



EU BAT Assessment of Thai Rayon Company and Verification of Key Sustainability Performance Indicators for

Livaeco by Birla Cellulose™

Enriched with Birla Modal

&

Purocel™ Eco fibers

prepared by

Sustainable Textile Solutions

for

Thai Rayon Public Co. Limited, Angthong, Thailand

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**SUSTAINABLE TEXTILE
SOLUTIONS**

Content

1	Introduction.....	4
2	Objective	4
3	Our Approach & Methodology	4
4	Indicated KPI Tracked	5
5	Time Frame considered	5
6	Thai Rayon Public Co. Limited, Angthong, Thailand.....	5
7	Fibre manufacturing.....	7
8	Data Verification of Key Environmental Performance Indicators	8
9.	Observations and KPI Data Analysis	10

Disclaimer

Established in 2012, Sustainable Textile Solutions has extensive knowledge of dyes and chemicals combined with decades of expertise on wet processing production techniques.

The dedicated STS team is passionate about environmental protection and reducing impact through its assignments.

The STS programs cover the following service areas: Chemical Management, Process Optimizations, Wastewater Management, Environmental Management, Education and Capacity Building. These are designed as bespoke single projects or long-term programs to meet the individual requirements of each client.

STS has team of more than 45+ experts globally who are dedicated to enable brands and retailers to understand, communicate, monitor and improve the capability of their supply chains and achieve compliance to their environmental, health and safety standards.

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1 Introduction

Birla Cellulose, a part of the Aditya Birla Group, is a global leader in Man Made Cellulosic Fibers (MMCF) with the highest quality of eco-friendly fibres such as viscose, lyocell and modal. The Group strives continually to improve its products and progress in ways that benefit the customers, consumers and the environment. In the novel initiative for the group sustainability journey, Birla Cellulose come up with new concept of Livaeco by Birla Cellulose™ purely based on indigenous process and product development with a purpose of creating fibers with outstanding sustainability credentials.

The theme for Livaeco by Birla Cellulose™ can be taken from various benefits of this product. The best available Closed Loop Technology has been applied in the viscose and modal manufacturing process and are continually improved in order to optimize the consumption level of all raw materials and to recover and recycle as much as possible. The 3R (reduce, recover and reuse) concept is applied for conservation of resources used in manufacturing process including chemicals and water, to reduce the consumption, reuse and recycle the resources multiple times. For energy, the consumption of energy per ton of fibre is reduced by improving the efficiency of the manufacturing processes as well as improvement in efficiency of boilers and turbine, reducing losses in the system and recovery and recycle of waste heat. The overall objective is to maximize the resource efficiency, minimize the environmental emissions and exposure of chemicals and reduce the generation of waste.

2 Objective

The objective of this assessment is to verify the ecological benefits of production of Livaeco by Birla Cellulose™, Livaeco By Birla Cellulose Enriched with Birla Modal and Purocel™ Eco fibers at the Thai Rayon Public Co. Limited, Angthong, Thailand. The assessment also aims to verify the conformance of EU BAT standards of the Thai Rayon Company for all its fiber production lines and adaptation of global best practices at the site, such as Higg FEM®, FSC® Chain of Custody system and use of tracer technology in the fiber.

3 Our Approach & Methodology

To meet the objective, we identified and validated both short- and long-term projects carried out towards bringing radical change in the environmental impact from the facility. In addition, parameters for benchmarking the facility as per EU BAT were also evaluated as an opportunity to identify and validate the impact of near and long projects carried out by the facility.

Sustainable Textile Solutions (STS), a stabilized advisory firm with the team of experts in the regenerated fibre production and energy conservation: Following experience and expertise STS brings to make the program effective:

- Expertise in global experience related to man-made fibre technology, energy conservations and wastewater technologies.
- Technical support in planning and implementation of identified improvements.
- Support in building the business and financial case.

- Verification and traceability confirmation as per standards such as Canopy, FSC®, Higg FEM, energy intensity, emission based on MIS verification link with external agencies report.

4 Indicated KPI Tracked

- The program will track the EU BAT norms for viscose fibers in order to measure the improvement realized from the implementation of resource efficiency measures and closed loop technologies.
- Efficiency of Closed Loop Production System including:
 - CS₂ Consumption (kg/TF)
 - Sulphur Emission (kg/TF)

5 Time Frame considered

The data used for comparison: Apr 2020 to Oct 2020

There are five production lines at TRC producing below fibers

Livaeco by Birla Cellulose™ enriched with **Birla Modal**

Birla Modal fibers

Purocel™ Eco fibers

Standard and specialty grade Viscose, modal and non-woven fibers

One production line is dedicated to Birla Modal fibers and the Livaeco by Birla Cellulose™ can be produced on 4 lines and Purocel™ Eco can be produced on two of the lines.

6 Thai Rayon Public Co. Limited, Anghong, Thailand

Birla Cellulose is a pioneer in Viscose, Modal, Lyocell and Non-woven Staple Fiber, made from fully renewable wood sourced from sustainably managed sources. Its fibers are responsibly produced using the best available technologies and are fully biodegradable in soil, water and marine conditions. Man Made Cellulosic fibers like Viscose and Modal are highly versatile and can be easily blended with other fibers and are widely used in apparels, home textiles, dress material, knitted wear and non-woven applications. Birla Cellulose offers the entire range of cellulose fibre under the umbrella brand 'Birla Cellulose', including Standard Viscose fiber, Modal, Lyocell, dope dyed fibre and non-woven fiber. The fibre can be used in its original form or can be blended with all natural and synthetic fibres for enhanced comfort, feel and luster. Birla Cellulose started first production of Viscose Staple Fibre (VSF) in 1954 at Nagda, India.

Thai Rayon Public Co. Limited (TRC) promoted by Grasim Industries Limited, India and local Thai entrepreneurs, was incorporated in 1974. Thai Rayon is the pioneer as well as sole manufacturer of viscose, modal and non-woven staple fibre (VSF) in Thailand and is listed on the Thailand Stock Exchange since 1984.

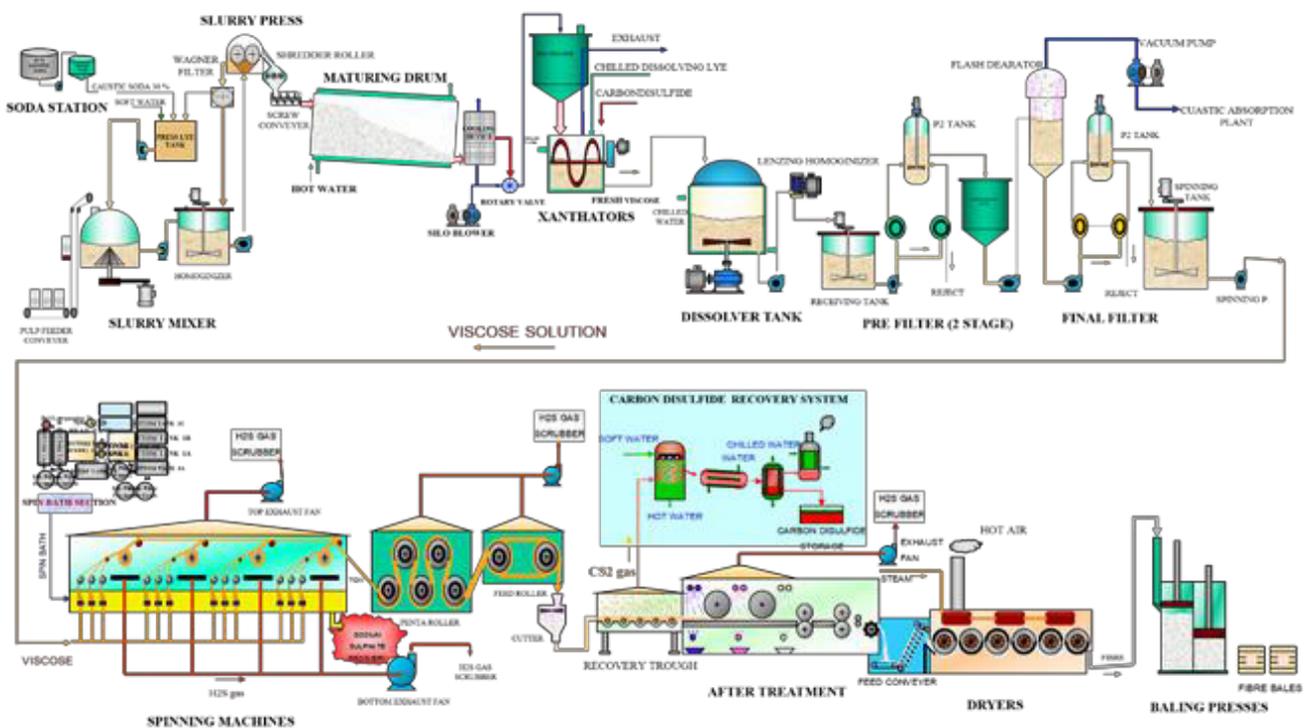
- TRC commenced production in 1976 with a production capacity of 9,000 MT per annum and currently has capacity to produce 151,000 MT per annum of staple

fibers. It has been five flexible VSF production lines for caters to the demands of both Textile and Non-Woven applications, producing viscose, modal and non-woven staple fibers in the range of 0.8 to 5.5 Denier, Staple Length in the range of 32 mm to 120 mm, Luster in Bright Bleach and Semi Dull and also chlorine -free and anti -bacterial applications. TRC has also increased its market share in specialty products like non-woven, micro denier and coarser deniers.

- More than 98% of Thai Rayon's VSF throughput is directly exported to more than 38 countries worldwide. VSF from Thai Rayon is marketed under the "Birla Cellulose" brand, and meets the stringent quality expectations of customers in the USA, China, Europe, Turkey, South Korea, Indonesia, Japan, Vietnam, Taiwan, India, Pakistan, Bangladesh, Sri Lanka and the Middle East.

Enhanced Sustainability Credentials of TRC fibers

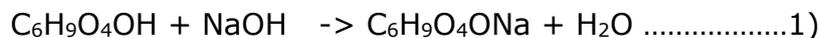
This eco enhanced products produced at TRC, viz. Livaeco by Birla Cellulose™ enriched with Birla Viscose and Birla modal fibers and Purocel™ Eco non-woven fibers are produced with enhanced sustainability benefits. These Pro-Planet fibers helps save water, increases forest cover and reduces CO₂ emission, so these regenerated fibres help and preserve the environment and reduce impacts. The raw material used is FSC® certified and full traceability is provided across value chain. The TRC is among the global leader in implementation of Higg FEM 3.0 and applies stringent supplier code of conduct on all its critical suppliers including conformance to no use of ZDHC MRSL in its raw materials.



7 Fibre manufacturing

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

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



Shredding – Pressed slurry is added on for shredding followed by ageing
Ageing – In this process, shredded alkali cellulose is matured in ageing box which reduces the DP (degree of polymerization) of fibre to required level. Afterwards it is routed through Xanthation process.

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 xanthate slurry is so produced is dropped into dissolver for thorough dissolving.



Ripening filtration & De-aeration - This system consists of blenders, receivers, filtration and flash de-aerators. The indigenous Continuous Filter are installed in all the stages of filtration.



Spinning – Wet spinning takes place by coagulation of filtered and deaerated viscose in spin bath having, Sulphuric acid, Zinc and Sodium sulphate. Machine is capable of producing various fibre count from finer to coarser denier.



8 Data Verification of Key Environmental Performance Indicators

8.1.1 CS₂ Consumption

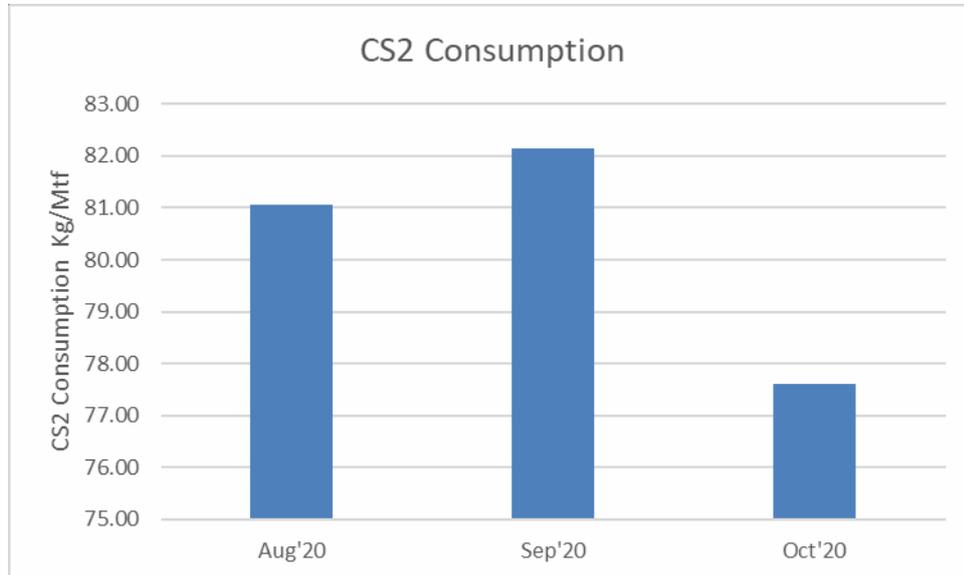


Fig 1: CS₂ Consumption

8.1.2 Sulphur Emission

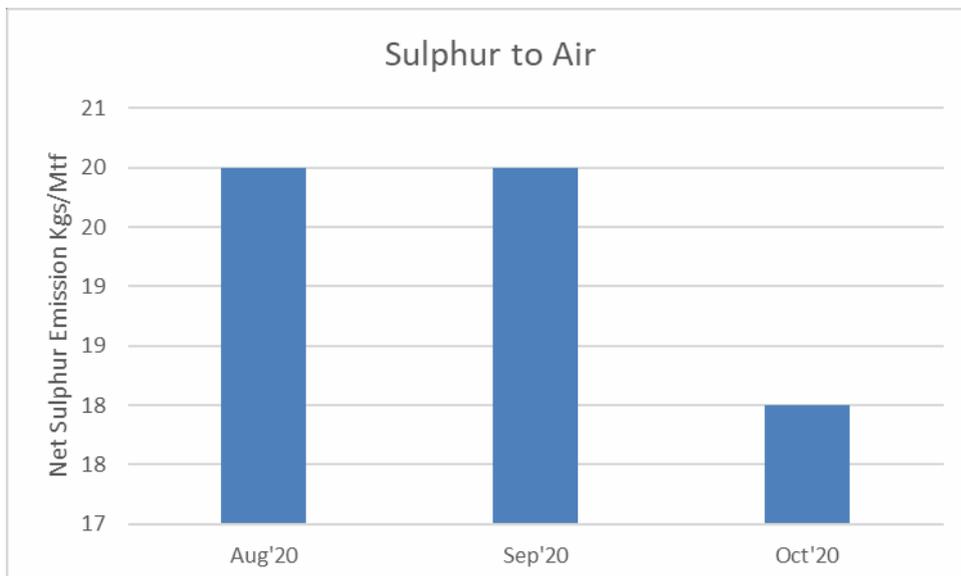


Fig 2: Sulphur Emission

8.1.3 Performance of the Closed Loop Production System

The Consumption ratios and Emission performance of the plant.

The consumption ratio of the key raw materials were verified using the historical data and the evaluation period of Purocel™ Eco™ (Apr 2020 to Oct 2020). The result of the evaluation is tabulated in the table 1. For the verification of the data, the plant records from log books and the MIS (management information system) were checked and verified.

The CS₂ recovery system

The TRC has expanded the capacity of the EU BAT reference technologies for recovery of CS₂ to strengthen the Closed Loop production system including CAP (CS₂ adsorption on Activated Carbon columns) and has optimized the performance of the system as well as collection volumes of the exhaust gases of the production lines connected to this system. A mass balance of the sulfur was done to check the effectiveness of the new closed loop technology in terms of controlling the sulfur emission to the air. The sulfur release to air is below 20 kg/TF based on mass balance, and meets the limit specified in EU BAT standards. The site also consistently met all the other EU BAT referred consumption and emission norms for the viscose fiber and these are tabulated below in Table 1.

Table 1 EU BAT norms of Viscose vis-à-vis TRC consumptions at a glance are as follows:

Sr. No.	Particulars / Parameters*	Unit	EU BAT	TRC
A	Consumptions per TF			
1	Energy	GJ	20-30	✓
2	Water (Fresh + Cooling)	m ³	224-330	✓
3	Pulp	t	1.035-1.065	✓
4	CS ₂	kg	80-100	✓
5	H ₂ SO ₄	t	0.6-1.0	✓
6	NaOH	t	0.4-0.6	✓
7	Zinc	kg	02-10	✓
8	Spin finish	kg	3-5	✓
9	NaOCl*	kg	0-50	✓
B	Air Emissions			
1	Sulphur to air (VSF Process)	kg/TF	12-20	✓
C	Treated Wastewater Discharge			
1	SO ₄ ²⁻	kg/TF	200-300	✓
2	COD	kg/TF	3-5	✓
3	Zinc	g/TF	10-50	✓
D	Waste & Noise			
1	Hazardous Waste	kg	0.2- 2.0	✓
2	Noise of the Fence	dB (A)	55-70	✓

Legend: ✓ - TRC production lines performance is well within EU BAT norms for production of viscose, modal and non-woven fibres.

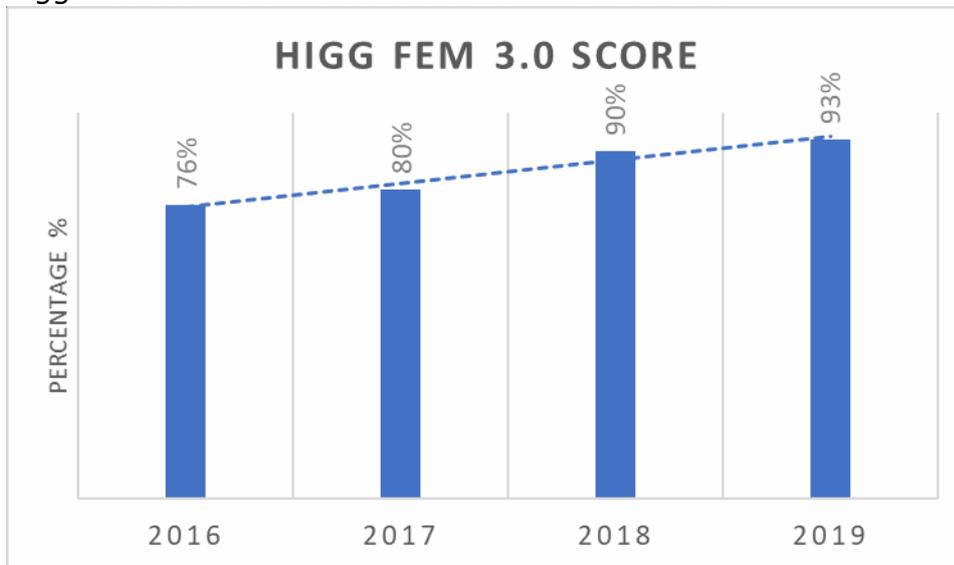
Note - *NaOCl (or any other chlorine based bleach) is not being used for bleaching in Non-woven production at TRC where chlorine bleach free material is required.

8.1.4 SAC Higg (3.0) FEM

Unit/Facility has carried out self-assessment and 3rd party verification of SAC Higg (3.0) Facility Environmental Module (FEM) as a global best practice/tool for further improvement in the following areas: Environmental Management System, Energy Use & GHG, Water Use, Wastewater, Air Emissions, Waste Management and Chemical Management.

Higg (3.0) FEM 2019 self-assessment was done in June 2020. Subsequently, it was assigned to 3rd party for onsite verification, which was done by Sphera (earlier Thinkstep) and the verified score of 93% was achieved by the site. The below chart reflects continual improvement of these standards at the site:

Higg Index FEM Verified score's trends as follow:



8.1.5 Renewable Energy

The site derives most of its energy requirements from the non-fossil-based sources and these comprised of a share of around 55% of total energy used in the process for the CY 2020. Steam produced from waste heat is used in the manufacturing process. TRC has the lowest GHG emissions among all the fibre manufacturing sites of Birla Cellulose.

9. Observations and KPI Data Analysis

<p>Production</p>	<p>Facility has improved the Closed Loop production year on year basis by improving its efficiency, recovery systems and productivity. Livaeco by Birla Cellulose™, Livaeco by Birla Cellulose enriched with Birla Modal and Purocel™ Eco production monitoring started after optimizing all production systems and environmental impacts and generating full traceability from forest to Fibre. The CAP system</p>
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	<p>installed in period 2015-16 and its expansion completed in June 2019.</p>
Traceability	<p>The site has FSC® (Forest Stewardship Council®) Chain of Custody (CoC) certification. The FSC® certification ensures that the materials and products have been checked at every stage of processing and the wood within the product comes completely from FSC-certified sources from well-managed forests. In-line facility production traceability was verified from pulp to fibre production using production records. For Livaeco by Birla Cellulose™ and Purocel™ Eco 100% credit of FSC® can be passed on the customers as per their request.</p> <p>The chemical consumption was found to be registered with its lot number confirmed. This makes the current whole production completely traceable back to the key raw materials in fiber manufacturing process.</p> <p>Higg FEM 3.0 has been implemented at site and the latest assessment was done in Apr-May 2020. The site evaluation of Higg FEM 3.0 was verified by the 3rd party, Sphera (earlier Thinkstep) and has achieved a benchmark score of 93% reflecting the high level of maturity in the benchmark best practices specified by Sustainable Apparel Coalition (SAC).</p>
Environmental Impacts Indicators	<p>Sulphur Emission has been reducing continuously after implementation of EU BAT system. Recovered Sulphur is again used in the process in the form of CS₂ and Sulfuric Acid. This is way for close looping the process.</p>
Tracer	<p>Site uses a unique tracer which is injected into Livaeco by Birla Cellulose™, Livaeco By Birla Cellulose enriched with Birla Modal and Purocel™ Eco production at the time of production of the fiber. This enables the traceability of the fiber across the value chain.</p>
By Products	<p>As indicated in spinning bath chemical reaction, process generates sodium sulphate (Na₂SO₄) (Reaction -5) salt as by-product which is recovered and is used in other industries. It is important to optimize the recovery of the salt as per stoichiometric reaction step, to ensure reduced load on effluent. With increase of production, the quantity of salt increased, and the salt recovery has been maintained at a consistent level.</p>
EU BAT	<p>The Thai Rayon Company (TRC) site follows the closed loop manufacturing process. Best available technologies (BAT) are implemented to recover and recycle all the material and energy resources. The site meets all the consumption norms of EU BAT as</p>

	<p>well as all water discharge norms in the last quarter i.e. from Aug 2020-Oct 2020</p> <p>The site meets all the local applicable norms related to environment and is certified for ISO 14001. The fibre brands Livaeco by Birla Cellulose™ viscose fibers, Livaeco By Birla Cellulose enriched with Birla Modal and Purocel™ Eco non-woven fibers meet the EU BAT referred norms for consumption and emission to environment.</p>
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End of the report

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