EU BAT Assessment Report

EU BAT ASSESSMENT
欧盟最佳可用技术评估

Tangshan Sanyou Group

唐山三友集团

COUNTRY 国家: China 中国

Sustainable Textile Solutions
May 2023　二零二三年五月

Sustainable Textile Solutions (STS) is a division of BluWin Ltd. (based in the UK). Solutions offered are clustered around the six cubes regenerative by design, sustainable fibers, processing excellence, clean chemistry, zero discharge of hazardous chemicals and climate positive. Each cube comprises impactful services which were developed with the objective to reduce the environmental footprint of the textile, leather, apparel and footwear production.

An interdisciplinary team of 50+ chemical engineers, dyers, textile & leather engineers, psychologists, environmental scientist, data analysists and economists give STS the unique position to derive innovative ideas and translate them to robust programs which drive the transformation of the apparel & footwear industry towards more sustainable production.
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Sustainable Textile Solutions (STS) 是 BluWin Ltd (总部在英国) 的一个分支部门，提供的解决方案围绕六大模块内容：可再生设计、可持续纤维、卓越加工、清洁化学品、有毒化学品零排放、气候改善。每一个模块都包含了有影响力的服务，旨在减少纺织、皮革、服装和鞋类生产的环境足迹。

我们团队是由 50 多个跨学科化学工程师、染色工程师、纺织和皮革工程师、心理学家、环境科学家、数据分析和经济学家组成，为 STS 提供了独特的地位，可以激发创新思想并转化为强大的计划推动服装和鞋类行业向更可持续生产方向发展。

我们这支拥有多国语言的全球专家团队在 40 多个国家的重要采购地区设有分部并开展工作。

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(1) Introduction 导言

Tangshan Sanyou Group is one of the largest suppliers of MMCF in China. They are known for their product versatility at the facility and committed to reducing the environmental impact of viscose production.
唐山三友集团是中国最大的人造纤维生产企业之一，其产品以多功能性著称，三友集团长期致力于减少粘胶生产对环境的影响。

Tangshan Sanyou Group Xingda Chemical Fibre Co. Ltd, & Tangshan Sanyou Group Yuanda Fibre Co. Ltd as the subsidiaries of Tangshan Sanyou Group, are located in Caofeidian new district, Tangshan, Hebei Province, China, adjacent to Beijing-Tianjin-Tangshan urban region. It has occupied area of 61.3 hectares.
唐山三友兴达化纤有限公司和唐山三友远达纤维有限公司是唐山三友集团的子公司，位于河北省唐山市曹妃甸新区，毗邻京津唐城市集群，占地面积为 61.3 公顷。

The first fibre production line of Sanyou Group was formally put into operation in 1998. For nearly twenty years, facility have continued the technological innovation and obtained more than 60 patents and the production capacity has increased from 20,000 tons to about 800,000 tons annually. The facility has one of the world's largest production single line of viscose staple fibre with a production capacity of 150,000 tons per line each year.
三友集团的第一条纤维生产线于 1998 年正式投产。近二十年来公司不断进行技术创新，获得了六十多项专利。公司的产能也在不断增长，年产量从 2 万吨发展到年产约 80 万吨。并拥有了全球最大的单条粘胶短纤生产线之一，该生产线年产能为十五万吨。

Tangshan Sanyou Group actively protects primary forest, practises responsible raw material procurement. They have obtained Chain of Custody (FSC) certifications for forest production and marketing (FSC License Codes: SGSHK-COC-330228/SGSHK-CW-330228, SGSHK-COC-330227/SGSHK-CW-330227). The group has also obtained the certificates of CFCC/PEFC (SGS-CFCC/PEFC-COC-001135 & SGS-CFCC/PEFC-COC-001134). Tangshan Xinda Chemical Fibre has got ISO 9001:2015 Quality Management System certification (15812Q7197R6L), ISO

14001:2015 Environmental Management System certification (15812E7081R4L) and ISO 45001:2018 Occupation Health Safety Management System certification (15812S7059R4L). The certificates of Management System for Energy are also obtained (CCSC22En0619R0M & CCSC22En0618R0L). Tangshan Group has been certified by OEKO-TEX with the OEKO-TEX STeP Green Cleaner Production (level 3) (17001302 & 18001099) at the production end, and OEKO-TEX Standard 100 (Appendix 6) certificate (BEFO 035708 & BEFO 084288) at the product end, etc. The ecological supervision on whole process from raw material to products has been achieved.

唐山三友集团积极保护原始森林，开展负责任的原料采购，获得了森林生产和销售监管链（FSC）认证（FSC 许可证代码：SGSHK-COC-330228/SGSHK-CW-330228、SGSHK-COC-330227/SGSHK-CW-330227）。集团还获得了 CFCC/PEFC 证书 (SGS-CFCC/PEFC-COC-001135 和 SGS-CFCC/PEFC-COC-001134)。唐山兴达化纤已通过 ISO 9001:2015 质量管理体系认证(15812Q7197R6L)、ISO 14001:2015 环境管理体系认证 (15812E7081R4L)、和 ISO 45001:2018 职业健康安全管理体系认证 (15812S7059R4L)。三友集团还获得了能源管理体系认证 (CCSC22En0619R0M、CCSC22En0618R0L)。唐山三友集团已通过了 OEKO-TEX 认证，在生产端通过了 OEKO-TEX STeP 绿色清洁生产（三级）认证 (17001302 & 18001099)，在产品端获得了 OEKO-TEX Standard 100（附录 6）证书 (BEFO 035708 & BEFO 084288) 等等。实现了从原材料到产品的全流程生态监控。

Sanyou Chemical Fibre upheld the concept of clean production and green development and continued to promote its development towards the goal of low and zero carbon by means of low carbon product development application of energy-saving and emission-reducing technologies, construction of brand strategy planning, etc. The company officially disclosed its corporate vision of carbon peaking and carbon neutrality – "strive to achieve a 30% carbon emission reduction per unit of product by 2030 and carbon neutrality by 2055". The company also joined the "30-60 Net-Zero Acceleration Plan" to promote low-carbon energy, green materials, clean production and low-carbon products, taking a leading role in addressing global climate change in the industry.

三友化纤坚持清洁生产、绿色发展的理念，通过产品开发和节能减排技术应用以及品牌战略规划建设等方式，不断推动公司朝着低碳零碳的目标发展。公司正式披露了碳达峰和碳中和的企业愿景 – "力争到 2030 年实现单位产品的碳减排 30%，到 2055 年实现碳中和"。公司还加入了 "30-60 中国纺织服装碳中和加速行动"，继续推进低碳能源、绿色材料、清洁生产和低碳产品，以应对全球气候变化的挑战。

Purpose and Scope of Assessment

Sustainable Textile Solutions was tasked to conduct an assessment at Tangshan Sanyou Group on 9th to 11th May 2023 with the following objectives:

(1) Measure the ecological impact of production.
(2) Assess the performance of viscose production with respect to the limits of EU BAT.
(3) Identify gaps against EU BAT requirements.

评估目的和范围

本次委托 STS 于 2023 年 5 月 9-11 日对唐山三友集团的评估目的如下:

(1) 粘胶短纤生产对生态的影响
(2) 行欧盟现有最佳可用技术 （EU BAT）的绩效
(3) 与欧盟最佳可用技术（EU BAT）要求的差距

The following activities were undertaken:

(1) Primary Data Collection by the production unit in preparation for the on-site assessment
(2) On-site assessment
    a) Opening Meeting
    b) Factory Tour
    c) Secondary Data Collection
    d) Closing Meeting
(3) Data Analysis
(4) Report Writing

开展了以下活动:

（1）生产单位收集原始数据以准备现场评估

(2) 现场评估

a) 首次会议
b) 工厂参观
c) 二次数据收集
d) 末次会议

（3）数据分析

（4）报告撰写

To validate the Facility's compliance against EU BAT limits for viscose production, the following data were collected and analysed:

为了验证工厂的粘胶生产对于 EU BAT 的应用，收集并分析了以下数据:

Resources and Process efficiency

- Fresh Water Consumption (M3/MTf)
- Energy Consumption (GJ/MTf)
- Sulphur Emission (Kg/MTf)
- CS2 (Kg/MTf)

资源和工艺流程效率

- 新鲜水消耗量 (M^3/MTf)
- 能源消耗量(GJ/MTf)
- 空气中的硫排放量 (Kg/MTf)
- 二硫化碳消耗量 (Kg/MTf)

Utility Efficiency

- Chemical Consumption (Kg/MTf)
  - Zn
  - H_2SO_4
  - NaOH
- Sulphate emission (Kg/MTf)

- Zn emission to water (g/MTf)
- COD Load (g/MTf)

使用效率

- 化学品消耗量 (Kg/MTf)
  - 锌
  - 硫酸
  - 烧碱
- 水中硫酸根的排放量 (Kg/MTf)
- 水中锌的排放量 (g/MTf)
- COD 负荷 (Kg/MTf)

(2) Facility Overview 工厂概况

Tangshan Sanyou Group Xingda Chemical Fibre Co., Ltd & Tangshan Sanyou Group Yuanda Fibre Co., Ltd are the subsidiaries of Tangshan Sanyou Group. As a manufacture of viscose fibre, the group holds strong knowledge and expertise in production process and innovation. There are three production plants with 5+1, 4+1 & 2 spinning lines respectively. Seven series viscose products including viscose staple fibre, modal fibre, Lyocell fibre, FR viscose fibre, dope dyed viscose, viscose filament, bamboo fibre and so on are produced in Xingda and Yuanda, which are wildly used in apparel, home textile, wet/dry wipes, and surgical dressing. The products are popular in international & domestic markets.

唐山三友兴达化纤有限公司和唐山三友远达纤维有限公司是唐山三友集团的子公司，作为粘胶生产企业，三友集团拥有对于生产工艺流程完备的理论知识和实践技能，勇于创新。三友化纤下辖的三家工厂分别有 5+1 条、4+1 条、2 条生产线。生产七大系列粘胶产品，包括粘胶短纤、莫代尔纤维、莱赛尔纤维、阻燃纤维、原液着色纤维、粘胶长纤、竹纤维等等，广泛应用于服装、家纺、干湿纸巾、医用材料等领域。唐山三友的产品在国内市场和国际市场深受欢迎。

Tangshan Sanyou Xingda Chemical Fibre & Tangshan Sanyou Yuanda Fibre purchase steam and electricity from their own group power company in the same industrial zone. The caustic soda used is provided by a subsidary company of the group. Xingda & Yuanda purchase CS_2, H_2SO_4 and other chemicals from outside sources.

唐山三友兴达化纤和唐山三友远达纤维从三友集团的热电公司购买蒸汽和电，烧碱由集团旗下的另一家公式提供，而 CS_2，H_2SO_4 和其它化学品则从集团之外采购。

The wastewater from Xingda Chemical Fibre (plant 1) is treated in an ETP with capacity of 30,000 M^3/day and the wastewater from Yuanda Fibre (plant 2 & plant 3) is treated in another ETP with capacity of 75,000 M^3/day. Treated wastewater from both ETPs are discharged to an external CWWTP in the industrial zone for further treatment. There is one chimney tower of height 160 meters in plant 1, and two chimney of 120 meters are located in plant 1 & plant 2 respectively.

兴达化纤公司（一厂）的废水由一个处理能力为 3 万吨/每日 的污水处理站进行处理，远达纤维公司（二厂和三厂）的废水一起进入另一个污水处理站（处理能力 7.5 万吨/每日）进行处理。经两个废水处理设施处理过的废水再排至园区的工业废水集中处理厂（唐山市南堡经济技术开发区污水处理厂）进行进一步处理。三厂的烟筒高 160 米，而一厂和二厂分别装有 120 米高的烟囱。

Facility Name 工厂名称	Tangshan Sanyou Group Xingda Chemical Fibre Co., Ltd (plant 1) 唐山三友集团兴达化纤有限公司（一厂） Tangshan Sanyou Group Yuanda Fibre Co., Ltd (plant 2 & plant 3) 唐山三友远达纤维有限公司（二厂, 三厂）
Address 地址	No1 Huaxian Road, Nanpu Development Zone, Caofeidian District, Tangshan City, Hebei Province 河北省 唐山市 曹妃甸区 南堡开发区 化纤路 1 号
No of Workers 员工人数	1848 (site 1 一厂), 2561 (site 2 二厂), 811 (site 3 三厂)
Production Capacity 产能	185,000 ton/y of site 1 一厂 335,000 ton/y of site 2 二厂 280,000 ton/y of site 3 三厂
Product Range 产品类别	Viscose staple fibre, Viscose filament, Modal fibre, Lyocell fibre, Dope dyed viscose, Flam-retardant viscose fibre, Bamboo fibre, etc. 粘胶短纤、粘胶长纤、莫代尔纤维、莱赛尔纤维、原液着色粘胶纤维、阻燃粘胶纤维，竹纤维等
Year of Establishment 建立年份	1995 for Xingda 兴达 2008 for Yuanda 远达
Processes 工艺	Viscose Fibre (see below for detailed process) 粘胶工艺（详见下图）

Process Flow Chart: 工艺流程图

The raw material in this unit is pulp and process starts as follows:

工厂使用的原料为木浆，工艺流程如下：

VISCOSE STAGE 粘胶阶段

Steeping of wood pulp – Process is carried out in pulper with caustic soda, where the pulp is fed in an auto dosing system and mercerized instantly.

浆粕浸渍：在碎浆机中使用烧碱进行处理，在此过程中，将浆粕送入自动加料系统并立即进行碱化处理。

$$C_6H_9O_4OH + NaOH \rightarrow C_6H_9O_4ONa + H_2O \quad \text{.....1)}$$

Shredding – Pressed Slurry is added for Shredding followed by Ageing.

粉碎：压浆加入粉碎机中进行粉碎，然后进行老成。

Ageing – In this process shredded alkali cellulose is slowly rotated in a drum for 4-6 hrs. In this process the DP (Degree of polymerization) of Fibres gets reduced to required levels. Afterward it passes through Xanthation step.

老成：粉碎的碱纤维素在老成鼓中缓慢旋转 4-6 小时。在这个过程中，纤维的 DP (聚合度) 降低到所需的水平。然后进行黄化步骤。

Xanthation & Dissolution – The Aged alkali cellulose is made to react with Carbon disulphide under vacuum in xanthator, which is later dissolved in caustic soda. The xanthator is then exhausted and the resultant slurry is dropped into dissolver for thorough dissolution.

黄化和溶解：经老成的碱性纤维素真空条件下在黄化机里与二硫化碳反应，并随后溶解在烧碱里。然后从黄化机倒出，所得浆液滴入溶解装置中彻底溶解。

$$C_6H_9O_4ONa + CS_2 \rightarrow C_6H_9O_4OCSSNa + Na_2CS_2 \quad \text{.....2)}$$

Ripening filtration & De-Aeration - This system consists of blenders, receivers, filtration and de- aerator.

熟成过滤和脱泡：这个过程包括混和机、接收机、过滤和脱泡机

$$C_6H_9O_4OCSSNa + NaOH \rightarrow \text{Viscose Solution (Mixing)} \quad \text{.....3)}$$

$$C_6H_9O_4OCSSNa + H_2O \rightarrow C_6H_9O_4OH + CS_2 + NaOH \text{ (Ripening)} \quad \text{.....4)}$$

EXTRUSION STAGE 纺丝阶段

Spinning – Wet spinning takes place by coagulation of filtered and deaerated viscose in spin bath which consists of Sulphuric acid, Zinc and Sodium sulphate. This process can produce the Fibre count from 0.9 to 2.0 dtex.

纺丝：湿法纺丝是过滤并脱泡后的粘胶在纺丝浴中凝固的过程，纺丝浴中含有硫酸、硫酸锌和硫酸钠。该工艺可生产 0.9 – 2.0 dtex 的纤维。

$$C_6H_9O_4OCSSNa + H_2SO_4 \rightarrow C_6H_9O_4OH + CS_2 + Na_2SO_4 \quad \text{.....5)}$$

(3) Methodology 方法

To meet the objective, we identified and validated both short- and long-term projects carried out by facility with respect to the environmental impact and the respective parameters for benchmarking as per Reference Document on Best Available Techniques in the Production of Polymers (http://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/pol_bref_0807.pdf) and applicable MMCF requirements.

为了实现目标，我们根据欧盟最佳可行技术（http://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/pol_bref_0807.pdf）和相关的 MMCF 要求，确定并验证了工厂所进行的短期和长期项目对环境的影响以及各个参数的基准值。

Focus areas considered for this assessment are: Energy, Air emission and Chemical consumption.

评估核查的重点部分包括：能源、废气排放和化学品消耗。

There are three plants with 11 production lines and 2 pilot lines to manufacture viscose staple, modal fibre, Lyocell fibre and many other viscose products at Tangshan Sanyou Group at moment.

唐山三友集团下辖三个纤维生产厂，拥有 11 条生产线和 2 条中试线，生产粘胶短纤、莫代尔纤维、莱赛尔纤维、和其它多种粘胶产品。

The data evaluated was for assessment period January to December of 2022.

评估的数据周期 – 2022 年 1 月至 12 月

Energy Intensity: Electricity, steam and diesel used directly for fibre manufacture combined to form the total intensity (in GJ/MTf) of fibre production.

能源强度：与纤维生产直接相关的电力、蒸汽和柴油的消耗共同构成了纤维生产的总能耗强度，以 GJ/MTf 计。

Air Emission: The factors considered for sulphur air emission with respect to total CS2 consumption are the recovery of CS2 through adsorption o activated carbon, through condensation and caustic cleaning, the biological treatment (convert the

CS2 & H2S to the harmless CO2 as well as elemental sulphur and sulphate by treating with thiobacillus), etc.

废气排放：含硫气体排放占总二硫化碳消耗量的百分比取决于工厂使用的二硫化碳回收和再利用技术，包括活性炭吸附、冷凝、碱洗、对废气的生物处理 (使用噬硫杆菌群，将废气中的 CS_2 和 H_2S 转化为无害的 CO_2 气体、单质硫或硫酸盐) 等技术。

(4) Data Verification 数据验证

The data analysis has been conducted for the timeframe:

数据分析按如下时间段计算

Fibre Production: January to December of 2022

纤维生产：2022 年 1 月 – 12 月

(5) Environmental Impact 环境影响

5a) Energy 能源

Energy Consumption: January – December of 2022

能源消耗：2022 年 1 月至 12 月

Individual processes have been considered for energy intensity and consumption. Data considered for energy intensity was Real time electricity (KWH), steam (MT) and diesel (Kg) for production and operation of viscose production only, as well as the energy consumption of wastewater treatment facility.

考虑单独计算每个流程的能源强度和消耗量。本评估能源强度计算的数据仅包括粘胶生产和运行的实时电力 (KWH)、蒸汽 (MT) 和柴油 (Kg) 的使用量，以及废水处理设施的能源消耗。

5b) Water 水

Water Consumption: January – December of 2022

水消耗：2022 年 1 月至 12 月

Facility has adopted water conservation and efficiency measures, including condensation and cooling water recovery processes.

工厂采用了各种节约和高效用水的措施，包括冷凝和冷却水的循环系统。

5c) Air Emission 废气排放

The data analysis has been conducted for the following timeframe:

相关数据应从以下时间段获取，与其它数据的时间段一致：

Sulphur Emission: January – December of 2022

硫排放：2022 年 1 月至 12 月

The factors considered for sulphur air emission with respect to total CS2 consumption are the recovery of CS2 through adsorption of activated carbon, through condensation and caustic cleaning, biological treatment with thiobacillus in this factory.

含硫气体排放占总二硫化碳消耗量的百分比取决于工厂使用的二硫化碳回收和再利用技术，包括活性炭吸附、冷凝、碱洗、生物处理等技术。

The total sulphur recovery/elimination rates were 93.5%, 92.4% & 95.1% at plant 1, plant 2 & plant 3 respectively for the timeframe in assessment.

一厂、二厂、三厂在评估时间段内总硫回收/去除率分别为 93.5%、92.4% 和 95.1%。

5d) Wastewater 废水

Wastewater & COD load (January – December of 2022)

废水和 COD 负荷（2022 年 1 月至 12 月）

Xingda Chemical Fibre has an onsite ETP for use by the plant 1. Yuanda Fibre has another onsite ETP which is shared by plant 2 & plant 3. The treated wastewater from both ETPs discharges to an external CWWTP in the industrial park for further treatment. The monthly COD loads of wastewater for plant 1, plant 2 & plant 3 could be calculated based on the wastewater generated by these three plants and the average COD testing data provided by the CWWTP. The COD loads of treated wastewater within data period (January – December of 2022) were 2.10 kg per unit production, 1.37 kg per unit production & 1.37 kg per unit production for plant 1, plant 2 & plant 3 respectively, which is lower than EU BAT limit.

兴达化纤有一个内部废水处理站，供一厂使用；而远达纤维有另一个废水处理站，为二厂和三厂共用。经这两个内部废除处理设施处理的废水再排放至工业园区的工业废水集中处理厂作进一步处理。根据所提供的各厂废水排放量以及园区中心污水处理厂排放废水的平均 COD 检测浓度，可以分别计算出各厂废水的月度 COD 负荷。在统计周期内（2022 年 1 月至 12 月），三家生产厂的废水 COD 负荷分别为 2.10 公斤/每吨纤维，1.37 公斤/每吨纤维和 1.37 公斤/每吨纤维，均低于 EU BAT 的限值范围。

(6) Plant Performance Comparison with EU BAT Limits
粘胶短纤生产的绩效数据与 EU BAT 比对

Data Comparison 数据比对	Unit 单位	EU BAT 最佳可用技术	Compliance with EU BAT 对 EU BAT 的符合性		
			Plant 1 一厂	Plant 2 二厂	Plant 3 三厂
nergy Intensity 能源强度 *	GJ/MTf *	20 - 30	√	√	√
Pulp Use 浆粕用量	MT/MTf	1.035-1.065	√	√	√
H_2SO_4 硫酸用量	MT/MTf	0.6 - 1.0	√	√	√
NaOH 烧碱用量	MT/MTf	0.4 - 0.6	√	√	√
CS_2 二硫化碳用量	Kg/MTf	80 - 100	√	√	√
COD Load 废水的 COD 负荷 **	kg COD/MTF	3 - 5	√	√	√
Zn 锌用量	Kg/MTf	2 - 10	√	√	√
Process Water 工艺用水 *	M3/MTf *	35 - 70	√	√	√
S to Air 废气中的硫	Kg/MTf	12 - 20	√	√	√
Spin Finish 纺纱油剂用量	Kg/MTf	3 – 5	√	√	√
NaOCl 次氯酸钠	Kg/MTf	0 – 50	√	√	√
Cooling Water 冷冻水量 *	M3/MTf *	189 - 260	√	√	√
Sulphate ion (SO_4^{-2}) emissions in wastewater 废水中的硫酸根含量 **	Kg/MTf	200 - 300	√	√	√
Zn in wastewater 废水中的锌含量 **	g/MTf	10 - 50	√	√	√
Hazardous Waste 危险废物 **	Kg/MTf	0.2 – 2.0	√	√	√
Noise 噪音 **	dB	55 -70	√	√	√

＊ - Energy, water & cooling water are calculated based on the scalar quantity of fibre (1.67 dtex).
能耗、水耗、冷冻水消耗皆基于折标纤维产量（1.67 dtex）计算

＊＊ – Plant 2 and plant 3 share one ETP and one storage for hazardous waste.
二厂和三厂共用一个污水处理站和一个危废仓库

(7) Observations 观察

1) Production 生产

Observation 观察结果

There are 11 production lines and 2 pilot lines in production of viscose staple fibre, modal fibre, Lyocell fibre, FR viscose fibre, dope dyed viscose, viscose filament, bamboo fibre and so on at Tangshan Sanyou Group (Xingda Chemical Fibre & Yuanda Fibre), which are used for textile and sanitary articles. The annual capacity of viscose products is up to 800,000 tons. In the data period (January – December 2022), the output of the group was around 650,000 tons.

唐山三友集团（兴达化纤公司和远达纤维公司）共拥有 11 条粘胶生产线和 2 条中试线，生产粘胶短纤、莫代尔纤维、莱赛尔纤维、阻燃纤维、原液着色粘胶纤维、粘胶长丝、竹纤维等粘胶产品，用作纺织产品和卫生用品的原料。唐山三友的粘胶纤维年生产能力约为 80 万吨，在本评估的数据统计周期内（2022 年 1 月至 12 月）的产量约为 65 万吨。

2) Traceability 可追溯性

Observation 观察结果

Tangshan Sanyou Group has obtained Chain of Custody (FSC) certifications for forest production and marketing (FSC License Codes: SGSHK-COC-330228/SGSHK-CW-330228 for Xingda Chemical Fibre, SGSHK-COC-330227/SGSHK-CW-330227 for Yuanda Fibre). The group has also obtained the certificates of CFCC/PEFC (SGS-CFCC/PEFC-COC-001135 & SGS-CFCC/PEFC-COC-001134). Those certificates enable Tangshan Sanyou to demonstrate legal and sustainable sourcing of forest products to its customers.

唐山三友集团已获得森林产销监管链（FSC）认证（FSC 许可证代码：兴达化纤 SGSHK-COC-330228/SGSHK-CW-330228，远达纤维 SGSHK-COC-330227/SGSHK-CW-330227）。集团还获得了 CFCC/PEFC 证书(SGS-CFCC/PEFC-COC-001135 和 SGS-CFCC/PEFC-COC-001134)。这些证书使唐山三友集团能够向客户展示其合法和可持续的森林产品的采购实践。

3) Environmental Impact Parameters – energy 环境影响参数 – 能源

Observation 观察结果

The energy intensity was calculated from consumption of electricity, steam and diesel usages. Tangshan Sanyou Group has all its energy intensities below the recommended limit or in the range set by EU BAT for the fibre production (17 – 24 GJ/MTf). Plant 1 currently consuming more energy compared to Plant 2 and Plant 3 as shown in above table. Plant 1 is an old unit but plant 2 & plant 3 have more in usage of new fibre development and research work. In addition, the production capacity of spinning lines in plant 2 & plant 3 are much bigger than the ones in plant 1. The good performance in energy consumption is due to process improvements and energy savings in moving to viscose manufacturing system, closed-loop system, recirculation system, spin bath recovery system etc. The waste energy has been recovered at several places as identified by the internal maintenance team to achieve short-term and long-term energy conservation targets.

能源强度是根据工厂提供的用电量、蒸汽量和柴油用量计算得出，三个工厂的结果分别低于 EU BAT 的能耗限量低值或在推荐范围内，为 17–24 GJ/MTf。一厂建成投产的时间最早，而二厂和三厂采用了更多新技术和新设备并且单线产能更大，所以表现出更优异的能耗水平。能源消耗的良好表现得益于粘胶生产流程、闭环系统、再循环系统、纺丝浴回收系统等过程的改进和节能。工厂已在多点进行废能的再利用，以实现短期和长期的节能目标。

4) Environmental Impact Parameters – wastewater 环境影响参数 – 废水

Observation 观察结果

Xingda Chemical Fibre has an onsite ETP for use by the plant 1 and Yuanda Fibre has another onsite ETP which is shared by plant 2 & plant 3. The treated wastewater from both ETPs discharges to an external CWWTP in the industrial park for further treatment. There are onsite labs to analyse the discharge parameters on a regular basis to meet the local pollution control regulation. The facility has a process in place to analyse wastewater from third-party to cross-verify the in-house reports.

兴达化纤有一个内部污水处理站，供一厂使用；而远达纤维有另一个污水处理站，为二厂和三厂共用。经由这两个内部废水处理设施处理的废水再排放至工业园区的工业废水集中处理厂作进一步处理。内部废水处理设施设置了实验室，对相关废水指标进行定期检测，以确保其符合法规要求。同时工厂还有第三方检测流程，以与内部检测结果进行交叉核实。

The monthly COD loads of wastewater are calculated based on the wastewater generated by these three plants and the average COD testing data provided by the CWWTP. The COD loads of treated wastewater within data period (January – December of 2022) were 2.10 kg per unit production & 1.37 kg per unit production for plant 1, plant 2 & plant 3 respectively, which is well below EU BAT limit.

根据所提供的各厂废水排放量以及园区中心废水处理厂排放废水的平均 COD 检测浓度，可以分别计算出各厂废水的月度 COD 负荷。在统计周期内（2022 年 1 月至 12 月），三家生产厂的废水 COD 负荷分别为 2.10 公斤/每吨纤维 和 1.37 公斤/每吨纤维，均低于 EU BAT 的限值范围。

5) Environmental Impact Parameters - air emission 环境影响参数 – 废气

Observation 观察结果

The mass balance is used to calculate the sulphur air emission with respect to total CS2 consumption, which is based on the recovery & elimination of CS2 through the technologies such as adsorption of activated carbon, condensation and caustic cleaning, biological treatment with thiobacillus, etc.

废气中硫的排放占总二硫化碳消耗量的百分比可以通过物料平衡进行计算，该数据取决于工厂使用的二硫化碳回收再利用和去除技术，工厂使用了活性炭吸附、冷凝、碱洗、噬硫杆菌的生物处理等技术。

The total sulphur recovery & elimination rate were from 92.4% to 95.1% for three production plants respectively in the timeframe of assessment. Based on this data, sulphur in emission air is below the usual level of the industry, which are well under local pollution control requirements & EU BAT limit.

在评估的时间段内三个工厂的总硫回收和去除率分别在 92.4% 到 95.1% 之间，基于这个回收率可计算出废气中的硫含量，数值低于行业的一般排放量，完全符合当地的法规要求和 EU BAT 的推荐限值。

6) Environmental Impact Parameters - hazardous waste 环境影响参数 – 危废

Observation 观察结果

It has been observed that the facility collects and segregates hazardous & non-hazardous wastes at the generation point and controls waste generation every year. The hazardous waste is stored in isolated storing area and treated by authorized third parties. Xingda Chemical Fibre (plant 1) has one storage for hazardous waste and there is another hazardous waste storeroom in Yuanda Fibre which is shared by plant 2 & plant 3. Annal hazard waste generated in the data period (Januargy – December 2022) varied from 0.168 Kg/MTf to 0.727 Kg/MTf, which were in the usual level of industry.

工厂在固废产生地进行收集、根据其危险性分隔存放、对年度废物量进行追踪控制。危险废物存放于专门的危险废物仓库，由具备资质的第三方进行处理。兴达化纤（一厂）有一个危废仓库，远达纤维也有一个危废仓库，为二厂和三厂共用。在评估期（2022 年 1 月 – 12 月）内的危废统计数据分别为 0.168 Kg/MTf 和 0.727 Kg/MTf,，处于 EU BAT 推荐标准范围内。

7) Salt recovery 盐回收

Observation 观察结果

As indicated in spinning bath chemical reaction, process generates sodium sulphate (Na_2SO_4) (Reaction -5) salt as by-product which is recovered and useful to other industries. It is important to optimize the recovery of the salt as per stoichiometric reaction step, to ensure reduced load on effluents. With increase of production, the quantity of salt increased, and the salt recovery has been maintained at a consistent level. In the assessment frame (January – December of 2022), the recovery rate from plant 1 was up to 82.4% as its liquid sodium sulphurate is directly sent to the chloro-alkali company of the group to be used as a raw material. However, the Glauber salt recovered from plant 2 & plant 3 are solid form, the recovery rate during the period were 58.94% and 59.78% respectively. The sodium sulphurate rate is calculated based on the caustic soda consumption in fibre production.

如纺丝浴化学反应中所述，过程产生的副产物硫酸钠（Na2SO4）被回收（反应-5），可用于其它行业。重要的是根据化学计量反应步骤优化盐的回收，以确保减少废水中硫酸盐的负荷。随着生产量增加，元明粉的绝对得量也将增加，但其回收率会维持在一个相对稳定的水平。在本数据周期（2022 年 1 月 – 12 月）内，一厂所回收的硫酸钠直接以液体状态送至集团旗下的氯碱公司用作生产原料，其硫酸钠的回高达 82.4%；而二厂和三厂的元明粉是以固体状态回收的，回收率分别为 58.94% 和 59.78%。硫酸钠的回收率以纤维生产所投入的烧碱中的钠为基准来计算。

8) EU BAT 对 EU BAT 规范限值的符合性

Observation 观察结果

It has been observed that all parameters of three plants are well within the range of EU BAT norms for viscose production.

根据数据计算分析和现场走访得知，集团三个工厂粘胶纤维生产的绩效皆处于 EU BAT 规范所推荐的限值范围内，甚至低于该限值范围。

(8) Conclusion 结论

Sustainable Textile Solutions was tasked to conduct EU BAT Assessment at Tangshan Sanyou Group (Xingda Chemical Fibre & Yuanda Fibre) on May 9-11th, 2023 for their viscose fibre production with the following objectives:

STS 的任务是于 2023 年 5 月 9-11 日访问唐山三友集团兴达化纤有限公司和远达纤维有限公司，对他们的粘胶纤维生产进行欧盟最佳可用技术（EU BAT）的评估，目的如下：

(1) Measure the ecological impact of production
衡量生产对于生态环境的影响

(2) Assess the performance of facility against EU BAT limits
评估工厂的生产绩效与 EU BAT 推荐限量的比对

(3) Point out gaps against EU BAT limits
指出与 EU BAT 的差距

It can be concluded that: 可以得出以下结论

(1) The group was following local requirements for controlling ecological impact for viscose production.
唐山三友兴达化纤和远达纤维生产粘胶纤维，遵循了国家及地方有关控制生态影响的法规要求。

(2) The air emission, energy intensity and rest for the group were well under EU BAT norms for viscose production.
生产粘胶纤维所致的废气排放、能源强度、以及其它各项数据皆处于 EU BAT 推荐的限值范围内，甚至低于该限值。

(3) There was no gap identified against EU BAT in the data for the assessment period between January – December of 2022.
在 2022 年 1 月至 12 月的评估期中，未发现工厂生产绩效数据与 EU BAT 的限值存在任何差距。

------ End Of Report ------