorter downtime and affordable pricing. Hyaluronic acid, botulinum toxin and collagen are the three major bioactive ingredients suitable for skin rejuvenation applications. Compared with hyaluronic acid and botulinum toxin, collagen has a smaller market share in skin rejuvenation applications due to high production cost and safety concerns of animal derived collagen. However, as recombinant collagen becomes affordable and possesses diverse biological properties for skin rejuvenation, recombinant collagen-based skin rejuvenation applications are anticipated to gain a higher market share.

#### *Skin rejuvenation application market size*

The market size of skin rejuvenation application market in China increased from RMB20.6 billion in 2017 to RMB42.4 billion in 2021 at a CAGR of 19.7%. The market is projected to continue to grow from RMB53.2 billion in 2022 to RMB125.5 billion in 2027 at a CAGR of 18.7%. In 2020, there was no recombinant collagen used in skin rejuvenation applications, but its penetration rate is expected to grow from 4.8% in 2022 to 9.7% in 2027.

**Market Size of Skin Rejuvenation Application Market  
(by retail sales value), China, 2017-2027E**



	Unit	2017	2018	2019	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E	CAGR (17-21)	CAGR (22E-27E)
Collagen	RMB Billion	1.6	2.1	2.6	2.8	3.7	5.1	6.5	8.1	9.8	11.7	13.7	22.2%	21.7%
Hyaluronic acid	RMB Billion	11.4	13.9	16.4	17.2	21.7	26.9	32.7	39.1	46.0	53.4	61.2	17.3%	17.9%
Botulinum toxin	RMB Billion	7.0	8.6	10.3	10.9	13.9	17.3	21.1	25.3	29.9	34.7	39.8	18.5%	18.2%
Others	RMB Billion	0.6	1.1	1.6	2.1	3.1	3.9	5.1	6.3	7.8	9.3	10.8	56.8%	22.4%
<b>Total</b>	<b>RMB Billion</b>	<b>20.6</b>	<b>25.7</b>	<b>30.9</b>	<b>33.0</b>	<b>42.4</b>	<b>53.2</b>	<b>65.4</b>	<b>78.8</b>	<b>93.5</b>	<b>109.1</b>	<b>125.5</b>	<b>19.7%</b>	<b>18.7%</b>

Source: Frost & Sullivan

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### Recombinant Collagen Application 3: Biomedical Materials

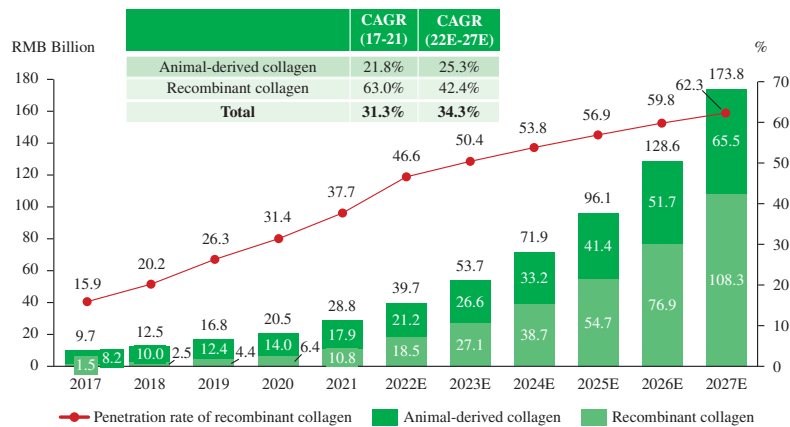
#### *Introduction to China’s collagen-based biomedical material market*

The market size of China’s collagen-based biomedical material market has grown from RMB1.0 billion in 2017 to RMB3.2 billion in 2021 at a CAGR of 33.5%, and is expected to further grow from RMB4.4 billion in 2022 to RMB19.9 billion in 2027 at a CAGR of 35.1%. Given its biocompatibility and ability to promote regeneration of osteoblast (bone-forming cells), recombinant collagen is an ideal bioactive ingredient for implantable medical devices, especially dental bone graft materials.

#### Summary of Market Size of China’s Recombinant Collagen-based Product Market

The market size of recombinant collagen products in China by retail sales value increased from RMB1.5 billion in 2017 to RMB10.8 billion in 2021 at a CAGR of 63.0%, and is expected to further increased from RMB18.5 billion in 2022 to RMB108.3 billion in 2027 at a CAGR of 42.4%. Correspondingly, the penetration rate of recombinant collagen products within the overall collagen-based product market increased from 15.9% in 2017 to 37.7% in 2021, and is projected to further increase from 46.6% in 2022 to 62.3% in 2027.

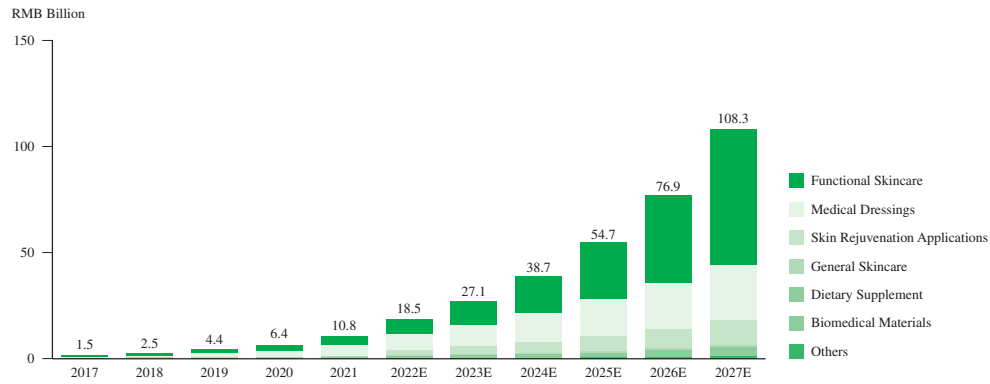
#### Market Size Breakdown by Technology Path of Collagen-based Product Market (by retail sales value), China, 2017-2027E



Source: Frost & Sullivan

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### Market Size Breakdown by Applications of Recombinant Collagen-based Product Market (by retail sales value), China, 2017-2027E



	Unit	2017	2018	2019	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E	CAGR (17-21)	CAGR (22E-27E)
Functional Skincare	RMB Billion	0.8	1.3	2.0	2.9	4.6	7.2	11.2	17.4	26.9	41.6	64.5	52.8%	55.0%
Medical Dressings	RMB Billion	0.4	0.8	1.9	2.8	4.8	7.2	10.1	13.5	17.3	21.3	25.5	92.2%	28.8%
Skin Rejuvenation Applications	RMB Billion	-	-	-	-	0.4	2.6	3.7	5.1	7.0	9.3	12.1	-	36.5%
General Skincare	RMB Billion	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	25.4%	13.3%
Dietary Supplement	RMB Billion	-	-	-	-	-	0.1	0.1	0.1	0.1	0.1	0.1	-	18.6%
Biomedical Materials	RMB Billion	0.1	0.2	0.2	0.3	0.5	0.7	1.0	1.4	1.9	2.7	3.7	39.1%	39.3%
Others	RMB Billion	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.4	0.6	0.9	1.3	64.7%	43.2%
<b>Total</b>	<b>RMB Billion</b>	<b>1.5</b>	<b>2.5</b>	<b>4.4</b>	<b>6.4</b>	<b>10.8</b>	<b>18.5</b>	<b>27.1</b>	<b>38.7</b>	<b>54.7</b>	<b>76.9</b>	<b>108.3</b>	<b>63.0%</b>	<b>42.4%</b>

Source: Frost & Sullivan

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### OVERVIEW OF GINSENOSES

Ginseng has been widely used in traditional Chinese medicine to boost energy levels and immunity. Ginsenosides are the major active ingredients in ginseng and other Panax genus plants, which have benefits of anti-tumor effects, and lowering blood sugar and lipid levels. Ginsenosides can be categorized into prototype ginsenosides and rare ginsenosides. Prototype ginsenosides exist naturally in ginseng and can be obtained by simple physical purification, while rare ginsenosides are derived from prototype ginsenosides by utilizing synthetic biology techniques, such as enzymatic hydrolysis or microbial fermentation. By altering the properties of prototype ginsenosides to become rare ginsenosides, rare ginsenosides are able to be more easily absorbed by human body and exhibit higher bioactivity when compared with prototype ginsenosides, resulting in a bioactive ingredient that provides enhanced benefits and one that is suitable to be used in health products and drugs.

### Applications and Major Products of Rare Ginsenoside

Examples of rare ginsenosides include Rg3, Rh2, Rk1, Rg5, Rk3, Rh4, Rk2, Rk3, CK and aPPD. Given their pharmacological properties which include but are not limited to the ability to suppress tumor growth and enhance immune systems, rare ginsenosides are often used in health products and drugs. Today, Rg3 has been approved for clinical cancer treatment in China, while other types of rare ginsenosides have been applied in a broad range of health products for strengthening immune systems, improving sleep and others.

### Market Demand of Rare Ginsenosides

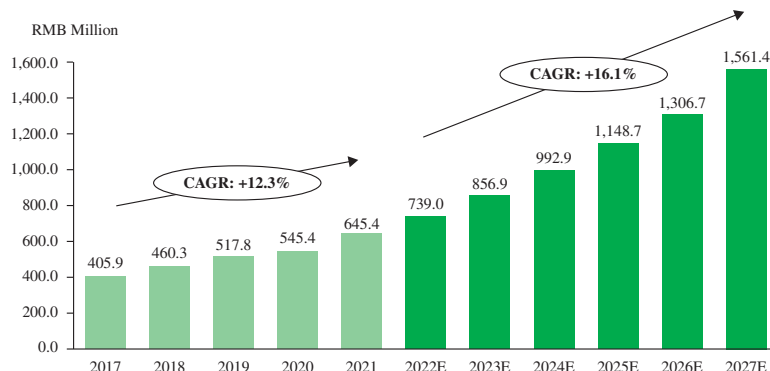
#### *Market size of China’s rare ginsenosides technology-based functional food market*

Consumers of ginsenoside products mainly come from Asian countries including China, South Korea and Japan, where the traditional medicine culture and practices are relatively popular. China is the world’s largest market for rare ginsenosides technology-based functional food. The sales value of China’s rare ginsenosides technology-based functional food grew from RMB405.9 million in 2017 to RMB645.4 million in 2021 at a CAGR of 12.3% and is further expected to increase to RMB1,561.4 million in 2027 at a higher CAGR of 16.1%. Our Company was the second-largest rare ginsenosides technology-based functional food company by retail sales in China in 2021, with a market share of 24.0%.



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### Market Size of Rare Ginsenosides Technology-based Functional Food Market (by sales value), China, 2017-2027E



Source: Frost & Sullivan

#### *Growth drivers and trends of rare ginsenosides technology-based functional food market*

- *Greater emphasis on health.* With growing affluence and improving living standards, consumers will place greater emphasis on physical health. There is an increasing health demand for healthy lifestyle, such as overall immunity enhancement, sleep improvement and wellness enhancement due to high work intensity and life pressure. The increasing health awareness will enhance the popularity of high-quality and specialized health products, including rare ginsenosides technology-based products.
- *Advancements in Production Technology.* The production of rare ginsenosides has traditionally been limited by high production costs and technological requirements needed to transform prototype ginsenosides into rare ginsenosides. The biotransformation and production process of rare ginsenosides often face challenges such as low production efficiency levels and inadvertent inactivation, which would in turn result in low production yields or quality levels of ingredients produced. As such, the continued advancements in synthetic biology have been critical in the development of rare ginsenosides, as it allows companies to overcome challenges faced during the production process, and enable mass production of multiple types of rare ginsenosides possible for commercial applications. As rare ginsenosides become more readily produced, rare ginsenosides become more cost-effective for health product and drug manufacturers to incorporate into their products, which in turn drive the increase in penetration rate of rare ginsenosides technology-based health products in the overall health product market.
- *Continued in-depth research on rare ginsenosides.* As further in-depth research continues to be conducted on the efficacy and functionalities of rare ginsenosides, such as Rk3, Rh4, Rk1, Rg5, and CK, it is expected that the applications of rare ginsenosides will further expand within and beyond functional foods.