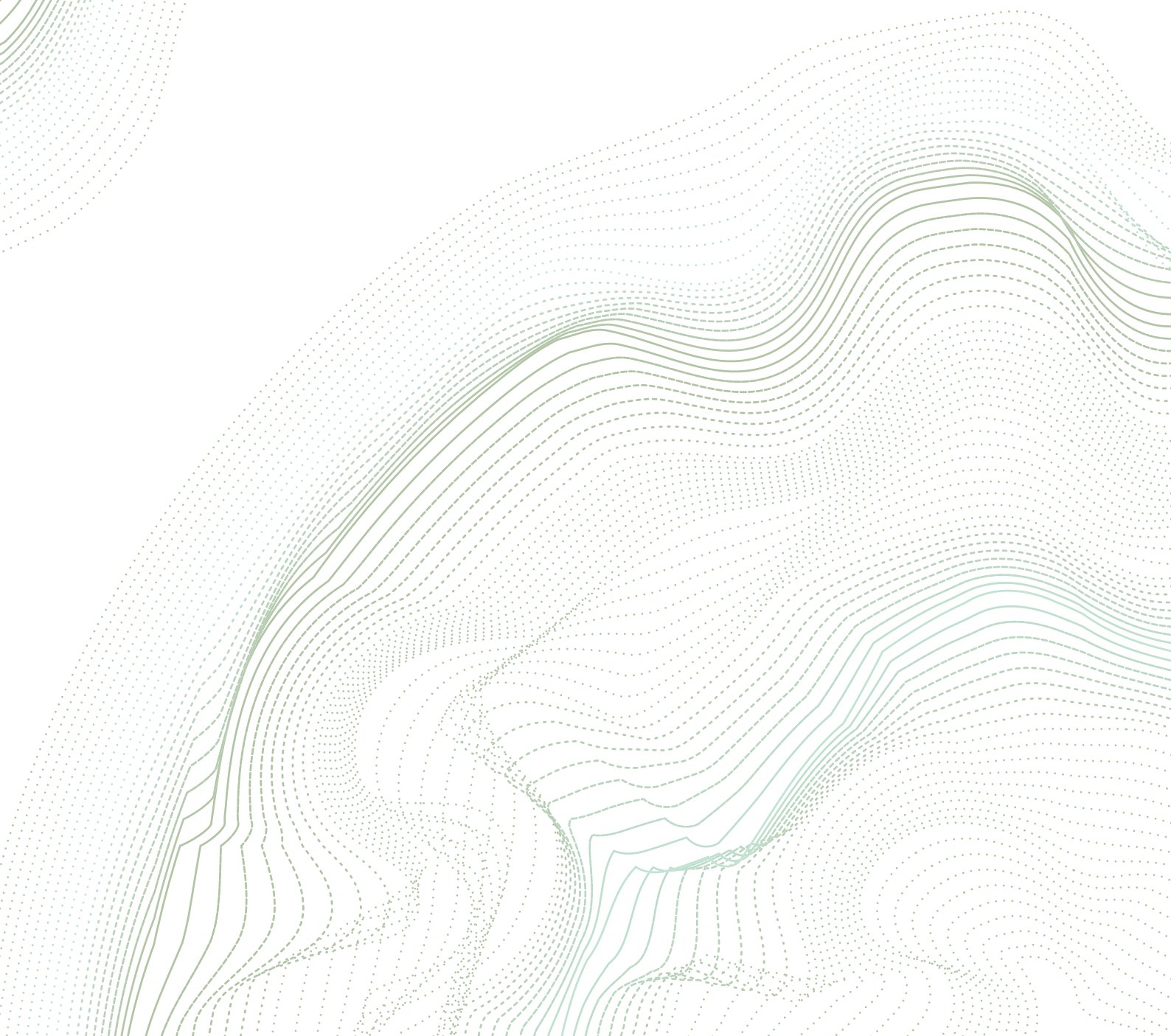
Collaboration for Sustainable Development of Viscose

2018

Sustainability Report



About this Report

This Report, jointly prepared by the Social Responsibility Office of the China National Textile and Apparel Council (CNTAC) and the China Chemical Fibers Association, reviews the development status of viscose industry in 2018 and elaborates on the sustainability governance model of the Collaboration for Sustainable Development of Viscose (CV) as well as the progress and practices of the economic, environmental and social responsibility in the industry. Moreover, this Report provides the sustainability planning and roadmap.

Reporting Organization:

Collaboration for Sustainable Development of Viscose (CV),established on March 15, 2018, is a public governance organization sponsored by viscose enterprises, upstream and downstream enterprises along the industrial chain, and associations upon the principle of voluntariness. As of December 2018, CV has a total of 14 members, including 2 industry associations and 12 viscose producers (which own 14 plants altogether)[1]. CV members are as follows (in no particular order):

1.China Chemical Fibers Association

2.China Cotton Textile Association

3.Tangshan Sanyou Group Xingda Chemical Fiber Co., Ltd.

4.Sateri[2]

5.Funing Aoyang Science and Technology Co., Ltd.

6.CHTC Helon (Weifang) New Materials Co., Ltd.

7.Jilin Chemical Fiber Group Co., Ltd.

8.Lenzing (Nanjing) Fiber Co., Ltd.

9.Shandong Yamei Science and Technology Co., Ltd.

10.Shandong Silverhawk Chemical Fiber Co., Ltd.

11.Xinxiang Bailu Chemical Fibre Group Co.,Ltd.

12.Yibin Grace Co., Ltd.

13.Zhejiang Fulida Co., Ltd.

14.Xinjiang Zhongtai Chemical Co., Ltd.[3]

Reporting period:

January 1, 2018 to December 31, 2018, including some historical information and data.

Compiling principles:

This Report quotes the reporting indicators of China Sustainability Reporting Guidelines for Apparel and Textile Enterprises (2008 Edition) (CSR-GATEs: 2008) and the Sustainable Development Goals (SDGs) of the United Nations, and reviews the members' sustainability performances during the reporting period.

Information source:

All information and data in this Report are provided by the CV members, including CV members' public information as well as statistics and summaries of data files. They are all approved by the CV members.

Report verification:

Refer to AA1000AS (2008) Assurance methodology, assurance level II, on Balance, Comparability, Accuracy, Timeliness, Clarity, Reliability, and give the evaluation.

Where any discrepancy arises between the English translation and the original Chinese version, the Chinese version will prevail.

1.In future, the CV will take in upstream and downstream players along the industrial chain to jointly propel the sustainability process of the industry.
2.Sateri includes Sateri (Fujian) Fiber Co., Ltd., Sateri (Jiangxi) Fiber Co., Ltd. and Sateri (Jiujiang) Fiber Co., Ltd.
3.Xinjiang Fulida Co., Ltd., a subsidiary of Xinjiang Zhongtai Chemical Co., Ltd., joined the CV in November 2018. To avoid any confusion, this Report uses Xinjiang Zhongtai Chemical Co., Ltd. as the member name, considering Zhejiang Fulida Co., Ltd. and Xinjiang Fulida Co., Ltd. come under the control of different corporate entities.



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Chapter 1
About the viscose industry in China

1.1 About the viscose industry in China

Specific molecular structures and production techniques create unique styles of various raw textile materials, from traditional natural fibers such as cotton, wool, silk and linen to chemical fibers represented by polyester, nylon and viscose. Viscose is a kind of fibers made from natural celluloses (linter, wood chip, hemp and bamboo), which are processed with a series of chemical and physical changes and woven into fibers. With a similar structure to cotton, viscose features good moisture absorption, air permeability and comfort and is widely used in apparel, home textiles, and other industries. It has become one of the most important textile fiber types.

In the past 20 years, China's viscose industry leaped forward, benefiting from multifaceted factors excellent characteristics of viscose, technological progress of the industry and market demand growth. Currently, global viscose production is distributed in Austria, Germany, China, Japan, India and Indonesia, and China is the largest producer and consumer. Statistics reveals that in 2018, China's viscose output hit 3.66 million[4] tons, representing more than two thirds of the world's total output. Of the world's top 10 viscose producers (in terms of revenue and sales), 80% are based in China, and the remaining have also established presences in China[5]. Thus, the development of China's viscose industry will deliver an important impact on the world's industry.



80% are based in China

Case: Overviews of Chinese viscose industry

Statistical data show that as of the end of 2018, the Chinese Mainland had a total of 19 viscose producers (28 plants), including 3 with an annual output of more than 500,000 tons, 3 with 200,000-500,000 tons and 6 with 100,000-200,000 tons. The top 6 players contribute about 70% of the industry's total capacity. The absolute majority of these companies have started gathering in the eastern region, the western region and Xinjiang Region. They have kept growing bigger with a significant increase in industrial concentration.



Figure 1 Distribution map of Chinese viscose producers

4. 2019 Market Trend Outlook for Viscose Industrial Chain, Zhejiang Huarui Information Consulting Co., Ltd., 2018
5. Dirty fashion on track for transformation, Change Markets Foundation, 2018.
6. Reference document on best available techniques (BAT) in the production of polymers, European Commission, 2007.

1.2 Sustainability status of China's viscose industry

(1) Sustainable product advantages

Viscose products have natural advantages in sustainability. On the one hand, viscose products are made from natural plant fibers, which are pure, recoverable, biodegradable and comfortable, thereby vesting viscose with natural advantages in sustainability. On the other hand, the decrease of cultivated land and the growing depletion of oil resources are posing a rising constraint to the production of natural fibers and synthetic fibers, while viscose is derived from renewable resources, so its existence and development will have important economic and social values.

(2) Demand for a more sustainable production process

Under the traditional "viscose" production process, the natural cellulose is used as the basic raw material, then made into cellulose xanthate through chemical reaction, further converted into the viscose liquid, and finally made into viscose with the processing and formation equipment. The entire process involves the use of multiple chemicals and is accompanied with the emission of certain amount of carbon disulfide (CS_2) and hydrogen sulfide (H_2S), which has remained a key concern of external stakeholders. Some countries have issued special standards to regulate the environmental management and pollutant emissions in the industry. For example, the Reference Document on Best Available Techniques (BAT) in the Production of Polymers issued by the EU in 2007 (referred to as the "EU BAT")[6]stipulates the best available techniques for the management of chemicals in the production of viscose and emission control standards.

In recent years, China's viscose industry has kept lifting the green production level, driven by with the improvement of industrial concentration, rapid technical progress and continuous natural selection in the market. The main drive is the pressure from tighter and stricter environmental regulation of the government. In fact, viscose producers come under strict supervision in the entire process from planning and construction to production and operation, and noncompliant companies have to pay a high violation cost and are even closed down. Stakeholders headed by industry associations have also continuously encouraged and guided companies to improve their management level and promoted the improvement of cleaner production level in the industry by formulating standards and recommending new technologies and processes. Statistic data of the China Chemical Fibers Association demonstrate that over past years, China's viscose industry has slashed the overall energy and water consumption per ton of products, gradually increased the total sulfur recovery rate and effectively driven the industry's sustainability level by upgrading production equipment and increasing the investment in technological transformation, energy conservation and environmental protection. Compared with 2005, the industry reduced unit energy consumption and wastewater discharge both by about 40%, and slashed the unit emissions of CS_2 and H_2S by more than 80% (see Figure 2) in 2015.

However, the industry still faces can't-ignore challenges. The total environmental impact of the industry has kept enlarging together with growing total energy consumption and pollutant emission (see Figure 3) in the context of continuous swift capacity expansion and further increase of industrial concentration. Current technological advances can't fully offset these environmental impacts derived from the capacity expansion. As the global environmental and resource constraints are strengthening, the international community is now getting increasingly imperative to pursue sustainable growth, and it is already an urgent challenge for the industry to support the global response to environmental and social challenges while assuring a healthy development.

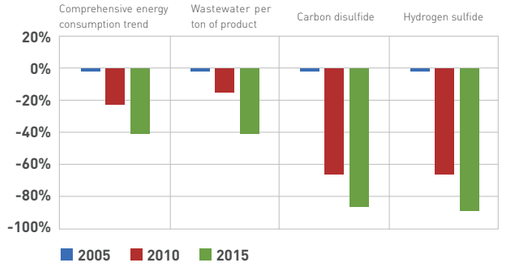


Figure2[7] Trend in environmental impact changes of China's viscose staple fiber (VSF) industry from 2005 to 2015: per ton of products

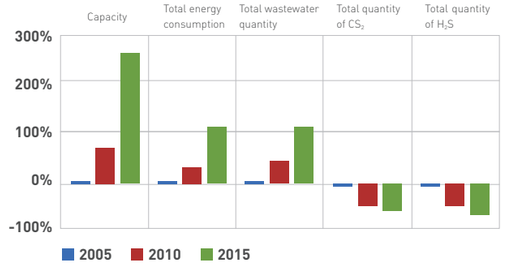


Figure3[7] Trend in environmental impact changes of China's viscose staple fiber (VSF) industry from 2005 to 2015: Industrial gross indicator

7. China's Viscose Industry Development and Environmental Protection (2017 Edition), China Textile & Apparel Press, 2017; China's Viscose Industry Development and Environmental Protection (2012 Edition), China Textile & Apparel Press, 2012; China's Viscose Industry Development and Environmental Protection (2009 Edition), China Textile & Apparel Press, 2009.

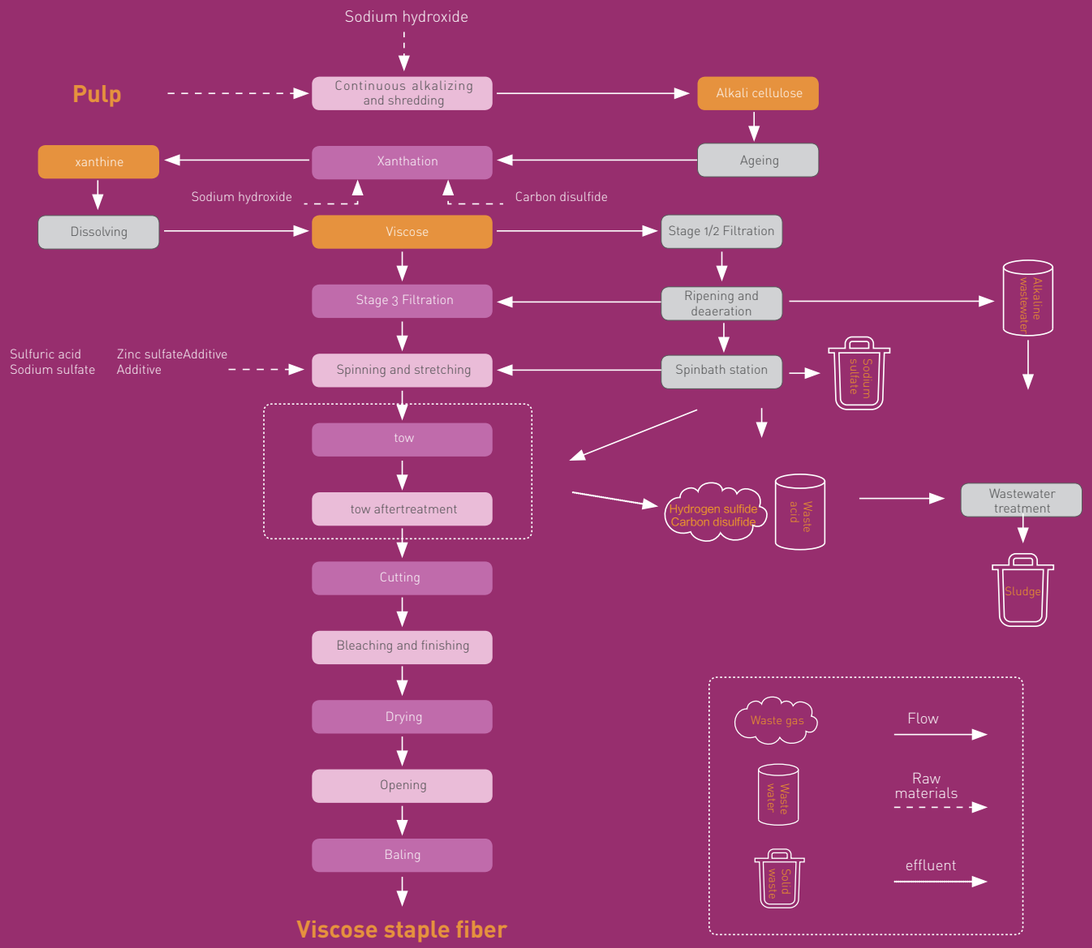


Figure 4 Production process chart for viscose fiber



Chinese Government Supervision

First, China has set industrial access conditions.The Viscose Fiber Industry Standard Conditions was released and implemented in 2010, and revised into the Viscose Fiber Industry Standard Conditions (2017 Version).] involving industrial layout, process and equipment, resource consumption, environmental protection, quality, management, occupational safety and health, corporate social responsibility and other aspects in order to promote the structural adjustment and upgrade of the viscose industry, reduce the waste of resources, and achieve a sustainable and sound development. Only enterprises that meet these conditions can carry out viscose production activities. China has also drawn a negative list of access in specific regions such as the Yangtze River Delta to strengthen environmental protection in these ecologically sensitive regions.

Second, in the planning process, the viscose enterprise shall take into consideration pollution control standards and requirements as well as total pollutant emission control requirements in the region, and adopt cleaner production with less energy consumption and less pollution. It shall perform the environmental impact assessment, analyze the potential environmental impact of the project, and put forward preventive and control measures on this basis. The project shall build supporting environmental protection facilities, which shall be designed, constructed, and put into use together with the project.

Third, after a project is put into operation, it shall be subject to territorial environmental supervision and management. The enterprise shall obtain the pollutant discharge license, discharge pollutants based on the license and assure compliant discharge in accordance with the pollutant discharge standards and requirements for the industry. Meanwhile, the enterprise shall perform clean production audit, increase the resource/energy utilization rate and reduce or avoid the environmental pollution in the production process.

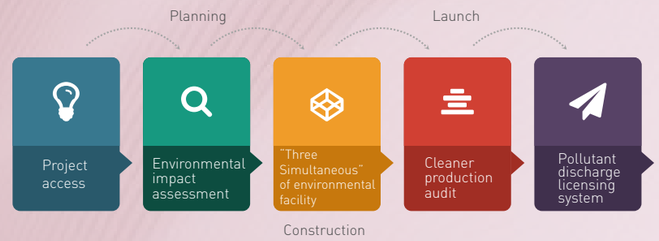


Figure 5 Major environmental requirements for the production, planning, and operation of Chinese viscose production enterprises

8. The Viscose Fiber Industry Standard Conditions was released and implemented in 2010, and revised into the Viscose Fiber Industry Standard Conditions (2017 Version).

chapter 2
Sustainability governance of viscose industry in China

2.1 Overview of the Collaboration for Sustainable Development of Viscose (CV)



Viscose is one of the main raw materials in the cotton textile industry, so the viscose industry also faces the attention and supervision from other stakeholders on the upstream and downstream of the industrial chain like brand owners, industry associations and environmental protection organizations. Driven by environmental protection organizations and consumers, brands take measures on the procurement side and set strict requirements for producers along the supply chain in a host of dimensions, including corporate social responsibility, environmental management and product safety with a view to improving the sustainability level of the supply chain through the force of procurement.

However, this operating mode driven by commercial demand has brought many challenges to brands and manufacturers. For one thing, brand undertake most of the work to promote the sustainability of the supply chain. However, restricted by the multi-level complexity of supply chain and the limitation of information disclosure, brands often don't know much about the actual situation of the supply chain and have a limited access to the motivation for suppliers at a deeper level. Besides, restricted by varying purchasing powers, different brands have uneven influence on driving the sustainability of the industrial chain, and large brands assume the major responsibility. For another, there are no comprehensive and uniform standards for the management of the sustainable supply chain worldwide. Brand usually choose supply chain management standards based on their own needs. As a result, manufacturers often face requirements from different brands and organizations on different dimensions of sustainability, which may be repeated or conflict with one another, thereby causing a high response cost and a large workload. Since the demand from brands is more of an order demand to satisfy customer demand for "differentiated products", so they are less stimulated to promote sustainability. Additionally, most enterprises are located in industrial parks. Affected by local industrial policies, park policies, and facilities, they are difficult to become independent and fulfill higher or contradictory external standards.

Under this situation, some far-sighted enterprises have selected the perspective of suppliers and decided to drive the sustainability of the supply chain through industry autonomy. They seek innovative solutions to realize win-win cooperation between the upstream and downstream of the full industrial chain, improve the efficiency of advancing sustainability and cut the cost. On March 15, 2018, the Collaboration for Sustainable Development of Viscose (CV) was established based on the initiative of the China Chemical Fibers Association and two leading enterprises, including Tangshan Sanyou Group and Sateri. Sponsored by viscose enterprises, upstream and downstream enterprises along the industrial chain, and associations, the CV aims to echo concerns and requirements of various stakeholders for sustainability of the industry, and seeks to forge a public governance platform for green development featuring peer supervision and reciprocal promotion based on the actual condition of the industry. Moreover, the CV works to explore and carry forward a sustainability model with strong applicability and operability so as to minimize the environmental and social impact of viscose products during their full life cycle.

On March 15, 2018, the Collaboration for Sustainable Development of Viscose (CV) was established



Overview of the Collaboration for Sustainable Development of Viscose (CV)

As of December 2018, CV had a total of 14 members, including the (CCFA), the (CCTA), and 12 viscose production enterprises: namely, Tangshan Sanyou Group Xingda Chemical Fiber Co., Ltd. (Sanyou), Sateri., Funing Aoyang Science and Technology Co., Ltd. (Aoyang), CHTC Helon (Weifang) New Materials Co., Ltd. (CHTC Helon), Jilin Chemical Fiber Group Co., Ltd. (Jilin), Lenzing (Nanjing) Fiber Co., Ltd. (Lenzing (Nanjing)), Shandong Yamei Science and Technology Co., Ltd. (Yamei), Shandong Silverhawk Chemical Fiber Co., Ltd. (Silverhawk), Xinxiang Bailu Chemical Fibre Group Co.,Ltd. (Xinxiang), Yibin Grace Co., Ltd. (Grace), Zhejiang Fulida Co., Ltd. (Zhejiang Fulida) and Xinjiang Zhongtai Chemical Co., Ltd. (Zhongtai). The total production capacity of the CV members adds up to nearly 3 million tons, contributing more than 50% of the global viscose capacity[9] . Therefore, the CV is capable and also willing to promote and lead the sustainability of the global industry by achieving its own responsible production and sustainability.

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CV had a total of 14 members, including the China Chemical Fibers Association

CV organizational structure

CV sets up a Council and a Secretariat. As the decision-making body of CV for sustainable development, the council is headed by Sanyou. as the Chairman and Sateri as the Vice Chairman. The China Chemical Fibers Association serves as the Secretariat and takes charge of daily organization and operation of CV, including formulation of sustainable development strategies and action plans, performance assessment of CV members, and future development planning of CV.

9. China's Chemical Fiber Industry Development Report (2016-2020), China Textile & Apparel Press, 2017.

CV access mechanism

CV implements the member access mechanism. To join the CV, an enterprise shall pass the review as to the Viscose Fiber Industry Rules (2017) or to be confirmed by the CV to meet equivalent requirements. Viscose Fiber Industry Rules (2017) is the guidelines issued by the Chinese government on the sustainable development of Viscose Fiber Industry. The government organizes applicants to bid for compliance with the standard and publishes the list of approved enterprises once every two years (the first review was completed in December 2017). At present, all the members of the CV have passed the national review, except Zhongtai.



In 2018, Zhongtai applied to join the CV after implementing a series of environmental protection projects. On November 8 and 9, 2018, CV organized external review experts to visit and assess Zhongtai and the experts recognized that it has met the standards. On November 21-23, 2018, CV agreed Zhongtai to join it after a collective vote at an internal meeting.

Major stakeholders concerns

Based on purposes and raw material sources of viscose products, the CV identifies major stakeholders as government regulator, downstream customer, terminal brand, upstream supplier, nongovernmental environmental protection organization and corporate employees. Besides, the CV maintains effective communication with these stakeholders through website, survey, report, meeting, event and other channels to understand their needs and expectations.

The feedbacks to the CV reveal that major key issues of various stakeholders now include responsible production of industry, sustainability of product, information disclosure and transparency. Responsible production of industry mainly includes the following contents:

- Chemical management
- Energy emission and greenhouse gas emissions
- Pollutant discharge control
- Employees' occupational health and safety
- Community-level environmental protection and restoration

Key stakeholders	Key concerns of stakeholders
Government's regulator	Compliant production and operation
Upstream supplier	Fair, stable and transparent procurement policy
Downstream customer	Product and service quality
Terminal brand	Sustainability of product Responsible production Information disclosure and transparency
Nongovernmental environmental protection organization	Responsible production Information disclosure and transparency
Corporate employee	Occupational Health & Safety

Table 1 CV's major stakeholders and related Concern

10.List of enterprises that meet the Viscose Fiber Industry Standard Conditions (the first batch): http://www.miit.gov.cn/n1146290/n4388791/c6003910/content.html

China Chemical Fibers Association

China Chemical Fibers Association (CCFA), incepted in 1992, is an industrial social organization composed of enterprises and nonprofit organizations engaged in chemical fiber production and research nationwide as well as upstream and downstream players along the closely associated industrial chain and supply chain. CCFA cherishes the objectives to carry out industrial policies of the state, safeguard legitimate rights and interests of members, promote technical progress and propel the industry development.

CCFA published the China's Viscose Industry Development and Environmental Protection (White Paper) in 2009 and updated it in 2012 and 2017 respectively in a move to drive the sustainability cause of the viscose industry. The white book discloses the environmental protection status in the industry and recommends advanced energy conservation and emission reduction technologies.





Figure 6 CV members

2.2 CV sustainable development management

（1）CV sustainable development roadmap

CV is committed to improving the sustainable development level of the industry, but faces the primary issue of how to evaluate sustainable development levels of enterprises and promote enterprises to do better in this regard after the establishment. CV must establish an explicit and feasible sustainable development roadmap based on the actual conditions of the industry. Immediately after the outset, the CV drew the CV Sustainable Development Roadmap ("CV Roadmap") (see Figure 8) based on the sustainable development challenges of the industry by consulting key stakeholders, including government authorities, research institutions, upstream suppliers, industrial counterparts, terminal brands and non-governmental environmental protection organization. The following two issues were considered in the development of the CV Roadmap:

[1] How to evaluate sustainable development levels of enterprises?

To scientifically perform sustainability levels of the members, CV has identified key sustainable development issues and indicators specific to the industry as well as the generally accepted standard system applicable to the industry and built a comprehensive performance assessment standard system.

a.Identification of key sustainable development issues and indicators of enterprises:

Guided by the principle of "sustainable production and consumption", i.e. SDG 12 goal of the 2030 Agenda for Sustainable Development, CV has identified the key issues of sustainable development management at three main links during the full life cycle of viscose products, including raw material, production process and product, based on major environmental and social impacts of production and operation activities of viscose enterprises as well as stakeholders concerns (see Figure 7).

12 Sustainable Consumption and Production

b.Evaluation of sustainable development level of enterprises

So, how to measure an enterprise's performance on key sustainable development issues? At present, CV members consign third parties to authenticate and evaluate their management performance of raw materials, production process, and products. The CV's survey has revealed that the standards used by enterprises are lack of uniformity and "systematicness", which makes it impossible for the CV to perform a comprehensive performance assessment and horizontal comparison. Therefore, it is necessary for CV to determine a unified and systematic comprehensive evaluation system. CV has combed more than 240 sustainable development standards of over 180 countries worldwide in 80-plus areas and assessed these standards in terms of applicability, measurability, operability, objectivity and foresight based on the opinions and recognition of key stakeholders (brands, government authorities, third-party institutions, etc.). Then, CV has selected the standards that are the most suitable to assess enterprises' core performance of sustainable development to serve as a comprehensive standard system for comprehensive sustainability assessment of enterprises.

[2] How to promote enterprises to improve the sustainable development performance?

Based on the general evaluation standard system of sustainable development levels of enterprises, CV has drawn the CV Sustainable Development Roadmap ("CV Roadmap") (see Figure 8) as a practical guideline for promoting enterprises to improve their sustainable development performance.
Through the implementation of the roadmap, CV expects to achieve the following goals within the next three years (2018-2020):

① Raw materials: Use globally applicable sustainable forestland standards and promote responsible dissolving pulp procurement;

② Production: Enhance sustainable development performance in every aspect;

a. Full compliance;

b. Comply with the international good practice for the environmental protection management system, realize quantitative management of energy and resource efficiency and emission factors in the whole process, carry forward the best available techniques (BAT) and achieve energy conservation and emission reduction;

c.Based on the basic level standard for cleaner production, promote the CV members to reduce the average comprehensive energy consumption by 10% and the fresh water consumption by 31% and increase the total sulfur recovery rate by 7%;

d. Adopt international advanced practices to control hazardous chemical emissions, and implement the Manufacturing Restricted Substances List (MRSL) in an all-round manner;

e. Promote international leading standards for corporate social responsibility, protect personal safety, rights and interests of employees and control the safety and health impact on surrounding communities.

③ Products - Produce green viscose products meet safety, harmfulness and environment-friendly standards, and realize verifiability throughout the product's lifecycle.

It is worth noting that continuous improvement and multi-stakeholder engagement are core principles of the CV Roadmap. The current CV Roadmap is initially established based on the status quo of the industry, major opinions of various stakeholders, and the current development levels of the selected standards. When implementing the roadmap in future, CV will continuously track the status quo and implementation progress of different enterprises and constantly improve the roadmap based on the actual development needs of the industry.

↘ 10%
the average comprehensive energy consumption by 10%

↘ 31%
he fresh water consumption by 31%

↗ 7%
increase the total sulfur recovery rate by 7%



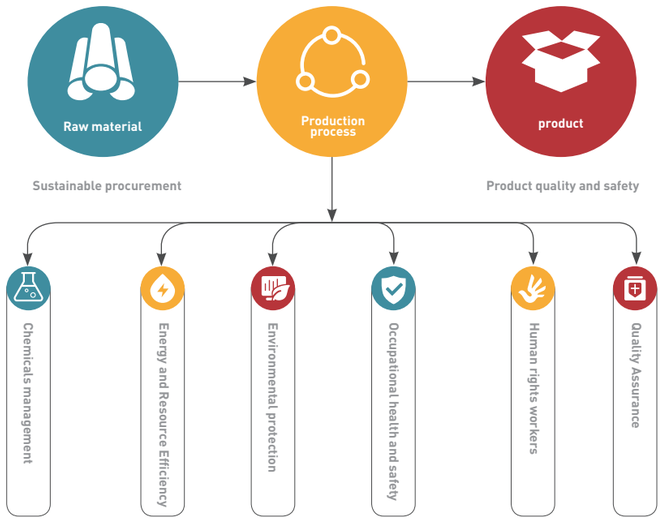


Figure 8 CV's key sustainable development issues

- Considering the availability of CV Roadmap and the development status of the members, CV will assess their implementation by stages:

  √ At the primary stage of 18 months from January 2018 to June 2019, the CV members will realize a green and sustainable growth of the industry, gradually practice various requirements of the standards and meet the primary requirements set forth by the CV Roadmap.

  √ At the advanced stage of 18 months from July 2019 to December 2020, the CV members will realize a green and sustainable growth of the industry, meet higher-level requirements of the standards while practicing the requirements of various standards, and satisfy advanced requirements set forth by the CV Roadmap.

Technical Standards		Evaluation Subject: Faci- lity	Evaluation Subject: Product	Basic Requirements (2018.1-2019.6)	Advanced Requirements (2019.7-2020.12)
Raw Material	PEFC or FSC		√	Source FSC® or PEFC™ certified pulp	Purchase FSC®or PEFCTM certified pulps, and take proactive management measures to reduce the risk of using wood products from High Conservation Value (HCV) or High Carbon Stock (HCS) forests
	Pulp purchased from legal sources and with legitimate permits	√	√	Pass the FSC® or PEFCTM Chain-of-Custody (CoC) audit for manufacturing facility	Pass the FSC® or PEFC™ Chain-of-Custody (CoC) audit for manufacturing facility
	Viscose Fiber Industry Rules (2017)	√	√	Legal compliance	Legal compliance
Manufacturing	Cleaner Production Assessment Standard for Man-made Cellulous Fibers (Viscose) Manufacturing	√	√	Full compliance	Full compliance
	Ø ZDHC	√	√	Achieve domestic basic level	Achieve domestic advanced, or international advanced level
	OEKO-TEX® STeP	√	√	Wastewater discharges shall meet the foundational limits for conventional parameters under the ZDHC Wastewater Guidelines	Wastewater discharges shall meet the foundational limits for conventional parameters and the reporting limits for MRSL parameters, while wastewater treatment sludge shall meet sludge-related requirements
	Higg FEM	√	√	Obtain the OKEO-TEX® StePcertification, scoring at Level 1 or above	Option1 : Obtain the OKEOTEX ® SteP certification, scoring Level 2 or above; Option2: develop improvement goals based on the Higg FEM 3.0 self assessment, and pass the third-party verification audit to confirm meeting the goals within 36 months of joining CV. Additionally, pass the SA8000® or BSCI audit
	BSCI or	√	√	Complete a Higg FEM 3.0 self assessment	
		√	√	————	Note: Options 1 and 2 are alternative choices for members; only one option is required to be completed.
Products			√	Obtain certification	Obtain certification
	GB/T 14463 Viscose staple fiber	√	√	Conformance to standards	Conformance to standards

Figure 8 CV Sustainable Development Roadmap (CV Roadmap)

（2）CV Three-Year Action Plan

In September 2018, CV released the Three-Year Action Plan for the Green Development of the Viscose Industry (2018-2020) ("CV Three-Year Action Plan") to better promote the implementation of the CV Roadmap. The action plan defines the basic principles and realization path of the CV Roadmap. As a public governance organization composed of upstream and downstream enterprises as well as industry associations, CV will create the following four platforms to do the work:

Industry information publishing platform

CV will improve the internal information communication and mechanism of the industry within one year and establish a mature external communication mechanism. It will periodically track and survey the sustainable development status of the industry, publish the CV Sustainability Report, improve information transparency of the industry and actively accept the attention and supervision of all stakeholders.

Green industrial chain sharing platform

CV will build a green supply chain sharing platform, and actively invite key stakeholders, including government, media, brands and third-party organizations, to participate in the public governance of the industry. CV will welcome all stakeholders to voice their appeals based on the industry situation and provide constructive opinions. CV will listen to opinions and suggestions from all stakeholders and jointly propel a sustainable growth of the industry.

Sustainability management platform

On the one hand, CV will define the sustainable development path and evaluation method of the industry based on the roadmap and continuously improve the sustainable development model according to the development performance of the industry and the demands of all stakeholders;
On the other hand, CV will establish the traceability system of the industrial chain and gradually shape a management system for CV-certified green products as well as upstream and downstream industrial chains, and promote the going-green process of the industrial chain through products.

Promotion platform for energy conservation and emission reduction technology

Based on technical professionals of the members, CV will set up the Technical Committee for Industry Sustainability to promote the exchange and promotion of advanced technologies in the industry. Meanwhile, the CV will band up with universities, scientific research institutes, equipment manufacturers, and technical service firms to jointly advance research, development and promotion of new technologies and equipment. CV will set up and update the Technical Equipment Committee for Industry Green Development and guide the industry to improve environmental protection equipment and optimize the technological process.

Chapter 3
Current status of CV sustainability management

To check the sustainable development statuses of the members, CV started surveying their certification as to the sustainable development standard system in January 2018. In May 2018, CV started the first round of basic data survey on the members (a total of 14 plants of 12 enterprises). The survey covered every enterprise's capacity and output, production line level, energy and material consumption, and the discharge and treatment of waste gas, wastewater, and solid waste. Based on the survey results, CV has summarized and analyzed the current implementation of the standard system under the CV Roadmap, key performance indicators of the members, pollution control and energy consumption to identify sustainability challenges faced by the CV to support sustainability governance.

12 enterprises

14 plants

3.1 Implementation of the standard system for the CV Roadmap

(1) International standards

CV has found that it is temporarily incapable to promote the implementation of some international standards involved in the CV Roadmap in work. For example:

- When CV organized the training about CV Roadmap in January 2018, the Higg Index – FEM 3.0 was just completed, but there were no third parties that could conduct the certification. It is highly similar to the STeP by OEKO-TEX® certification currently conducted by most of the CV enterprises. CV will further solicit opinions from stakeholders and assess the necessity of its certification.

- As for the wastewater guide of the Zero Discharge of Hazardous Chemicals (ZDHC), some enterprises have finished the certification, but found that the standard was poor in implementation. CV has cooperated with ZDHC and advised the latter about the MMCF Guideline under preparation. The guideline is expected to come out in early 2019, and CV will review its applicability, operability and other aspects after its release.

  At present, CV will focus on promoting the environment certification - key issue faced by the industry, including FSC®/PEFC™ certification for raw materials, STeP by OEKO-TEX® certification for production, and Standard 100 by OEKO-TEX® certification for products. CV will carry forward the implementation of the SA 8000 and BSCI standards related to corporate social responsibility in the second phase according to the roadmap.

(2) Domestic standards

The CV Roadmap contains three Chinese national standards as the implementation standards for production and products. All enterprises have complied with the Viscose Fiber Industry Standard Conditions (2017 Version) that regulate production and the GB/T 14463-2008 Viscose Staple Fiber (VSF) that measures product quality. These are the basic standards that must be met by enterprises in production and operation.

The Cleaner Production Indicator System for Viscose Manufacturing (Viscose Method) is jointly prepared by the National Development and Reform Commission, the Ministry of Ecology and Environment, and the Ministry of Industry and Information Technology and intended to more effectively guide and promote enterprises to implement cleaner production and increase the efficiency of resource utilization. The standard was released for public comment in September 2017 and officially implemented in December 2018. In 2019, CV will push enterprises to improve their cleaner production performance as required in every aspect.

The status of CV certification is shown in Table 2 (as of December 2018).

Type	Certification standard	Industry certification status
Raw material certification	Pulp procurement has passed FSC® certification or PEFC™ certification	Sanyou, Grace and Silverhawk obtained the FSC® certificate Sateri obtained the PEFC™ certificate Jilin, Yamei, Xinxiang, Zhongtai and Lenzing (Nanjing) obtained the FSC® and PEFC™ certificates
Production process certification	Viscose Fiber Industry Rules (2017)	All enterprises meet the requirements, except for Zhongtai. In November 2018, CV organized experts to visit and assess Zhongtai and the experts recognized that it has met the equivalent requirements of the standard.
	Cleaner Production Assessment Standard for Man-made Cellulous Fibers (Viscose) Manufacturing (CPS)	The standard was officially implemented in December 2018. CV will promote implementation of the standard in 2019.
	STeP by OEKO-TEX®	4 enterprises (Sateri, Sanyou, Yamei and Jilin) have obtained the certificates at level 3 (the highest).
	ZDHC wastewater review	2 enterprises (Sateri and Tangshan Sanyou) have passed review
	Higg Index FEM 3.0	2 enterprises (Sateri and Lenzing (Nanjing)) have obtained the certificate.
	SA 8000/BSCI	1 enterprise (Jilin) has obtained the certificate.
Product certification	Standard 100 by OEKO-TEX®	All enterprises, except for Zhejiang Fulida, have obtained the certificate.
	GB/T 14463-2008 Viscose Staple Fiber (VSF)	All enterprises meet the requirements

Note: Most of the CV members are now working to implement the CV Roadmap. However, Aoyang, CHTC Helon and Zhejiang Fulida have made sluggish progress for objective reasons, including plant relocation, building and transformation.

Table 2 Third-party certification of factories and products of CV enterprises

3.2 Enterprise environmental management statuses

（1）Enterprises compliance management

At present, all CV members have made comprehensive environmental management policies and set up special environmental management departments to perform daily supervision to ensure that their construction, production and operation comply with relevant laws and regulations of China as well as industrial standards:

- Industry access

  The new viscose building, renovation and expansion projects comply with the Viscose Fiber Industry Rules (2017)

- Environmental impact assessment

  All enterprises have conducted environmental impact pre-assessment and passed the review at the project planning stage according to the Law of the People's Republic of China on Environmental Impact Assessment and the Regulations on Environmental Protection Management of Construction Projects.

- Simultaneous design, construction and use of environmental facilities

  All enterprises have built environmental facilities in accordance with the Regulations on Environmental Protection Management of Construction Projects. The main environmental facilities include: sewage treatment facilities and waste gas treatment facilities.





Biological treatment device for waste gas and sewage treatment pond of Zhongtai





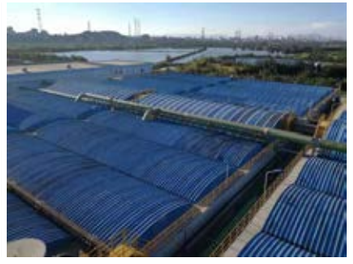
Waste gas treatment facility of Sanyou





Wastewater biochemical treatment facility of Sanyou





Wastewater biochemical treatment facility of Sateri (Fujian)

- Cleaner production audit

  All enterprises passed the national cleaner production audit according to the Measures of the People's Republic of China on Cleaner Production Audit and local government requirements.

- Compliant emission

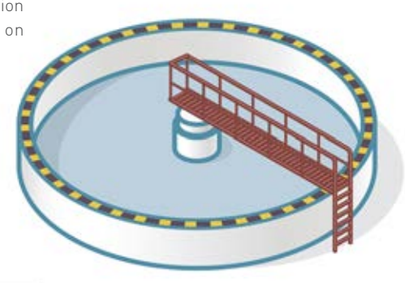
  All enterprises have realized compliant emission in accordance with related laws and regulations of China, including the Law of the People's Republic of China on Prevention and Control of Water Pollution and the Law of the People's Republic of China on Prevention and Control of Air Pollution.

  Waste gas emission standards:

- Emission Standards for Odor Pollutants (GB14554-1993)
- Integrated Emission Standard of Air Pollutants (GB16297-1996)
- Emission Standard of Air Pollutants for Thermal Power Plants (GB13223-2011)

  Applicable wastewater discharge standards:

- Integrated Wastewater Discharge Standard (GB8978-1996)



（2）Key environmental performance

Pursuant to the CV Roadmap and the Three-Year Action Plan, CV will evaluate the environmental management performance of the production process of the enterprises with the Cleaner Production Indicator System for Viscose Manufacturing (Viscose Method). The indicator system identifies six primary factors: production process, equipment and technology; resource and energy consumption; comprehensive utilization of resources; pollutant generation indicators; product characteristics indicators, and cleaner production management indicators. All the indicators are quantified and divided into three levels, where Level I means the international leading level, Level II means the domestic advanced level, and Level III means the domestic average level, except that the cleaner production management indicator is not quantified. Subject to the requirements of the CV Roadmap, by the end of 2020, CV members shall reach Level II and the CV's average level of key environmental performance indicators shall reach Level I. CV will focus on the disclosure and improvement of three key indicators, namely, comprehensive energy consumption, fresh water consumption, and total sulfur recovery rate, pursuant to the overall objectives set forth by the Three-Year Action Plan for the Green Development of the Viscose Industry (2018-2020).

CV Roadmap vs. EU BAT

In this part we have compared it with the internationally recognized and advanced standard - EU BAT, as shown in Table 3.

No.	Item	Unit	EU Best Available Techniques (EU BAT)	CV Roadmap		Comparison result
				Indicator value	Source	
Consumption per ton of products						
1	Comprehensive energy consumption	GJ	20-30	⩽ 28[11]	Cleaner production (Level I)	Key indicator Consistent
2	Water consumption	m^3	35-70	⩽ 45[12]	Cleaner production (Level I)	Key indicator Consistent
3	Cooling water	m^3	189-260	——		Not specified
4	Pulp	t	1.035-1.065	⩽ 1.010	Cleaner production (Level I)	Better than EU BAT
5	CS_2	kg	80-100	⩽ 80	Cleaner production (Level I)	Better than EU BAT
6	H_2SO_4	t	0.6-1	⩽ 0.72	Cleaner production (Level I)	Consistent
7	NaOH	t	0.4-0.6	⩽ 0.47	Cleaner production (Level I)	Consistent
8	Zn	kg	2-10	⩽ 4	Cleaner production (Level I)	Consistent
9	Oiling agent	kg	3-5	——		Not specified[13]
10	NaOCl	kg	0-50	——		Not specified[14]
Emission per ton of products						
11	Sulfur emitted into the air	kg	12-20	⩽ 18.9[15]	Cleaner production (Level I)	Key indicator Same
12	Sulfate ions in water	kg	200-300	Under development	ZDHC	Not specified
13	Zinc ions in water	g	10-50			Not specified[16]
14	Chemical oxygen demand (COD)	g	3000-5000			Not specified[17]
Solid waste						
15	Hazardous waste	kg	0.2-2	——		Not specified[18]
Noise						
16	Noise at factory boundary	dB(A)	55-70		Compliance Review Emission standard for industrial enterprises noise at boundary (GB12348-2008)	Consistent

Table 3 Comparison of environmental performance indicators between the CV Roadmap and the EU BAT

11. Level I indicator of the cleaner production standard specifies "integrated energy consumption ⩽ 900kgce/t", which is about 28GJ after conversion.
12. Water consumption under the Cleaner Production Indicator System includes water supply from surface water, underground water and urban water supply project as well as total quantity of other water bought by the enterprise from the market or water content in aqueous products. Cooling water is repeatedly used in the production process, and the actual consumption is far lower than the recommended range of the EU-BAT.
13. The consumption of oiling agent depends on the enterprise's production process, product requirement and selection of oiling agent type. It is temporarily not seen as an environmental indicator in the industry.
14. NaClO is used for bleaching in production, namely, it will affect the "whiteness" of fibers. Its consumption depends on the mandatory requirements for the product of the enterprise. It is temporarily not seen as an environmental indicator in the industry.

The comparison demonstrates that there is a high degree of overlap between the EU BAT and the CPS in terms of key technical indicators, indicating that there is a basic consensus on the environmental performance management of the industry globally.

Judging from comparable data, such as energy consumption, CS_2 consumption, and sulfur emitted into the air (total sulfur recovery rate), the Level I standard values of the CPS basically fall into the recommended ranges of the EU BAT.

However, as the two standards have different focuses and different countries have varying measurement and statistical methods (such as water consumption and concentration of sulfate ions in wastewater), they are less comparable in non-core indicators. In 2018, CV received inquiries from multiple stakeholders about whether the CV would implement the EU BAT. However, on the one hand, the CV has not found the statistical and computational methods of the EU BAT in available references due to limited access to information. On the other hand, CV has consulted the brands and third parties that are implementation the EU BAT, but received no response indicating that EU methodologies could be implemented or understood. Therefore, based on its own understanding, CV has compared the two standards and believed that all the key indicators and most of the non-key indicators in the two standards are consistent.

Analysis of key environmental performance indicators of enterprises

To understand the actual sustainable development statuses of enterprises, CV has selected four indicators that are most concerned by stakeholders and can best represent the environmental performance of the production process, including consumption of CS_2 per unit of products, comprehensive energy consumption per unit of products, fresh water consumption per unit of products, and total sulfur recycling rate, and then compared the CPS and the EU BAT. CV has calculated the number of CV members (14 plants) under the two standards (expressed as a percentage) and compared CV's average level (arithmetic mean), CV's best level (enterprise's best value) and CV's worst indicator value (enterprises' lowest values) to portray the overall situation of environmental management of CV members. Overall, the cleaner production levels of CV enterprises are good and close to the Level I standard of the CPS, but the levels vary from one enterprise to another.

01

Some* enterprises are far superior to the highest requirements of the CPS and represent the advanced level of the industry;

02

Several indicators of some* enterprises still fail to meet the requirements of the Level III standard of the CPS, and far lag behind the industry's best level.

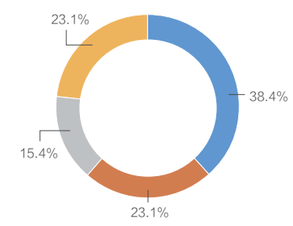
03

Different indicators may come at different levels. For example, 58% of the enterprises can meet the Level I indicator of the CPS, but only 28.6% of them can satisfy the Level I indicator for fresh water consumption per ton of products.

*The proportions of the enterprises falling into different ranges vary in terms of different indicators under different standards, as detailed in Figure 9.

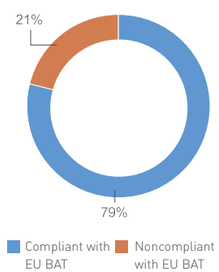
15. Level I indicator of the Cleaner Production Standard System specifies "total sulfur recovery rate ⩾ 92%", which is about 18.9kg/t for sulfur emitted into the air after conversion.
16. The pollutant density in the wastewater from the enterprise shall meet the national and local requirements before discharge.
17. The pollutant density in the wastewater from the enterprise shall meet the national and local requirements before discharge.
18. Hazardous wastes shall be handed over to qualified institutions for treatment pursuant to legal requirements of the state

Energy consumption （per ton of products, kgce/t）

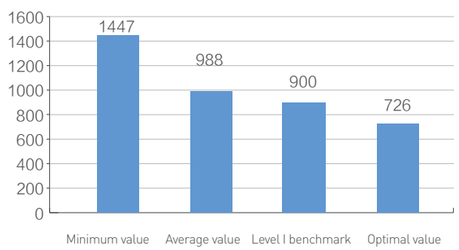


CPS

(Level I: 900; Level II: 950; Level III: 1000)



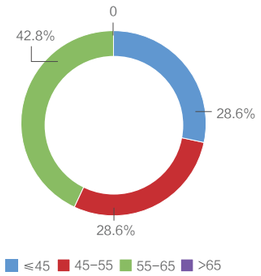
EU BAT



CV's average, best and lowest levels

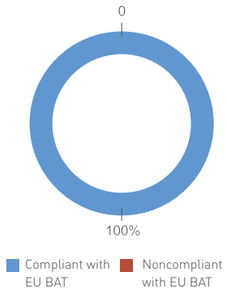
1. 38.4% of the plants conform to the Level I standard of the CPS, 23.1% reach Level II, and 23.1% even can't meet the Level III basic requirements.
2. 79% of the plants fall within the recommended range of the EU BAT, while 21% do not.
3. The best value of CV plants exceeds the Level I benchmark value of the CPS, the average level falls between Level II and Level I and will still need to decline 8.9% to meet the Level I, and the worst values will have to be reduced by 37.8% to meet the Level I benchmark value.

Water consumption （per ton of products, m^3/t）

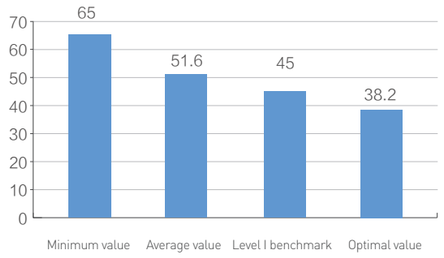


CPS

(Level I: 45; Level II: 55; Level III: 65)



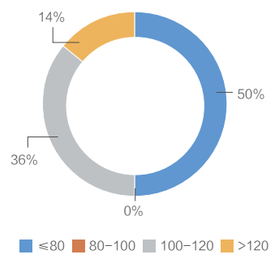
EU BAT



CV's average level and enterprises'best and worst values

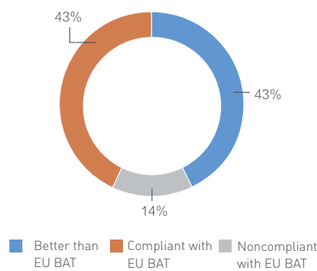
1. 28.6% of the plants reach the Level I standard of the Cleaner Production Indicator System, 28.6% come at Level II, and all of the plants meet the Level III basic requirements.
2. All the plants fall within the recommended range of the EU BAT.
3. The best value of CV plants exceeds the Level I benchmark value of the Cleaner Production Indicator System, the average level falls between Level II and Level I and will still need to decline 13.3% to meet the Level I, and the worst values will have to be reduced by 30.7% to meet the Level I benchmark value.

CS_2 consumption （per ton of products, kg/t）

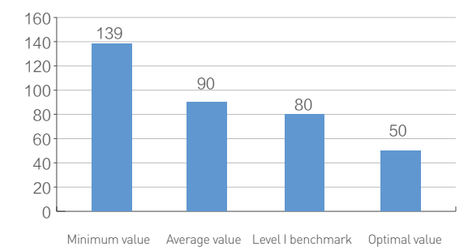


CPS

(Level I: 80; Level II: 100; Level III: 120)



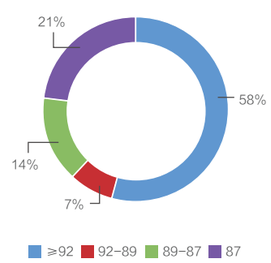
EU BAT



CV's average level and enterprises'best and worst values

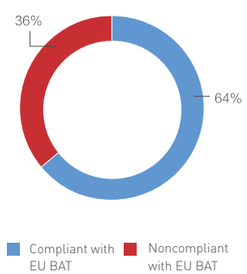
1. 50% of the plants reach the Level I standard of the CPS, and 14% still can't meet the Level III basic requirements.
2. 43% of the plants outperform the recommended range of the EU BAT, 14% fall into the recommended range, and 43% don't comply.
3. The best value of CV plants exceeds the Level I benchmark value of the CPS, the average level falls between Level II and Level I and will still need to decline 11% to meet the Level I, and the worst values will have to be reduced by 42% to meet the Level I benchmark value.

Total sulfur recovery rate （%）

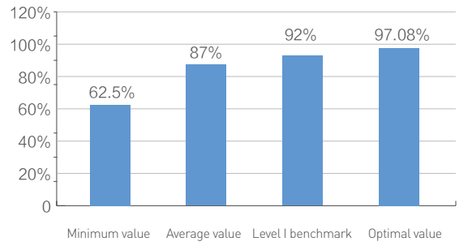


CPS

(Level I: 92; Level II: 89; Level III: 87)



EU BAT



CV's average level and enterprises'best and worst values

1. 58% of the plants conform to the Level I standard of the CPS, 7% reach Level II, and 21% even can't meet the Level III basic requirements.
2. 64% of the plants fall within the recommended range of the EU BAT, while 36% do not.
3. The best value of CV plants exceeds the Level I benchmark value of the CPS, the average level falls between Level II and Level I and will still need to decline 6% to meet the Level I, and the worst values will have to be reduced by 47% to meet the Level I benchmark value.

Figure 9 Analysis of CV plants' performance of energy consumption, water consumption, total sulfur recovery rate and CS_2 consumption

（3）Waste prevention and treatment

Wastewater

The survey reveals CV members adopt two wastewater treatment methods: discharge into the municipal sewage pipe network and discharge directly into the environmental water body. Currently, 57% of the CV plants discharge wastewater into the environmental water body after treating with proprietary sewage treatment facility and satisfying the standard, and implement the Integrated Wastewater Discharge Standard (GB8978-1996). 43% of the CV plants discharge the wastewater to the municipal sewage pipeline network after treating it with the proprietary sewage treatment facility and satisfying the standard, and then consigns a third-party sewage treatment plant to perform further treatment.

Subject to the Viscose Fiber Industry Rules (2017), the wastewater from a newly built, renovated and expanded viscose project shall in principle be treated independently or discharged after treated with the centralized industrial wastewater treatment facilities, and in principle, the wastewater shall not be discharged into the urban sewage treatment system, and if it is truly necessary to connect the urban sewage treatment system, the enterprise shall comply with related provisions of the state and local region.

	Level I standard	Level II standard	Level III standard
Urban secondary sewage plant	60	120	--
Other pollutant discharge sources	100	150	500

Table 4 COD discharge requirements stipulated by the Integrated Wastewater Discharge Standard (GB8978-1996)



Wastewater



Waste gases



Solid waste recycling

Waste gases

CV members emit waste gases in two ways: organized emission and unorganized emission. Waste gases under organized emission come from multiple working procedures of viscose production, and major pollutants include CS_2 and H_2S. Atmospheric pollutants under unorganized emission mainly come from volatilization in the production process, breathing loss in the raw material storage tank area and volatilization in the treatment process of the sewage station.

The applicable standard is the Emission Standards for Odor Pollutants (GB 14554-1993). The standard defines the limit requirement for the pollutant density in the waste gases under organized emission from the detox tower (exhaust funnel) of the enterprise[19]. Meanwhile, it also stipulates the pollutant limit for pollutants in the waste gases under unorganized emission in the factory. The CV members implement the Level II standard ($H_2S \leqslant 0.02$ mg/m^3, $CS_2 \leqslant 0.5$mg/m^3) and realize compliant discharge.

Solid waste recycling

The main characteristic wastes produced in the viscose production process include waste viscose, sludge and waste activated carbon as well as other conventional solid wastes like oil rags. Different types of wastes are treated according to national and municipal requirements:

- Waste viscose: It is fully recycled for recycling, sale or burying.
- Sludge: It is treated in an environment-friendly manner, and most of the enterprises send it qualified enterprises for treatment.
- Activated carbon: Waste activated carbon is a hazardous waste, which shall be treated by a qualified enterprise pursuant to the provisions of the state.
- Other solid wastes, such as waste machine oil, waste lamp tubes and waste circuit boards, and other hazardous wastes are handled by qualified enterprises; coal ash, coal cinder, waste paper, waste iron wire, waste iron barrels and other wastes are sold to waste recycling enterprises.

19.he limit varies against the height of the detox tower.

Zhongtai's Practices for Comprehensive Utilization of Tail Water

Zhongtai is located in adjacent to Korla City, Xinjiang, which is close to the Taklamakan Desert. Zhongtai has invested RMB 40 million in a comprehensive tail treatment project for green development to realize comprehensive utilization of tail water and also improve the ecological and environmental statuses in Taklamakan Desert and along the Tarim River. The project has reduced COD in the wastewater to 30-50mg/L with a proprietary profound sewage treatment facility, transmitted the water to the Qunke absorption site in Taklamakan Desert and built the Qunke Reservoir. The enterprise worked with the Nanjing Institute of Environment Sciences of the Ministry of Ecology and Environment and the Xinjiang Institute of Ecology and Geography of the Chinese Academy of Sciences to carry out a hydrogeological survey, sampling and sample analysis in and around the Qunke Reservoir in batches. It has planted a variety of drought-resistant and alkali-tolerant green vegetations suitable for the desert environment, such as saxaul, rose willow and reeds, and raised a variety of creatures like white swans and wild ducks. At the same time, the reservoir has attracted all kinds of wild migratory birds, which has made a significant effect on the biodiversity protection and the fragile and sensitive ecological environment, and achieved a win-win result for both the restoration of desert ecosystem and the enterprise's comprehensive wastewater utilization.









Noncompliance supervision against enterprises

Online monitoring at sewage outlet

Wastewater: All enterprises have installed automatic monitoring devices at the main wastewater outlets and connected them with the monitoring equipment of the local environmental authorities, and the main monitoring indicators include pH, COD, ammonia nitrogen and other substances as well as wastewater flow. The enterprises consign third-party monitoring institutions and environmental protection bureaus to perform normal monitoring from time to time and accept stringent supervision of multiple stakeholders.

Waste gases: Every year, the enterprise consigns a third-party institution to perform at least one comprehensive inspection and issue an inspection report, which mainly covers CS_2, H_2S and other indicators. The enterprise also performs regular selective examination to assure compliant emission.

Noncompliance supervision mechanism

The CV has built a noncompliance supervision mechanism consisting of "finding problems - solving problems - continuous improvement": It communicates with the Institute of Public & Environmental Affairs (IPE), and real-time supervision of production compliance and legality of the member based on the environmental information data in the Blue Map provided by IPE. When finding a problem, CV will urge the enterprise to explain relevant problem to the public, and assist the enterprise to take remedial and corrective actions and make an emergency plan to eliminate potential problem source. In June 2018, CV invited the IPE to provide a theme training for the members.

The historical data of the Blue Map reveal that in 2015-2017, 12 members of the CV recorded 10 to 15 environmental noncompliance events annually on average, but in 2018, they recorded no event after the establishment of the supervision mode "finding problems -- solving problems -- continuous improvement".





Online wastewater detection equipment at Sanyou



Online wastewater emission monitoring facility and monitoring facility at main wastewater outlet of Zhongtai



Monitoring facility at main wastewater outlet of Sateri (Jiujiang) and public sampling point

（4）Enterprise resource management

• Chemical management

The production of viscose involves the use of different chemicals based on the needs of the production stage. It mainly uses five chemicals: Caustic soda (NaOH), sulfuric acid (H_2SO4), carbon disulphide (CS_2), oiling agent and other chemical materials, including titanium dioxide, sodium sulfate (Na_2SO4), zinc sulfate ($ZnSO_4$), sodium sulfide (Na_2S) and hydrochloric acid (HCl).

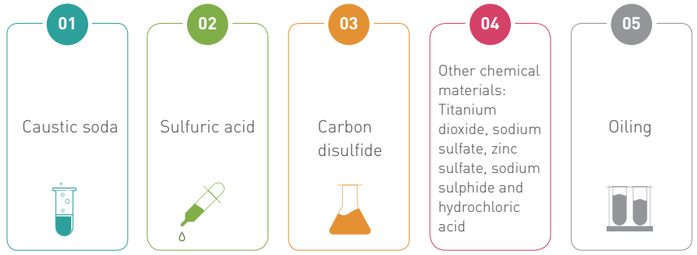
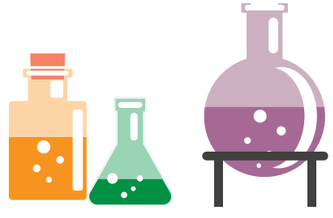


Figure 10 Major chemicals used in viscose production

• Chemical management system

The enterprises observe relevant laws, regulations and standards of the state pertaining to transportation, use and storage of chemicals during chemical management. The enterprises have formulated the hazardous chemical management system in accordance with the Regulations on the Safe Management of Hazardous Chemicals, designed the hazardous chemical management procedure based on types and hazardous characteristics of involved chemicals and defined the warehousing and storage requirements for hazardous chemicals. They have also made emergency response plans and contingency plans, provided emergency goods and protective supplies, and organized regular drills to ensure the safe management of hazardous chemicals and reduce occupational exposure.









Chemical storage area of Sateri (Fujian) Plant

• Reduction of chemical use

Heavy use of chemicals poses a potential threat to the environment as well as workers' health and safety. The industry has always been committed to reducing the use of chemicals, particularly staple chemicals, at the source. They have reduced the use of NaOH, H_2SO_4 and CS_2 through equipment transformation and upgrade, technical improvement and management innovation. For example, in 2017, the CV members used 50kg/t CS_2 of product at minimum, representing 34% of the industry's average level in 2015.

Enterprises have reduced the use of chemicals mainly in the following manners:

a Equipment transformation and upgrade:
a.Transformation the equipment such as the acid bath filter in the acid station to reduce the acidic water emission and acid consumption.

b Process improvement:
Change waste gas recycling to alkali allocation to reduce alkali consumption.Recycle caustic soda with the nano-filtration process to reduce the use of caustic soda.

c Management innovation:
Implement the lean management project to increase the utilization rate of chemicals and reduce their use.

• Chemical recycling

Carbon dioxide recovery

The main recycled chemical in the industry is CS_2, which is widely used and pollutes the environment heavily when discharged into the air and water. Therefore, it has remained the key target of the environmental governance of the industry and one of the key concerns of the international community. In recent years, the industry has greatly reduced CS_2 pollution by reducing consumption and increasing the recovery rate. More than half of the CV enterprises have recorded a total sulfur recovery rate of 92%. Based on the input of 280 kg/t, a recovery rate of 92% means that the final emission of sulfur into the air will be 18.9 kg/ton of products. These enterprises include Sanyou, Sateri, Lenzing (Nanjing), Yamei and Zhongtai (in no particular order), and in particular, Sateri (Fujian) has realized the highest total sulfur recovery rate, up to at 97.08%. For the CS_2 that can't be recycled and is finally discharged into the air, the enterprises often enhance factory ventilation and heighten funnels to dilute the CS_2 content in the air, reduce its harm and protect workers' health.

Currently, global viscose manufacturers all utilize the condensation recycling method to perform preliminary recycling of CS_2, and there are several technical routes to treat the low-concentration CS_2 in waste gases after the preliminary recycling. One is to convert CS_2 into H_2SO_4 through the wet-process acid production technology and use it for further production. This technology can effectively reduce the sulfuric acid purchase of the factory, but will greatly increase the unit consumption of CS_2. The other is to recycle the condensed CS_2 with the activated carbon adsorption technology, which will realize a more complete recovery of CS_2. In addition, the biological treatment technology is gradually applied in the industry to recycle waste gases with a lower density of CS_2, and expected to further reduce CS_2 emissions.

97.08%
The highest total sulfer recovery rate reaches to

H_2S recovery

The CV members recover H_2S contained in waste gases in three ways to reduce its emissions: Use alkali spray to convert waste gases containing H_2S into liquid sodium hydrosulfide as raw materials for downstream enterprises, directly treat H_2S in waste gas with the complexation iron technology, and prepare sulfuric acid with the catalytic oxidation technology.

Sodium sulfate recycling

The heavy use of NaOH and H_2SO_4 in viscose production leads to a high concentration of Na^+ and SO_4^{2-} in the discharged wastewater. Under the traditional process, enterprises prepare mirabilite ($Na_2SO_4 \cdot 5H_2O$) with the multi-stage flash evaporation technology, and further make sodium sulfate (Na_2SO_4) for sale as a way to recycle Na^+ and SO_4^{2-} in wastewater. The one-step nitrate extraction technology, namely, directly produce sodium sulfate with the Acid bath evaporation device, is getting increasingly mature. In theory, the one-step nitrate extraction technology is more energy-saving than traditional evaporation and crystallization processes, and better tests an enterprise's technical reserve and operation level. Now, some enterprises attempt to convert SO_4^{2-} into $BaSO_4$, and further convert Na^+ into NaOH with new technologies. In particular, $BaSO_4$ creates higher economic value added, and NaOH is recyclable.

Zinc ion recycling

Since zinc sulfate is used in the viscose production process, zinc ions in wastewater require more attention. However, as the wastewater generated by viscose is weakly alkaline, zinc ions in alkaline water will be converted to $Zn(OH)_2$ precipitation and enter the sludge. Thus, the concentration of zinc ions in the final wastewater is very low. Enterprises consign qualified institutions to dispose of the sludge containing zinc ions. Some enterprises treatment the sludge otherwise. For example, Sanyou supplies the sludge containing zinc ions to zinc oxide enterprises, which will recycle zinc oxide through high-temperature calcination.



Zhongtai online monitors the density of Zn ions in wastewater



Chemical recycling of Sanyou

Based on the regional industrial advantages and chemical demands from other industries, Sanyou recycles chemicals from waste gas, wastewater and sludge, which are used by upstream industries or other industries as raw materials. This has realized a waste symbiosis and the circular economy of chemicals, and achieved good environmental and economic benefits. Now, Sanyou has basically realized the recycling of all chemicals.

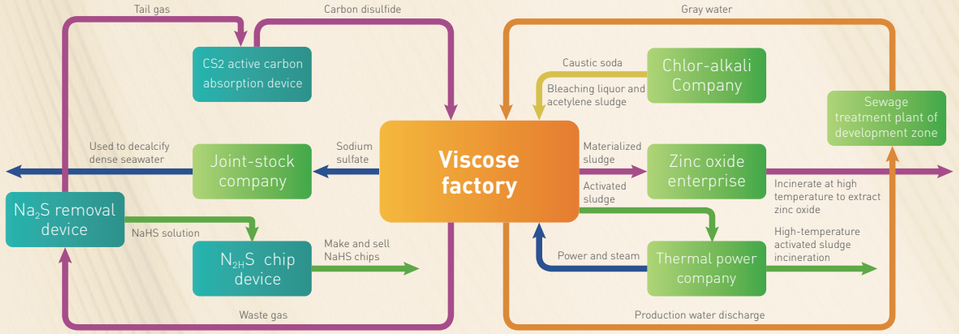


Figure 11 Schematic diagram of circular economy at Sanyou Chemical Industrial Park



Waste gas treatment and recycling facility of Sanyou



Sanyou washes H_2S with NaOH to produce NaHS, and then converts NaHS into tablets for industrial purpose. Illustrated are completed NaHS tablets

Waste alkaline liquid recycling and efficient resource utilization at Grace

The impregnation process in the viscose production technique will yield a large quantity of waste alkaline liquid (with a hemicellulose content of some 3-5%), which is poorly degradable and high in treatment cost and pollutes the environment. To mitigate the environmental impact, Grace has independently developed a series of innovative patented technologies for alkali recovery and resource recycling. It separates and treats waste alkali with the membrane separate technology and uses the pure liquid alkali for the fiber production process again. It has recorded a total waste alkali recovery rate of more than 95% and reduced the alkali consumption to below 0.5t per ton of viscose. At the same time, membrane separation will generate hemicellulose in the waste liquid, and hemicellulose is a new material that is applicable to the biotech sector and extends the industrial chain of viscose. Now, the company converts 100% of hemicellulose into products with high values added, and turns out 30,000 tons of hemicellulose annually, and the biological industry creates an annual output value of RMB 250 million, thereby achieving efficient resource utilization.

Water management

At present, enterprises use water mainly from four sources: surface water (from adjacent lakes), groundwater, purchase of municipal water, and sewage reuse. Enterprises vary in the consumption of different types of water, which principally depends on the water resources condition in the local region. 92% of the enterprises use surface water as their main source of water.

92%
enterprises use surface water

Viscose producers consume a lot of water. Water saving is now a major energy conservation and emission reduction objective in the industry in the context of rising shortage of water resources and the rising cost of water use. To reduce water consumption, the industry has done a lot to reasonably use water, reduce the use of water resources and increase the recycling ratio of water, and made an evident effect. In 2018, the average fresh water consumption per ton of products in CV enterprises was 51.9 m^3/t, representing a reduction of 56% from 2005, and the CV's best level could reach 38.2m^3/t.

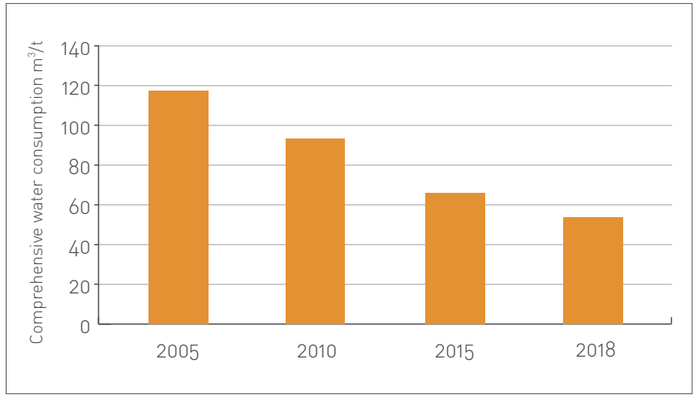
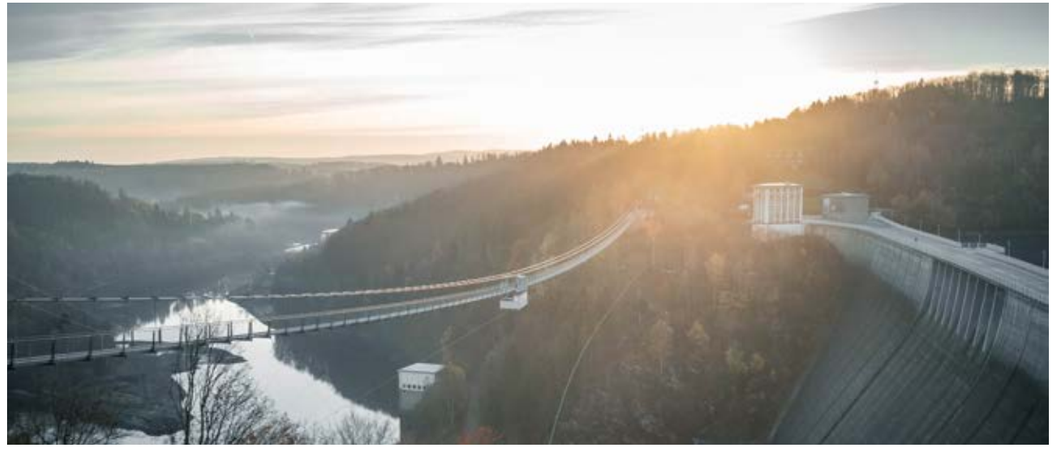


Figure 12 Comprehensive water consumption of China's viscose industry in recent years[20]



20. Data of the industry in 2005, 2010 and 2015 came from the China's Viscose Industry Development and Environmental Protection. There was no statistical data on the comprehensive water consumption of the industry in 2018, and the consumption is represented by the average level of the CV enterprises.

Zhongtai Water Management Practic

Zhongtai is located adjacent to the Taklamakan Desert, where water resources are very precious. In March 2018, Xinjiang began phasing out the use of groundwater by replacing it with surface water, which greatly intensified the pressure on water use. To alleviate the pressure and reduce the cost, Zhongtai took various measures to improve the water saving rate and wastewater recycling efficiency, with remarkable results. In 2018, Zhongtai recorded the fresh water consumption per ton of products at 38.2 kg/t, and the wastewater recycling rate at 96.72%.

Its water resource utilization measures include:

- Connect three DN20 glass reinforced plastic tubes with the circulating cooling water pipe in the acid station workshop after implementing the technical upgrade towards micro-hole cleaning and water saving, install a valve to thee tubes, and replace the circulating cooling water with filtration water to save filtration water and reduce sewage emission. This technology saves 12,700 m^3 of filtered water per year.
- It has transformed the water replenishment system of the CS_2 recycling tank to reduce the waste of water overflow and saved 16,500 m^3 of water per year;
- Domestic wastewater is used for landscape irrigation after treatment, saving 67,000 m^3 of fresh water per year while reducing wastewater discharge;
- Implement energy saving transformation for steam condensed water from the lithium bromide unit. Direct discharge of condensed water from the unit after operation leads to a large energy loss. The steam condensation is discharged to the sewage pump inlet of the original cooling pool, where it is recycled. This has saved 24,000 m^3 of fresh water per year;
- The sewage plant treats production wastewater with the physicochemical + biochemical process, and replaces fresh industrial water with the conforming water after biochemical treatment to resolve limestone, thereby saving 200,000 m^3 of fresh water every year;
- Mix hot water from defoaming with filtrated water to wash cloth, thereby saving 54,600 m^3 of fresh water per year;
- Recycle CS_2 pressurized carbon water at the storage center: Add carbon steel tanks, and channel pressurized carbon water previously discharged to these tanks to recycle CS_2 and use the pressurized carbon water.



96.72%

the wastewater recycling rate at



Energy management and carbon emission

The main energy consumed by viscose enterprises include purchased electricity and coal, shows a survey. In the past decade, the industry has continuously explored innovative technologies and equipment, concentrated production capacity, and slashed the energy consumption. In 2018, the CV members recorded an energy consumption per ton of products at 988 kgce/t, representing a decline of 41.3% from the comprehensive energy consumption per ton in 2005. The best enterprise could achieve 726 kgce/t.

41.3%

reduced the comprehensive energy consumption per ton to

Major energy saving measures

Part 01

Establishing an energy management system: So far, all enterprises have established and operated the energy management system in accordance with the GB/T 23331-2012 Energy Management System Requirements to regulate the energy consumption and utilization at the management level.

Part 02

They have employed cleaner production processes to phase out energy-consuming equipment, and developed and replaced high-efficiency and energy-saving equipment such as motors to reduce energy consumption.

Part 03

They have increased the energy utilization efficiency and reduced the consumption of power and coal through heat recovery, steam recycling or power generation.

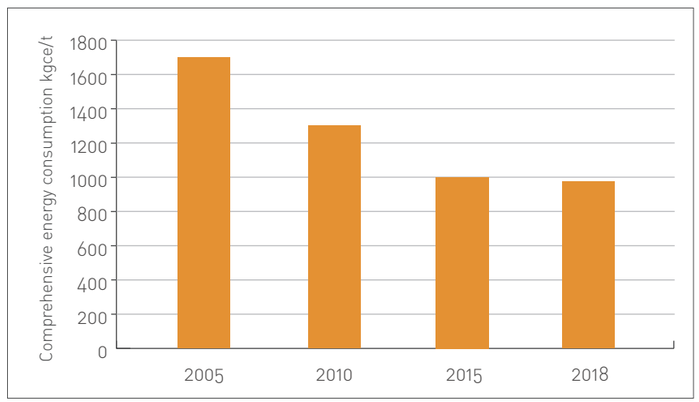


Figure 13 Comprehensive energy consumption per unit of products of China's viscose industry in recent years[21]

21.Data of the industry in 2005, 2010 and 2015 came from the China's Viscose Industry Development and Environmental Protection. There was no statistical data on the comprehensive water consumption of the industry in 2018, and the consumption is represented by the average level of the CV enterprises.

Yamei energy conservation and emission reduction practices

In 2018, Yamei reduced the energy consumption to 750kgce/t with the following measures:

1. It has refined the energy saving management system, reinforced the education, training and evaluation among employees of the energy-consuming functions and broken down the energy saving objective and task to every person, thereby reinforcing energy saving management at the personal level and eliminating drainage and omission in production.

2. It has optimized major energy-consuming technical processes and process designs and selected energy-saving and high-efficiency energy consumption equipment. Meanwhile, it has strengthened energy consumption management of energy consuming equipment in operation, replaced current energy-consuming equipment with the equipment with high energy efficiency and continuously increased the energy utilization rate. It has introduced the variable frequency speed regulating technology to the air compressor, air-conditioner and other large power users, and adopted the inactive local compensation technology at the workshop, thereby increasing the power factor of power consuming equipment.

Energy consumption and carbon emission in the industry

Table 5 displays the comprehensive energy consumption data of the viscose industry in 2005, 2010 and 2015 respectively[22]. It is easy to see from these data that despite a continuous decline of energy consumption per unit of products and the constant improvement of energy efficiency in recent years, the total energy consumption of the industry has kept rising in the context of industry expansion and sustained capacity growth, as demonstrated in Table 5.

Year	2005	2010	2015	Change from 2005 to 2014
Comprehensive energy	1682	1300	1000	41% ↓
Total energy consumption of industry (10,000 tons SCE)	163	229	330	102% ↑

Table 5 Energy consumption status at industry level

750 kgce/t
reduced the energy consumption to

Based on the overall energy consumption, CV has made a preliminary estimate of the industry's carbon emissions in 2005, 2010 and 2014. In 2014, for example, the industry's carbon dioxide emissions reached 860 tons.

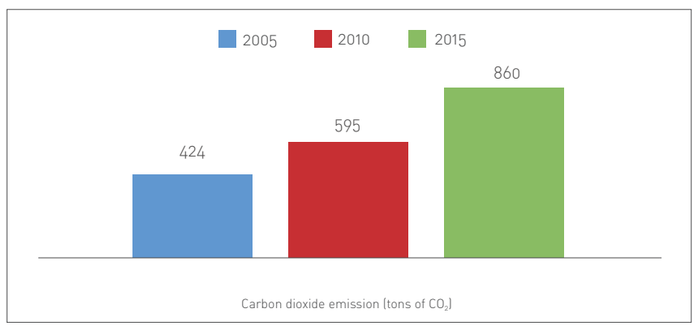


Figure 14 Trend in carbon emissions of viscose industry from 2005 to 2015[22]

In 2015, the international community adopted the Paris Agreement on Climate Change to arrange the global climate change response action after 2020. According to the Paris Agreement, the entire world will arrive at the peak of greenhouse gas emissions as soon as possible and strive to realize a zero net emission of greenhouse gases in the second half of this century. In 2015, China submitted its Intended Nationally Determined Contribution document addressing climate change, which has defined the autonomous action objectives by 2030. The viscose industry will face a significant emission reduction challenge, judging from either the international initiative or China's intended nationally determined emission reduction objectives.

22.Data of the industry in 2005, 2010 and 2015 came from the China's Viscose Industry Development and Environmental Protection.
23.The data are calculated in accordance with the Guide to Accounting and Reporting of Greenhouse Gas Emissions from Industrial Enterprises in Other Sectors (Tentative) issued by the National Development and Reform Commission.

3.3 Corporate social responsibility and public development

（1）Employee care

Basic insurance for employees

The CV members now have a total of 29351 employees, show statistical data. The enterprises have signed labor contracts in accordance with laws and regulations of the state, covered nearly 100% of the employees with the social insurance, and guaranteed the minimum salary, social insurance and other basic subsistence security for employees.

99.7%
Employee insurance coverage ratio

Occupational health and safety of employees

Employees' occupational health and safety are one of the basic management systems of the enterprises. Sateri (Jiangxi), Sateri (Jiujiang), Aoyang, CHTC Helon, Xinxiang and Silverhawk have passed the certification as to the OHSAS 18001 occupational health management system, and Sateri (Fujian) is receiving the audit in respect of the ISO 45001 occupational health management system. At the same time, enterprises assure employees' occupational health with multifaceted measures, including knowledge training on occupational health, regular monitoring and assessment of occupational hazard factors, regular occupational health examination, and provision of comfortable and effective protective supplies.

Work safety

Work safety is the responsibility of corporate entities, and enterprises shall strictly implement the responsibility system for work safety, pursuant to the Work Safety Law, the Occupational Disease Prevention and Control Law, other laws and regulations. Pursuant to these requirements, all CV members have established the work safety management mechanism, set up the work safety committee and made the policy framework for work safety, which cover safety check, hazard detection, safety and environmental protection education and training, material hazard source management, emergency plan and training. They have implemented the responsibility system for work safety and assured employees' life safety.

Improvement of working environment

Unorganized gas emission and noise pollution in viscose production factories are the most important factors affecting the working environment of employees. To deal with unorganized gas emissions, the enterprises have strengthened the air control within plant areas, and taken a host of measures to reduce the density of hazardous gases in the air and improve the working environment. These measures include reasonably designing and improving the enclosing system of production equipment, reducing unorganized gas and odorous emissions, and strengthening the ventilation intensity and efficiency in the plant areas.

Currently, enterprises treat noise pollution in accordance with the Environmental noise emission standards for industrial enterprises (GB12348-2008). Enterprises have reduced the negative impact of noise on employees in the production process through reasonable planning of workshop location, isolation protection, reduction of equipment noise, provision of noise-proof headphones and other measures.

In addition, enterprises have set up special staff lounges and provided necessary protective supplies and emergency medicines to ensure the physical and mental health of employees.

Yamei cares for employees

Yamei has built a sound occupational disease protection system to assure employees' physical health with every effort. First, it has perfected the physical examination and rehabilitation system for employees, covered employees with the large-amount additional medical insurance, and aided employees in need with the needy employee assistance fund. Also, it has organized more than 700 employees (2018) to receive physical examination at work or rehabilitation free of charge outside the company and assured a benign trend of employees' health management. Second, it has strengthened the restaurant and dormitory management, provided free food and accommodation for employees and assured balanced nutrition and scientific schedule of employees. Third, it has taken various actions to improve the working environment. For example, it has planted different types of trees, bushes or lawns in the areas around the living area and working area of employees, and built a dedicated parking lot for employees. Fourth, it has periodically organized the detection of occupational hazard factors in workplace and improved the working environment of employees through third-party detection.

The company also opens the special "Loving Mom's Room", the "Parent-baby Interaction Room" and the "Lounge", which offer different types of goods for mothers and babies as well as books and magazines communicating health knowledge, and thus provide a safe and comfortable rest environment for mothers and babies in need.



Loving Mom's Room at Yamei

700

Organizing on-the-job physical check-ups and external medical treatments free of charge for 700 employees.







（2）Community care

It is the most fundamental requirement for protecting the environment safety of ambient communities to reduce the emission of waste gases, wastewater and solid wastes in the production process and root out the illegal and noncompliant emission. To eliminate illegal and noncompliant discharge, China's local environmental regulators have taken an array of measures to assure compliant emissions of enterprises. These measures include real-time monitoring over pollutant discharge at sewage outlets, regular or irregular environmental supervision, and severe penalty against noncompliance. At present, all enterprises can realize compliant discharge and strictly abide by the pollution bottom line.

On this basis, different enterprises have also taken some other measures to further improve the community environment:

part 01

seal major unorganized discharge areas by, for example, sealing the sewage treatment area so as to reduce unorganized gas and odor emissions and ensure that the surrounding communities no longer smell the odor (Zhongtai and Sanyou).

part 02

Landscape factory boundary and surrounding environment, plant green vegetation and perform regular maintenance (Sateri, Xinxiang, Silverhawk, Zhongtai , etc.).

part 03

Cooperate with communities, launch environmental protection publicity and education activities, invite the community public to visit the enterprise and strengthen mutual understanding and contact between the enterprise and the community.

Zhongtai invites the public for on-site visits

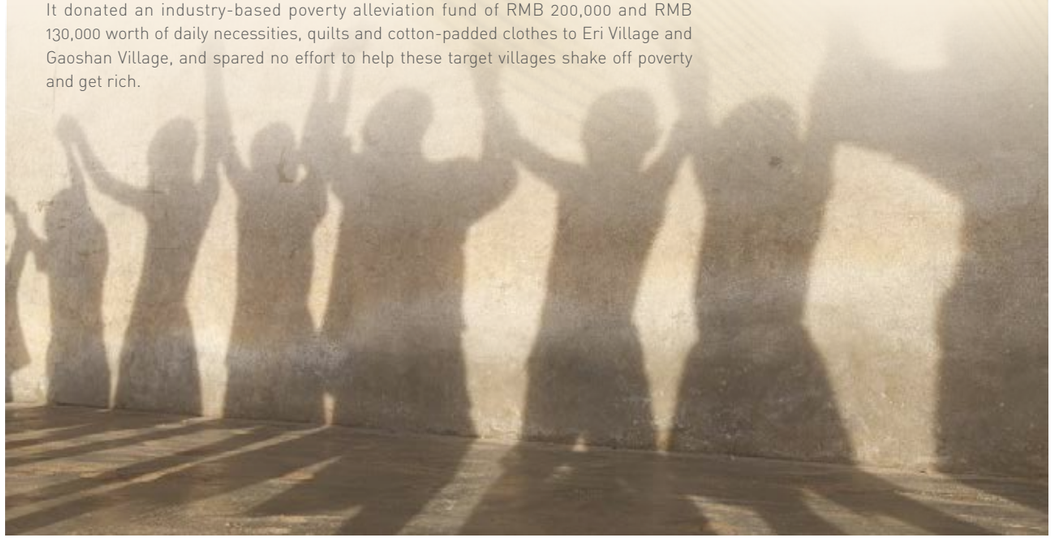
Zhongtai regularly invites villager representatives from Xinier Town along the plant boundary to visit the park and experience its environmental protection efforts over a zero distance.





Grace has actively propelled public development

Statistical data reveal that in 2016-2018, Grace donated more than RMB 1.80 million, including money and materials, to the poverty alleviation program, helped Shuangfeng Village apply for a policy aid of RMB 2.3 million to improve the infrastructures, and allocated RMB 4 million or so to open the Dadipo Party-Mass Event Center with the local government. Meanwhile, echoing the call of "Thousand Enterprises Help Thousand Villages" from the CPC Committee of the province, it aided counterpart villages, including Eri Village and Gaoshan Village, Rulong Town, Xinlong County, Ganzi Prefecture, and selected excellent cadres to work at these villages and participate in the "Aid Tibet" program. The company introduced the "enterprise + villager" assistance mode to help impoverished villagers get employed, provided an intelligence support for the impoverished villages under the "enterprise + talent" assistance mode, and focused on assistance through intelligence and industry. It donated an industry-based poverty alleviation fund of RMB 200,000 and RMB 130,000 worth of daily necessities, quilts and cotton-padded clothes to Eri Village and Gaoshan Village, and spared no effort to help these target villages shake off poverty and get rich.



（3）Public welfare

By the end of 2018, the CV members had recorded various donations totaling RMB 1.2 million, according to statistics. They have done a lot of work in community-level poverty alleviation, community infrastructure building, care for left-behind children, and enrichment of community's entertainment activities.

Sanyou poverty alleviation practice

In 2018, Sanyou earmarked a poverty alleviation fund of RMB 56,000 to Heigou Village, Longhua County, Chengde City, a counterpart village under the poverty alleviation program. It helped more than 160 employees in need and offered a minimal subsistence aid of RMB 150,000. Also, it initiated several volunteer events, including "Send Health" and "Send Service", at the communities. They measured blood pressure for the old and repaired bicycles for the public.





Chapter 4
CV Sustainability Outlook

4.1 Risks and challenges threatening CV

（1）External risks

The main external risks faced by the industry come from three aspects:

First, the Chinese government, which is now vigorously promoting ecological civilization construction, has committed ambitious intended nationally determined emission reduction objectives. Thus, the government will further intensify the supervision of enterprises in respect of energy conservation, emission reduction and pollution control and continuously aggravate the penalty against noncompliant enterprises, which will increase the noncompliance cost and even pose the suspension risk to enterprises.

Second, as global environmental and resource issues are emerging, the international community has generally agreed to implement sustainable growth and protect the earth and mankind. In this context, the industry has suffer and will continue to suffer various stakeholders' supervision and doubt.

Third, similar products have already appeared in the market and proved more friendly with environment. If the viscose industry can't adopt a more responsible production pattern, it will be most likely to be squeezed out of the market by other products.

（2）Internal challenges

Based on CV's baseline survey results, the sustainable development level of the industry has kept rising. The CV member's average levels of various key technical indicators don't lag a lot behind the Level I benchmark values, namely international leading levels, and some enterprises[24] even outperform the maximum requirements of the Cleaner Production Indicator System and the EU BAT. However, the sustainable development of CV still faces can't-ignore challenges. This is the most important reason why the CV has performed the baseline survey: find out where challenges come, seek corresponding solutions and increase the CV's efficiency to promote sustainability. The challenges faced CV come from two factors:

a.Sustainability of enterprises

- Demand for more advanced processes, technology and equipment: Enterprises will need to make further improvement in pollution prevention, resource recycling and other aspects, which will in turn require the support of advanced technology, processes and equipment. However, this may be restricted by the financial strengths of enterprises and the barriers to intellectual property rights of advanced technology.

24. The proportions of the enterprises falling into different ranges vary in terms of different indicators under different standards, as detailed in Figure 10 in Chapter 3.2.

- Disparity of sustainability in the CV: The development levels of different CV members are not the same. For example, some enterprises already possess advanced technology and equipment in relation to energy consumption, water consumption and total sulfur recovery rate and lead the international advanced level, but some only meet the national minimum requirements.

- Inadequate active information disclosure: Viscose comes at the upstream of the textile industry, but it is difficult for the public to obtain relevant information about the sustainable development process of the industry, which leads to misunderstanding and questioning of the actual situation of the industry and affects the image and influence of the industry. At present, three CV enterprises have issued sustainable development reports.

b.Sustainable governance of CV:

- More effective improvement of CV's overall performance level:

  √ CV will improve strategy and mechanism building, encourage enterprises to actively implement the CV Roadmap, and integrate sustainable development into the core of corporate culture and management;
  √ Although the reference standard system has been scientifically evaluated, it is still far from the industry reality and the demands of stakeholders;
  √ To help enterprises actually improve sustainable development performance, CV needs to play a greater role in capacity building, technical support and other aspects.

- More scientific evaluation of sustainable development performance:

  √ Data collection: The willingness and ability of enterprises to submit data needs to improve. Scientific and uniform data reporting determines the accuracy, validity and comparability of data, and how to evaluate the development performance of CV enterprises scientifically.
  √ Performance evaluation: At present, despite the wide coverage and high recognition of the performance evaluation standard system, which has been scientifically evaluated and screened, it still falls short of the industry reality and expectations of stakeholders.

- Communication and participation of stakeholders: It is necessary to further improve information transparency, respond to the demands of key stakeholders, strengthen active communication with stakeholders, and encourage more stakeholders to participate in CV's public governance.

4.2 Outlook on CV sustainable development

（1）2018 CV Work summary and progress

2018 is CV's first year. Relying on the establishment of four platforms, CV has carried out the following work in response to the risks and challenges it faces:



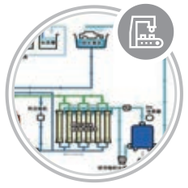
Industry Information Publishing Platform



Green Industry Chain Sharing Platform



Sustainable Development Management Platform



Energy Saving and Emission Reduction Technology

1 Industry information publishing platform

- CV organized the baseline survey of CV enterprises to understand the current sustainable development of the industry and to identify problems and challenges in the industry, so as to take targeted and more effective measures to promote the sustainable development of the industry in the future. The preliminary findings are disclosed in Chapter III of this report.

- CV built a public platform for information release (www.cvroadmap.com). It regularly tracks and investigates the development trends, hot spots and green practices of member enterprises, and compiles quarterly Chinese and English briefings to disclose the real-time process of sustainable development of the industry.

- CV prepared the sustainable development report for key stakeholders to learn about the enterprises, thereby improving the transparency of the industry and strengthening the foundation of multi-party governance.

2 Green industrial chain sharing platform

- Meeting of stakeholders: To present the status and the past years achievements in the sustainable development of the industry, and to increase the participation of key stakeholders, CV organized the first meeting of stakeholders in Beijing on January 14, 2019. More than 100 people from pulp enterprises, viscose production enterprises, cotton textile enterprises, terminal brands and government representatives were invited. They discussed the traceability of raw materials, the current situation of sustainable development, the future prospects of the industry, and the governance problems of the industry.

- Meeting of downstream cotton textile enterprises: To enhance the enthusiasm of CV enterprises to participate in the work of sustainable development and strengthen the communication and connection between the upstream and downstream of the industrial chain, CV, by relying on the relationship between the China Cotton Textile Association and its member enterprises and the cotton textile enterprises, is gathering a group of cotton textile enterprises which will serve as "industrial chain members" with the goal of building a green industrial chain through win-win cooperation.

- CV has actively participated in the communication and dialogue platform of the international community, and communicated with stakeholders to collect opinions and suggestions, thus improving the transparency of the industry.

√ In December 2018, CV organized representatives to attend the annual meeting of ZDHC (Zero Discharge of Hazardous Chemicals), and organized a closed-door meeting where they had an in-depth discussion on the preparation of the MMCF Guideline.

√ CV attended the 2nd China Hangzhou Viscose Industry Forum held on May 23, 2018, where Zhang Zixin, secretary general of CV, shared the industry's exploration and practice of green and sustainable development with relevant stakeholders.

√ On September 28, 2018, VC Secretary-General Zhang Zixin participated in a seminar under the theme "Small label, big influence! How to establish consumer confidence with ecological label" organized by TESTEX, and shared the experience and progress in promoting green development of the industry with STeP.

√ In September 2018, CV members Sanyou and Sateri participated in the London Fashion Week and the New York Fashion Week together with upstream and downstream supplier partners, and promoted the green industrial chain of viscose.





Sanyou at London Fashion Week - Fashions made of green viscose as raw materials

3 Sustainable development management platform

- CV has issued a roadmap for sustainable development and a three-year action plan, and in the process of advancing the roadmap and the three-year action plan, it has explored more suitable and effective practice models for the industry.

- Establishment of CV methodology: During CV's baseline survey, it was found that different enterprises have different opinions on the boundary of information reporting, and there are also differences in data statistics and calculation models, resulting in the poor horizontal comparability of data. Since December 2018, the CV has maintained communication with stakeholders, consulted them and started designing the CV methodology, namely, the data statistics standard of the industry, based on the internal expert team. The CV expects to complete and release the first part of the statistical standard, which will define the statistical methods of comprehensive energy consumption, water consumption and total sulfur recovery rate, including determination of data scope and data calculation method in the second quarter of 2019.

4 Energy conservation and emissions reduction technology promotion platform

- CV established the Technology Committee for Industry Sustainable Development and formulated the Recommended Catalogue of Technical Equipment for Industry Green Development. In CV's three-year action plan, the first batch of technical equipment targets were issued, covering a total of 15 technologies including skills, water saving, consumption reduction, and waste disposal.

- CV has promoted technology exchange and sharing among enterprises by organizing training and regular visits, and advanced the application of best available techniques and best environmental practices in the whole industry.

In 2018, CV launched the Long March of Green Development. It organized representatives from member enterprises to visit production and environmental protection facilities of various enterprises, promoting internal technology and experience exchange among member enterprises. In 2018, CV visited two enterprises, including Sanyou and Sateri (Jiujiang), and the enterprises responded well, which briefed their advantages and exchanged views over a broad range of topics with the representatives of the CV members.



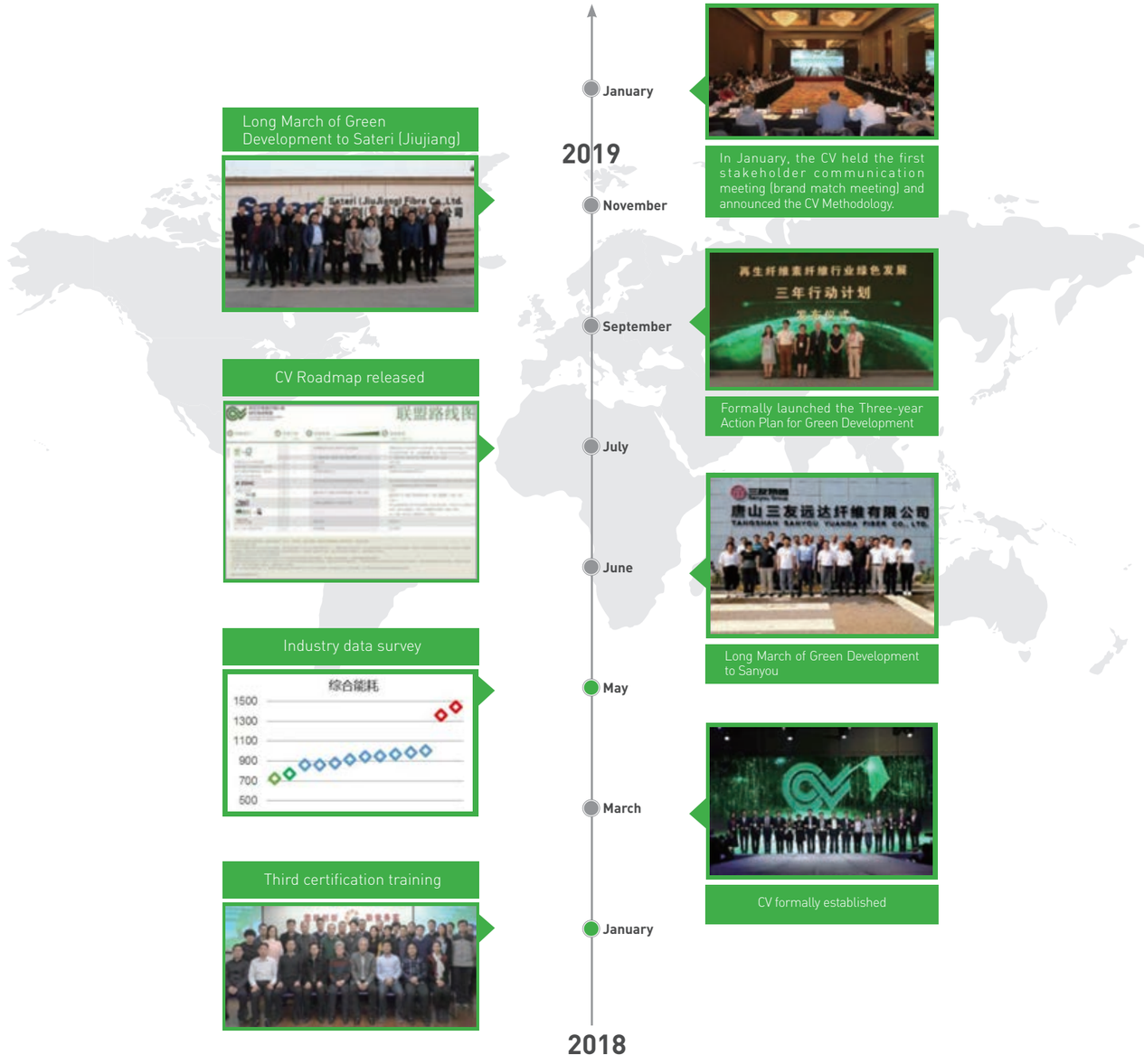
CV members on a visit to Sateri (Jiujiang)

To enhance enterprises awareness of sustainable development and promote sustainable development practices, CV organized three internal trainings in 2018, covering the enhancement of enterprises awareness of sustainable development and third-party certification experience. After one-year efforts, CV enterprises, which once had no understanding of the connotation of sustainable development, began to realize the importance of sustainable development, and were committed to actively implementing the CV Roadmap.

15

covering a total of 15 technologies including skills

Memorabilia of CV in 2018



（2）Outlook on CV sustainable development

In the future, CV will continue to actively respond to the risks and challenges ahead, and continuously improve the governance model based on the promotion of the four platforms. The next major plans include:

01

Further improve the transparency, comprehensiveness and accuracy of information disclosure, and allow the internal and external stakeholders of CV to have a comprehensive understanding towards the sustainable development level of the industry based on the information openness and disclosure in CV level and enterprise level. Define the sustainable key performance of the industry and unify the key data scope of the industry through the preparation of the **CV Methodology**.

02

Further carry out the visit activities within the industry as well as the upstream and downstream of industry chain. Through the mutual learning and capacity building, facilitate the enterprises to improve the performance regarding key and difficult issues in various aspects such as chemical management, water management, energy management, waste gas and waste water discharging, guide the enterprises to be in alignment with the international advanced level, and finally achieve responsible production.

03

Continue to promote the implementation of the three-year action plan, urge all enterprises to meet the requirements of the CV Roadmap by 2020, and promote the overall improvement in three aspects of raw materials, production process and product management, especially for the backward enterprises. Based on sustainable performance and stakeholders' opinions, prepare the **"CV Roadmap 2025"** to set sustainable goals for the next stage.

04

On the basis of responsible production and procurement, further promote the innovation of industrial products, processes, technologies and management from the key issues such as climate change and carbon emission reduction, water resource management, chemical recycling and green alternative, so as to provide the industrial solutions in face of the global resource and environmental challenges.

05

Gradually receive industrial chain members. Give priority to receiving textile enterprises to join the CV, and continue commitment by right of the initiative of **"Committing Responsibility to Nature, from Wood to Fashion"** . Explore the business path of gradually building the responsible and completed industrial chain from woodland to fashion through the collaboration of the upstream and downstream of the industrial chain.

Climate change initiative

The industry is now pushing for a development plan for 2025. As mentioned above, the industry is taking actions to reduce its negative impact on climate change and support the international community to jointly tackle climate change. In December 2018, the United Nations Framework Convention on Climate Change released the Fashion Industry Charter for Climate Action. Together with global brands and industry organizations, CV will join the climate change initiative to map out a carbon reduction roadmap and meet the commitment to reduce total carbon emissions by 30% in 2030.

UNFCCC Fashion Industry Charter for Climate Action

Signed by 29 international brands and 11 industry organizations worldwide



Echo new international sustainability trend and join Climate Change Pioneers



Draw CV's carbon emission reduction roadmap and commitment to cut 30% carbon emission by 2030

2019 — Carbon Responsibility Pioneer
Build enterprises' carbon awareness and capacity
Build enterprises' capacity of carbon emission reduction

2020 — Set scientific carbon objective
Fix carbon footprint of product

2025 — Realize carbon objective

2030

30%
reduce total carbon emissions by



Notes on Data in the 2018 CV Sustainability Report

In 2018, the CV devised an indicator system, preliminarily surveyed the members' sustainability performance records for three times and collected related data and information disclosed by the members on a voluntary basis, in a move to check the status quo and enhance the transparency of the industry's sustainability. When doing this, the CV encountered many challenges. For example, enterprises were less motivated to submit data, their data calculation methods and reporting terms were inconsistent, The CV has realized that such voluntary reporting mode will tend to undermine, effectiveness and comparability of data. Therefore, the CV has mainly quoted some data to perform a preliminary analysis of the industry's sustainability performance in some dimensions. The CV has organized an expert team and banded up with stakeholders to assess the scientific attribute of data reporting. In 2019, the CV will announce the data statistics standard (CV Methodology) to define the scope, calculation method, statistical term and submission channel of data reporting, and perform training and on-site survey at enterprises to ensure, effectiveness and comparability of data.

Key indicators in 2018



Assurance Statement of Sustainability Report

TUV Thuringen (Shanghai) Co., Ltd. ('TUV Thuringen' for short) has been commissioned by the management of The Collaboration for Sustainable Development of Viscose ('CV' for short) to carry out an independent assurance of the 2018 Social Responsibility Report of CV('report' for short）.

CV is responsible for the collection, analysis, aggregation and presentation of information within the Report. TUV Thuringen's responsibility in performing this work (assurance of the report) is in accordance with terms of reference agreed in the scope of engagement with CV. CV is the intended users of this statement.

This statement is based on the assumption that the data and information provided in the report is complete and true. This report is the first sustainability report for CV, and it's for CV to invite TUV Thuringen give independent assurance.

Assurance Scope

- The report revealed the accuracy and reliability for key performance, information and management system which happened in 2018.
- Assurance address is in 18 Chaoyangmen Ave. (N.), Beijing City, P.R.China., where CV head office locates.
- TUV Thuringen evaluate the collection, analysis, aggregation of the information and data.

Assurance of the Report was done on 01 March 2019.

Assurance Methodology

Assurance process including following activities:

- Review the document information which provide by CV;
- Interview the person who collected the report information;
- Interview the representatives from the members.
- View the related websites and media reports, verify the data and information through sampling method;
- Refer to China Sustainability Reporting Verification Rules and Instructions (CSR-VRAI) on Completeness, objectivity, suitability, responsiveness and development;
- Assessment of compliance with AA1000 AS (2008) Principles, type II, Medium Guarantee Level;
- Assurance activity is based on TUV Thuringen Sustainability Report Assurance Procedure.

Assurance Conclusion

The Report provide an appropriate and objective view of the sustainability & social programs and performances in 2018. The data in report is reliable and objective, TUV Thuringen didn't find the system error or substantial error.

- The report discloses the development status of the Collaboration for Sustainable Development of Viscose in 2018, describes the sustainable development governance model and the progress and practices in the aspect of economic, environmental and social responsibilities of viscose industry, and puts forward the sustainable development plan and roadmap.
- The report discloses the action and performance of the Collaboration for Sustainable Development of Viscose in practice its social responsibility in 2018 from the dimensions of environmental management, social responsibility and public development, and forecasts the vision of the sustainable development by issuing the CV roadmap.

- In order to realize the stakeholders' requirement better, CV determined the key material aspects and disclosured them in the report ,which feedback the stakeholder expectation and concerning well.

Suggestion for improvement

Through assurance and evaluation, TUV Thuringen gives following improvement suggestion on social responsibility practice and management:

- It is suggested that the disclosure of the data related to economic and health&safety should be increased to enhance the completeness of the report.
- It is suggested to cover as many stakeholders as possible in the identifying and investigating process.
- It is suggested that the disclosure of negative performance data should be increased to enhance the objectivity and balance of the report.
- It is suggested that the performance and case study should be collected more widely to enhance their balance.
- CV collected relevant data and information through the members' self-evaluation and declaration. the calculation and statistical method are not consistently used by some members. It is suggested that the scope, calculation and statistical method of disclosure data should be further clarified in future.

Note: more suggestions will be elaborated in the "audit report".

Special statement

This statement excluding:

- The activity outside information reveal;
- The position, idea, faith, object, future developing direction, and promise which stated by CV and its members.

Statement of Independence and Competence

TUV Thuringen e.V. is the world's famous certification body in inspection, testing and verification, and providing services which includes management systems and product certification; quality, environmental, health&Safety auditing and training; environmental; social responsibility and sustainability report assurance.

TUV Thuringen (Shanghai) Co., Ltd. is independence from The Collaboration for Sustainable Development of Viscose and confirms that there is no conflicts of interest with the organization or any of its members and stakeholders when performing the assurance of the Report to ensure its independence and impartiality. TUV Thuringen was not involved in any manner with CV, when the latter was preparing the Report.

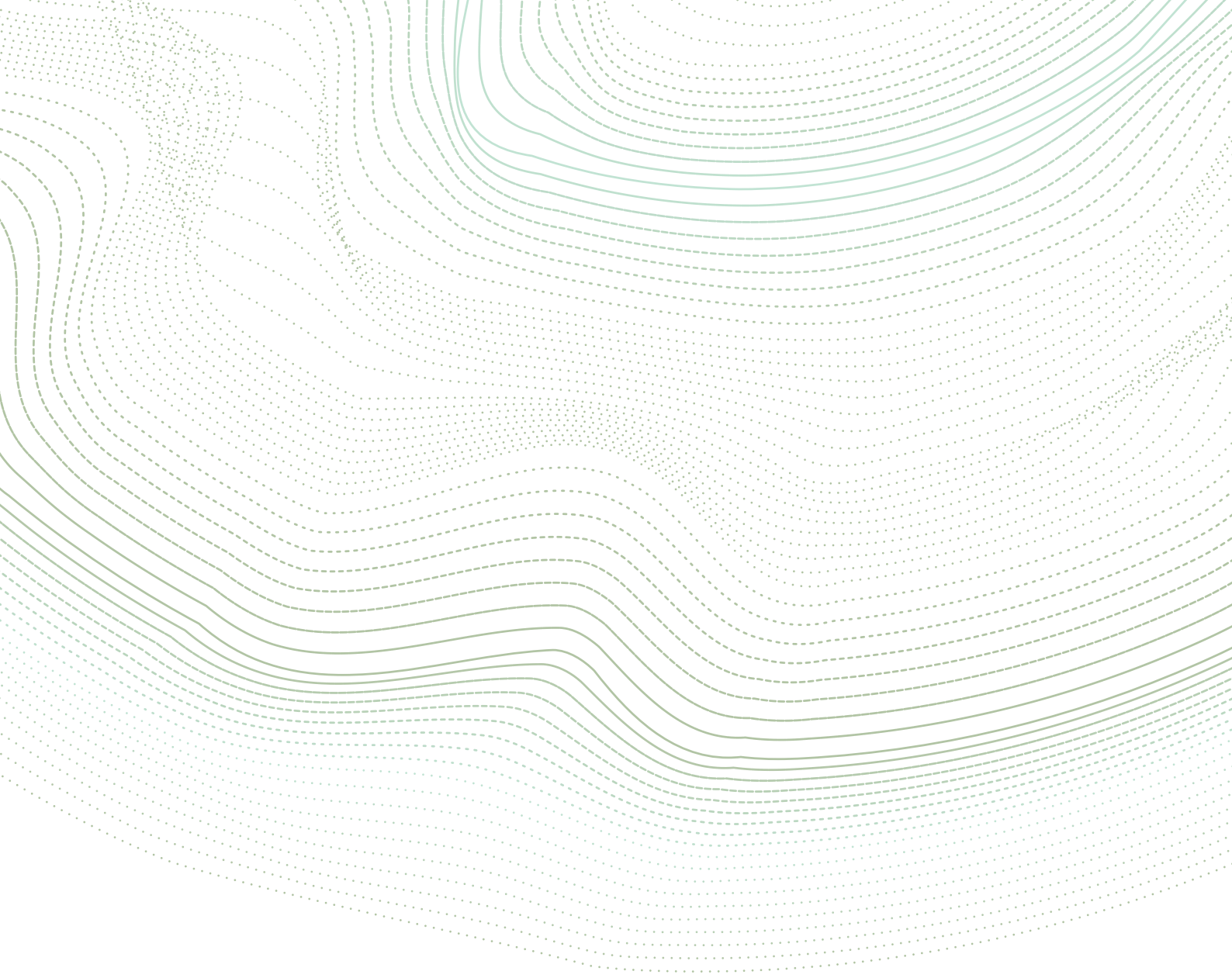
The Statement was issued by TUV Thuringen (Shanghai) Co., Ltd.

The Authorized person: Jia Hongwei

The Lead Assessor: Zhao Yuhong

Date :05.03.2019

Note: When there is a deference between the Chinese and English versions, please refer to the Chinese version.



More information
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Collaboration for Sustainable Development of Viscose

2018
Sustainability Report

This report is printed on recycled paper