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ANNEX 2
MODULES OF TEXTILES PRETREATMENT PROCESS

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1 Scouring - Flax/Pes fabric

Name	Desizing&Scouring	
Sources	Report LCA I06: TM-108-002	F.1.4 Scouring in Torpedo at 60°C
Reference year	2000	
Geographic reference	Italy	
Technological level	modern	
Reference flow	100 kg of flax/pes fabric	
Equipment	Torpedo operating mode: batch bath volume (m3): 2,5 run time (h): 2,6 N.of run/year 309 absorbed power (kW): 22 processed fabric per run (kg): 149 processed fabric (kg/yr): 46088	
Notes		
Procedural steps (flow-chart)		
Water:from Softening Treatment:equip volume Non ionic surfactant (1058)=3 g/l. Steam Water:from Softening Treatment:1500 l Water:from Softening Treatment:equip volume	<pre> graph TD A["Bath T=60°C t=50 min Indirect heating"] --> B["Continuous washing"] B --> C["Discharge"] C --> D["Washing"] D --> E["Discharge"] </pre>	Wastewater: 1500 l <i>COD [mg/l]= 1250;</i> <i>TSS [mg/l]= 115</i> Wastewater: equip. volume <i>COD [mg/l]= 810;</i> <i>TSS [mg/l]= 65;</i> Wastewater: equip. volume <i>COD [mg/l]= 150</i> <i>TSS [mg/l]= 12</i>

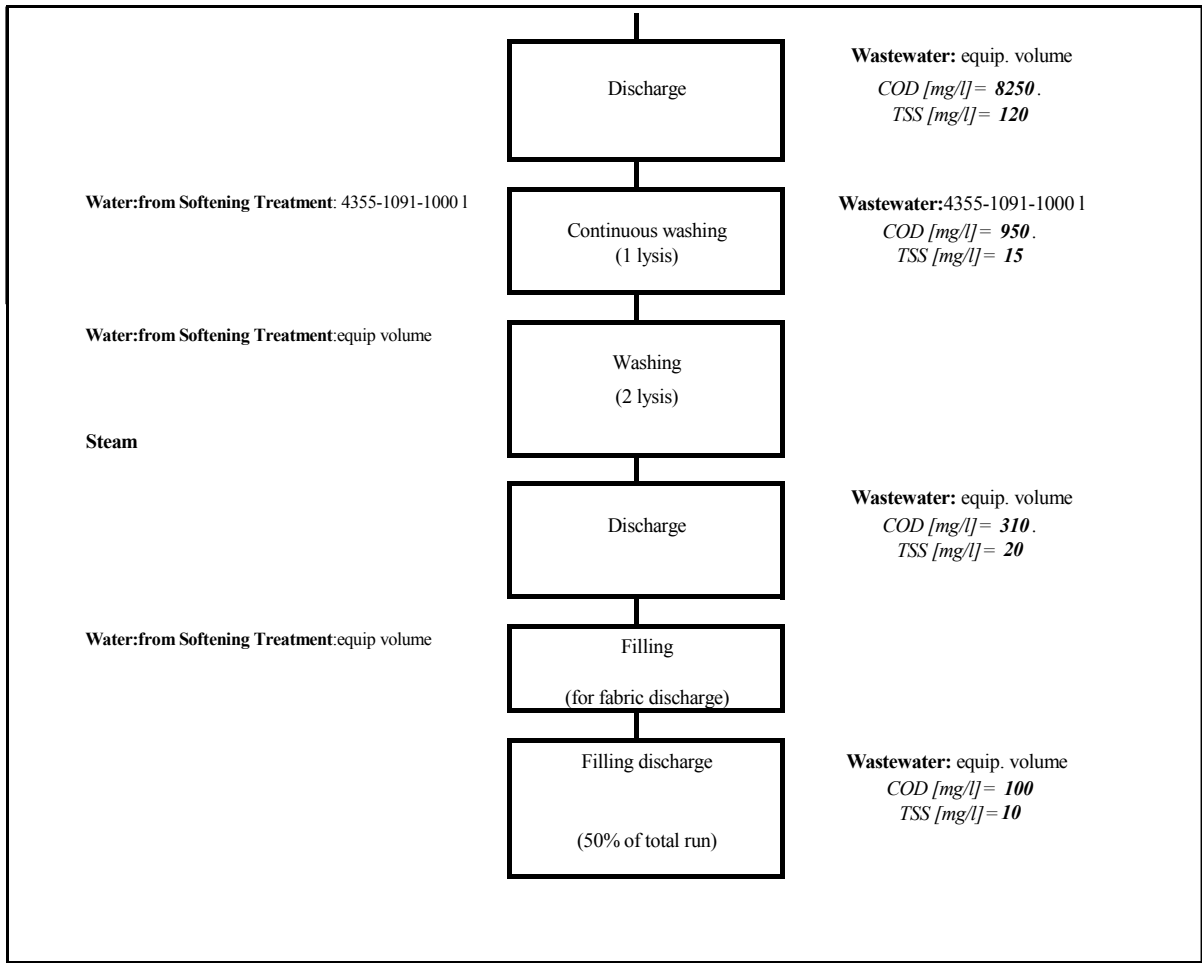
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	Flow	Units	Value	
INPUTS	(r) Iron (Fe, ore)	kg	1,23E-01	
	(r) Natural Gas (in ground)	kg	2,36E+01	
	(r) Oil (in ground)	kg	6,76E+00	
	(r) Uranium (U, ore)	kg	4,12E-05	
	Flax/Pes fabric: to Scouring	kg	1,00E+02	
	Water: Public Network	litre	0,00E+00	
	Water: Unspecified Origin	litre	6,23E+01	
	Water: Well	litre	0,00E+00	
	Water: from Softening Treatment	litre	5,94E+03	
OUTPUTS	(a) Alkane (unspecified)	g	3,27E+00	
	(a) Arsenic (As)	g	4,43E-03	
	(a) Benzene (C6H6)	g	4,80E-01	
	(a) Butane (n-C4H10)	g	1,80E+00	
	(a) Cadmium (Cd)	g	8,60E-03	
	(a) Carbon Dioxide (CO2, fossil)	g	8,43E+04	
	(a) Ethane (C2H6)	g	1,16E+01	
	(a) Ethylene (C2H4)	g	1,18E+01	
	(a) Heptane (C7H16)	g	1,21E-01	
	(a) Hexane (C6H14)	g	2,43E-01	
	(a) Hydrocarbons (except methane)	g	5,77E+01	
	(a) Lead (Pb)	g	1,96E-02	
	(a) Methane (CH4)	g	2,98E+02	
	(a) Nickel (Ni)	g	1,70E-01	
	(a) Nitrogen Oxides (NOx as NO2)	g	8,79E+01	
	(a) Nitrous Oxide (N2O)	g	5,95E-01	
	(a) Propane (C3H8)	g	3,06E+00	
	(a) Sulphur Oxides (SOx as SO2)	g	3,47E+02	
	(a) Toluene (C6H5CH3)	g	2,81E-01	
	(a) Vanadium (V)	g	6,73E-01	
	(s) Arsenic (As)	g	1,95E-04	
	(s) Chromium (Cr III, Cr VI)	g	2,44E-03	
	(s) Zinc (Zn)	g	7,32E-03	
	(w) Ammonia (NH4+, NH3, as N)	g	3,04E-01	
	(w) Benzene (C6H6)	g	9,10E-02	
	(w) Cadmium (Cd++)	g	2,60E-04	
	(w) Chromium (Cr III)	g	5,12E-03	
	(w) Chromium (Cr III, Cr VI)	g	1,62E-03	
	(w) Nitrogenous Matter (unspecified, as N)	g	3,76E-01	
	(w) Oils (unspecified)	g	1,48E+00	
	Flax/Pes fabric: to Dyeing Flax	kg	1,00E+02	
	Wastewater	litre	5,94E+03	
	REMINDERS	E Feedstock Energy	MJ	2,52E+01
		E Fuel Energy	MJ	1,33E+03
		E Non Renewable Energy	MJ	1,31E+03
E Renewable Energy		MJ	3,99E+01	
E Total Primary Energy		MJ	1,35E+03	
Electricity		MJ elec	1,69E+02	
COD: to Wastewater Treatment Plant		kg	3,68E+00	
TSS: to Wastewater Treatment Plant		kg	3,10E-01	

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2 Desizing - Flax/Pes fabric

Name	Desizing&Scouring	
Sources	Report LCA I06: TM-108-002	F.3.2 Desizing in Jigger at 70°-90°C
Reference year	2000	
Geographic reference	Italy	
Technological level	modern	
Reference flow	100 kg of flax/pes fabric	
Equipment	Jigger operating mode: batch bath volume (m3): 2 run time (h): 5 N. of run/year 257 absorbed power (kW): 25 processed fabric per run (kg): 197 processed fabric (kg/yr): 50556	
Notes	Production of chemicals considered: Soda Solvay, Sodium Hydrosulphite	
Procedural steps (flow-chart)		
<p>Water:from Softening Treatment:equip volume</p> <p>Non ionic surfactant (2057)=7,5 g/l; Sodium Hydrosulphite (1017)=2 g/l.</p> <p>Steam</p>	<div style="border: 1px solid black; padding: 5px; text-align: center;"> 1st bath T=70-90°C t=30 min Indirect heating </div>	
	↓	
	Discharge	Wastewater: equip. volume COD [mg/l]= 10750 TSS [mg/l]= 185
	↓	
<p>Water:from Softening Treatment:equip volume</p> <p>Non ionic surfactant (2057)=7,5 g/l; Sodium Hydrosulphite (1017)=2 g/l.</p> <p>Steam</p>	<div style="border: 1px solid black; padding: 5px; text-align: center;"> 2nd bath T=70-90°C t=30 min Indirect heating </div>	
	↓	
	Discharge	Wastewater: equip. volume COD [mg/l]= 8600. TSS [mg/l]= 93
	↓	
<p>Water:from Softening Treatment:equip volume</p> <p>Sodium Hydrosulphite (1017)=2 g/l; Non ionic surfactant (1058)=2 g/l; Soda Solvay (1016)=0,5 g/l; Surfactant (2057)=7,5 g/l.</p> <p>Steam</p>	<div style="border: 1px solid black; padding: 5px; text-align: center;"> 3rd bath T=70-90°C t=30 min Indirect heating </div>	
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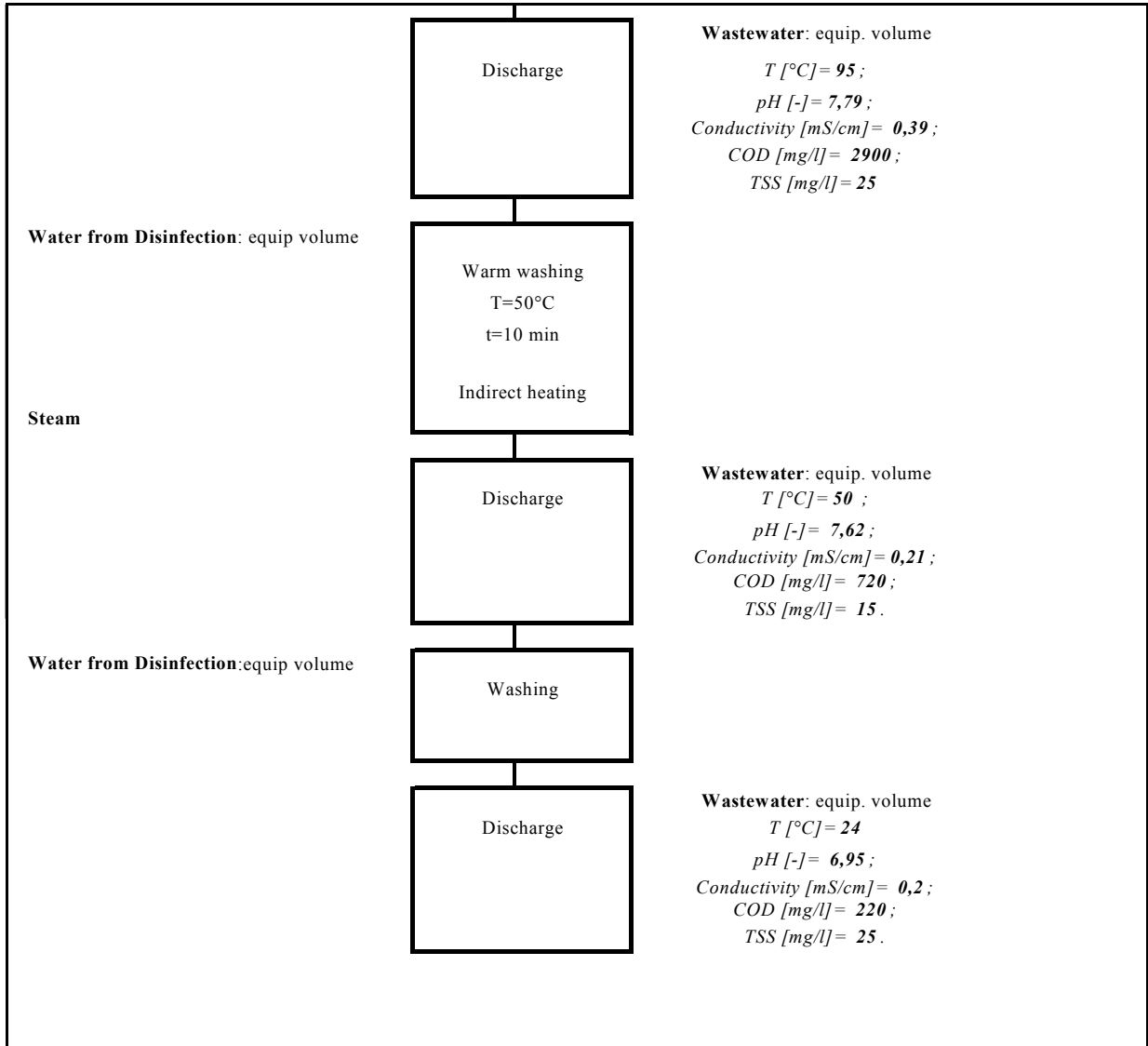


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	Flow	Units	Value	
INPUTS	(r) Iron (Fe, ore)	kg	4,05E-01	
	(r) Natural Gas (in ground)	kg	8,12E+01	
	(r) Oil (in ground)	kg	1,23E+01	
	(r) Potassium Chloride (KCl, as K2O, in ground)	kg	7,29E-02	
	(r) Uranium (U, ore)	kg	2,62E-04	
	Flax/Pes fabric: to Scouring	kg	1,00E+02	
	Water: Public Network	litre	6,72E+00	
	Water: Unspecified Origin	litre	1,69E+02	
	Water:Well	litre	1,54E-04	
	Water: from Softening Treatment	litre	7,29E+03	
OUTPUTS	(a) Alkane (unspecified)	g	1,02E+01	
	(a) Arsenic (As)	g	8,04E-03	
	(a) Benzene (C6H6)	g	1,51E+00	
	(a) Butane (n-C4H10)	g	4,40E+00	
	(a) Cadmium (Cd)	g	1,48E-02	
	(a) Carbon Dioxide (CO2, fossil)	g	2,49E+05	
	(a) Ethane (C2H6)	g	2,47E+01	
	(a) Ethylene (C2H4)	g	4,01E+01	
	(a) Heptane (C7H16)	g	2,14E-01	
	(a) Hexane (C6H14)	g	4,29E-01	
	(a) Hydrocarbons (except methane)	g	1,65E+02	
	(a) Hydrocarbons (unspecified)	g	5,24E+00	
	(a) Hydrogen Chloride (HCl)	g	8,85E+00	
	(a) Lead (Pb)	g	3,77E-02	
	(a) Methane (CH4)	g	6,53E+02	
	(a) Nickel (Ni)	g	2,93E-01	
	(a) Nitrogen Oxides (NOx as NO2)	g	2,30E+02	
	(a) Nitrous Oxide (N2O)	g	1,57E+00	
	(a) Propane (C3H8)	g	6,75E+00	
	(a) Sulphur Oxides (SOx as SO2)	g	6,64E+02	
	(a) Toluene (C6H5CH3)	g	8,15E-01	
	(a) Vanadium (V)	g	1,15E+00	
	(s) Arsenic (As)	g	6,66E-04	
	(s) Chromium (Cr III, Cr VI)	g	8,34E-03	
	(s) Zinc (Zn)	g	2,50E-02	
	(w) Ammonia (NH4+, NH3, as N)	g	5,69E-01	
	(w) Benzene (C6H6)	g	1,68E-01	
	(w) Cadmium (Cd++)	g	5,18E-04	
	(w) Chromate (CrO4--)	g	1,40E-03	
	(w) Chromium (Cr III)	g	1,75E-02	
	(w) Nitrogenous Matter (unspecified, as N)	g	7,03E-01	
	(w) Oils (unspecified)	g	4,33E+00	
	Flax/Pes fabric: to Dyeing Flax	kg	1,00E+02	
	Wastewater	litre	7,29E+03	
	REMINDERS	E Feedstock Energy	MJ	7,64E+01
		E Fuel Energy	MJ	4,06E+03
		E Non Renewable Energy	MJ	4,06E+03
		E Renewable Energy	MJ	7,48E+01
		E Total Primary Energy	MJ	4,13E+03
		Electricity	MJ elec	3,48E+02
COD: to Wastewater Treatment Plant		kg	2,94E+01	
TSS: to Wastewater Treatment Plant		kg	4,52E-01	

3 HT Scouring – Silk yarn

Name	HT Scouring	
Sources	Report LCA I09: TM-108-004	F.1.3 HT scouring
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): 1,1 N.of run/year 552 absorbed power (kW): 4 processed fabric per run (kg): 200 processed fabric (kg/yr): 110397	
Notes		
Procedural steps (flow-chart)		
<p>Water from Disinfection:equip volume</p> <p>Solubilizing agent (10389)= 5 g/l; Sequestering agent (10433)= 2 g/l.</p> <p>Steam</p>	<div style="border: 1px solid black; padding: 5px; text-align: center;"> 1st bath T=130°C t=40 min Indirect heating </div>	
	↓	
	<div style="border: 1px solid black; padding: 5px; text-align: center;"> Discharge </div>	<p>Wastewater: equip. volume T [°C]= 110 ; pH [-]= 7,26 ; Conductivity [mS/cm]= 0,88 ; COD [mg/l]= 18785 ; TSS [mg/l]=.</p>
	↓	
<p>Water from Disinfection:equip volume</p> <p>Sequestering -dispersant agent (10299)=g/l;</p> <p>Steam</p>	<div style="border: 1px solid black; padding: 5px; text-align: center;"> 2nd bath T=98°C t=20 min Indirect heating </div>	



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	Flow	Units	Value	
INPUTS	(r) Coal (in ground)	kg	1,55E+00	
	(r) Iron (Fe, ore)	kg	2,53E-01	
	(r) Natural Gas (in ground)	kg	5,22E+01	
	(r) Oil (in ground)	kg	8,34E-01	
	(r) Uranium (U, ore)	kg	1,01E-04	
	Silk yarn: to Scouring	kg	1,00E+02	
	Water from Disinfection	l	4,00E+03	
	Water: Unspecified Origin	l	1,09E+02	
OUTPUTS	(a) Alkane (unspecified)	g	6,06E+00	
	(a) Arsenic (As)	g	1,01E-03	
	(a) Benzene (C6H6)	g	9,02E-01	
	(a) Butane (n-C4H10)	g	1,81E+00	
	(a) Cadmium (Cd)	g	9,83E-04	
	(a) Carbon Dioxide (CO2, fossil)	g	1,32E+05	
	(a) Carbon Monoxide (CO)	g	7,96E+01	
	(a) Ethane (C2H6)	g	7,17E+00	
	(a) Ethylene (C2H4)	g	2,58E+01	
	(a) Hydrocarbons (except methane)	g	3,28E+01	
	(a) Hydrocarbons (unspecified)	g	1,66E-02	
	(a) Hydrogen Chloride (HCl)	g	1,23E+00	
	(a) Lead (Pb)	g	5,33E-03	
	(a) Manganese (Mn)	g	1,25E-02	
	(a) Methane (CH4)	g	1,64E+02	
	(a) Nickel (Ni)	g	1,96E-02	
	(a) Nitrogen Oxides (NOx as NO2)	g	7,60E+01	
	(a) Nitrous Oxide (N2O)	g	3,47E-01	
	(a) Propane (C3H8)	g	2,16E+00	
	(a) Sulphur Oxides (SOx as SO2)	g	7,28E+01	
	(a) Toluene (C6H5CH3)	g	4,40E-01	
	(a) Vanadium (V)	g	7,00E-02	
	(s) Arsenic (As)	g	4,32E-04	
	(s) Chromium (Cr III, Cr VI)	g	5,41E-03	
	(s) Zinc (Zn)	g	1,62E-02	
	(w) Ammonia (NH4+, NH3, as N)	g	6,29E-02	
	(w) Benzene (C6H6)	g	2,07E-02	
	(w) Cadmium (Cd++)	g	9,72E-05	
	(w) Chromium (Cr III)	g	1,14E-02	
	(w) Chromium (Cr III, Cr VI)	g	2,49E-04	
	(w) COD (Chemical Oxygen Demand)	g	8,07E-01	
	(w) Nitrate (NO3-)	g	2,02E-02	
	(w) Nitrogenous Matter (unspecified, as N)	g	5,37E-02	
	(w) Oils (unspecified)	g	2,24E+00	
	Silk yarn: to Dyeing	kg	1,00E+02	
		Waste Water to Membrane ultra-filtration	l	1,00E+03
		Wastewater	l	3,00E+03
	REMINDERS	E Feedstock Energy	MJ	1,06E+01
		E Fuel Energy	MJ	2,24E+03
		E Non Renewable Energy	MJ	2,24E+03
		E Renewable Energy	MJ	8,81E+00
		E Total Primary Energy	MJ	2,25E+03
Electricity		MJ elec	5,18E+01	
COD: to Membrane ultra-filtration & Waste Water Treatment Plant		kg	2,26E+01	
TSS: to Membrane ultra-filtration & Waste Water Treatment Plant		kg	1,57E+00	

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4 Light scouring – Silk yarn

Name	Light Scouring	
Sources	PIDACS I09	F.1.1 Silk yarn light scouring
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): 0,5 N. of run/year 716 absorbed power (kW): 4 processed yarn per run (kg): 200 processed yarn (kg/yr): 143223	
Notes	Production of anionic-non ionic surfactant is excluded because of lack of data.	
Procedural steps (flow-chart)		
Water from Disinfection :equip volume Anionic-non ionic surfactant = 5 g/l Steam	Bath T=60°C t= 30 min Indirect heating Discharge	Wastewater: equip. volume COD [mg/l]=3480 TSS [mg/l]=120

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	Flow	Units	Value
INPUTS	(r) Iron (Fe, ore)	kg	4,39E-02
	(r) Natural Gas (in ground)	kg	9,04E+00
	(r) Oil (in ground)	kg	2,69E-01
	(r) Uranium (U, ore)	kg	1,75E-05
	Silk yarn	kg	1,00E+02
	Water from Disinfection	l	1,00E+03
	Water: Unspecified Origin	l	1,93E+01
OUTPUTS	(a) Alkane (unspecified)	g	1,06E+00
	(a) Arsenic (As)	g	2,41E-04
	(a) Benzene (C6H6)	g	1,58E-01
	(a) Butane (n-C4H10)	g	3,30E-01
	(a) Cadmium (Cd)	g	3,07E-04
	(a) Carbon Dioxide (CO2, fossil)	g	2,34E+04
	(a) Ethane (C2H6)	g	1,38E+00
	(a) Ethylene (C2H4)	g	4,47E+00
	(a) Hydrocarbons (except methane)	g	6,61E+00
	(a) Hydrocarbons (unspecified)	g	3,30E-03
	(a) Hydrogen Chloride (HCl)	g	2,50E-01
	(a) Lead (Pb)	g	1,21E-03
	(a) Methane (CH4)	g	3,22E+01
	(a) Nickel (Ni)	g	6,07E-03
	(a) Nitrogen Oxides (NOx as NO2)	g	1,48E+01
	(a) Nitrous Oxide (N2O)	g	7,53E-02
	(a) Propane (C3H8)	g	4,11E-01
	(a) Sulphur Oxides (SOx as SO2)	g	1,79E+01
	(a) Vanadium (V)	g	2,28E-02
	(s) Arsenic (As)	g	7,48E-05
	(s) Chromium (Cr III, Cr VI)	g	9,36E-04
	(s) Zinc (Zn)	g	2,81E-03
	(w) Ammonia (NH4+, NH3, as N)	g	1,71E-02
	(w) Benzene (C6H6)	g	5,17E-03
	(w) Cadmium (Cd++)	g	2,17E-05
	(w) Chromium (Cr III)	g	1,97E-03
	(w) Chromium (Cr III, Cr VI)	g	7,26E-05
	(w) COD (Chemical Oxygen Demand)	g	1,47E-01
	(w) Nitrate (NO3-)	g	4,36E-03
	(w) Nitrogenous Matter (unspecified, as N)	g	1,55E-02
	(w) Oils (unspecified)	g	3,97E-01
	Silk yarn	kg	1,00E+02
	Wastewater	l	1,00E+03
REMINDERS	E Feedstock Energy	MJ	2,18E+00
	E Fuel Energy	MJ	3,94E+02
	E Non Renewable Energy	MJ	3,94E+02
	E Renewable Energy	MJ	2,12E+00
	E Total Primary Energy	MJ	3,96E+02
	Electricity	MJ elec	1,37E+01
	COD: to Wastewater Treatment Plant	kg	3,48E+00
	TSS: to Wastewater Treatment Plant	kg	1,20E-01

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5 Scouring – Silk yarn

Name	Stella Scouring	
Sources	PIDACS I09	F.3.3 Stella scouring
Reference year	2000	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of silk yarn	
Equipment	Stella operating mode: batch bath volume (m3): 3 run time (h): 3 N. of run/year 594 absorbed power (kW): 6,75 processed fabric per run (kg): 75 processed fabric (kg/yr): 44578	
Notes	Productions of detergent and sequestering-dispersant agent are excluded because of lack of data	
Procedural steps (flow-chart)		
Water from Disinfection: equip volume Detergent = 20 g/l; Steam Water from Disinfection: equip volume Sequestering-dispersant agent = 4 g/l Water from Disinfection: equip volume Water from Disinfection: equip volume	Bath T=90°C; t=120 min. Indirect heating Discharge 1 st washing Discharge 2 nd washing Discharge 3 rd washing Discharge	Wastewater: equip. volume COD [mg/l]= 27850 TSS [mg/l]= 430 Wastewater: equip. volume COD [mg/l]= 2100 TSS [mg/l]= 25 Wastewater: equip. volume COD [mg/l]= 1200 TSS [mg/l]= 12 Wastewater: equip. volume COD [mg/l]= 500 TSS [mg/l]= 10

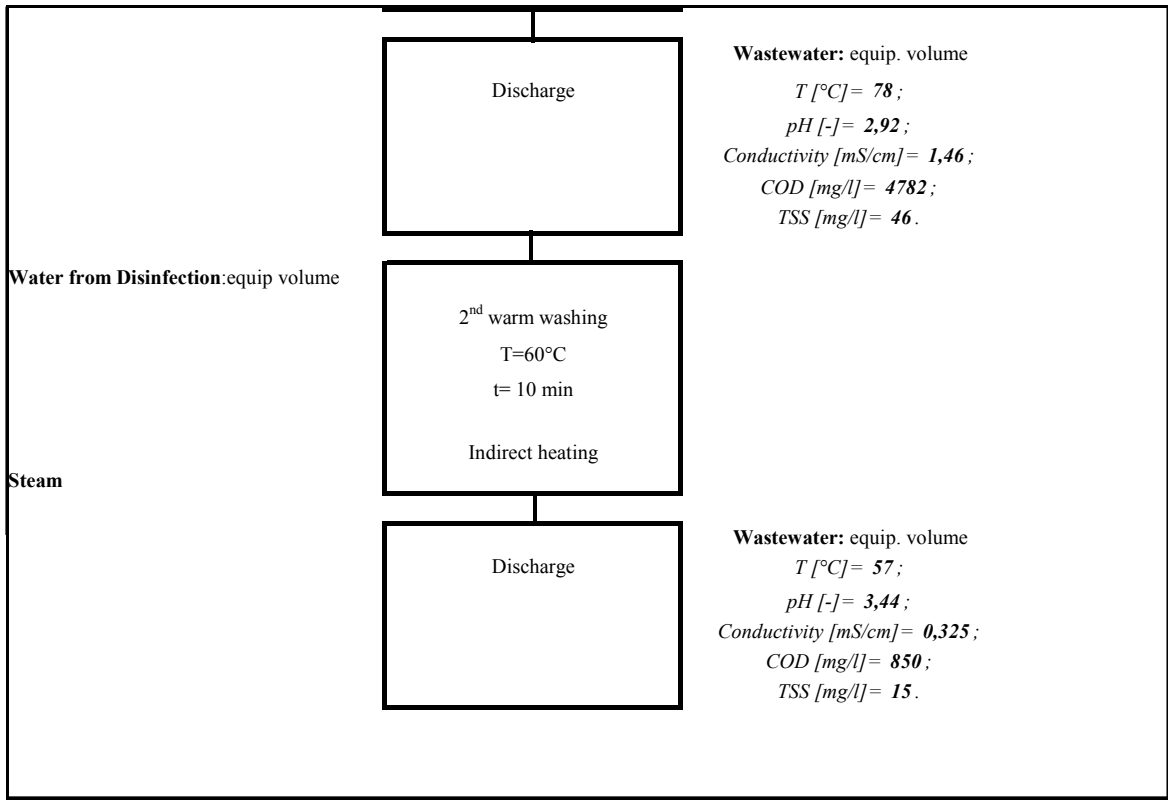
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	Flow	Units	Value
INPUTS	(r) Coal (in ground)	kg	3,52E+00
	(r) Iron (Fe, ore)	kg	3,37E-01
	(r) Natural Gas (in ground)	kg	6,85E+01
	(r) Oil (in ground)	kg	5,55E+00
	(r) Uranium (U, ore)	kg	1,30E-04
	Silk yarn	kg	1,00E+02
	Water from Disinfection	l	1,60E+04
OUTPUTS	Water: Unspecified Origin	l	1,61E+02
	(a) Alkane (unspecified)	g	8,30E+00
	(a) Arsenic (As)	g	3,89E-03
	(a) Benzene (C6H6)	g	1,23E+00
	(a) Butane (n-C4H10)	g	3,02E+00
	(a) Cadmium (Cd)	g	6,57E-03
	(a) Carbon Dioxide (CO2, fossil)	g	1,90E+05
	(a) Ethane (C2H6)	g	1,49E+01
	(a) Ethylene (C2H4)	g	3,39E+01
	(a) Hexane (C6H14)	g	1,99E-01
	(a) Hydrocarbons (except methane)	g	7,47E+01
	(a) Hydrocarbons (unspecified)	g	3,82E-02
	(a) Hydrogen Chloride (HCl)	g	3,07E+00
	(a) Lead (Pb)	g	1,81E-02
	(a) Methane (CH4)	g	3,62E+02
	(a) Nickel (Ni)	g	1,30E-01
	(a) Nitrogen Oxides (NOx as NO2)	g	1,47E+02
	(a) Nitrous Oxide (N2O)	g	8,78E-01
	(a) Propane (C3H8)	g	4,21E+00
	(a) Sulphur Oxides (SOx as SO2)	g	2,99E+02
	(a) Vanadium (V)	g	5,07E-01
	(s) Arsenic (As)	g	5,66E-04
	(s) Chromium (Cr III, Cr VI)	g	7,09E-03
	(s) Zinc (Zn)	g	2,13E-02
	(w) Ammonia (NH4+, NH3, as N)	g	2,89E-01
	(w) Benzene (C6H6)	g	8,40E-02
	(w) Cadmium (Cd++)	g	2,90E-04
	(w) Chromium (Cr III)	g	1,49E-02
	(w) Chromium (Cr III, Cr VI)	g	1,38E-03
	(w) Nitrate (NO3-)	g	6,00E-02
	(w) Nitrogenous Matter (unspecified, as N)	g	3,04E-01
	(w) Oils (unspecified)	g	3,27E+00
	Silk yarn	kg	1,00E+02
Wastewater	l	1,60E+04	
REMINDERS	E Feedstock Energy	MJ	2,73E+01
	E Fuel Energy	MJ	3,15E+03
	E Non Renewable Energy	MJ	3,15E+03
	E Renewable Energy	MJ	3,47E+01
	E Total Primary Energy	MJ	3,18E+03
	Electricity	MJ elec	2,51E+02
	COD: to Wastewater Treatment Plant	kg	1,27E+02
	TSS: to Wastewater Treatment Plant	kg	1,91E+00

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6 Polymer charge – Silk yarn

Name	Polymer charge	
Sources	Report LCA I09: TM-108-004	F.2 Polymer charge
Reference year	2000	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of charged silk yarn	
Equipment	Autoclave operating mode: batch bath volume (m3): 4 run time (h): 2,25 N.of run/year 165 absorbed power (kW): 20 processed fabric per run (kg): 300 processed fabric (kg/yr): 49597	
Notes		
Procedural steps (flow-chart)		
<p>Water from Disinfection:equip volume</p> <p>Metacrylamide (10073)= 80.%; Ammonium sulphate (10012)=8 %; Formic acid (10005) = 5 g/l.</p> <p>Steam</p>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Bath</p> <p>T=70°C; t=120 min.</p> <p>Indirect heating</p> </div>	
	↓	
	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>Discharge</p> </div>	<p>Wastewater: equip. volume</p> <p>$T [^{\circ}C] = 69$; $pH [-] = 2,68$; $Conductivity [mS/cm] = 4,83$; $COD [mg/l] = 20384$; $TSS [mg/l] = 100$.</p>
	↓	
<p>Water from Disinfection:equip volume</p> <p>Steam</p>	<div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>1st warm washing</p> <p>T=80°C t=15 min</p> <p>Indirect heating</p> </div>	



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	Flow	Units	Value
INPUTS	(r) Coal (in ground)	kg	1,58E+00
	(r) Iron (Fe, ore)	kg	1,20E-01
	(r) Natural Gas (in ground)	kg	2,41E+01
	(r) Oil (in ground)	kg	2,85E+00
	(r) Uranium (U, ore)	kg	4,50E-05
	Silk yarn: to Polymer charge	kg	1,00E+02
	Water: from Disinfection	l	4,00E+03
	Water: Unspecified Origin	l	6,03E+01
OUTPUTS	(a) Alkane (unspecified)	g	2,99E+00
	(a) Arsenic (As)	g	1,95E-03
	(a) Benzene (C6H6)	g	4,44E-01
	(a) Butane (n-C4H10)	g	1,20E+00
	(a) Cadmium (Cd)	g	3,51E-03
	(a) Carbon Dioxide (CO2, fossil)	g	7,03E+04
	(a) Carbon Monoxide (CO)	g	4,07E+01
	(a) Ethane (C2H6)	g	6,44E+00
	(a) Ethylene (C2H4)	g	1,19E+01
	(a) Hydrocarbons (except methane)	g	3,20E+01
	(a) Hydrocarbons (unspecified)	g	1,71E-02
	(a) Hydrogen Chloride (HCl)	g	1,41E+00
	(a) Lead (Pb)	g	8,89E-03
	(a) Manganese (Mn)	g	6,06E-03
	(a) Methane (CH4)	g	1,60E+02
	(a) Nickel (Ni)	g	6,92E-02
	(a) Nitrogen Oxides (NOx as NO2)	g	5,79E+01
	(a) Nitrous Oxide (N2O)	g	3,55E-01
	(a) Propane (C3H8)	g	1,78E+00
	(a) Sulphur Oxides (SOx as SO2)	g	1,51E+02
	(a) Toluene (C6H5CH3)	g	2,34E-01
	(a) Vanadium (V)	g	2,72E-01
	(s) Arsenic (As)	g	1,99E-04
	(s) Chromium (Cr III, Cr VI)	g	2,49E-03
	(s) Zinc (Zn)	g	7,48E-03
	(w) Ammonia (NH4+, NH3, as N)	g	1,38E-01
	(w) Benzene (C6H6)	g	4,10E-02
	(w) Cadmium (Cd++)	g	1,31E-04
	(w) Chromium (Cr III)	g	5,23E-03
	(w) Chromium (Cr III, Cr VI)	g	6,98E-04
	(w) COD (Chemical Oxygen Demand)	g	4,85E-01
	(w) Nitrate (NO3-)	g	2,87E-02
	(w) Nitrogenous Matter (unspecified, as N)	g	1,58E-01
	(w) Oils (unspecified)	g	1,21E+00
	Silk yarn: to Dyeing	kg	1,00E+02
Wastewater	l	4,00E+03	
REMINDERS	E Feedstock Energy	MJ	1,26E+01
	E Fuel Energy	MJ	1,15E+03
	E Non Renewable Energy	MJ	1,15E+03
	E Renewable Energy	MJ	1,75E+01
	E Total Primary Energy	MJ	1,17E+03
	Electricity	MJ elec	1,30E+02
	COD: to Wastewater Treatment Plant	kg	3,47E+01
	TSS: to Wastewater Treatment Plant	kg	2,15E-01

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7 Scouring – Mix acetate fabric

Name	Scouring in Jigger	
Sources	PIDACS I04	F.1.3 Scouring in Jigger
Reference year	2000	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of mix acetate fabric	
Equipment	Jigger operating mode batch bath volume (m3) 0,8 run time (h,m): 2,00 N. of run/year 606 absorbed power (kW): 6,9 processed fabric per run (kg): 350 processed fabric (kg/yr): 221967	
Notes	Production of soaping agent is excluded because of lack of data.	
Procedural steps (flow-chart)		
Water from Softening: equip volume Soda solvay= 2 g/l Soaping agent = 4 g/l Steam Water from Storgae: 8000 l	Scouring bath T=60°C t=90 min. Indirect heating Discharge Continuous rinsing t=30 min	Wastewater: equip. volume COD [mg/l]= 6300 TSS [mg/l]= 14 Wastewater: 5500 l COD [mg/l]= 450 TSS [mg/l]= 10

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	Flow	Units	Value
INPUTS	(r) Iron (Fe, ore)	kg	5,18E-02
	(r) Natural Gas (in ground)	kg	1,06E+01
	(r) Oil (in ground)	kg	8,21E-01
	(r) Uranium (U, ore)	kg	3,83E-05
	Mix acetate fabric	kg	1,00E+02
	Water from Softening Treatment	l	2,29E+02
	Water from Storage	l	2,29E+03
	Water: Unspecified Origin	l	2,09E+01
OUTPUTS	(a) Alkane (unspecified)	g	1,27E+00
	(a) Arsenic (As)	g	5,76E-04
	(a) Benzene (C6H6)	g	2,07E-01
	(a) Butane (n-C4H10)	g	4,58E-01
	(a) Cadmium (Cd)	g	9,66E-04
	(a) Carbon Dioxide (CO2, fossil)	g	2,95E+04
	(a) Ethane (C2H6)	g	2,23E+00
	(a) Ethylene (C2H4)	g	5,21E+00
	(a) Hexane (C6H14)	g	2,86E-02
	(a) Hydrocarbons (except methane)	g	1,12E+01
	(a) Hydrogen Chloride (HCl)	g	9,94E-01
	(a) Lead (Pb)	g	4,83E-03
	(a) Methane (CH4)	g	5,57E+01
	(a) Nickel (Ni)	g	1,91E-02
	(a) Nitrogen Oxides (NOx as NO2)	g	2,31E+01
	(a) Nitrous Oxide (N2O)	g	1,22E-01
	(a) Propane (C3H8)	g	6,34E-01
	(a) Sulphur Oxides (SOx as SO2)	g	4,74E+01
	(a) Toluene (C6H5CH3)	g	9,67E-02
	(a) Vanadium (V)	g	7,44E-02
	(s) Arsenic (As)	g	8,71E-05
	(s) Chromium (Cr III, Cr VI)	g	1,09E-03
	(s) Zinc (Zn)	g	3,27E-03
	(w) Ammonia (NH4+, NH3, as N)	g	4,13E-02
	(w) Benzene (C6H6)	g	1,22E-02
	(w) Cadmium (Cd++)	g	4,19E-05
	(w) Chromium (Cr III)	g	2,29E-03
	(w) Chromium (Cr III, Cr VI)	g	1,99E-04
	(w) COD (Chemical Oxygen Demand)	g	1,96E-01
	(w) Nitrate (NO3-)	g	9,16E-03
	(w) Nitrogenous Matter (unspecified, as N)	g	4,78E-02
	(w) Oils (unspecified)	g	4,98E-01
Mix acetate fabric	kg	1,00E+02	
Wastewater	l	2,51E+03	
REMINDERS	E Feedstock Energy	MJ	4,00E+00
	E Fuel Energy	MJ	4,91E+02
	E Non Renewable Energy	MJ	4,89E+02
	E Renewable Energy	MJ	5,58E+00
	E Total Primary Energy	MJ	4,95E+02
	Electricity	MJ elec	4,31E+01
	COD to Wastewater Treatment Plant	kg	2,47E+00
	TSS to Wastewater Treatment Plant	kg	2,61E-02

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8 Scouring – Bemberg or Viscose fabric

Name	Scouring in Overflow	
Sources	PIDACS I04	F.1.4 Scouring in overflow
Reference year	2000	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of bemberg or viscose fabric	
Equipment	Overflow operating mode batch bath volume (m3) 1 run time (h,m): 2,00 N. of run/year 739 absorbed power (kW): 20.05 processed fabric per run (kg): 112 processed fabric (kg/yr): 82782	
Notes	Productions of soaping agent and sodium hydrosulphide are excluded because of lack of data	
Procedural steps (flow-chart)		
Water from Softening: equip volume Soda solvay= 0,5 g/l Soaping agent = 0,5 g/l Sodium hydrosulphide= 5 g/l Steam Water from Storage: 1800 l Water from Softening: equip volume Steam	Scouring bath Continuous rinsing t=10 min Discharge Rinsing T=60°C t=30 min Indirect heating Discharge	Wastewater: 1800 l COD [mg/l]= 1500 TSS [mg/l]= 25 Wastewater: equip. volume COD [mg/l]= 1500 TSS [mg/l]= 18 Wastewater: equip. volume COD [mg/l]= 250 TSS [mg/l]= 14

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	Flow	Units	Value
INPUTS	(r) Iron (Fe, ore)	kg	2,23E-01
	(r) Natural Gas (in ground)	kg	4,45E+01
	(r) Oil (in ground)	kg	6,74E+00
	(r) Uranium (U, ore)	kg	8,26E-05
	Fabric	kg	1,00E+02
	Water from Softening Treatment	l	1,79E+03
	Water from Storage	l	1,61E+03
OUTPUTS	Water: Unspecified Origin	l	1,06E+02
	(a) Alkane (unspecified)	g	5,65E+00
	(a) Arsenic (As)	g	4,57E-03
	(a) Benzene (C6H6)	g	8,46E-01
	(a) Butane (n-C4H10)	g	2,46E+00
	(a) Cadmium (Cd)	g	8,45E-03
	(a) Carbon Dioxide (CO2, fossil)	g	1,36E+05
	(a) Ethane (C2H6)	g	1,39E+01
	(a) Ethylene (C2H4)	g	2,21E+01
	(a) Hydrocarbons (except methane)	g	6,85E+01
	(a) Hydrocarbons (unspecified)	g	1,11E+00
	(a) Hydrogen Chloride (HCl)	g	3,15E+00
	(a) Lead (Pb)	g	2,15E-02
	(a) Methane (CH4)	g	3,51E+02
	(a) Nickel (Ni)	g	1,67E-01
	(a) Nitrogen Oxides (NOx as NO2)	g	1,17E+02
	(a) Nitrous Oxide (N2O)	g	7,99E-01
	(a) Propane (C3H8)	g	3,79E+00
	(a) Sulphur Oxides (SOx as SO2)	g	3,58E+02
	(a) Vanadium (V)	g	6,58E-01
	(s) Arsenic (As)	g	3,67E-04
	(s) Chromium (Cr III, Cr VI)	g	4,60E-03
	(s) Zinc (Zn)	g	1,38E-02
	(w) Ammonia (NH4+, NH3, as N)	g	3,16E-01
	(w) Benzene (C6H6)	g	9,46E-02
	(w) Cadmium (Cd++)	g	2,87E-04
	(w) Chromium (Cr III)	g	9,65E-03
	(w) Chromium (Cr III, Cr VI)	g	1,64E-03
	(w) COD (Chemical Oxygen Demand)	g	1,21E+00
	(w) Nitrite (NO2-)	g	1,66E-04
	(w) Nitrogenous Matter (unspecified, as N)	g	3,79E-01
	(w) Oils (unspecified)	g	2,35E+00
	Fabric	kg	1,00E+02
	Wastewater	l	3,39E+03
REMINDERS	E Feedstock Energy	MJ	2,78E+01
	E Fuel Energy	MJ	2,21E+03
	E Non Renewable Energy	MJ	2,20E+03
	E Renewable Energy	MJ	4,10E+01
	E Total Primary Energy	MJ	2,24E+03
	Electricity	MJ elec	3,08E+02
	COD to Wastewater Treatment Plant	kg	3,97E+00
	TSS to Wastewater Treatment Plant	kg	6,88E-02

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9 Continuous Scouring – Viscose fabric

Name	Continuous Scouring in Mezzera	
Sources	Report LCA I04: TM-108-005 F.1.1 Continuous scouring in mezzera	
Reference year	2000	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of viscose fabric	
Equipment	Mezzera operating mode: continuous bath volume (m3): 34 cycle time (h:m): 32 n. of cycle/year 42 absorbed power (kW): 40,5 processed fabric per hour (kg/h): 504 processed fabric (kg/yr): 674912	
Notes	Production of soaping agent is excluded because of lack of data.	
Procedural steps (flow-chart)		
Water from Softening: 250 l Reintegration : 250 l/h Caustic soda = 20 g/l Water from Softening: equipment volume Soaping agent = 6 g/l Steam Water from Softening: 2000 l Water from Storage: 4000 l/h Water from Storage: 500 l/h Acetic acid = 0.5 g/l	Doping Scouring T=50°C Indirect heating Filling Rinsing Discharge Neutralization	Wastewater: 250 l COD [mg/l]= 300 TSS [mg/l]= 22 Wastewater: equipment volume COD [mg/l]= 9500 TSS [mg/l]= 130 Wastewater: 4000 l/h COD [mg/l]= 500; TSS [mg/l]= 50. Wastewater: 2000 l COD [mg/l]= 320 TSS [mg/l]= 10 Wastewater: 500 l/h COD [mg/l]= 320 TSS [mg/l]= 10

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	Flow	Units	Value	
INPUTS	(r) Iron (Fe, ore)	kg	4,12E-02	
	(r) Natural Gas (in ground)	kg	8,16E+00	
	(r) Oil (in ground)	kg	1,47E+00	
	(r) Uranium (U, ore)	kg	1,61E-05	
	Viscose fabric to: Scouring	kg	1,00E+02	
	Water from Storage	l	7,97E+02	
	Water from Softening Treatment	l	2,75E+02	
	Water: Unspecified Origin	l	1,98E+01	
OUTPUTS	(a) Alkane (unspecified)	g	1,06E+00	
	(a) Arsenic (As)	g	9,75E-04	
	(a) Butane (n-C4H10)	g	4,85E-01	
	(a) Cadmium (Cd)	g	1,83E-03	
	(a) Carbon Dioxide (CO2, fossil)	g	2,58E+04	
	(a) Ethane (C2H6)	g	2,84E+00	
	(a) Ethylene (C2H4)	g	4,06E+00	
	(a) Hydrocarbons (except methane)	g	1,44E+01	
	(a) Hydrogen Chloride (HCl)	g	6,90E-01	
	(a) Lead (Pb)	g	5,82E-03	
	(a) Methane (CH4)	g	7,20E+01	
	(a) Nickel (Ni)	g	3,62E-02	
	(a) Nitrogen Oxides (NOx as NO2)	g	2,35E+01	
	(a) Propane (C3H8)	g	7,68E-01	
	(a) Sulphur Oxides (SOx as SO2)	g	7,63E+01	
	(a) Vanadium (V)	g	1,43E-01	
	(s) Arsenic (As)	g	6,74E-05	
	(s) Chromium (Cr III, Cr VI)	g	8,43E-04	
	(s) Zinc (Zn)	g	2,53E-03	
	(w) Ammonia (NH4+, NH3, as N)	g	6,87E-02	
	(w) Benzene (C6H6)	g	2,03E-02	
	(w) Cadmium (Cd++)	g	6,13E-05	
	(w) Chromium (Cr III)	g	1,77E-03	
	(w) Chromium (Cr III, Cr VI)	g	3,56E-04	
	(w) COD (Chemical Oxygen Demand)	g	1,93E-01	
	(w) Nitrate (NO3-)	g	1,40E-02	
	(w) Nitrogenous Matter (unspecified, as N)	g	8,33E-02	
	(w) Oils (unspecified)	g	4,48E-01	
	Viscose fabric to: Dyeing	kg	1,00E+02	
	Wastewater	l	1,02E+03	
	REMINDERS	E Feedstock Energy	MJ	5,86E+00
		E Fuel Energy	MJ	4,17E+02
E Non Renewable Energy		MJ	4,14E+02	
E Renewable Energy		MJ	8,80E+00	
E Total Primary Energy		MJ	4,22E+02	
Electricity		MJ elec	6,68E+01	
COD to Wastewater Treatment Plant		Kg	2,41E+00	
TSS to Wastewater Treatment Plant		Kg	6,73E-02	

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10 Continuous scouring – Viscose fabric

Name	Continuous Scouring in Pad-Steam	
Sources	Report LCA I04: TM-108-005	F.1.2 Continuos scouring in pad-steam
Reference year	2000	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of viscose fabric	
Equipment	Pad-steam operating mode: continuous cycle time (h,m): 2,10 N. of cycle/year 1455 absorbed power (kW): 92 processed fabric per hour (kg/h): 462 processed fabric (kg/yr): 1486681	
Notes	Production of chemicals considered: Caustic soda, Acetic acid	
Procedural steps (flow-chart)		
Water from Softening: 1200 l Reintegration : 100 l/h Caustic soda = 5 g/l Soaping agent = 10 g/l Steam	Doping T=60°C Indirect heating	Wastewater: 1200 l COD [mg/l]= 5900 TSS [mg/l]= 150
Water from Softening: 400 l/h Soaping agent = 15 g/l Steam	Steaming T=60°C Indirect heating	Wastewater: 400 l/h COD [mg/l]= 2300 TSS [mg/l]= 130
Water from Storage: 7200 l	Filling	
Water from Storage: 7000 l/h	Rinsing	Wastewater: 7000 l/h COD [mg/l]= 1250 TSS [mg/l]= 50
Water from Storage: 40 l/h Acetic acid = 0.5 g/l	Discharge Neutralization	Wastewater: 7200 l COD [mg/l]= 2800 TSS [mg/l]= 10 Wastewater: 40 l/h COD [mg/l]= 320 TSS [mg/l]= 10

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	Flow	Units	Value	
INPUTS	(r) Coal (in ground)	kg	1,86E+00	
	(r) Iron (Fe, ore)	kg	5,77E-02	
	(r) Natural Gas (in ground)	kg	1,10E+01	
	(r) Oil (in ground)	kg	3,68E+00	
	(r) Uranium (U, ore)	kg	1,98E-05	
	Viscose fabric to: Scouring	kg	1,00E+02	
	Water from Storage	l	3,08E+03	
	Water from Softening	l	2,26E+02	
	Water: Unspecified Origin	l	3,81E+01	
OUTPUTS	(a) Alkane (unspecified)	g	1,55E+00	
	(a) Arsenic (As)	g	2,31E-03	
	(a) Butane (n-C4H10)	g	9,03E-01	
	(a) Cadmium (Cd)	g	4,51E-03	
	(a) Carbon Dioxide (CO2, fossil)	g	4,14E+04	
	(a) Ethane (C2H6)	g	5,92E+00	
	(a) Ethylene (C2H4)	g	5,49E+00	
	(a) Hydrocarbons (except methane)	g	3,09E+01	
	(a) Hydrogen Chloride (HCl)	g	1,45E+00	
	(a) Lead (Pb)	g	1,34E-02	
	(a) Methane (CH4)	g	1,55E+02	
	(a) Nickel (Ni)	g	8,88E-02	
	(a) Nitrogen Oxides (NOx as NO2)	g	4,77E+01	
	(a) Propane (C3H8)	g	1,56E+00	
	(a) Sulphur Oxides (SOx as SO2)	g	1,85E+02	
	(a) Vanadium (V)	g	3,53E-01	
	(s) Arsenic (As)	g	9,01E-05	
	(s) Chromium (Cr III, Cr VI)	g	1,13E-03	
	(s) Zinc (Zn)	g	3,39E-03	
	(w) Ammonia (NH4+, NH3, as N)	g	1,69E-01	
	(w) Benzene (C6H6)	g	4,90E-02	
	(w) Cadmium (Cd++)	g	1,41E-04	
	(w) Chromium (Cr III)	g	2,37E-03	
	(w) Chromium (Cr III, Cr VI)	g	8,80E-04	
	(w) COD (Chemical Oxygen Demand)	g	6,98E-01	
	(w) Nitrate (NO3-)	g	3,27E-02	
	(w) Nitrogenous Matter (unspecified, as N)	g	2,06E-01	
	(w) Oils (unspecified)	g	7,24E-01	
	Viscose fabric to: Dyeing	kg	1,00E+02	
	Wastewater	l	3,29E+03	
	REMINDERS	E Feedstock Energy	MJ	1,27E+01
		E Fuel Energy	MJ	6,49E+02
		E Non Renewable Energy	MJ	6,41E+02
E Renewable Energy		MJ	2,06E+01	
E Total Primary Energy		MJ	6,62E+02	
Electricity		MJ elec	1,59E+02	
COD to Wastewater Treatment Plant		kg	7,15E+00	
TSS to Wastewater Treatment Plant		kg	1,20E-01	

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11 Continuous scouring –Silk fabric

Name	Silk Continuous Scouring	
Sources	Report LCA I15: TM-108-006	F.1.1 Silk continuous scouring
Reference year	2001	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of silk fabric	
Equipment	Mezzera operating mode: continuous bath volume (m3): 30 cycle time (h,m): 55,00 N. of cycle/year 124 absorbed power (kW): 21,5 processed fabric per hour (kg/h): 151 processed fabric (kg/yr): 1027044	
Notes	Production of chemicals considered: Soda Solvay, Ammonia	
Procedural steps (flow-chart)		
Water from Softening: equip. volume Soaping agent = 5 g/l Sequestering agent = 0,5 g/l Dispersant agent = 1 g/l Soaping agent = 6 g/l Soda Solvay = 1,5 g/l Reintegration : 3000 l Refreshing water : equip. volume Steam Water from Softening: 3000 l/h (165 m ³ per cycle) Ammonia = 330 l; Stabilizing agent = 200 ml; Antifoaming agent = 300 ml. Steam Water from Softening: 3000 l/h (165 m ³ per cycle) Water from Softening: 3000 l/h (165 m ³ per cycle)	Bath T=96°C; Indirect heating Ammonia treatment T=60°C; Indirect heating 1 st rinsing 2 nd rinsing	Wastewater: 2*equip. volume COD [mg/l]= 18000 TSS [mg/l]= 22 Wastewater: 3000 l/h COD [mg/l]= 650 TSS [mg/l]= 10 Wastewater: 3000 l/h COD [mg/l]= 140 TSS [mg/l]= 10 Wastewater: 3000 l/h COD [mg/l]= 132 TSS [mg/l]= 10

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	Flow	Units	Value	
INPUT	(r) Iron (Fe, ore)	kg	7,28E-01	
	(r) Natural Gas (in ground)	kg	1,53E+02	
	(r) Oil (in ground)	kg	4,01E+00	
	(r) Uranium (U, ore)	kg	3,00E-04	
	Silk fabric to Scouring	kg	1,00E+02	
	Water: from Softening Treatment	litre	6,71E+03	
	Water: Public Network	litre	4,37E+01	
	Water: Unspecified Origin	litre	3,28E+02	
OUTPUT	(a) Aldehyde (unspecified)	g	4,45E-03	
	(a) Alkane (unspecified)	g	1,75E+01	
	(a) Ammonia (NH3)	g	6,77E-01	
	(a) Arsenic (As)	g	3,76E-03	
	(a) Benzene (C6H6)	g	2,70E+00	
	(a) Butane (n-C4H10)	g	5,41E+00	
	(a) Cadmium (Cd)	g	4,61E-03	
	(a) Carbon Dioxide (CO2, fossil)	g	3,94E+05	
	(a) Ethane (C2H6)	g	2,24E+01	
	(a) Ethylene (C2H4)	g	7,40E+01	
	(a) Hydrocarbons (except methane)	g	1,06E+02	
	(a) Hydrogen Chloride (HCl)	g	4,08E+00	
	(a) Lead (Pb)	g	3,05E-02	
	(a) Methane (CH4)	g	5,90E+02	
	(a) Nickel (Ni)	g	9,14E-02	
	(a) Nitrogen Oxides (NOx as NO2)	g	2,45E+02	
	(a) Propane (C3H8)	g	6,68E+00	
	(a) Sulphur Oxides (SOx as SO2)	g	2,85E+02	
	(a) Vanadium (V)	g	3,41E-01	
	(s) Arsenic (As)	g	1,24E-03	
	(s) Chromium (Cr III, Cr VI)	g	1,55E-02	
	(s) Zinc (Zn)	g	4,66E-02	
	(w) Ammonia (NH4+, NH3, as N)	g	2,59E-01	
	(w) COD (Chemical Oxygen Demand)	g	2,73E+00	
	(w) Nitrate (NO3-)	g	7,01E-02	
	(w) Nitrogenous Matter (unspecified, as N)	g	2,52E-01	
		Silk fabric to Dyeing or Printing	kg	1,00E+02
		Wastewater	litre	6,67E+03
	REMINDERS	E Feedstock Energy	MJ	3,43E+01
		E Fuel Energy	MJ	6,66E+03
		E Non Renewable Energy	MJ	6,66E+03
		E Renewable Energy	MJ	3,31E+01
E Total Primary Energy		MJ	6,69E+03	
Electricity		MJ elec	2,14E+02	
COD to Wastewater Treatment Plant		kg	1,48E+01	
TSS to Wastewater Treatment Plant		kg	1,91E+00	

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12 Discontinuous scouring - Silk fabric

Name	Silk Discontinuous Scouring	
Sources	PIDACS I15	F.1.2 Silk discontinuous scouring
Reference year	2001	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of silk fabric	
Equipment	Star operating mode: batch bath volume (m3): 5 cycle time (h,m): 2,15 N. of cycle/year: 211 absorbed power (kW): 1,15 processed fabric per cycle (kg): 540 processed fabric (kg/yr): 114116	
Notes	Production of chemicals considered: Ammonia	
Procedural steps (flow-chart)		
Water from Softening: equip volume Soaping agent = 10 g/l Steam Water from Softening: equip volume Ammonia = 2 l Steam Water from Softening: 3000 l	Bath T=96°C; t=90 min. Indirect heating Discharge Ammonia treatment T=60°C t=30 min Indirect heating Discharge Continuous washing t=15 min	Wastewater: equip. volume COD [mg/l]= 6500 TSS [mg/l]= 14 Wastewater: equip. volume COD [mg/l]= 350 TSS [mg/l]= 10 Wastewater: 3000 l COD [mg/l]= 200 TSS [mg/l]= 10

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	Flow	Units	Value
INPUT	(r) Iron (Fe, ore)	kg	7,18E-01
	(r) Natural Gas (in ground)	kg	1,49E+02
	(r) Oil (in ground)	kg	1,55E+00
	(r) Uranium (U, ore)	kg	2,90E-04
	Silk fabric	kg	1,00E+02
	Water: from Softening Treatment	litre	2,41E+03
	Water: Unspecified Origin	litre	3,11E+02
OUTPUT	(a) Aldehyde (unspecified)	g	4,37E-03
	(a) Alkane (unspecified)	g	1,72E+01
	(a) Ammonia (NH3)	g	1,99E-02
	(a) Arsenic (As)	g	2,27E-03
	(a) Benzene (C6H6)	g	2,65E+00
	(a) Butane (n-C4H10)	g	5,00E+00
	(a) Carbon Dioxide (CO2, fossil)	g	3,73E+05
	(a) Carbon Monoxide (CO)	g	2,41E+02
	(a) Cadmium (Cd)	g	1,59E-03
	(a) Ethane (C2H6)	g	1,92E+01
	(a) Ethylene (C2H4)	g	7,33E+01
	(a) Hexane (C6H14)	g	5,54E-02
	(a) Hydrocarbons (except methane)	g	8,94E+01
	(a) Hydrocarbons (unspecified)	g	1,00E-01
	(a) Hydrogen Chloride (HCl)	g	3,17E+00
	(a) Lead (Pb)	g	2,29E-02
	(a) Manganese (Mn)	g	3,53E-02
	(a) Methane (CH4)	g	4,40E+02
	(a) Nickel (Ni)	g	3,18E-02
	(a) Nitrogen Oxides (NOx as NO2)	g	2,11E+02
	(a) Propane (C3H8)	g	5,85E+00
	(a) Sulphur Oxides (SOx as SO2)	g	1,61E+02
	(a) Vanadium (V)	g	1,04E-01
	(w) Ammonia (NH4+, NH3, as N)	g	1,50E-01
	(w) Benzene (C6H6)	g	4,82E-02
	(w) Cadmium (Cd++)	g	2,53E-04
	(w) Chromium (Cr III)	g	3,23E-02
	(w) Chromium (Cr III, Cr VI)	g	5,12E-04
	(w) Nitrogenous Matter (unspecified, as N)	g	1,16E-01
	(w) Oils (unspecified)	g	6,31E+00
	(s) Arsenic (As)	g	1,23E-03
	(s) Chromium (Cr III, Cr VI)	g	1,54E-02
(s) Zinc (Zn)	g	4,62E-02	
Silk fabric	kg	1,00E+02	
Wastewater	litre	2,41E+03	
REMINDERS	E Feedstock Energy	MJ	2,68E+01
	E Fuel Energy	MJ	6,33E+03
	E Non Renewable Energy	MJ	6,34E+03
	E Renewable Energy	MJ	1,97E+01
	E Total Primary Energy	MJ	6,36E+03
	Electricity	MJ elec	1,05E+02
	COD to Wastewater Treatment Plant	kg	6,45E+00
	TSS to Wastewater Treatment Plant	kg	2,78E-02

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13 Continuous scouring – Synthetic fibres

Name	Continuous scouring	
Sources	PIDACS I15	F.1.3 Synthetic fibres continuous scouring
Reference year	2001	
Geographic reference	Italy	
Technological level	average	
Reference flow	100 kg of synthetic fibres	
Equipment	Mezzera operating mode: continuous bath volume (m3): 40 cycle time (h,m): 44,00 N. of cycle/year 43 absorbed power (kW): 21,5 processed fabric per cycle (kg): 9504 processed fabric (kg/yr): 407610	
Notes	Productions of soaping agent and sequestering agent excluded because of lack of data	
Procedural steps (flow-chart)		
Water from Softening: equip. volume Sequestering agent = 2 g/l Soaping agent = 1 g/l Reintegration : 3430 l Refreshing water: equip. volume Steam Water from Softening: 2500 l/h (110 m3 per cycle) Water from Softening: 2500 l/h (110 m3 per cycle) Water from Softening: 2500 l/h (110 m3 per cycle)	Bath T=90°C Indirect heating 1 st rinsing 2 nd rinsing 3 rd rinsing	Wastewater: 2*equip. volume COD [mg/l]= 2300 TSS [mg/l]= 15 Wastewater: 2500 l/h COD [mg/l]= 200 TSS [mg/l]= 15 Wastewater: 2500 l/h COD [mg/l]= 100 TSS [mg/l]= 10 Wastewater: 2500 l/h COD [mg/l]= 200 TSS [mg/l]= 10

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	Flow	Units	Value
INPUT	(r) Coal (in ground)	kg	1,73E+00
	(r) Iron (Fe, ore)	kg	2,01E-01
	(r) Natural Gas (in ground)	kg	4,11E+01
	(r) Oil (in ground)	kg	2,07E+00
	(r) Uranium (U, ore)	kg	7,88E-05
	Synthetic fibres	kg	1,00E+02
	Water: from Softening Treatment	litre	4,35E+03
OUTPUT	Water: Unspecified Origin	litre	9,30E+01
	(a) Aldehyde (unspecified)	g	1,23E-03
	(a) Alkane (unspecified)	g	4,89E+00
	(a) Ammonia (NH3)	g	7,57E-03
	(a) Arsenic (As)	g	1,67E-03
	(a) Benzene (C6H6)	g	7,40E-01
	(a) Butane (n-C4H10)	g	1,64E+00
	(a) Carbon Dioxide (CO2, fossil)	g	1,10E+05
	(a) Cadmium (Cd)	g	2,57E-03
	(a) Ethane (C2H6)	g	7,48E+00
	(a) Ethylene (C2H4)	g	2,03E+01
	(a) Hexane (C6H14)	g	7,43E-02
	(a) Hydrocarbons (except methane)	g	3,55E+01
	(a) Hydrogen Chloride (HCl)	g	1,46E+00
	(a) Lead (Pb)	g	9,30E-03
	(a) Methane (CH4)	g	1,79E+02
	(a) Nickel (Ni)	g	5,08E-02
	(a) Nitrogen Oxides (NOx as NO2)	g	7,18E+01
	(a) Propane (C3H8)	g	2,16E+00
	(a) Sulphur Oxides (SOx as SO2)	g	1,26E+02
	(a) Vanadium (V)	g	1,96E-01
	(w) Ammonia (NH4+, NH3, as N)	g	1,11E-01
	(w) Benzene (C6H6)	g	3,44E-02
	(w) Cadmium (Cd++)	g	1,25E-04
	(w) Chromium (Cr III)	g	8,94E-03
	(w) Chromium (Cr III, Cr VI)	g	5,32E-04
	(w) Nitrogenous Matter (unspecified, as N)	g	1,22E-01
	(w) Oils (unspecified)	g	1,87E+00
	(s) Arsenic (As)	g	3,40E-04
	(s) Chromium (Cr III, Cr VI)	g	4,26E-03
	(s) Zinc (Zn)	g	1,28E-02
	Synthetic fibres	kg	1,00E+02
	Wastewater	litre	4,31E+03
REMINDERS	E Feedstock Energy	MJ	1,28E+01
	E Fuel Energy	MJ	1,83E+03
	E Non Renewable Energy	MJ	1,83E+03
	E Renewable Energy	MJ	1,48E+01
	E Total Primary Energy	MJ	1,85E+03
	Electricity	MJ elec	1,03E+02
	COD to Wastewater Treatment Plant	kg	2,34E+00
	TSS to Wastewater Treatment Plant	kg	4,73E-02