The report of evaluating the effectiveness of dyeing water efficiency Initiatives

Calendar Year 2021

Bureau Veritas

April 19, 2021

Mission Statements

Assessment Conclusions

The non-aqueous medium dyeing demonstration production line project with an annual output of 3,000 tons of cotton loose fiber replaces traditional dyeing methods with a non-aqueous medium dyeing system to save dyeing water; and through the improvement of water treatment technology, basically achieve zero discharge of sewage.

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Table of Contents

Abstract

Entrusted by Zhejiang LvYu Textile Technology Co., Ltd. (Here in after referred to as Zhejiang LvYu), this water consumption accounting report is to calculate the water consumption and incidental electricity consumption of the company's "3000 tons of cotton bulk fiber non-aqueous medium dyeing demonstration production line project". Because this production line is a new research and development project, the benchmark data used in its calculation is the data which is selected from those universal and representative cotton bulk fiber printing and dyeing industry and have continuous production for more than one year. Meanwhile, the accounting also compare related standards to the water consumption and output of traditional printing and dyeing technology companies. At the same time, in order to ensure the authenticity and accuracy of the energy consumption and output data of the production line, Zhejiang LvYu installed an energy online detection system and output measurement system for its production line. All the relevant data used in this report for the production line of this project are adopted from online monitoring system and output measurement system.

1. Description of accounting items

1.1 Purpose of Accounting

After the implementation of the project, the authenticity and accuracy of the project data will be determined through on-site investigations and data verification in links such as product output, electricity and water usage, and the provision of energy measuring instruments.

Through the calculation of the project, determine the unit product water intake and unit product power consumption of the "3000 tons of cotton bulk fiber non-aqueous medium dyeing demonstration production line project", and at the same time, compare to the data and related standard of cotton bulk fiber printing and dyeing industry who using traditional printing and dyeing technology.

1.2 Accounting basis and standards

1. <General rules for calculation of the comprehensive energy consumption> (GB/T 2589-2020)

2. <General perinciple for equipping and managing of the measuring instrument of energy in organization of energy using> (GB/T 17167-2006)

3. <Water consumption (withdrawal) quota in Zhejiang Province> (2019)

1.3 Project boundary and accounting content

1. This accounting report is an accounting of the water intake per unit product and the power consumption per unit product of the entire production line of the non-aqueous medium dyeing demonstration line project with an annual output of 3,000 tons of bulk cotton.

2. This accounting content is to calculate the water consumption per unit product and the power consumption per unit product of the project. The main

content includes four aspects: 1st--the benchmarking water consumption, power consumption, output in the traditional printing and dyeing industry and in the production line of this project, 2nd--product output, 3rd--energy Management and measurement system, 4th--energy leakage.

2. Description of the accounting process

2.1 Accounting institutions and activities

Entrusted by Zhejiang LvYu Textile Technology Co., Ltd. this accounting is undertaken by the Bureau Testing Technology Service (Zhejiang) Co., Ltd.

The accounting personnel are composed of relevant professionals selected by Bureau Testing Technology Service (Zhejiang) Co., Ltd, and the specific members are detailed in the list of accounting groups.

List of Accounting Groups

Group Leader	Shi Ying chao	technical title	Engineer
Member	Xi Tao ran	technical title	Assistant engineer

2.2 Accounting schedule

The accounting team formally accepted the accounting task of the project on August 8, 2020. On September 17, 2020, the accounting team went to the project site to perform accounting and complete the data collation and analysis. On April 13, 2021, this <Water Consumption Accounting Report> was completed. ".

2.3 Accounting implementation

The accounting implementation is carried out in three steps:

Step 1: First, according to relevant standards and technical data, make a preliminary understanding of the information and data of the "3000 tons of cotton bulk fiber non-aqueous medium dyeing demonstration production line project", and determine whether the project is a newly developed project.

Step 2: Conduct an in-depth investigation of the project, and review the original documents and vouchers of the project-related materials in detail. The baseline water and power consumption are determined mainly based on holding

seminars, on-site observation and consulting various statistical reports, financial invoices and other related materials.

Step 3: Check and take photos in the project installation site implemented by the project unit to determine the authenticity of the project, verify the energy consumption and output of the project, and further determine the water intake and power consumption per unit of the project.

3. Accounting party and project profile

3.1 Basic situation of the project unit

Zhejiang LvYu Textile Technology Co., Ltd. was established in 2014. It is a technology development company specializing in the development of non-aqueous medium dyeing technology. The company is located in High-tech Industrial Park of Haining City. It is a high-tech enterprise led by national experts, and co-founded by senior professors from Zhejiang Sci-Tech University and many enterprise elites in Zhejiang Province. The company has independent intellectual property rights of non-aqueous dyeing technology, and has research accumulation for many years in theory and technology. It has pioneered a number of new silicon-based non-aqueous dyeing techniques, which are unique in the field of textile dyeing and finishing at home and abroad, and have received widespread attention. With the strong support of relevant departments of Haining City, the company has invested more than 10 million RMBs in research and development so far. It has built research rooms, laboratories and pilot workshops of about 1,000 square meters, equipped with corresponding instruments and equipments. At present, it has prepared an annual 3,000 tons Non-aqueous cotton bulk dyeing production demonstration line; the company has a team that combines production, education and research. The project team members include experts, professors and entrepreneurs who have been engaged in scientific research and production practices in the textile and chemical fields for decades. A group of young and energetic entrepreneurs and young scientific and technological personnel have been gathered here. On the other hand, a professional non-aqueous dyeing laboratory and corresponding pilot workshop are build, equipped with a complete

set of equipment. The research strength is constantly increasing. The company has close cooperative relations with Zhejiang Sci-Tech University and Shanghai University of Engineering Science. Since its establishment, the company has achieved a number of important research results, and has 16 patents related to non-aqueous medium dyeing. The "Silicon-based dyeing technology research and industrialization demonstration" project led by the company was approved as a key research project in Zhejiang Province in 2017.The company participated in the national "13th Five-Year Plan" key research and development project led by Professor Wang Jiping. Zhejiang LvYu undertakes the construction of a demonstration project line which has an annual output of 3000 tons silicon-based non-aqueous medium dyeing production. The non-aqueous medium dyeing technology and products have been promoted in many printing and dyeing enterprises.

3.2 Basic situation of accounted items

This project is located in one of the existing production workshops of Zhejiang huayuan textile co. LTD (with 7077 m^2 building area). The company had custom-made 76 sets of non-aqueous medium bulk fiber dyeing machines, dryers and dyeing materials centralized distribution system, reclaimed water reuse system, online monitoring system and other equipments. A full-process intelligent control system composed of non-aqueous medium dyeing, sewage heat recovery, reclaimed water reuse, condensed water recovery technology, a centralized distribution system of dyeing materials and a volume management system. The project changes the status quo of traditional dyeing methods in water salt, and chemicals consuming, and develops a new dyeing system that uses recyclable,

healthy and environmentally friendly silicon-based solvents as the medium (keep the part of water needed for the functions of fiber swelling, dye auxiliaries dissolution and dyeing assistance, and use a part of water that only has the function of medium, that is, the function of material transport and energy conduction. It can neither dissolve the dye nor interact with water. Compatible non-polar solvents to replace), and corresponding special dyeing technology, to form a non-aqueous medium dyeing demonstration production line with an annual output of 3,000 tons of cotton bulk fiber.

4. Energy utilization of the project

4.1 Project production status

1. Production situation of enterprises adopting traditional printing and dyeing technology

According to the January-December 2020 production report provided by Haiyan Qiuxin Textile Printing and Dyeing Co., Ltd., it can be seen that the output of bulk cotton printed and dyed using traditional printing and dyeing technology is 4,193 tons.

Statistical table of product output of Haiyan Qiuxin in 2020

month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Tot.
output（Ton）	321	52	380	435	452	398	441	289	302	395	422	306	4193

2. Production situation after the implementation of the project

The project uses non-aqueous medium dyeing methods to produce. According to the output measurement system, the total output of printed and dyed in bulk cotton from January 19, 2021 to March 20, 2021 is 122.4 tons.

4.2 Energy consumption of the project

1. Energy consumption of enterprises adopting traditional printing and dyeing technology

According to the January-December 2020 production report provided by Haiyan Qiuxin Textile Printing and Dyeing Co., Ltd., it is known that the traditional printing and dyeing process for printing and dyeing within 4,193 tons of bulk cotton requires 310,683 tons of water and 1,491,408 kWh of power consumption.

Statistical table of water withdrawal of Haiyan Qiuxin in 2020

month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Tot.
water withdrawal（Ton）	25364	5126	28836	32481	34295	29863	30997	22230	23144	27065	30028	21254	310683

Statistical table of electricity consumption of Haiyan Qiuxin in 2020

month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Tot.
Electricity consumption（kWh）	113256	17293	134587	133489	144671	144285	163710	108377	117176	159741	144368	110455	1491408

2. Energy consumption after the implementation of the project

(1) Water consumption of the project

The process about water-flow of the non-aqueous medium dyeing demonstration line project with an annual output of 3,000 tons of bulk cotton is as follows:

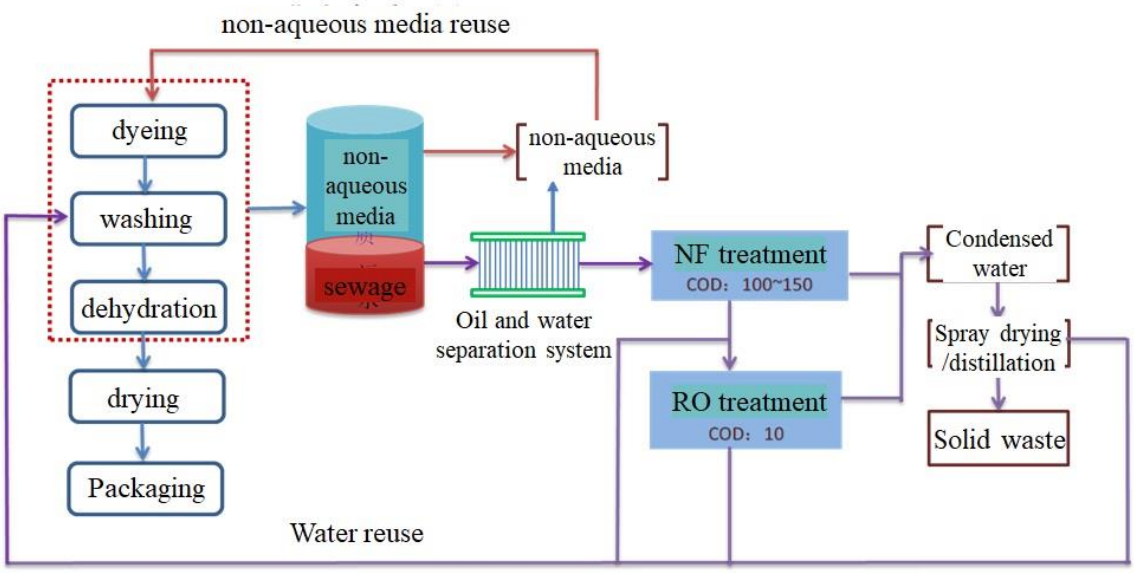
① External water inflow direction: industrial water → softened water tank

② The direction of actual replenishment of fresh water: softening water tank → dyeing vat → dyeing wastewater

③ Trend of cooling water: softening water tank → dyeing vat → condensed cooling water reuse system → softening water tank

④ The trend of condensate water: steam → dye vat → condensed cooling water reuse system → softened water tank

The specific process is shown in the figure below:



The actual supplementary fresh water and cooling water are in the same pipeline before entering the dyeing vat. A inlet flow meter for dye VAT measures the total amount of water in the two channels. This flow meter is installed between the softening water tank and the dyeing vat. The cooling water and condensate water are combined into the same pipeline after passing through the dyeing tank. A condensation/cooling water flow meter measures the total amount of the two water channels. This flow meter is installed between the condensate cooling water system and the softened water tank. Total amount of condensation water = total steam, measured by the total steam meter in the plant. It can be seen from the above expression:

① Total condensation/cooling water = condensate water volume + cooling water volume

That is, the amount of cooling water = the total amount of condensed cooling water - the amount of condensed water

That is, the amount of cooling water = the total amount of condensed cooling water - the total amount of steam in the plant

② The total water inflow of the dyeing vat = the amount of fresh water

added + the amount of cooling water

That is, the amount of fresh water added = the total amount of water in the dyeing vat - the amount of cooling water

③ Take the conclusion in ① to get the following:

Replenishment of fresh water = total water inflow from dyeing vat - total condensate cooling water + total steam in the plant area

According to the data obtained from the online energy monitor installed in the project, the total water intake of the dyeing vat from January 19, 2021 to March 20, 2021 is 201.5 tons, and the weight of condensate cooling water is 374 tons, and the total steam volume of the plant is 200.3 tons. The amount of fresh water added is: 201.5-374+200.3=27.8 tons.

(2) Electricity consumption in Project

The total electricity consumption of the non-aqueous dyeing demonstration line project with an annual output of 3,000 tons of bulk cotton from January 19, 2021 to March 20, 2021 is: power consumption of dryer + power consumption of dyeing vat + power consumption of water treatment. According to the energy online monitor, the power consumption of the dryer is 8627.2 kWh, the power consumption of the dyeing vat is 21695 kWh, and the power consumption of water treatment is 4107 kWh. The total electricity consumption is 34429.2 kWh.

4.3 Energy consumption of the project equipment

The main energy-consuming equipments of the non-aqueous medium dyeing demonstration line project with an annual output of 3,000 tons of bulk cotton are an opener, a cake breaker, a weighing system, a dyeing vat, a dryer, etc. The specific equipment is shown in the table:

List of key energy-using equipment

Equipment name	water	electricity
Opener		√
Cracker		√
Weighing and chemical system	√	√
Dye vat	√	√
Dryer		√
Dewatering machine		√
Grease film system		√
Nanofiltration membrane system		√
Reverse osmosis membrane system		√
Condensate cooling water reuse system		√

5. Description of energy-saving technical measures

5.1 Technical principle comparison

1. Principles of Traditional Printing and Dyeing Technology

In traditional water bath dyeing, the role of water is very important. The basic method of dyeing is to dissolve the dye in water, and then put the fiber in the dye solution for dyeing. This dyeing is essentially a process of distribution of the dye between the two phases of the fiber and the water. Because the dyes dissolved in water are highly compatible with water, the dyes tend to stay in the water without dyeing the fibers, and a large amount of electrolytes need to be added to promote dyeing. When the dyeing is balanced, there is still a certain amount of dye remaining in the water, that is to say, the dye uptake of the fiber cannot reach 100%, so a large amount of dye-containing colored wastewater will be produced. This is an inevitable problem of water-bath dyeing of water-soluble dyes.

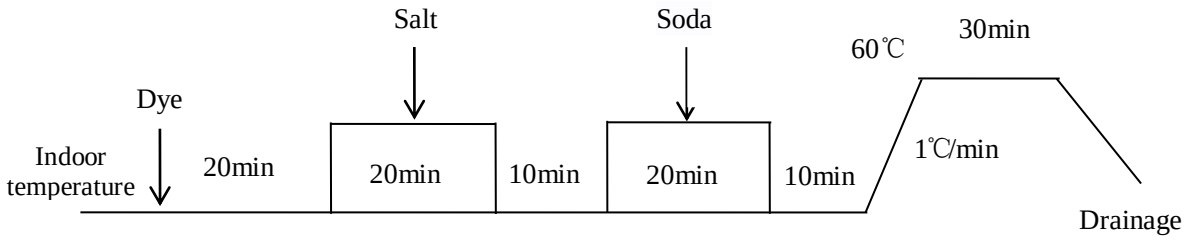
2. Technical principle of this project

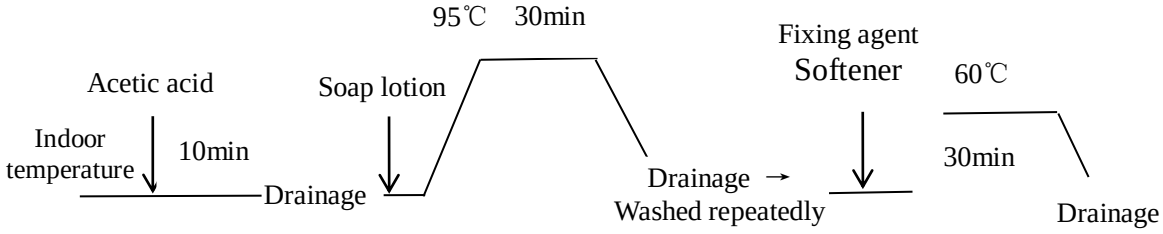
In order to improve the dye uptake rate of dyeing, this project separates the water in water bath dyeing according to function, and retains the part of water needed for the functions of fiber swelling, dye auxiliaries dissolution and dyeing aid, and will only have the function of the medium, that is, the material transport The part of water that has the function of energy conduction is replaced with a non-polar solvent that can neither dissolve the dye nor dissolve with water. In such a system, there are three different phases: non-aqueous medium phase, water phase and fiber solid phase. Since the amount of water needed to achieve the functions of dissolving dyes, swelling fibers, and assisting dyeing is very small, the water in the system The phase quality can be controlled very low, it can be completely

absorbed by the hydrophilic fiber, and is not compatible with the surrounding non-aqueous medium, and it is not suitable to fall off the fiber; when the dye is added to the system, the hydrophilic dye is completely It is insoluble in non-aqueous media, but has a high affinity with the water on the fiber and the fiber itself. Therefore, the dye has a strong tendency to discard the medium and tend to contain water fibers, that is, the distribution rate of the dye on the fiber has an absolute advantage over the medium. This dyeing mechanism is very different from the dyeing mechanism in the traditional water bath. It can reach 100% dyeing rate without electrolyte at all, and the water in the system is basically taken away by the fiber after dyeing, and it will not produce Dyeing wastewater. In principle, this dyeing method is suitable for dyeing hydrophilic fibers with all water-soluble dyes, and has high universality. For reactive dyes, since dyeing can be completed under conditions of very little water and low temperature and within a short period of time, the hydrolysis of the dye is controlled and the fixation rate of the dye is greatly improved. This technology can realize the reduction of 100% of the wastewater in the dyeing stage with reactive dyes under salt-free conditions, the reduction of post-dyeing rinsing wastewater >90%, the saving of dyes>20%, the saving of salt by 100%, the dye uptake rate is close to 100%, and the fixation. The target rate is 90%.

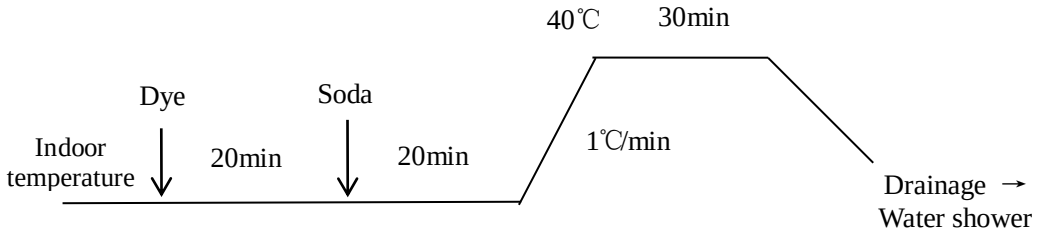
5.2 Process flow comparison

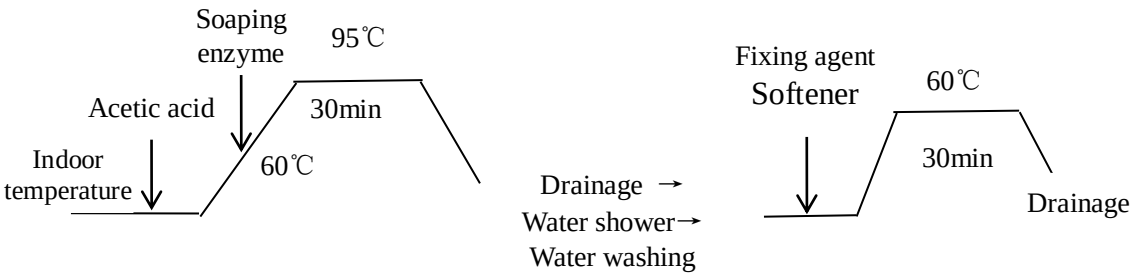
1. Traditional printing and dyeing process





2. Process flow of this project





6. Project monitoring

6.1 Provision and management of energy measuring instruments for the project

In order to ensure the accuracy of energy consumption management and statistics for this project, the company has established a statistical ledger for energy consumption, and the meter reading records are managed by a computer network. In accordance with the "General Principles for the Provision and Management of Energy Measuring Instruments for Energy-Using Units" (GB17167-2006) and relevant industry standards and rules, energy measuring instruments are equipped to meet the requirements of energy classification measurement, grading sub-item assessment and trade settlement. The main measuring instrument accounts of this project are as follows:

list of measuring instruments

	first-class meter	second-class meter	third-class meter
Water meter		Intake gauge for dye vat	
		Water meter for soluble dyes	
		Intake gauge for wastewater	
		Water meter for nanofiltration reuse	
		Water meter for reverse osmosis reuse	
		Water meter for condensate and cooling water reuse	
		Water meter for emergency discharge	
Steam meter	Steam meter for plant		
		Steam meter for dye vat and dryer	
			Steam meter for dryer
Electric meter		Electric meter for dye vat	
		Electric meter for dryer	
		Electric meter for Water treatment	

6.2 Project energy-consuming process equipment operation monitoring

The company conducts online monitoring of key energy-using processes and equipment energy metering, and staff regularly inspects and records daily to ensure the accuracy and timeliness of project energy consumption data.

7. Project unit consumption calculation

7.1 Project boundary

This accounting report is to calculate the water intake per unit product and the electricity consumption per unit product of the non-aqueous dyeing demonstration line project with an annual output of 3,000 tons of loose cotton.

7.2 Determine method selection

Refer to the<General rules for calculation of the comprehensive energy consumption> (GB/T 2589-2020) standard content, the calculation formula for the water withdrawal per unit product is：

e = E/M

e —— water withdrawal per unit product of the product;

E —— the amount of water taken by the product;

M——the output of the product.

The formula for calculating the power consumption per unit product is:

g = G/N

g —— the unit product power consumption of the product;

G —— the power consumption of the product;

N —— the output of the product.

7.3 Calculation of water withdrawal per unit product and electricity consumption per unit product

1. Calculation of water withdrawal per unit product

(1) Haiyan Qiuxin Textile Printing and Dyeing Co., Ltd. produces 4,193 tons of cotton bulk printing and dyeing products from January to December 2020. The water intake of fresh water is 31068 m^3, and the water intake per unit product is:

$$310683 \div 4193 = 74.10 m^3/t$$

(2) The non-aqueous dyeing demonstration line project with an annual output of 3,000 tons of bulk cotton. From January 19, 2021 to March 20, 2021, a total of 122.4 tons of cotton bulk printing and dyeing products will be produced, and the fresh water volume will be 27.8m^3.

(3) Measurement uncertainty

The water consumption data collected in this project's accounting is from January 19, 2021 to March 20, 2021. Due to the short data collection period, the annual cycle cannot be effectively covered, and the accuracy of the water metering instrument is taken into account. It will have a certain impact on the accuracy of data collection. Taking the above factors into consideration, the fresh water intake will be increased by 2%, and the project's fresh water intake will be:

$$27.8 \times (1+2\%) = 28.356t$$

The water withdrawal per unit product is:

$$28.356 \div 122.4 = 0.231 m^3/t$$

2. Calculation of power consumption per unit product

(1) Haiyan Qiuxin Textile Printing and Dyeing Co., Ltd. produces 4,193 tons of cotton bulk printing and dyeing products from January to December 2020, and consume 1,491,408 kWh of electricity. The unit power consumption of the product is:

$$1491408 \div 4193 = 355.69 kWh/t$$

(2) The non-aqueous dyeing demonstration line project with an annual output of 3,000 tons of bulk cotton. From January 19, 2021 to March 20, 2021, a total of 122.4 tons of cotton bulk printing and dyeing products will be produced, and the

power consumption will be 34429.2kWh.

(3) Measurement uncertainty

The electricity consumption data collected in this project's accounting is from January 19, 2021 to March 20, 2021. Due to the short data collection period, the annual cycle cannot be effectively covered. At the same time, factors such as the accuracy of the electrical metering instrument are taken into consideration. It will have a certain impact on the accuracy of data collection. Taking the above factors into consideration, Increase the power consumption by 1%, and the project power consumption will be:

$$34429.2\times(1+1\%)=34773.492\text{kWh}$$

The power consumption per unit product is:

$$34773.492\div122.4=284.1\text{kWh/t}$$

7.4 Energy-saving benchmarking analysis

According to the industry code C1721 in Table 14 of the <Water consumption (withdrawal) quota in Zhejiang Province> (2019), the category name is wool top and wool yarn processing, and the product name is colored wool and other fibers. The general value of water intake per unit product is 120 cubic meters/ton, the advanced value is 50 cubic meters/ton.

7.5 Calculation results

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8.0 Summary of attachment

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