ANNEX 5

MODULES OF TEXTILES FINISHING PROCESS

1 Antistatic Finishing - Flax/Pes fabric

Name	Antistatic finishing	
Sources	Report LCA I06: TM-108-002	**H.4 Antistatic finishing**
Reference year	2000	
Geographic reference	Italy	
Technological level	modern	
Reference flow	100 kg of flax/pes fabric	
Equipment	Rameuse	
	operating mode:	continuous
	bath volume (m3):	0,1
	run time (h):	1,7
	N.of cycles/year	566
	absorbed power (kW):	50
	processed fabric per hour (kg/h):	85
	processed fabric (kg/yr):	82729
Notes		

Procedural steps (flow-chart)

Water:from Softening Treatment:85 l/h.

Antistatic agent (3045): 10 g/l

Doping

Wringing

Thermosetting (T=140°C)

Wastewater 70 l/cycle

COD [mg/l] = ***14650*** ;

TSS [mg/l] = ***200*** .

	Flow	Units	Value
INPUTS	(r) Coal (in ground)	kg	5,25E+00
	(r) Natural Gas (in ground)	kg	5,54E+00
	(r) Oil (in ground)	kg	1,41E+01
	Flax/Pes fabric: to Finishing	kg	1,00E+02
	Water: Public Network	litre	0,00E+00
	Water: Unspecified Origin	litre	6,99E+00
	Water: Well	litre	0,00E+00
	Water: from Softening Treatment	litre	1,00E+02
OUTPUTS	(a) Aldehyde (unspecified)	g	1,86E+00
	(a) Alkane (unspecified)	g	1,79E+00
	(a) Arsenic (As)	g	8,82E-03
	(a) Butane (n-C4H10)	g	2,34E+00
	(a) Cadmium (Cd)	g	1,80E-02
	(a) Carbon Dioxide (CO2, fossil)	g	6,77E+04
	(a) Ethane (C2H6)	g	1,90E+01
	(a) Ethylene (C2H4)	g	3,04E+00
	(a) Heptane (C7H16)	g	2,53E-01
	(a) Hexane (C6H14)	g	5,06E-01
	(a) Hydrocarbons (except methane)	g	9,77E+01
	(a) Methane (CH4)	g	5,09E+02
	(a) Nickel (Ni)	g	3,55E-01
	(a) Nitrogen Oxides (NOx as NO2)	g	1,26E+02
	(a) Nitrous Oxide (N2O)	g	1,00E+00
	(a) Propane (C3H8)	g	4,79E+00
	(a) Sulphur Oxides (SOx as SO2)	g	6,97E+02
	(a) Toluene (C6H5CH3)	g	2,26E-01
	(a) Vanadium (V)	g	1,41E+00
	(a) VOC (Volatile Organic Compounds)	g	6,32E+01
	(s) Arsenic (As)	g	4,40E-05
	(s) Chromium (Cr III, Cr VI)	g	5,51E-04
	(s) Zinc (Zn)	g	1,65E-03
	(w) Ammonia (NH4+, NH3, as N)	g	6,13E-01
	(w) Benzene (C6H6)	g	1,81E-01
	(w) Cadmium (Cd++)	g	4,86E-04
	(w) Chromium (Cr III)	g	1,16E-03
	(w) Chromium (Cr III, Cr VI)	g	3,35E-03
	(w) Nitrogenous Matter (unspecified, as N)	g	7,78E-01
	(w) Oils (unspecified)	g	1,26E+00
	Flax/Pes fabric: from Finishing	kg	1,00E+02
	Wastewater	litre	1,00E+02
REMINDERS	E Feedstock Energy	MJ	4,59E+01
	E Fuel Energy	MJ	9,32E+02
	E Non Renewable Energy	MJ	8,98E+02
	E Renewable Energy	MJ	7,98E+01
	E Total Primary Energy	MJ	9,78E+02
	Electricity	MJ elec	3,31E+02
	COD: to Wastewater Treatment Plant	kg	1,46E+00
	TSS: to Wastewater Treatment Plant	kg	2,00E-02

2 Water Finishing – Viscose fabric

Name	Water finishing	
Sources	Report LCA I02: TM-108-003	**I.1 Water finishing**
Reference year	2000	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of viscose fabric	
Equipment	Water finishing	
	operating mode:	continuous
	bath volume (m3):	0,1
	run time (h):	4
	N.of cycles/year	90
	absorbed power (kW):	29,7
	processed fabric per hour (kg/h):	143
	processed fabric (kg/yr):	51111
Notes		
Procedural steps (flow-chart)		

Water: from Softening Treatment 143 l/h

Doping

Wringing

Thermosetting (T=130°C)

Wastewater: 100 l/cycle
*COD [mg/l]= **350** ;*
*TSS [mg/l]= **50** .*

	Flow	Units	Value
INPUTS	(r) Coal (in ground)	kg	1,32E+00
	(r) Natural Gas (in ground)	kg	1,40E+00
	(r) Oil (in ground)	kg	3,56E+00
	Viscose fabric: to Finishing	kg	1,00E+02
	Water: Public Network	litre	0,00E+00
	Water: Unspecified Origin	litre	1,76E+01
	Water: Well	litre	0,00E+00
	Water: from Softening Treatment	litre	1,00E+02
OUTPUTS	(a) Aldehyde (unspecified)	g	3,64E+00
	(a) Alkane (unspecified)	g	4,52E-01
	(a) Ammonia (NH3)	g	1,40E+01
	(a) Arsenic (As)	g	2,23E-03
	(a) Butane (n-C4H10)	g	5,90E-01
	(a) Cadmium (Cd)	g	4,54E-03
	(a) Carbon Dioxide (CO2, fossil)	g	1,71E+04
	(a) Ethane (C2H6)	g	4,80E+00
	(a) Ethylene (C2H4)	g	7,68E-01
	(a) Heptane (C7H16)	g	6,38E-02
	(a) Hexane (C6H14)	g	1,28E-01
	(a) Hydrocarbons (except methane)	g	2,54E+01
	(a) Methane (CH4)	g	1,28E+02
	(a) Nickel (Ni)	g	8,95E-02
	(a) Nitrogen Oxides (NOx as NO2)	g	6,07E+01
	(a) Nitrous Oxide (N2O)	g	2,52E-01
	(a) Propane (C3H8)	g	1,21E+00
	(a) Propylene (CH2CHCH3)	g	2,65E-02
	(a) Sulphur Oxides (SOx as SO2)	g	1,76E+02
	(a) Toluene (C6H5CH3)	g	5,69E-02
	(a) Vanadium (V)	g	3,57E-01
	(s) Arsenic (As)	g	1,11E-05
	(s) Chromium (Cr III, Cr VI)	g	1,39E-04
	(s) Zinc (Zn)	g	4,17E-04
	(w) Benzene (C6H6)	g	4,58E-02
	(w) Cadmium (Cd++)	g	1,22E-04
	(w) Chromium (Cr III)	g	2,92E-04
	(w) Chromium (Cr III, Cr VI)	g	8,44E-04
	(w) Nitrogenous Matter (unspecified, as N)	g	1,96E-01
	(w) Oils (unspecified)	g	3,17E-01
	Viscose fabric: from Finishing	kg	1,00E+02
	Wastewater	litre	1,00E+02
REMINDERS	E Feedstock Energy	MJ	1,16E+01
	E Fuel Energy	MJ	2,35E+02
	E Non Renewable Energy	MJ	2,27E+02
	E Renewable Energy	MJ	2,01E+01
	E Total Primary Energy	MJ	2,47E+02
	Electricity	MJ elec	8,35E+01
	COD: to Wastewater Treatment Plant	kg	3,50E-02
	TSS: to Wastewater Treatment Plant	kg	5,00E-03

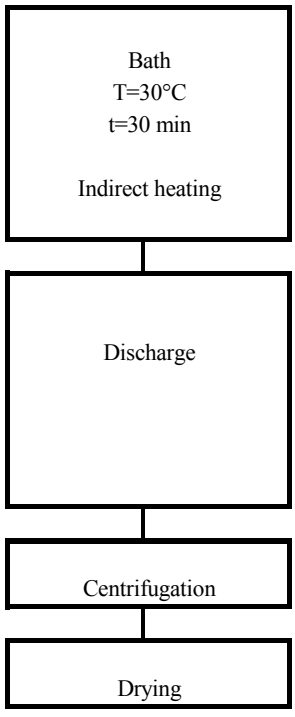
3 Softener Finishing (Morbidol) - Silk yarn

Name	Softener finishing
Sources	Report LCA I09: TM-108-004 **H.1.1 Softener finishing**
Reference year	2000
Geographic reference	Italy
Technological level	average
Reference flow	100 kg of silk yarn
Equipment	Autoclave operating mode: batch bath volume (m3): 2 run time (h): 0,75 N.of run/year 168 absorbed power (kW): 4 processed fabric per run (kg): 200 processed fabric (kg/yr): 33515
Notes	Production of chemicals considered: Acetic acid
Procedural steps (flow-chart)	

Water from Disinfection: equipment volume

Softener (10344) = 3%;
Acetic acid (10002)= 2 g/l.

Steam



Wastewater: equip. volume

*T [°C]= **30** ;*
*pH [-]= **5,4** ;*
*Conductivity [mS/cm]= **0,31** ;*
*COD [mg/l]= **1200** ;*
*TSS [mg/l]= **30** .*

	Flow	Units	Value
INPUTS	(r) Coal (in ground)	kg	3,86E-01
	(r) Iron (Fe, ore)	kg	8,25E-03
	(r) Natural Gas (in ground)	kg	1,55E+00
	(r) Oil (in ground)	kg	2,51E+00
	(r) Uranium (U, ore)	kg	1,44E-05
	Silk yarn: to Finishing	kg	1,00E+02
	Water: from Disinfection	l	1,00E+03
	Water: Unspecified Origin	l	1,48E+01
OUTPUTS	(a) Alkane (unspecified)	g	8,44E-01
	(a) Arsenic (As)	g	3,90E-04
	(a) Benzene (C6H6)	g	5,37E-02
	(a) Butane (n-C4H10)	g	1,26E-01
	(a) Cadmium (Cd)	g	6,08E-04
	(a) Carbon Dioxide (CO2, fossil)	g	6,44E+03
	(a) Carbon Monoxide (CO)	g	7,86E+00
	(a) Ethane (C2H6)	g	1,20E+00
	(a) Ethylene (C2H4)	g	8,13E-01
	(a) Hydrocarbons (except methane)	g	1,77E+01
	(a) Hydrocarbons (unspecified)	g	1,93E+01
	(a) Hydrogen Chloride (HCl)	g	3,47E-01
	(a) Lead (Pb)	g	1,65E-03
	(a) Manganese (Mn)	g	5,31E-04
	(a) Methane (CH4)	g	2,93E+01
	(a) Nickel (Ni)	g	1,20E-02
	(a) Nitrogen Oxides (NOx as NO2)	g	8,05E+00
	(a) Nitrous Oxide (N2O)	g	4,59E-02
	(a) Propane (C3H8)	g	2,21E-01
	(a) Sulphur Oxides (SOx as SO2)	g	2,50E+01
	(a) Toluene (C6H5CH3)	g	4,24E-02
	(a) Vanadium (V)	g	4,75E-02
	(s) Arsenic (As)	g	1,26E-05
	(s) Chromium (Cr III, Cr VI)	g	1,58E-04
	(s) Zinc (Zn)	g	4,75E-04
	(w) Ammonia (NH4+, NH3, as N)	g	1,99E-01
	(w) Benzene (C6H6)	g	3,24E-02
	(w) Cadmium (Cd++)	g	1,60E-04
	(w) Chromium (Cr III)	g	3,32E-04
	(w) Chromium (Cr III, Cr VI)	g	6,09E-04
	(w) COD (Chemical Oxygen Demand)	g	1,79E+01
	(w) Nitrate (NO3-)	g	3,18E-01
	(w) Nitrogenous Matter (unspecified, as N)	g	2,87E-01
	(w) Oils (unspecified)	g	2,68E-01
	Silk yarn: from Finishing	kg	1,00E+02
	Wastewater	l	1,00E+03
REMINDERS	E Feedstock Energy	MJ	9,50E+01
	E Fuel Energy	MJ	8,58E+01
	E Non Renewable Energy	MJ	1,78E+02
	E Renewable Energy	MJ	2,40E+00
	E Total Primary Energy	MJ	1,81E+02
	Electricity	MJ elec	1,66E+01
	COD: to Wastewater Treatment Plant	kg	1,20E+00
	TSS: to Wastewater Treatment Plant	kg	3,00E-02

4 Softener Finishing (Rucofil) - Silk yarn

Name	Softener finishing	
Sources	PIDACS I09	**H.1.2 Softener finishing**
Reference year	2000	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of silk yarn	
Equipment	Autoclave	
	operating mode:	batch
	bath volume (m3):	0,65
	run time (h):	0,75
	N. of run/year	817
	absorbed power (kW):	5
	processed fabric per run (kg):	40
	processed fabric (kg/yr):	32678
Notes	Production of chemicals considered: Acetic acid	

Procedural steps (flow-chart)

Water from Disinfection:
equipment volume

Softener = 1,5%
Acetic acid = 3 g/l

Steam

Bath
T=30°C
t=30 min

Indirect heating

Discharge

Centrifugation

Drying

Wasetwater: equip. volume

COD [mg/l]= 1436
TSS [mg/l]= 27

	Flow	Units	Value
INPUTS	(r) Iron (Fe, ore)	kg	1,67E-02
	(r) Natural Gas (in ground)	kg	2,91E+00
	(r) Oil (in ground)	kg	4,37E+00
	(r) Uranium (U, ore)	kg	1,86E-05
	Silk yarn	kg	1,00E+02
	Water from Disinfection	l	1,63E+03
	Water: Unspecified Origin	l	2,56E+01
OUTPUTS	(a) Alkane (unspecified)	g	1,25E+00
	(a) Arsenic (As)	g	1,29E-03
	(a) Benzene (C6H6)	g	9,76E-02
	(a) Butane (n-C4H10)	g	3,86E-01
	(a) Cadmium (Cd)	g	2,40E-03
	(a) Carbon Dioxide (CO2, fossil)	g	1,54E+04
	(a) Ethane (C2H6)	g	3,28E+00
	(a) Ethylene (C2H4)	g	1,53E+00
	(a) Hydrocarbons (except methane)	g	3,10E+01
	(a) Hydrocarbons (unspecified)	g	2,36E+01
	(a) Hydrogen Chloride (HCl)	g	8,99E-01
	(a) Lead (Pb)	g	5,56E-03
	(a) Methane (CH4)	g	8,40E+01
	(a) Nickel (Ni)	g	4,73E-02
	(a) Nitrogen Oxides (NOx as NO2)	g	2,25E+01
	(a) Nitrous Oxide (N2O)	g	1,56E-01
	(a) Propane (C3H8)	g	7,30E-01
	(a) Sulphur Oxides (SOx as SO2)	g	9,49E+01
	(a) Vanadium (V)	g	1,88E-01
	(s) Arsenic (As)	g	2,38E-05
	(s) Chromium (Cr III, Cr VI)	g	2,97E-04
	(s) Zinc (Zn)	g	8,93E-04
	(w) Ammonia (NH4+, NH3, as N)	g	3,00E-01
	(w) Benzene (C6H6)	g	5,65E-02
	(w) Cadmium (Cd++)	g	2,41E-04
	(w) Chromium (Cr III)	g	6,24E-04
	(w) Chromium (Cr III, Cr VI)	g	1,05E-03
	(w) COD (Chemical Oxygen Demand)	g	2,19E+01
	(w) Nitrate (NO3-)	g	3,99E-01
	(w) Nitrogenous Matter (unspecified, as N)	g	4,22E-01
	(w) Oils (unspecified)	g	4,65E-01
	Silk yarn	kg	1,00E+02
	Wastewater	l	1,63E+03
REMINDERS	E Feedstock Energy	MJ	1,20E+02
	E Fuel Energy	MJ	2,13E+02
	E Non Renewable Energy	MJ	3,22E+02
	E Renewable Energy	MJ	1,03E+01
	E Total Primary Energy	MJ	3,33E+02
	Electricity	MJ elec	7,81E+01
	COD: to Wastewater Treatment Plant	kg	2,33E+00
	TSS: to Wastewater Treatment Plant	kg	4,39E-02

5 Softener Finishing – Silk yarn

Name	Water finishing	
Sources	PIDACS I09	**H.4 Fabric softener finishing**
Reference year	2000	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of silk yarn	
Equipment	Rameuse	
	operating mode:	Continuous
	bath volume (m3):	0,1
	run time (h):	14,5
	N. of run/year	145
	absorbed power (kW):	31
	processed fabric per run (kg):	603
	processed fabric (kg/yr):	86840
Notes		

Procedural steps (flow-chart)

Water from Disinfection: 87 l/h

Water from Disinfection: 100 l/cycle

Doping

Wringing

Thermosetting (T=130°C)

Wastewater: 100 l/cycle

COD [mg/l]= 313
TSS [mg/l]= 15

	Flow	Units	Value
INPUTS	(r) Coal (in ground)	kg	4,94E+00
	(r) Iron (Fe, ore)	kg	7,37E-02
	(r) Natural Gas (in ground)	kg	1,19E+01
	(r) Oil (in ground)	kg	1,28E+01
	(r) Uranium (U, ore)	kg	1,39E-05
	Silk yarn	kg	1,00E+02
	Water from Disinfection	l	2,26E+02
	Water: Unspecified Origin	l	7,73E+01
OUTPUTS	(a) Alkane (unspecified)	g	2,42E+00
	(a) Arsenic (As)	g	8,09E-03
	(a) Benzene (C6H6)	g	3,47E-01
	(a) Butane (n-C4H10)	g	2,35E+00
	(a) Cadmium (Cd)	g	1,64E-02
	(a) Carbon Dioxide (CO2, fossil)	g	7,85E+04
	(a) Ethane (C2H6)	g	1,81E+01
	(a) Ethylene (C2H4)	g	6,16E+00
	(a) Hexane (C6H14)	g	4,60E-01
	(a) Hydrocarbons (except methane)	g	9,23E+01
	(a) Hydrocarbons (unspecified)	g	5,35E-02
	(a) Hydrogen Chloride (HCl)	g	4,73E+00
	(a) Lead (Pb)	g	3,52E-02
	(a) Methane (CH4)	g	4,81E+02
	(a) Nickel (Ni)	g	3,23E-01
	(a) Nitrogen Oxides (NOx as NO2)	g	1,23E+02
	(a) Nitrous Oxide (N2O)	g	9,45E-01
	(a) Propane (C3H8)	g	4,61E+00
	(a) Sulphur Oxides (SOx as SO2)	g	6,38E+02
	(a) Vanadium (V)	g	1,29E+00
	(s) Arsenic (As)	g	9,69E-05
	(s) Chromium (Cr III, Cr VI)	g	1,21E-03
	(s) Zinc (Zn)	g	3,64E-03
	(w) Ammonia (NH4+, NH3, as N)	g	5,60E-01
	(w) Benzene (C6H6)	g	1,66E-01
	(w) Cadmium (Cd++)	g	4,50E-04
	(w) Chromium (Cr III)	g	2,55E-03
	(w) Chromium (Cr III, Cr VI)	g	3,05E-03
	(w) Nitrate (NO3-)	g	1,07E-01
	(w) Nitrogenous Matter (unspecified, as N)	g	7,08E-01
	(w) Oils (unspecified)	g	1,43E+00
	Silk yarn	kg	1,00E+02
	Wastewater	l	1,66E+01
REMINDERS	E Feedstock Energy	MJ	4,28E+01
	E Fuel Energy	MJ	1,14E+03
	E Non Renewable Energy	MJ	1,11E+03
	E Renewable Energy	MJ	7,31E+01
	E Total Primary Energy	MJ	1,18E+03
	Electricity	MJ elec	5,72E+02
	COD: to Wastewater Treatment Plant	kg	5,19E-03
	TSS: to Wastewater Treatment Plant	kg	2,49E-04

6 Water Finishing – Mix acetate fabric

Name	Equipment washing	
Sources	PIDACS I04	**H.1 Water finishing**
Reference year	2000	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of mix acetate fabric	
Equipment	Rameuse	
	operating mode	continuous
	bath volume (m3):	50
	run time (h,m):	11,00
	n. of run/year	102
	absorbed power (kW):	81
	processed fabric per run (kg):	7700
	processed fabric (kg/yr):	767993
Notes		
Procedural steps (flow-chart)		

Water from Softening: 50 l

Water from Storage (Reintegration): 250 l/h

Doping

Wringing

Thermosetting (T=130°C)

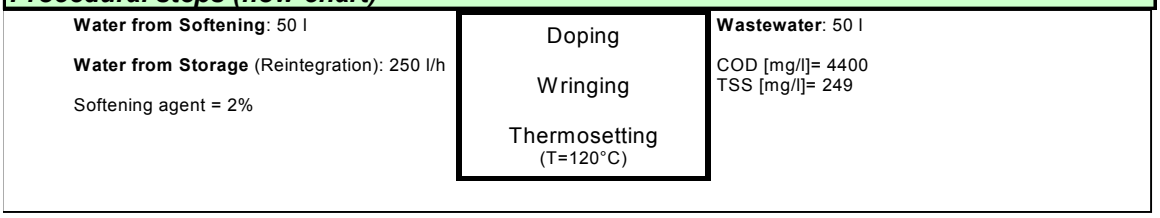
Wastewater: 50 l

COD [mg/l]= 400
TSS [mg/l]= 50

	Flow	Units	Value
INPUTS	(r) Iron (Fe, ore)	kg	1,13E-01
	(r) Natural Gas (in ground)	kg	1,77E+01
	(r) Oil (in ground)	kg	2,19E+01
	(r) Uranium (U, ore)	kg	1,86E-05
	Mix acetate fabric	kg	1,00E+02
	Water from Softening Treatment	l	7,14E+00
	Water from Storage	l	3,57E+01
	Water: Unspecified Origin	l	1,23E+02
OUTPUTS	(a) Alkane (unspecified)	g	3,83E+00
	(a) Arsenic (As)	g	1,38E-02
	(a) Benzene (C6H6)	g	5,48E-01
	(a) Butane (n-C4H10)	g	3,92E+00
	(a) Cadmium (Cd)	g	2,79E-02
	(a) Carbon Dioxide (CO2, fossil)	g	1,28E+05
	(a) Ethane (C2H6)	g	3,06E+01
	(a) Ethylene (C2H4)	g	9,23E+00
	(a) Hexane (C6H14)	g	7,85E-01
	(a) Hydrocarbons (except methane)	g	1,56E+02
	(a) Hydrogen Chloride (HCl)	g	8,03E+00
	(a) Lead (Pb)	g	5,99E-02
	(a) Methane (CH4)	g	8,14E+02
	(a) Nickel (Ni)	g	5,51E-01
	(a) Nitrogen Oxides (NOx as NO2)	g	2,07E+02
	(a) Nitrous Oxide (N2O)	g	1,60E+00
	(a) Propane (C3H8)	g	7,77E+00
	(a) Sulphur Oxides (SOx as SO2)	g	1,09E+03
	(a) Toluene (C6H5CH3)	g	4,25E-01
	(a) Vanadium (V)	g	2,19E+00
	(s) Arsenic (As)	g	1,44E-04
	(s) Chromium (Cr III, Cr VI)	g	1,80E-03
	(s) Zinc (Zn)	g	5,41E-03
	(w) Ammonia (NH4+, NH3, as N)	g	9,55E-01
	(w) Benzene (C6H6)	g	2,83E-01
	(w) Cadmium (Cd++)	g	7,64E-04
	(w) Chromium (Cr III)	g	3,78E-03
	(w) Chromium (Cr III, Cr VI)	g	5,20E-03
	(w) COD (Chemical Oxygen Demand)	g	1,19E+00
	(w) Nitrate (NO3-)	g	1,82E-01
	(w) Nitrogenous Matter (unspecified, as N)	g	1,21E+00
	(w) Oils (unspecified)	g	2,33E+00
	Mix acetate fabric	kg	1,00E+02
	Wastewater	l	7,14E+00
REMINDERS	E Feedstock Energy	MJ	7,27E+01
	E Fuel Energy	MJ	1,83E+03
	E Non Renewable Energy	MJ	1,78E+03
	E Renewable Energy	MJ	1,25E+02
	E Total Primary Energy	MJ	1,90E+03
	Electricity	MJ elec	9,76E+02
	COD to Wastewater Treatment Plant	kg	4,76E-04
	TSS to Wastewater Treatment Plant	kg	5,95E-05

7 Softener3 Finishing

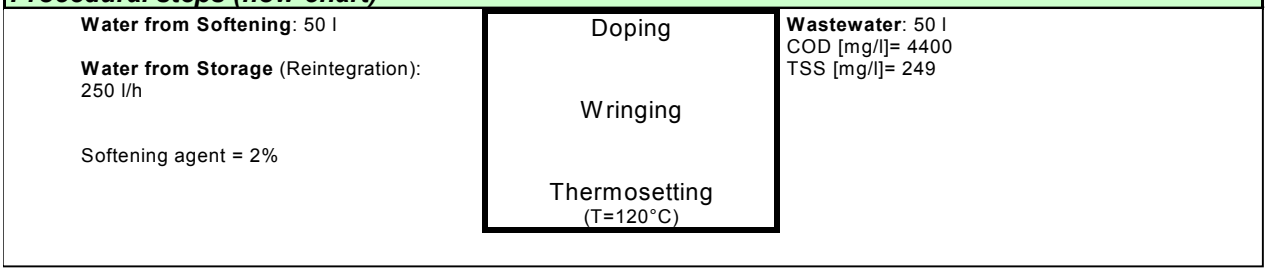
Name	Softener 3 Finishing	
Sources	PIDACS I04	**H.2.3 Softener3 finishing**
Reference year	2000	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of fabric	
Equipment	Rameuse	
	operating mode	continuous
	bath volume (m3):	50
	run time (h,m):	11,00
	n. of run/year	13
	absorbed power (kW):	81
	processed fabric per run (kg):	7700
	processed fabric (kg/yr):	95340
Notes		
Procedural steps (flow-chart)		



	Flow	Units	Value
INPUTS	(r) Iron (Fe, ore)	kg	5,06E-02
	(r) Natural Gas (in ground)	kg	9,95E+00
	(r) Oil (in ground)	kg	2,10E+00
	(r) Uranium (U, ore)	kg	1,79E-05
	Fabric	kg	1,00E+02
	Water from Softening Treatment	l	6,49E-01
	Water from Storage	l	3,57E+01
	Water: Unspecified Origin	l	2,55E+01
OUTPUTS	(a) Alkane (unspecified)	g	1,31E+00
	(a) Arsenic (As)	g	1,38E-03
	(a) Benzene (C6H6)	g	2,14E-01
	(a) Butane (n-C4H10)	g	6,39E-01
	(a) Cadmium (Cd)	g	2,62E-03
	(a) Carbon Dioxide (CO2, fossil)	g	3,26E+04
	(a) Ethane (C2H6)	g	3,86E+00
	(a) Ethylene (C2H4)	g	4,95E+00
	(a) Hydrocarbons (except methane)	g	1,96E+01
	(a) Hydrocarbons (unspecified)	g	1,88E-02
	(a) Hydrogen Chloride (HCl)	g	9,05E-01
	(a) Lead (Pb)	g	8,24E-03
	(a) Methane (CH4)	g	9,83E+01
	(a) Nickel (Ni)	g	5,17E-02
	(a) Nitrogen Oxides (NOx as NO2)	g	3,11E+01
	(a) Nitrous Oxide (N2O)	g	2,09E-01
	(a) Propane (C3H8)	g	1,04E+00
	(a) Sulphur Oxides (SOx as SO2)	g	1,08E+02
	(a) Vanadium (V)	g	2,05E-01
	(s) Arsenic (As)	g	8,21E-05
	(s) Chromium (Cr III, Cr VI)	g	1,03E-03
	(s) Zinc (Zn)	g	3,08E-03
	(w) Ammonia (NH4+, NH3, as N)	g	9,72E-02
	(w) Benzene (C6H6)	g	2,87E-02
	(w) Cadmium (Cd++)	g	8,53E-05
	(w) Chromium (Cr III)	g	2,16E-03
	(w) Chromium (Cr III, Cr VI)	g	5,07E-04
	(w) COD (Chemical Oxygen Demand)	g	2,40E-01
	(w) Nitrite (NO2-)	g	3,70E-05
	(w) Nitrogenous Matter (unspecified, as N)	g	1,19E-01
	(w) Oils (unspecified)	g	5,68E-01
	Fabric	kg	1,00E+02
	Wastewater	l	6,49E-01
REMINDERS	E Feedstock Energy	MJ	8,06E+00
	E Fuel Energy	MJ	5,22E+02
	E Non Renewable Energy	MJ	5,18E+02
	E Renewable Energy	MJ	1,24E+01
	E Total Primary Energy	MJ	5,30E+02
	Electricity	MJ elec	9,44E+01
	COD to Wastewater Treatment Plant	kg	2,86E-03
	TSS to Wastewater Treatment Plant	kg	1,62E-04

8 Softener Finishing - Viscose fabric

Name	Softener 2 finishing	
Sources	Report LCA I04: TM-108-005 **H.2.2 Softener Finishing**	
Reference year	2000	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of viscose fabric	
Equipment	Rameuse	
	operating mode:	continuous
	bath volume (m3):	50
	cycle time (h:m):	11
	n. of cycle/year	74
	absorbed power (kW):	81
	processed fabric per hour (kg/h):	700
	processed fabric (kg/yr):	562427
Notes	Production of softening agent is excluded because of lack of data.	
Procedural steps (flow-chart)		



	Flow	Units	Value
INPUTS	(r) Iron (Fe, ore)	kg	5,06E-02
	(r) Natural Gas (in ground)	kg	9,95E+00
	(r) Oil (in ground)	kg	2,13E+00
	(r) Uranium (U, ore)	kg	1,79E-05
	Viscose fabric to: Finishing	kg	1,00E+02
	Water from Softening Treatment	l	7,11E-01
	Water from Storage	l	3,57E+01
	Water: Unspecified Origin	l	2,56E+01
OUTPUTS	(a) Alkane (unspecified)	g	1,31E+00
	(a) Arsenic (As)	g	1,38E-03
	(a) Butane (n-C4H10)	g	6,41E-01
	(a) Cadmium (Cd)	g	2,63E-03
	(a) Carbon Dioxide (CO2, fossil)	g	3,27E+04
	(a) Ethane (C2H6)	g	3,87E+00
	(a) Ethylene (C2H4)	g	4,96E+00
	(a) Hydrocarbons (except methane)	g	2,03E+01
	(a) Hydrogen Chloride (HCl)	g	9,05E-01
	(a) Lead (Pb)	g	1,03E-02
	(a) Methane (CH4)	g	9,85E+01
	(a) Nickel (Ni)	g	5,18E-02
	(a) Nitrogen Oxides (NOx as NO2)	g	3,18E+01
	(a) Propane (C3H8)	g	1,04E+00
	(a) Sulphur Oxides (SOx as SO2)	g	1,08E+02
	(a) Vanadium (V)	g	2,05E-01
	(s) Arsenic (As)	g	8,21E-05
	(s) Chromium (Cr III, Cr VI)	g	1,03E-03
	(s) Zinc (Zn)	g	3,08E-03
	(w) Ammonia (NH4+, NH3, as N)	g	1,00E-01
	(w) Benzene (C6H6)	g	2,92E-02
	(w) Cadmium (Cd++)	g	8,77E-05
	(w) Chromium (Cr III)	g	2,16E-03
	(w) Chromium (Cr III, Cr VI)	g	5,15E-04
	(w) COD (Chemical Oxygen Demand)	g	2,45E-01
	(w) Nitrate (NO3-)	g	1,93E-02
	(w) Nitrogenous Matter (unspecified, as N)	g	1,22E-01
	(w) Oils (unspecified)	g	5,71E-01
	Viscose fabric	kg	1,00E+02
	Wastewater	l	7,11E-01
REMINDERS	E Feedstock Energy	MJ	8,02E+00
	E Fuel Energy	MJ	5,24E+02
	E Non Renewable Energy	MJ	5,19E+02
	E Renewable Energy	MJ	1,24E+01
	E Total Primary Energy	MJ	5,32E+02
	Electricity	MJ elec	9,43E+01
	COD to Wastewater Treatment Plant	Kg	3,13E-03
	TSS to Wastewater Treatment Plant	Kg	1,77E-04

9 Aronina® Softener Finishing – Pes fabric

Name	Aronina Softener Finishing	
Sources	PIDACS I15	**M.3.1 Aronina softener finishing**
Reference year	2001	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of PES fabric	
Equipment	Rameuse	
	operating mode:	continuous
	bath volume (m3):	100
	cycle time (h,m):	2,48
	N. of cycle/year	142
	absorbed power (kW):	29,6
	processed fabric per cycle (kg):	504
	processed fabric (kg/yr):	71446
Notes	Production of softening agent is excluded because of lack of data.	
Procedural steps (flow-chart)		

Water from Softening: 100 l + 180 l/h **(reintegration)**

Softening agent = 10 g/l

Doping

Wringing

Thermosetting (T=120°C)

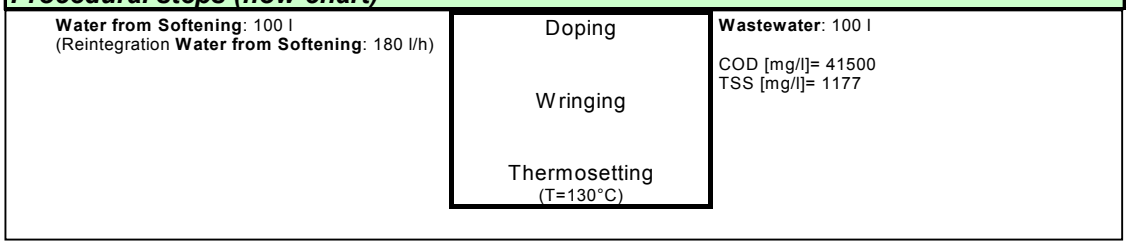
Wastewater: 100 l

COD [mg/l]= 3350
TSS [mg/l]= 249

	Flow	Units	Value
INPUT	(r) Iron (Fe, ore)	kg	4,14E-02
	(r) Natural Gas (in ground)	kg	7,82E+00
	(r) Oil (in ground)	kg	2,88E+00
	(r) Uranium (U, ore)	kg	1,32E-05
	PES fabric	kg	1,00E+02
	Water: from Softening Treatment	litre	1,19E+02
	Water: Unspecified Origin	litre	2,80E+01
OUTPUT	(a) Aldehyde (unspecified)	g	3,14E+00
	(a) Alkane (unspecified)	g	1,13E+00
	(a) Ammonia (NH3)	g	1,56E+01
	(a) Arsenic (As)	g	1,86E-03
	(a) Benzene (C6H6)	g	1,68E-01
	(a) Butane (n-C4H10)	g	6,92E-01
	(a) Cadmium (Cd)	g	3,66E-03
	(a) Carbon Dioxide (CO2, fossil)	g	3,03E+04
	(a) Carbon Monoxide (CO)	g	1,60E+01
	(a) Ethane (C2H6)	g	4,66E+00
	(a) Ethylene (C2H4)	g	3,92E+00
	(a) Hydrocarbons (except methane)	g	2,34E+01
	(a) Hydrogen Chloride (HCl)	g	1,15E+00
	(a) Lead (Pb)	g	8,40E-03
	(a) Methane (CH4)	g	1,21E+02
	(a) Nickel (Ni)	g	7,22E-02
	(a) Nitrogen Oxides (NOx as NO2)	g	3,44E+01
	(a) Propane (C3H8)	g	1,22E+00
	(a) Sulphur Oxides (SOx as SO2)	g	1,46E+02
	(a) Toluene (C6H5CH3)	g	1,01E-01
	(a) Vanadium (V)	g	2,87E-01
	(w) Ammonia (NH4+, NH3, as N)	g	1,29E-01
	(w) Benzene (C6H6)	g	3,83E-02
	(w) Cadmium (Cd++)	g	1,08E-04
	(w) Chromium (Cr III)	g	1,69E-03
	(w) Chromium (Cr III, Cr VI)	g	6,89E-04
	(w) Nitrogenous Matter (unspecified, as N)	g	1,60E-01
	(w) Oils (unspecified)	g	5,36E-01
	(s) Arsenic (As)	g	6,44E-05
	(s) Chromium (Cr III, Cr VI)	g	8,06E-04
	(s) Zinc (Zn)	g	2,42E-03
	PES fabric	kg	1,00E+02
	Wastewater	litre	1,98E+01
REMINDERS	E Feedstock Energy	MJ	1,04E+01
	E Fuel Energy	MJ	4,72E+02
	E Non Renewable Energy	MJ	4,65E+02
	E Renewable Energy	MJ	1,68E+01
	E Total Primary Energy	MJ	4,82E+02
	Electricity	MJ elec	1,30E+02
	COD to Wastewater Treatment Plant	kg	6,65E-02
	TSS to Wastewater Treatment Plant	kg	4,94E-03

10 Morbidol® Finishing – Silk fabric

Name	Morbidol Softener finishing	
Sources	Report LCA I15: TM-108-006	**M.3.4 Morbidol finishing**
Reference year	2001	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of silk fabric	
Equipment	Rameuse	
	operating mode:	continuous
	bath volume (m3):	100
	cycle time (h,m):	2,48
	N. of cycle/year	383
	absorbed power (kW):	29,6
	processed fabric per hour (kg/h):	180
	processed fabric (kg/yr):	193090
Notes		
Procedural steps (flow-chart)		



	Flow	Units	Value
INPUT	(r) Iron (Fe, ore)	Kg	4,14E-02
	(r) Natural Gas (in ground)	kg	7,82E+00
	(r) Oil (in ground)	kg	2,88E+00
	(r) Uranium (U, ore)	kg	1,32E-05
	Silk fabric to Finishing	kg	1,00E+02
	Water: from Softening Treatment	litre	1,20E+02
	Water: Unspecified Origin	litre	2,80E+01
OUTPUT	(a) Aldehyde (unspecified)	g	3,14E+00
	(a) Alkane (unspecified)	g	1,13E+00
	(a) Ammonia (NH3)	g	1,56E+01
	(a) Arsenic (As)	g	1,86E-03
	(a) Benzene (C6H6)	g	1,66E-01
	(a) Butane (n-C4H10)	g	6,92E-01
	(a) Cadmium (Cd)	g	3,66E-03
	(a) Carbon Dioxide (CO2, fossil)	g	3,03E+04
	(a) Ethane (C2H6)	g	4,66E+00
	(a) Ethylene (C2H4)	g	3,92E+00
	(a) Hydrocarbons (except methane)	g	2,34E+01
	(a) Hydrogen Chloride (HCl)	g	1,15E+00
	(a) Lead (Pb)	g	8,19E-03
	(a) Methane (CH4)	g	1,21E+02
	(a) Nickel (Ni)	g	7,22E-02
	(a) Nitrogen Oxides (NOx as NO2)	g	3,44E+01
	(a) Propane (C3H8)	g	1,22E+00
	(a) Sulphur Oxides (SOx as SO2)	g	1,46E+02
	(a) Vanadium (V)	g	2,87E-01
	(s) Arsenic (As)	g	6,44E-05
	(s) Chromium (Cr III, Cr VI)	g	8,06E-04
	(s) Zinc (Zn)	g	2,42E-03
	(w) Ammonia (NH4+, NH3, as N)	g	1,28E-01
	(w) COD (Chemical Oxygen Demand)	g	2,38E-01
	(w) Nitrate (NO3-)	g	2,54E-02
	(w) Nitrogenous Matter (unspecified, as N)	g	1,60E-01
	Silk fabric to Finishing	kg	1,00E+02
	Wastewater	litre	1,97E+01
REMINDERS	E Feedstock Energy	MJ	1,04E+01
	E Fuel Energy	MJ	4,72E+02
	E Non Renewable Energy	MJ	4,65E+02
	E Renewable Energy	MJ	1,68E+01
	E Total Primary Energy	MJ	4,82E+02
	Electricity	MJ elec	1,30E+02
	COD to Wastewater Treatment Plant	kg	8,17E-01
	TSS to Wastewater Treatment Plant	Kg	2,32E-02

11 Waterproof Finishing – Silk fabric

Name	Waterproof Finishing	
Sources	PIDACS I15	**M.5 Waterproof finishing**
Reference year	2001	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of silk fabric	
Equipment	Rameuse	
	operating mode:	continuous
	bath volume (m3):	100
	cycle time (h,m):	2,48
	N. of cycle/year	375
	absorbed power (kW):	29,6
	processed fabric per cycle (kg):	504
	processed fabric (kg/yr):	189125
Notes		

Procedural steps (flow-chart)

Water from Softening: 100 l
(Reintegration
Water from Softening: 180 l/h)

Doping

Wringing

Thermosetting
(T=120°C)

Wastewater: 100 l

COD [mg/l]= 35900
TSS [mg/l]= 323

	Flow	Units	Value
INPUT	(r) Coal (in ground)	kg	1,23E+00
	(r) Iron (Fe, ore)	kg	4,14E-02
	(r) Natural Gas (in ground)	kg	7,82E+00
	(r) Oil (in ground)	kg	2,87E+00
	(r) Uranium (U, ore)	kg	1,32E-05
	Silk fabric	kg	1,00E+02
	Water: from Softening Treatment	litre	1,20E+02
	Water: Unspecified Origin	litre	2,80E+01
OUTPUT	(a) Aldehyde (unspecified)	g	3,14E+00
	(a) Alkane (unspecified)	g	1,13E+00
	(a) Ammonia (NH3)	g	1,56E+01
	(a) Arsenic (As)	g	1,86E-03
	(a) Benzene (C6H6)	g	1,66E-01
	(a) Butane (n-C4H10)	g	6,92E-01
	(a) Carbon Dioxide (CO2, fossil)	g	3,03E+04
	(a) Cadmium (Cd)	g	3,66E-03
	(a) Ethane (C2H6)	g	4,66E+00
	(a) Ethylene (C2H4)	g	3,92E+00
	(a) Hexane (C6H14)	g	1,03E-01
	(a) Hydrocarbons (except methane)	g	2,34E+01
	(a) Hydrogen Chloride (HCl)	g	1,15E+00
	(a) Lead (Pb)	g	8,19E-03
	(a) Methane (CH4)	g	1,21E+02
	(a) Nickel (Ni)	g	7,22E-02
	(a) Nitrogen Oxides (NOx as NO2)	g	3,44E+01
	(a) Propane (C3H8)	g	1,22E+00
	(a) Sulphur Oxides (SOx as SO2)	g	1,46E+02
	(a) Vanadium (V)	g	2,87E-01
	(w) Ammonia (NH4+, NH3, as N)	g	1,28E-01
	(w) Benzene (C6H6)	g	3,82E-02
	(w) Cadmium (Cd++)	g	1,08E-04
	(w) Chromium (Cr III)	g	1,69E-03
	(w) Chromium (Cr III, Cr VI)	g	6,89E-04
	(w) Nitrogenous Matter (unspecified, as N)	g	1,60E-01
	(w) Oils (unspecified)	g	5,36E-01
	(s) Arsenic (As)	g	6,44E-05
	(s) Chromium (Cr III, Cr VI)	g	8,06E-04
	(s) Zinc (Zn)	g	2,42E-03
	Silk fabric	kg	1,00E+02
	Wastewater	litre	1,98E+01
REMINDERS	E Feedstock Energy	MJ	1,04E+01
	E Fuel Energy	MJ	4,72E+02
	E Non Renewable Energy	MJ	4,65E+02
	E Renewable Energy	MJ	1,68E+01
	E Total Primary Energy	MJ	4,82E+02
	Electricity	MJ elec	1,30E+02
	COD to Wastewater Treatment Plant	kg	7,12E-01
	TSS to Wastewater Treatment Plant	kg	6,41E-03