Introduction of RECP Project

The textile industry is one of the sectors hardest hit by the economic slowdown in Indonesia textile industry is estimated to remain sluggish in 2016 due to the lack of positive sentiment to lift growth. Moreover, global economic conditions as export markets, has not recovered. The International Monetary Fund (IMF) has cut its forecast for world economic growth this year from 3.6 percent to 3.4 percent. While US economic growth is estimated at only 2.6 percent. In fact, Indonesian textile exports are very dependent on the global economy, especially the United States (US) and Europe as its biggest market. Portions of textile exports to the United States and Europe respectively 31 percent and 16 percent.

Exports of textiles in the last five years of stagnant, and even tends to fall. Based on data from the Central Statistics Agency (BPS) performance of textile exports in 2011 reached USD 13.17 billion, and in 2015 continued to drop to just USD12,33 billion. It is inversely proportional to the performance of textile imports which rose from USD6,52 billion in 2011 to USD 6,95 billion in 2015.This makes the textile trade surplus continues to fall.

In general, the problems facing the textile industry today, namely: *First*, the marketing difficulties. Enthusiasts of domestic textile continue to decrease because consumers prefer import textile. Now, with the ASEAN free market, domestic products increasingly tormented because the price was not competitive anymore. *Secondly*, production costs rise. Expensive imported raw materials plus the increase in electricity tariffs weigh heavily on textile industry.

When the economy situation is not good, some elected textile industries are following the RECP programme. The programme is focused on demonstrating and replicating RECP methods and techniques. The demonstrations are conducted with the dual aim of demonstrating economic, resource conservation and environmental benefits in selected companies and for further training and coaching of national (trainee)

experts. The success is measured in terms of actual implementation of appropriate RECP options by the demonstration enterprises, and the benefits achieved thereby.

Upon completion it is expected that the enterprises will have:

- Obtained a catalogue of RECP options that will improve resource efficiency and reduce pollution with recommendations for implementation; and
- Improved awareness, understanding and capacity to manage and minimize resource consumption and pollution generation.

In parallel, it is expected that trainee experts will have:

- Gained practical experience in conducting RECP assessments in sector, under guidance of RECP expert team; and
- Complete basic RECP assessment training and obtain recognition as RECP expert.

RECP project in PT Insansandang Internusa will practice the systematic generation of resource efficiency and cleaner production opportunities for a Fabric Dyeing & Finishing Department. This Dyeing & Finishing Department processes the fabric according to customers' specifications cotton, and rayon/polyester or cotton/polyester blends, in package dyeing & finishing machineries.

The project will be led by Mr Tedja Maladi as a leader accompanied by Mr Hermanto and Mrs.Euis as members. The trainee experts of RECP are Mr Mukti Widodo dan Mr Alvi Wichandra

Baseline Situation

PT Insansandang Internusa is a national company engaged in the business field of textiles with weaving, dyeing and finishing. The company was established on June 20, 1988 with initial capital obtained from some of the company's founder. At the initial investment, the capital obtained from the investors with a total value of Rp. 30,000,000,000, -. The

company is located at Jalan Raya Rancaekek Km.22,5 Cintamulya Village, District of Sumedang.

The land area of PT Insansandang Internusa is 81 440 m2 with a building area of 38 160 m2 which consists of production space, offices, and others. The location and layout of the company can be seen in Figure 1 below.

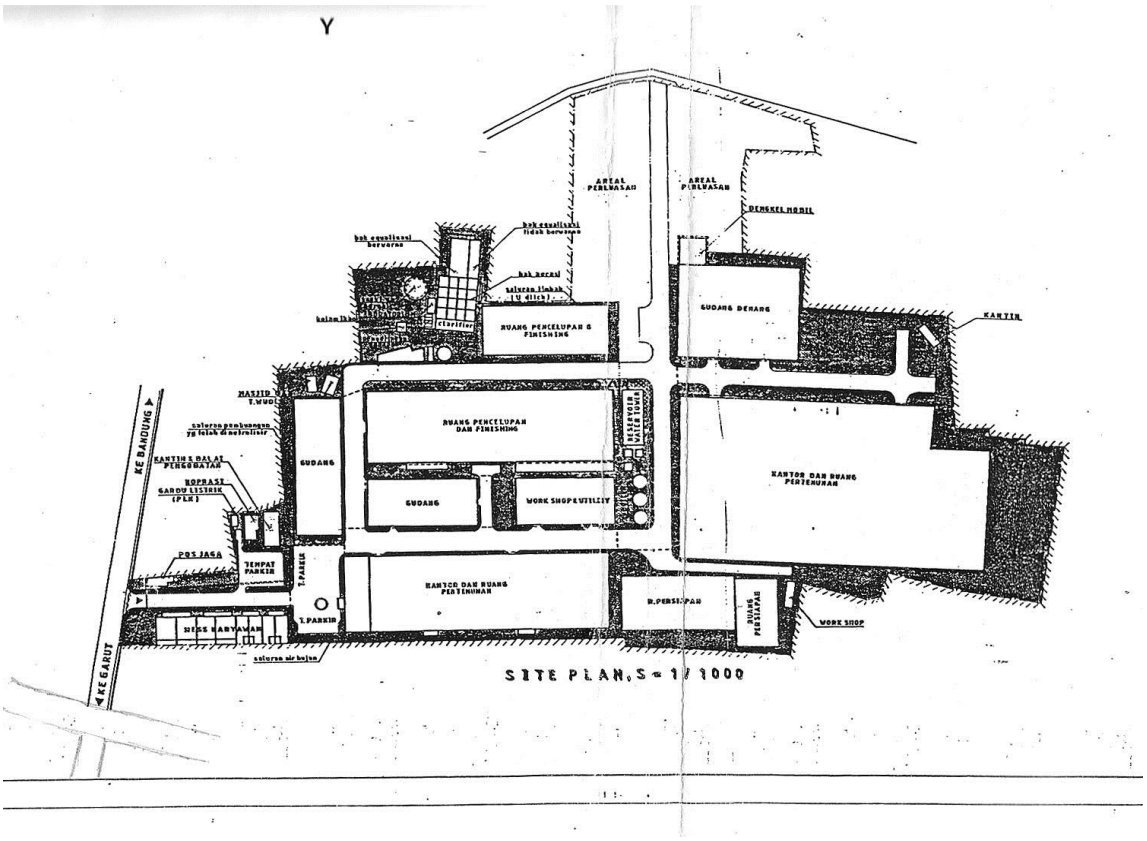

Figure 1. Location and layout PT Insansandang Internusa

PT Insansandang Internusa in its efforts to produce grey fabric and finished fabric. This company produces grey fabrics with raw material of staple yarn and polyester filament, cotton, rayon, blends of polyester-cotton and polyester-rayon. The weaving process using 110 units of machine water jet loom and 3 units of sulzer weaving machines. This type of fabric produced is grey fabric with woven plain, twill and satin fabric construction are manifold. The average production capacity of 60,000

meter/day. The sequences the weaving process can be seen in the picture below:

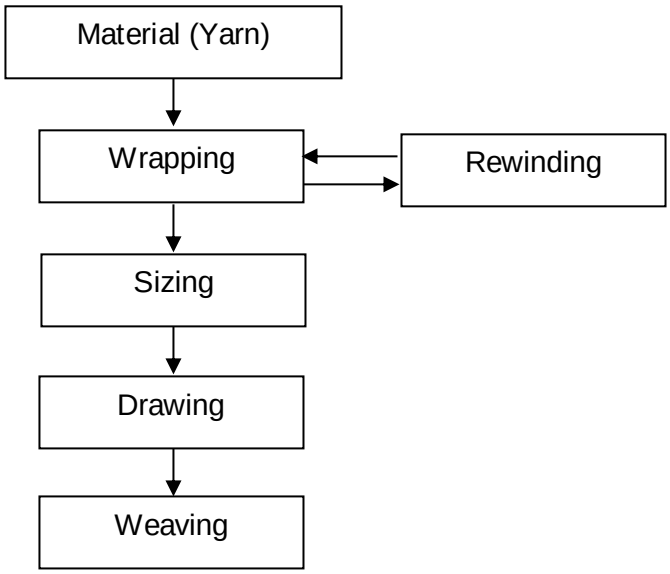

Figure 2. Sequences of Weaving Process

The company is also working on the process of dyeing and finishing the fabric that comes from the process of weaving. The product is a fabric which is largely for the suit. The average capacity of the monthly production of 45,000 meters / day.

Based on agreement with the management company, the location of this RECP pilot project is in dyeing and finishing department. In general, the process sequence is as follows:

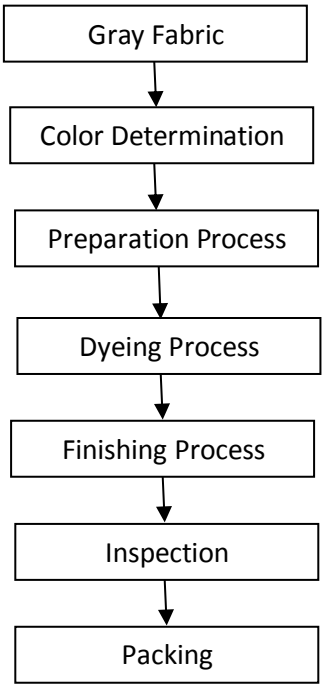

Figure 3. The flow of process in the dyeing and finishing department

Color Determination

At the initial stage, for every order that comes in, do the analysis to assign a color to be produced, including the type of dye and the composition of the recipe used. This process is carried out in the laboratory

Gray Fabric Preparation

Gray fabric to be used in the production process is set to order, and then asked to go to the warehouse. Before processing, gray cloth that has been provided is checked back in to match the type and amount of fabric in accordance with the card process and work plan.

Preparation Process

The preparation process is all the processes carried out on raw textile materials which aims to facilitate the production process to obtain a good result. The preparation process includes singeing, de-sizing, scouring, bleaching, mercerizing and heat setting. The raw materials used are gray fabric obtained from the warehouse because of the process of weaving. The preparation process flow diagram shown in Figure 4.

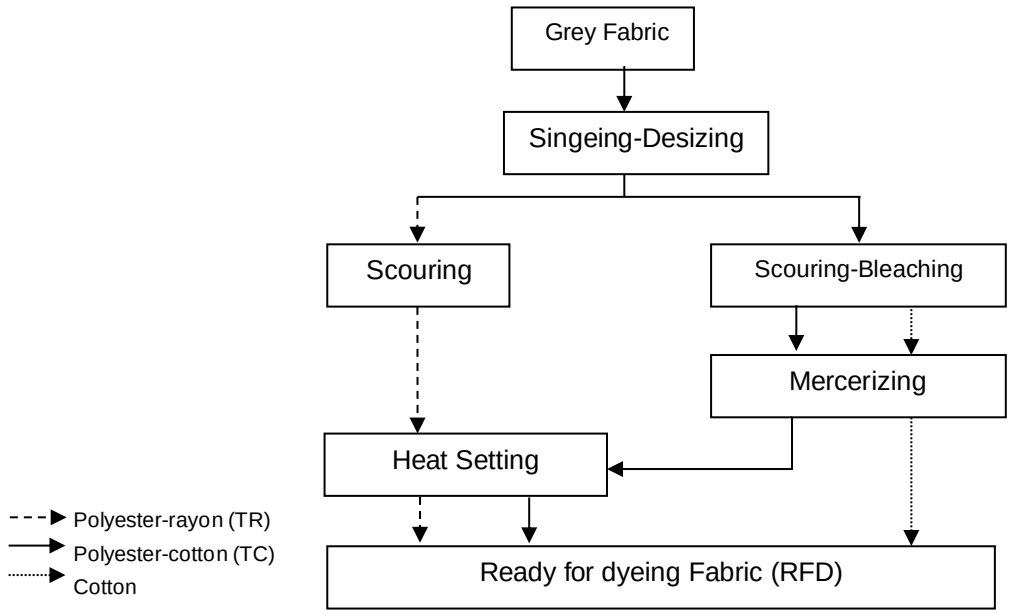

Figure 4. The Flow of Preparation Process

Dyeing Process

Dyeing process is the process of color on the material evenly and permanently. The process of dyeing in PT Insansandang Internusa done in two ways, namely continuous and discontinuous dyeing system or exhaust. For polyester fiber fabric, the continuous dyeing system is using thermosol, while the exhaust system is using a jet dyeing. For natural fiber fabric, normally use soluble vessel dye and cold reactive dyes. For the mixed fabric, dyeing with disperse-vessel dyes usually done to colors of light to medium, while dyeing with disperse – reactive dyes done to color of medium to dark.

The Fabric Dyeing of Polyester, Polyester-Cotton and Polyester-Rayon with Continuous System

Polyester fabric dyeing using disperse dyes made using pad dry thermo-fixation methods. Ready to dye fabric is passed in a tub of dyes through padder with a squeeze effect 58-61%, then passed on space infrared and steam room. Once it goes into the thermos-fixation machine and processed at a temperature of 200 - 215 ˚C for 2 minutes and followed by a washing process. Fabric dyeing with vessel disperse dyes carried out simultaneously and continuously by means of thermos-fixation pad dry, followed by pad steam and oxidation to generate the vessel dye.

Fabric passed on a tub of disperse dyes and dissolved vessel dyes through padder with 58 - 61% squeeze effect, then do the fixation process disperse dyes such as the dyeing of polyester. After going through the process of thermofixation, then entered into a series of pad steam machine by passing the fabric into the solution containing sodium hydrosulfite and caustic soda and steam at a temperature of 102˚C. Then passed in a tub of water and then cooling it winds. To increase the penetration of the dyes into the fiber, the oxidation process is carried out using an oxidant. Fabric rinsed with cold water and then passed through a bath containing a solution of H_2O_2 and acid at a temperature of 60˚C. Then rinsed again with cold water followed by washing in a solution of soap at a temperature of 80 - 90˚C. After rinsing, the fabric is dried by tumble dry.

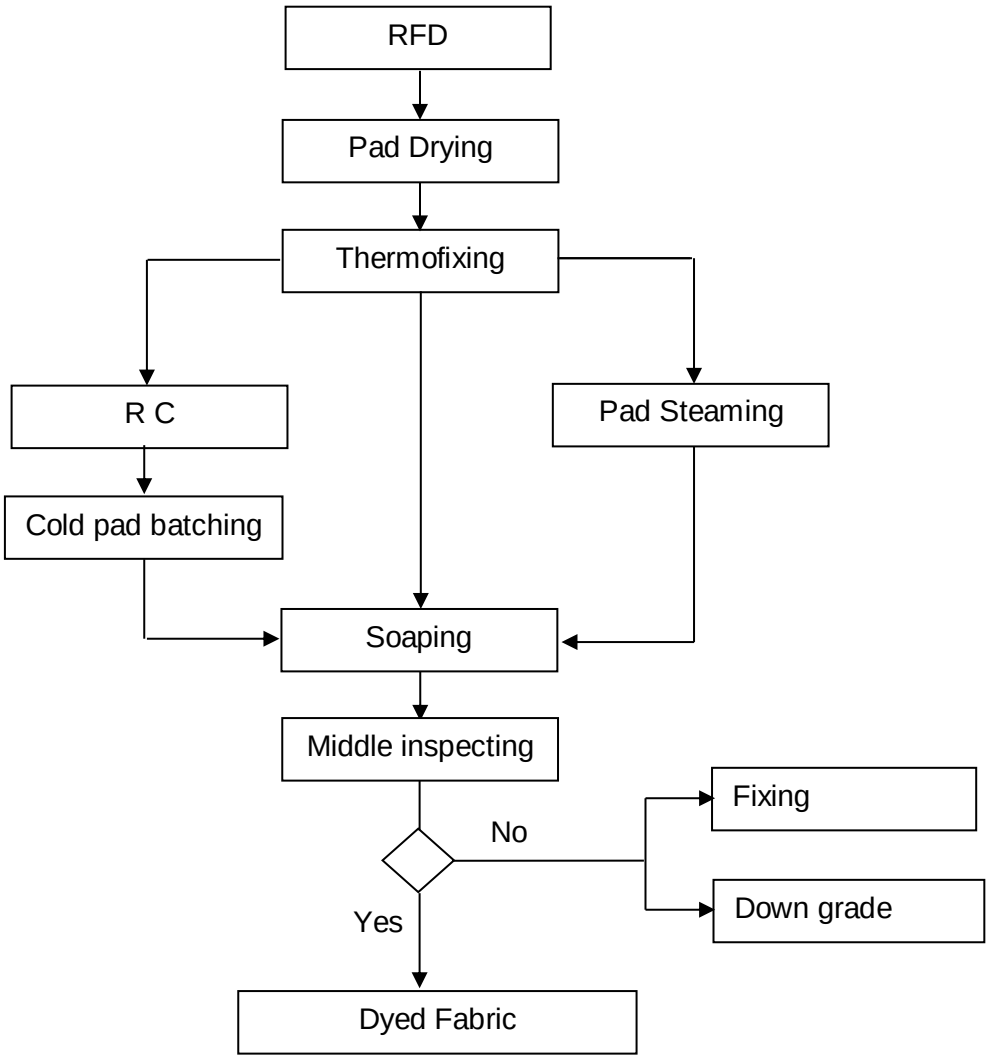

Figure 5. The Flow of Continue Dyeing Process

For mixed fabric dyed with reactive-disperse dyes, the dye solution on the pad dryer machines only contain disperse dyes. After going through the process of thermofixation, fabric rinsed and do the washing process reduction using acetic acid at a temperature of 90˚C for 10 minutes, followed by dyeing using reactive dyes is done by cold pad batching with a squeeze effect of 58 - 63%. Batching time is generally 8 hours, except for

the colors of turquoise takes time around 12 hours and then continued by soap washing and drying.

The Fabric Dyeing of Polyester, Polyester-Cotton and Polyester-Rayon with Discontinuous System

Fabric to be dyed using a jet dyeing at the stage of preparation is not through the process of fine fibers burning. This is intended to avoid interference due to combustion of the fibers that can affect the evenness of color. Temperature dyeing at 135˚C for 20 minutes, at a speed of 400-500 m/min. Burning of fibers performed after dyeing disperse dyes with jet dyeing. For mixed fabric, after dyeing with disperse dyes followed by dyeing natural fiber components using reactive dyes with cold pad batching.

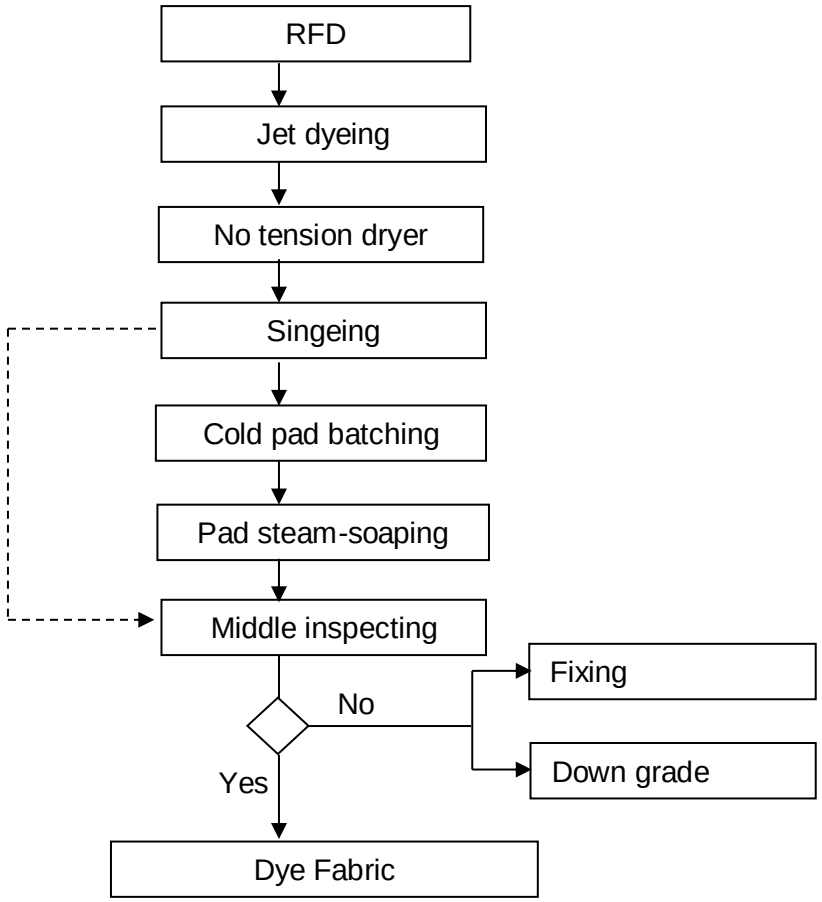

Figure 6 The Flow of Discontinue Dyeing Process

In the mixed fabric dyeing, after dyeing process for polyester fibers, examination of the appropriateness and evenness of color by means of burn-out, which eliminates the natural fiber component in the fabric by dissolving it in strong acid. If the color is obtained in accordance with expectations, proceed to the next process. However, when there are differences or unevenness of color, improvements were made to re-dyeing process using recipes that have been determined by the laboratory. After the dyeing process, before the finishing process, re-examine is needed. If it is not in accordance with the expected then it repairs. But if not possible to repair the fabric grade lowered.

Finishing Process

Finishing process is a process that aims to improve the properties of textile that have been through the process of preparation and dyeing or provide special properties as needed. Finishing process in PT Insansandang Internusa divided into two groups, namely the finishing of chemical and mechanical. Finishing of chemical is often referred to as wet or resin finishing, because in this process a chemical solution is used to obtain the properties of certain fabrics, such as anti-wrinkle, waterproof, water reject, anti-fungal, as well as a softener and anti-static. This process uses the cold pad batching. Fabric that has been dipped passed on the resin bath with 60-65% squeeze effect, then dried on a stenter machine. Polymerization was carried out on the baking machine, with a temperature of 180 ˚C for 2 minutes. The finishing of mechanical who performed in PT Insansandang Internusa is a finishing of anti-shrink (sanforization) and calender. Sanforization aims to improve the dimensional stability of the fabric. Woven fabric, especially cotton, tends to increase the length after going through the process of heating, bleaching, and dyeing due to the pulling that happened during the process, so that the fabric has the

potential to shrink back after washing. To eliminate these properties, need to implement the sanforization process. Fabric is passed on by a steam roller, then when moist fabric bites the rubber blanket attached tightly to the drying cylinder with a certain pressure so that the fabric be compressed. Then the fabric out through conveyor roll. The resulted fabric of the sanforization process is tested for shrinkage. Calander finishing carried out with the aim of change the fabric properties to become softer and more shiny appearance. This process is not carried out on all fabrics but is done only at the request of the consumer. In this process, the fabric is passed on the conveyor roll and passing hot rollers at a temperature of 90 - 100˚C and a speed of 20 m/ min.

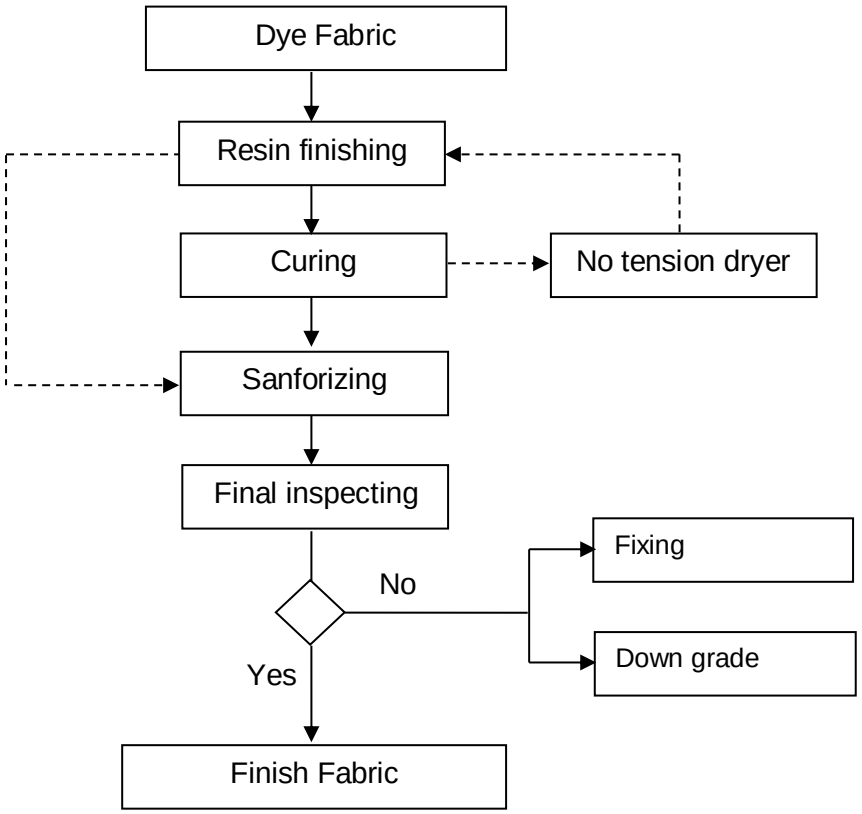

Figure 7 The Flow of Finishing Process

Now production quantity in PT Insansandang Internusa vary due to market condition. Several current variables can be measured in dyeing and finishing departments, namely:

- Production of finished fabrics: 700,000 meters/month
- Water consumption 32,000 m3/month
- The use of coal 1,300 tons/month
- Electricity consumption 245,000 kWh/month
- Use of chemicals of 21,000 kg /month

Dyeing and finishing departments are facing some problems related to production, energy and the environment, among others:

- The use of machinery/equipment is not optimal for the low level of efficiency. This is due to the low level of product orders from customers.
- Still using a lot of old machines are relatively wasteful of energy, water and chemicals.
- Still considered to be involved in the problems of pollution of the river by the NGO/community.
- There is still the potential for waste on steam generator system.

Assessment

Measuring Instruments

In the DF production site, measuring instruments installed in the production machineries are still limited. It is quite difficult to do a better process control.

Pad Steam Machine

A machine that has a water flow meter is the pad steam machine. Production data on the pad steam machine on August 10, 2016, namely: the volume of water used at 288 m^3 and total production amounted to 65,378 m. With ratio of weight to length of fabric is 320 g/m, then the

weight of the fabric production amounted to 20,920,960 g = 20,920.96 kg. Water consumption/kg fabric of 13.76 liter/kg. Water consumption is not yet considered the amount of water used in the form of steam. While the benchmark of water uses around 8 - 12 liter/kg. From the above figures, there is still potential saving of water use

Steam and Hot Oil Pipes

Sources of energy used in the DF process include steam and hot oil. From steam and hot oil pipes still remain the potential energy savings. This is indicated by the presence of pipes that have not been insulated.

Steam Traps

Company should be careful to the status of steam traps. Because people are easy forget about steam traps when they are working properly. It is recommendable to check all steam traps at least twice a year and provide canopy shield for each stream traps that installed outdoor.

Drain Recovery

It is recommendable to recover “drain” from steam traps. The drain from steam traps is very clean water. When the drain is recovered, the drain can be used to BFW without any additional treatment. Especially, the drain from drum dryer shall be recovered, because rather big amount of drain is produced at narrow area.

Pictures

Uninsulated Pipes	
	
Uninsulated Jet Dyeing	
	
	
Steam Traps and Valves	
	
Pad Steam	

Heating LPG tubes with condensate

Root Cause Diagnosis

Root Cause Category		Energy in DF processing
Process Input		Boiler setting
People		Prevailing attitudes that spills and leaks are normal
Plant	Process Control	O_2 content at boiler flue gas and temperature at point of use
	Equipment	Maintenance
	Technology	Type and life of boiler, hot oil heater and DF machineries
Product		Finished fabric
Waste		Waste heat from surface of machineries and pipe
		Waste heat from condensate

Root Cause

Root Cause Category	Water using in pad steam machine
Process Input	Choice of water volume and cleaning agent
People	• Operating practices of workers

		• Prevailing attitudes that spills and leaks are normal
Plant	Process Control	Flow rate of water
	Equipment	Direct inject of steam
	Technology	Type and life of pad steam machine
Product		Dye fabric
Waste		Waste water

Option Generation

RECP Practices		Energy in DF processing
Input		Controlling excess air at flue gas by resetting of supplied air into furnace of boiler
Good House Keeping		Improved operator awareness
Plant	Process Control	Completing the measuring instruments
	Equipment	• Install the insulation in jet dyeing machines and pipes or valves of hot fluid. • Repair steam traps and broken insulation
Reuse		Condensate collected and supplied as Boiler Feed Water (BFW)

Option Generation

RECP Practices	Water using in pad steam machine
Input	Reset of water flowrate
Good House Keeping	Standard operating procedure

Plant	Process control	Checking the quality of the fabrics every changing of the water flow rate setting
Reuse		• Consider using the heat exchanger to replace the direct inject of steam. • not to use condensate to heat LPG tube.