

Eco-friendly Processing: Time, Water, Energy Saving

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Introduction

Industrialisation has, over the years, led to wasteful use of energy and consequent uninhibited depletion of non-renewable sources and ominous levels of environment pollution, thus threatening the survival of earth's flora and fauna. The textile industry is one of the largest polluting industries. Recently there has been a significant increase in concerns for ecological aspects. Processing of textiles is time-consuming and needs a large quantity of chemicals, water and energy.

Amongst various stages of processing, the pretreatment and dyeing process results in large volume of effluent that has harmful effect on the environment. In today's competitive market not only is the fabric processed by eco-friendly products but there is also a need to develop shorter processes coupled with savings in energy and water.

Machinery manufacturers have made efforts to reduce the water consumption per kg fabric by introducing lower-liquor-ratio machines, from 1:8-1:10 to 1:4-1:6.

SAREX has taken the initiative to develop processes for lower-liquor-ratio machines with eco-friendly products that will save time, water and energy. The various concepts used for ecological processes are given below:

Products:

- **All-in-one pretreatment, no caustic required, Low Total Dissolved Salts (TDS), less degradation of fabric.** Univ-AIO is an all-in-one speciality product in powder form for bleaching of cellulose and their blends. Due to its unique formulation it acts as a wetting cum detergent and peroxide stabiliser and no caustic is required during bleaching. Combined scouring and bleaching can be carried out using peroxide and Univ-AIO only.
- **Low temperature, low caustic bleaching**

- **with energy saving, less degradation of fabric.** Ketoprep-LA is a novel product which requires low alkali and low temperature during bleaching of cellulosic substrates. Bleaching with Ketoprep-LA exhibits very good softness, absorbency, rewetting and whiteness of bleached fabric. Bleached fabrics suffer less strength loss and weight loss as the concentration of alkali used is very low.
- **Enzyme based peroxide killer, stable up to 70 °C and pH 5.0-7.0, combined peroxide killing and biopolishing.** Peroxy-ALK is a catalase based enzyme with a broad application spectrum for scavenging of residual peroxide after bleaching. Peroxy-ALK is a unique formulation which saves water, energy and time as it is stable up to 70 °C and at a broad range of pH (5.0-7.0). Combined peroxide killing and biopolishing can

be carried out with Peroxy-ALK.

- **All-in-one solubilising, dispersing cum levelling agent for reactive dyes, reduces dosing time of salt and alkali with reproducible shades.** Sarakol-RDL is a special all-in-one formulation to improve the solubilising, dispersing and levelling properties of reactive dyes under adverse conditions of dyeing. It reduces strike rate therefore uneven dyeing with incompatible dyes can be minimised. It eliminates the use of urea in dye dissolution. It prevents dark creases in dyeing of cotton knits due to precipitation of dyes.
- **Single bath soaping-off for dark shades with reactive dyes reduces process time and water consumption.** Erkol-PR is a speciality product for single bath soaping-off agent for dark shades. It works at wide pH range



(pH 5-7). Erkol-PR reduces the time, energy and water against conventionally used soaping-off agent.

Process

Recommended eco-friendly and shortened processes with above products by Sarex are given below:

PROCESS 1: For cellulosic yarn/knit in machine with 1:4 - 1:6 M:L

Pretreatment:

A: Celldet-R (wetting agent)	0.5%
B: Univ-AIO	2.0%
C: Hydrogen peroxide	2.5%
Treat at 95°C for 30-45 min and drain the bath	
Hot wash at 70°C for 10 min	
pH 6-7 with acetic acid	
D: Peroxy-ALK (peroxide scavenger)	0.5%
Run for 20 min and drain the bath	
(Figure 1)	

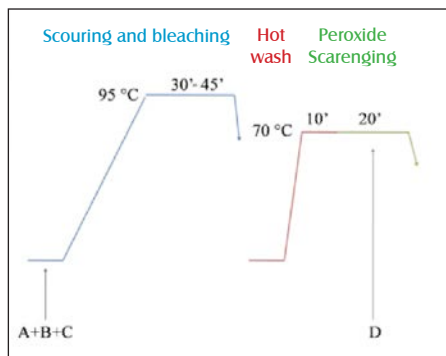


Figure 1: Schematic diagram for pre-treatment with Univ-AIO

Dyeing:

Sarakol-RDL 1.0%
(Half quantity of Sarakol-RDL to be added during dissolving of the dyestuffs and balance quantity to be added in the dyebath)
This is best suited for difficult Turquoise blue and tonal trichromy shades
Dyeing to be carried out with Glauber's salt and alkali as per dye manufacturer's recommendation
Drain the bath

Soaping of dyed fabric:

Cold wash for 10 min followed by warm wash at 50°C for 10 min
Neutralise with acetic acid to pH 5.5-6.5 and run for 5 min
Increase temperature to 60°C and hold for 10 min and drain the bath
pH 5-6 with acetic acid
E: Erkol-PR 1.5-2.0%
Increase temperature to 95°C and hold for 20 min and drain the bath

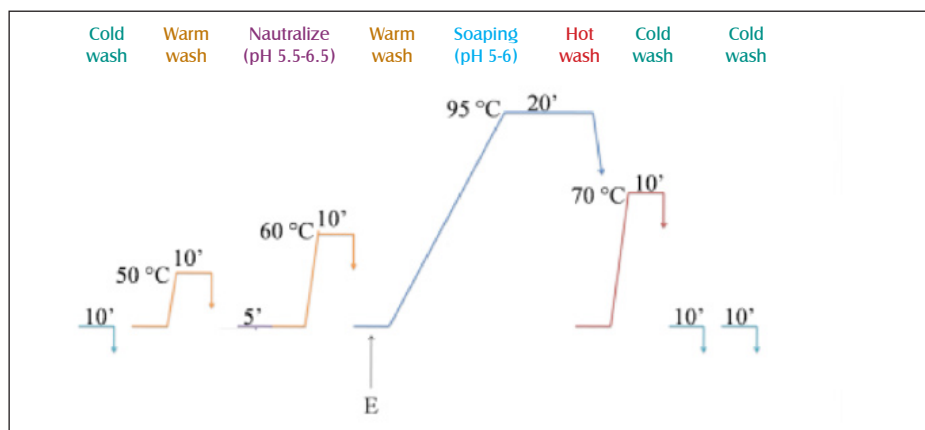


Figure 2: Schematic diagram for soaping with Erkol-PR at 95 °C

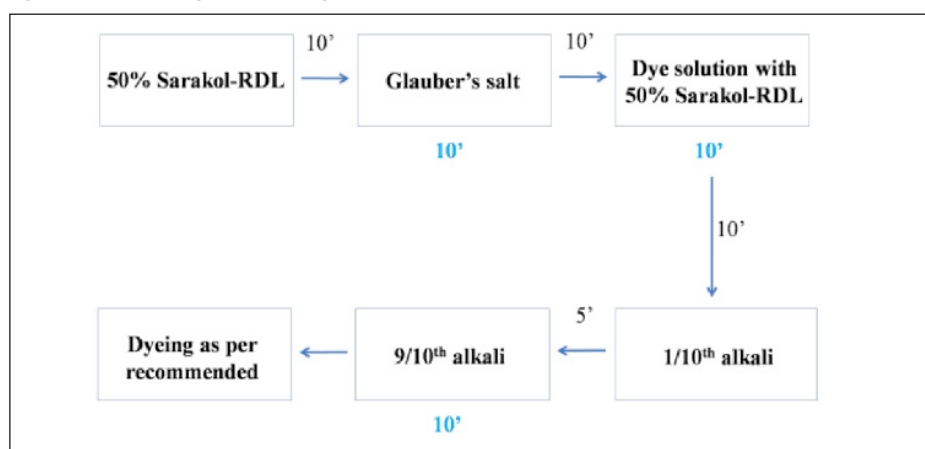


Figure 3: Schematic diagram for pretreatment with Ketoprep-LA

Hot wash at 70°C for 10 min followed by two cold wash for 10 min each
(Figure 2)

Advantages of Sarex process vs. conventional process:

- No caustic require during bleaching
- Less TDS, BOD and COD in wastewater thereby reducing effluent load
- Feel of the fabric is softer and lower degradation
- Saving in water as one hot wash is eliminated during bleaching
- Bleaching time is reduced by 15 min
- Peroxy-ALK is stable at 70°C and pH7 so no intermediate cold wash required during peroxide scavenging
- One bath soaping with one hot wash as compared to conventional soaping by two baths and two hot washes

No caustic + Less waste water + Shorter time + Lower effluent load

PROCESS 2: For cellulosic yarn/knit in machines with 1:4 - 1:6 M:L at low temperature

Pretreatment:

A: Celldet-R (wetting agent)	0.4%
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B: Ketoprep-LA	1.0%
C: Caustic flakes	1.0%
D: Hydrogen peroxide	2.0%
Treat at 75°C for 45 min and drain the bath	
Hot wash at 70°C for 10 min	
pH 6-7 with acetic acid	
E: Peroxy-ALK (peroxide scavenger)	0.5%
Run for 20 min and drain the bath	
(Figure 3)	

Dyeing:

In general, dyeing of cotton with reactive dye is carried out by dosing dyes, Glauber's salt and alkali at intervals, which increases the dyeing time. The use of Sarakol-RDL reduces the dosing time and ensures reproducible, level dyeing.

Sarakol-RDL	1.0%
Half quantity of Sarakol-RDL is added with the dyestuffs	
Balance quantity is added in the dyebath and run for 10 min	
This is best suited for difficult Turquoise blue and tonal trichromy shades	
Dose Glauber's salt in 10 min and run for 10 min	
Add dye solution with Sarakol-RDL to the bath and run for 10 min	
Dose 1/10th of the total amount of alkali and run	

for 5 min

Dose remaining alkali in 10 min and continue dyeing as per recommended temperature by dye manufacturer

Drain the bath

(Figure 4)

Soaping of dyed fabric:

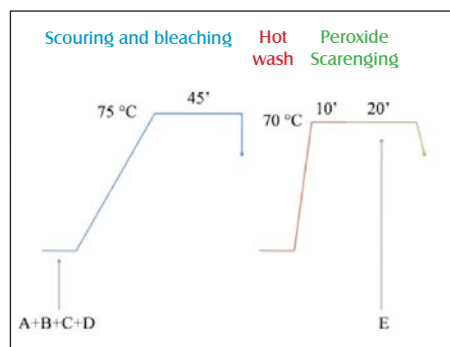


Figure 5: Schematic diagram for soaping with Erkol-PR at 70 °C

Cold wash for 10 min followed by warm wash at 50°C for 10 min

Neutralise with acetic acid to pH 5.5-6.5 and run for 5 min

Increase temperature to 60°C and hold for 10 min and drain the bath

pH 5-6 with acetic acid

F: Erkol-PR

2.0-3.0%

Increase temperature to 75°C and hold for 20-30 min and drain the bath

Hot wash at 70°C for 10 min for two times

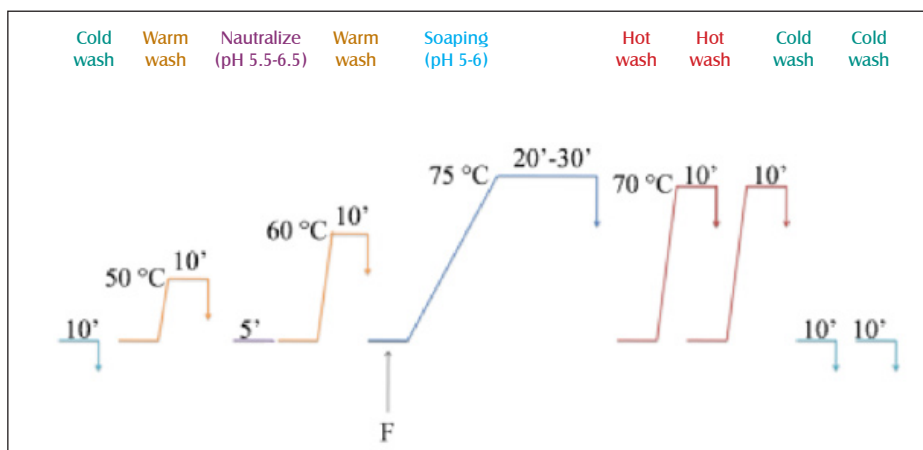


Figure 4: Schematic diagram for dosing with Sarakol-RDL in dyeing

followed by two cold wash for 10 min each (Figure 5)

Advantages of Sarex process vs. conventional process:

- Less caustic is required during bleaching
- Less TDS, BOD and COD in wastewater thereby reducing effluent load
- Feel of the fabric is softer and lower degradation
- Saving in energy as bleaching is carried out at lower temperature
- Saving in water as one hot wash is eliminated during bleaching
- Peroxy-ALK is stable at 70°C and pH7 so no intermediate cold wash required during peroxide scavenging
- Dosing time for Glauber's salt and alkali is

reduced from 45min to 10-15 min. So dyeing time can be shortened by 60-75 min

- One-bath soaping as compared to conventional two bath soaping
- Saving in energy as soaping is carried out at lower temperature

**Less energy + Less waste water + Shorter time
+ Less Caustic**

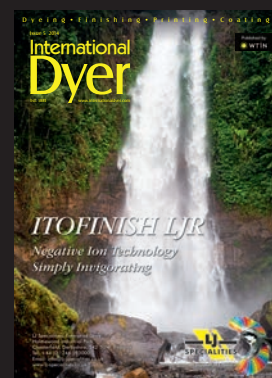
Conclusions

- By Sarex processes, water consumption is 40-42 litre/kg of fabric as against conventional process 50-55 litre/kg
- Overall process time is shortened by 90-120 min
- Considerable saving in energy
- Reduction in effluent load

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