Appendices

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Appendix A

Fabric Specifications for each of the Demonstration Project Factories

1. Dakahleya Spinning and Weaving - Knitted Fabric Specifications

- Single Jersey 30/1 - Giza 75 Combed 120gm/m^2
- Single Jersey 30/1 - Giza 80 Combed 110gm/m^2
- Melton 24/1 - Giza 80 Combed 220gm/m^2
- Single Jersey 24/1 - Giza 75 Combed 160gm/m^2
- Rip 20/1 - Giza 75 Combed 193gm/m^2
- Fine Rip 22/1 - Giza 75 Combed

2. El Nasr Spinning and Weaving - Woven Fabric Specifications

The fabric tested at El Nasr Spinning and Weaving had a weight of 208 gm/metre with count 20/1.

3. Amirtex - Knitted Fabric Specifications

Type	Weight g/metre	Counts
Melton	190 220	40/1, 30/1
Prasulla	160 180	40/1, 30/1
Fine Rib	140 - 150	24/1, 20/1
Interlock	180 190	40/1
Rib Lycra	200	(100% cotton)

Appendix B

Summary of Results from Pilot Scale Experiments at Each of the Three Factories

Work carried out at El Nasr Spinning and Weaving on Jiggers for woven fabric

The dye was dissolved at 50°C in a mixture of sodium hydroxide and half amount of glucose. In the mean time, the jigger was filled with water, and the temperature raised to 70°C. Half the dye mixture was added during first end and half at the second. The temperature was then raised to 90-95°C, where salt is added in two portions in two ends. Then a quarter of the amount of glucose was added at the fifth end and the next quarter at the six end. Dyeing was then continued over next 4 ends. The total dyeing time was thus 90 minutes. The oxidation was carried out at 60-65°C for six ends, corresponding to 55 minutes.

Work carried out at Dakahleya Spinning and Weaving on jets for knitted fabric

The fabric was loaded in the jet, the jet being half filled with water. Then hemactol, NaOH and one half amount of glucose were added. The temperature was raised to 60°C. The dye was added in 3 equal portions for a total time of 25 minutes. Then the second half of the glucose was added. The temperature was then raised to 90-95°C where dyeing was continued for 75 minutes. In the oxidation step, acetic acid was added to cold fresh water and the fabric was run through the same for 5 minutes. Hydrogen peroxide was then added to the cold water, without circulation to the dosing tank. Then the temperature was raised to 60-65°C where oxidation is achieved for 30 minutes. Softening was modified by introducing acetic acid first, to ensure acidity of the bath and after 5 minutes the softener was introduced.

Work carried out at AmirTex on winches for knitted fabric

Scoured knitted fabric was loaded on the winch with the winch 75% full with water. The motor was then started. The Na-HMP (previously dissolved in 20 litres of water) was added in 4 equal portions for a total time of 5 minutes. Next, NaOH (previously prepared in 20 litres of water) in 4 portions was added in a total time of 5 minutes. The temperature was raised to 40°C and glucose (previously prepared in 20 litres of water) was added. After 10 minutes, dye was added in 4 equal portions in 20 litres of boiling water for a total time of 10 minutes. The water level in the winch was checked, as now it was expected to be near full. The temperature was raised to 80°C and dyeing was allowed to proceed for 50 minutes. This was followed by overflow washing and separate cold washing until clear water is discharged.

Appendix C

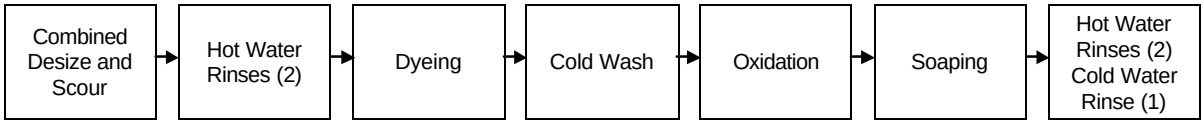
Process Flow Diagrams of the Conventional and Optimised Processes at the Three Demonstration Factories

Simplified Flow Diagrams Showing Where Modifications Were Implemented and the Associated Savings Made

(modified process indicated by shading)

(a) El Nasr Factory combining the desizing and scouring stages

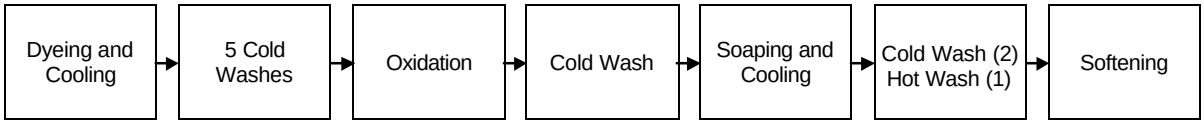
Modified Process



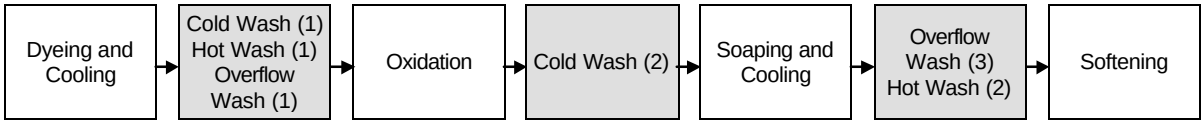
Conventional Process:

(b) Dakahleya Factory elimination of hot, cold and overflow washes

Modified Process:

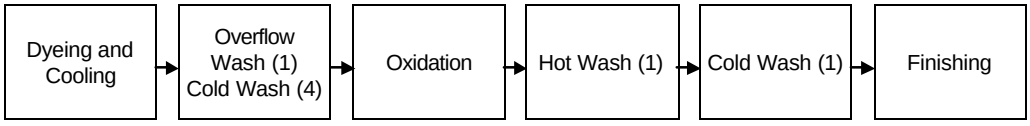


Conventional Process:

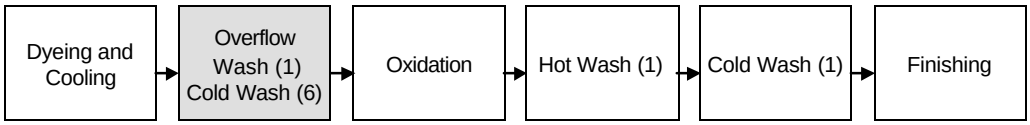


(c) AmirTex Factory elimination of hot, cold and overflow washes

Modified Process:



Conventional Process:



Appendix D

Cost Analyses of Implementation at El Nasr, Dakahleya and AmirTex Factories

Table D1
Costs Associated with Sodium Sulphide and Potassium Dichromate Substitution at El Nasr Spinning and Weaving for 100 kg of Grey Shade
(woven fabric, dyed in Jiggers)

Chemicals	Conventional Process		Modified Process		Cost Difference (LE)
	Quantity (kg)	Cost (LE)	Quantity (kg)	Cost (LE)	
Beta-amylase	1.5	5.2	-	-	- 5.2
Ammonium persulphate	-	-	0.25	2	+ 2
Espycon 1030	2	4.3	1.5	3.2	- 1.1
NaOH (38 Be)	35	38.5	43	47.3	+ 8.8
Dye	0.81	5.6	0.81	5.6	0
Na_2S	4	6	-	-	- 6
Na_2CO_3	2	1.3	-	-	- 1.3
Glucose	-	-	5	7.3	+ 7.3
NaCl	15	6	15	6	0
Acetic Acid	3	10.8	3	10.8	0
Potassium Dichromate	1.5	7.3	-	-	- 7.3
Sodium perborate	-	-	0.5	1.6	+ 1.6
Water (m^3)	9,200	4.6	8,000	4	- 0.6
Steam	700	8.8	590	7.4	- 1.4
Electricity (kWh)	33	6.3	25.6	4.9	- 1.4
Labour		40		31	- 9
Time (h)	8		6.2		--
Total	**--**	**144.7**	**--**	**131.1**	**- 13.6**

Table D2
Costs Associated with Sodium Sulphide and Potassium Dichromate Substitution at El Nasr Spinning and Weaving for 100 kg of Black Shade
(woven fabric, dyed in Jiggers)

Chemicals	Conventional		Modified		Cost Difference (LE)
	Quantity (kg)	Cost (LE	Quantity (kg	Cost (LE	
Beta-amylase	1.5	5.2	-	-	- 5.2
Ammonium persulphate	-	-	0.25	2	+ 2
Espycon 1030	2	4.3	1.5	3.2	- 1.1
NaOH (38 Be)	35	38.5	43	47.3	+ 8.8
Dye	5	33.1	5	33.1	0
Na_2S	8	12	-	-	- 12
Na_2CO_3	4	2.9	-	-	- 2.9
Glucose	-	-	17	24	+ 24
NaCl	15	6	15	6	0
Acetic Acid	3	10.8	3	10.8	0
Potassium Dichromate	1.5	7.2	-	-	- 7.2
Sodium perborate	-	-	0.5	1.6	+ 1.6
Water	9,200	4.6	8,000	4	- 0.6
Steam	700	8.8	590	7.4	- 1.4
Electricity (kWh)	33	6.3	25.6	4.9	- 1.4
Labour		40		31	- 9
Time (h)	8		6.2		--
Total	**-**	**179.7**	**-**	**175.3**	**- 4.4**

Table D3
Costs Associated with Sodium Sulphide Substitution at Dakahleya Spinning and Weaving for 216 kg of Black Shade
(knitted fabric, dyed in Jets)

Chemicals	Conventional		Modified		Cost Difference (LE)
	Quantity (kg)	Cost (LE)	Quantity (kg)	Cost (LE)	
Hostapal sfk	2	14.5	1.1	8	- 6.5
Organic Stabiliser	2	11.3	2	11.3	0
Hemactol	1.6	13.2	1.6	13.2	0
NaOH	5	5.5	13	14.3	+ 8.8
Dye	16	110.4	16	110.4	0
Na_2S	19	28.5	-	-	- 28.5
Na_2CO_3	10	7.3	0.5	0.3	- 7.0
Glucose	-	-	30	43.5	+ 43.5
NaCl	75	30	75	30	0
H_2O_2	11.6	30.2	11.6	30.2	0
Acetic Acid	4.6	16.6	2.6	9.4	- 7.2
Softazine	6.1	30.9	6	30.4	- 0.5
Water	65,500	32.8	40,000	20	- 12.8
Steam	3150	75.6	1930	46.3	- 29.3
Electricity (kWh)	97.5	18.5	60	11.4	- 7.1
Labour		97.5		60	- 37.5
Time (h)	13		8		--
Total		**522.8**		**438.7**	**- 84.1**

Table D4
Costs Associated with Sodium Sulphide and Sodium Dichromate Substitution at AmirTex for 1 Ton of Black Shade
(and Hydrogen Peroxide as the Oxidant)

(knitted fabric, dyed in winches)

Chemicals	Conventional (sodium sulphide and hydrogen peroxide)		Conventional (sodium sulphide and sodium dichromate)		Modified		Cost Difference (LE)
	Quantity (kg)	Cost (LE	Quantity (kg)	Cost (LE	Quantity (kg)	Cost (LE	
Na_2CO_3	0.056	0.051	0.056	0.051	0.033	0.003	- 0.048
Na-HMP	0.027	0.111	0.027	0.111	0.027	0.111	0
Na_2S	0.167	0.367	0.167	0.367	-	-	- 0.367
NaOH	-	-	-	-	0.077	0.15	+ 0.15
Sodium dichromate	-	-	0.01	0.058	-	-	- 0.058
Glucose	-	-	-	-	0.167	0.242	+ 0.242
Dye	0.09	0.72	0.09	0.72	0.09	0.72	0
NaCl	0.33	0.036	0.33	0.036	0.33	0.036	0
Acetic Acid	0.013	0.046	0.013	0.046	0.013	0.046	0
H_2O_2	0.013	0.025	-	-	0.013	0.025	0
Detergent	0.016	0.048	0.016	0.048	0.016	0.048	0
Water	141	0.11	141	0.11	121	0.093	- 0.017
Steam	2.9	0.448	3.7	0.573	2	0.448	0
Electricity (kWh)	0.071	0.0127	0.071	0.013	0.067	0.012	- 0.001
Labour		0.143		0.143		0.135	- 0.008
Time (min)	2.86		2.86		2.7		
Total		**2.1177**		**2.276**		**2.069**	**- 0.107**