

Decentralized innovative treatment of ammonium-rich urban wastewater

SCR AUDIT AND SCENARIOS

LIFE DeNTreat INFO DAY

March 7th, 2019

SCR - Stamperia di Cassina Rizzardi



MAIN ACTIVITIES AND TASKS

A PREPARATORY ACTIONS

A.1 Characterization of the addressed wastewater and requirements collection

B IMPLEMENTATION ACTIONS

B.1 Demonstration plant design and construction

B.2 Water treatment demonstration plant operation

B.3 Laboratory tests on digital textile printing company wastewater

B.4 Sustainability, transferability and replication of project results

C MONITORING OF THE IMPACT OF THE PROJECT ACTIONS

C.1 Environmental, social and economic impacts analysis

D PUBLIC AWARENESS AND DISSEMINATION OF RESULTS

D.1 Dissemination of project results

E PROJECT MANAGEMENT

E.1 Management and reporting to the EC

E.2 After Life N-free

A1.2.2

Report on SCR wastewater characterization Annex A – PIDACS SCR

Reference year: 2017

Location: Stamperia Cassina Rizzardi

Sampling and data collection period:

September 2017 – June 2018



69 samples



118 samples

GENERAL DATA – Production

<i>Fibre</i>	<i>Type</i>	<i>(%) on total weight</i>
Cotton (CF)	Fabric	53.62
Viscose (VF)	Fabric	1.96
Polyester (PEF)	Fabric	27.39
Silk (SF)	Fabric	2.72
Lycra (LF)	Fabric	14.30
<i>TOTAL</i>		<i>100</i>

A1.2.2

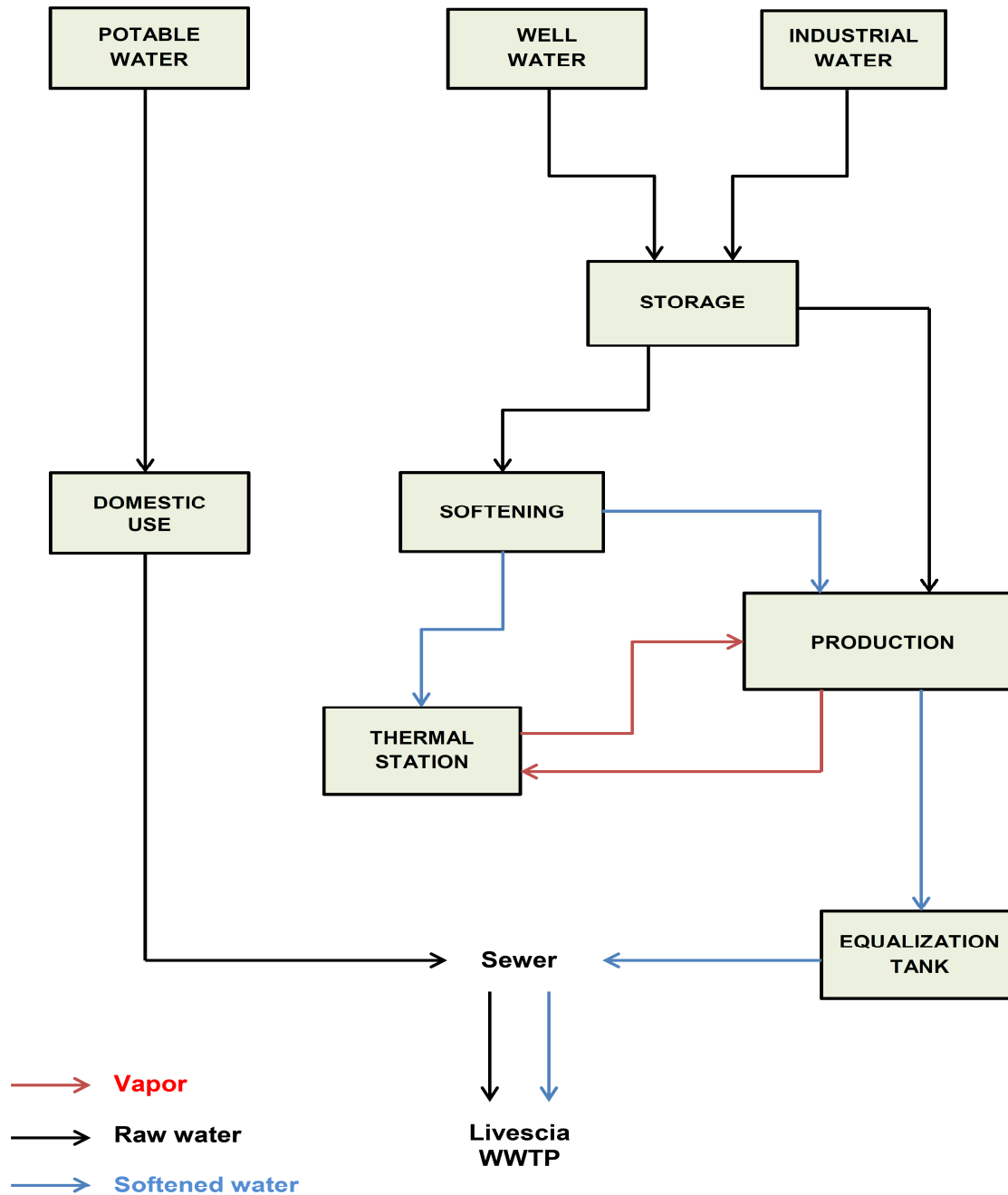
Report on SCR wastewater characterization - Annex A – Pidacs SCR

GENERAL DATA – Water use

Supplied water

Source	Quantity [m³/yr]	Specific Cost [€/m³]
Well	12'115	0.42
Industrial water	309'643	0.42
Tap water	8'550	0.8
TOTAL	330'308	

Water type	Source	Treatment	Use	Quantity [m³/yr]	Treatment specific cost [€/m³]
W1	Well+industrial	None	Production	189'285	-
W2	Well+industrial	Softening	Production	132'473	-
W3	Tap water	None	Domestic	8'550	-



Water flow chart

A1.2.2 Report on SCR wastewater characterization - Annex A – Pidacs SCR

GENERAL DATA – Water use

Discharged water

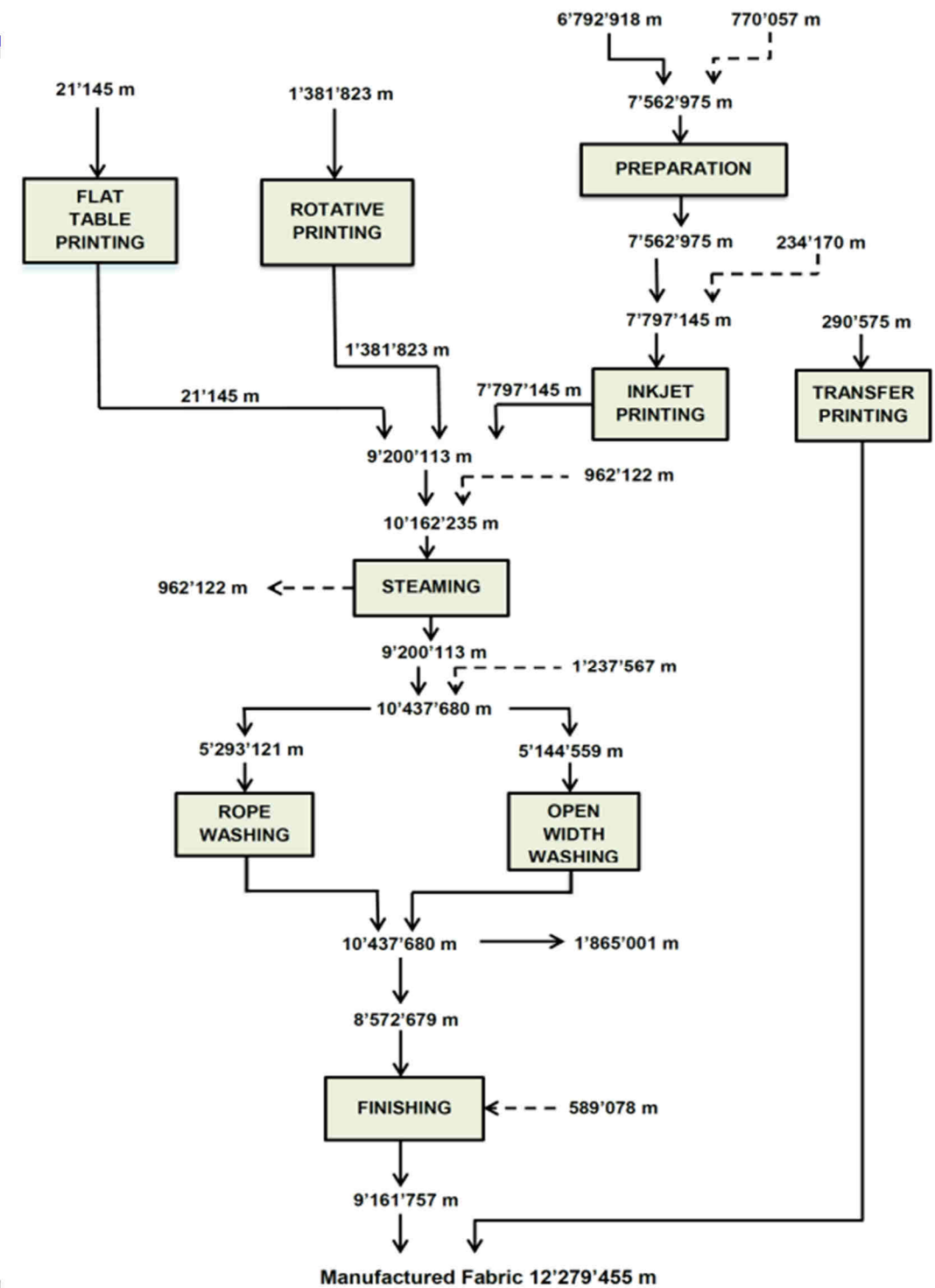
$N-NH_4/TKN = 0.66$

$N-NO_3$ e $N-NO_2$ are very low

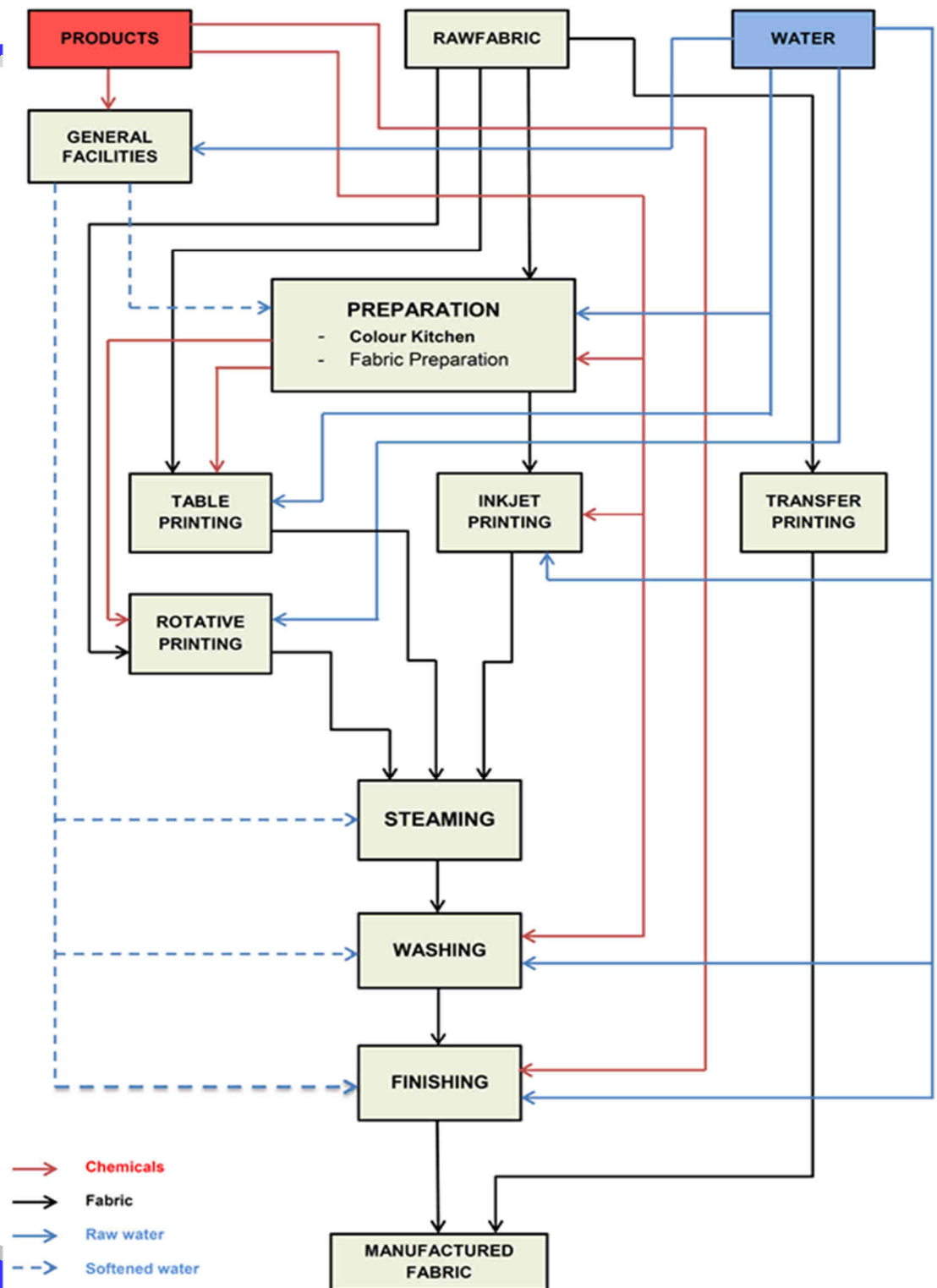
Authorized limit to sewer is
100 mgN/l, today SCR
discharge with derogation.

	Type	
	D1 2017	D1 Sept 2017 / Feb 2018
Quantity [m ³ /y]	278'668	
Final destination	Livescia WWTP	
T [°C]		33.8
Conductivity [mS/cm]		2180
Alkalinity [mgCaCO ₃ /l]		889
pH [-]	8.57	9.28
COD [mg/l]	713	830
COD filtrate [mg/l]		721
BOD ₅ [mg/l]		226
BOD ₂₀ [mg/l]		367
TSS [mg/l]	70	72.9
TKN [mg/l]	175	201
N-NH ₄ [mg/l]	115	160
N-NO ₂ [mg/l]	0.03	0.18
N-NO ₃ [mg/l]	0.26	0.56
N _{org} [mg/l]	43.6	40.4
P _{tot} [mg/l]	0.4	1.72
Anionic surf. [mgMBAS/l]		1.82
Non-ionic surf. [mgBiAS/l]		85
Cationic surf. [mg/ l]		<0.05
Total surf. [mg/ l]		86.8
Zinc [mg/l]		0.15
Sulphates [mg/l]		115
Chlorides [mg/l]		229
Copper [mg/l]		0.07
Nickel [mg/l]		0.01
Cadmium [mg/l]		<0.002
Molybdenum [mg/l]		<0.01
Cobalt [mg/l]		<0.005

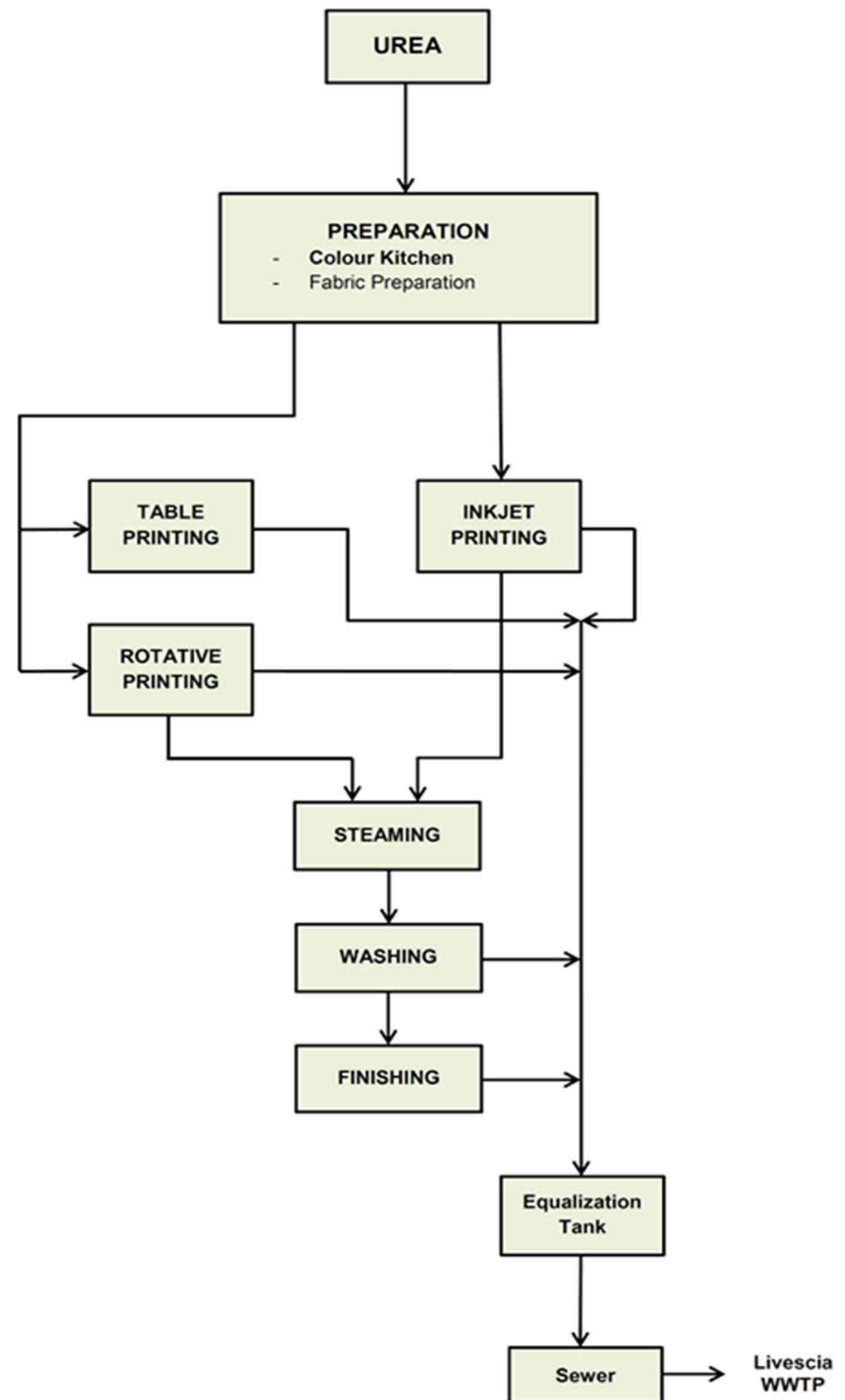
Production scheme



Material flow chart



Nitrogen flow chart



PRODUCTION MODEL

Department			OPERATING RUN per year (batch and continuous process)						OPERATING HOURS per year (continuous process)					
			eq.1	eq.2	TOTAL processes	% OF TOTAL	TOTAL process type	% OF TOTAL	eq.1	eq.2	TOTAL process	% OF TOTAL	TOTAL process type	% OF TOTAL
	Process type	Process												
Preparation	G.1: Mercerizing	G.1.1: Mercerizing	156		156	6,75	156	6,75			100	70,42	100	70,42
	G.2: Bleaching	G.2.1: Bleaching		184	184	7,96	549	23,75			5	3,52	11	7,75
		G.2.2: Bleaching with anti-pilling treatment		365	365	15,79					6	4,23		
	G.3: Pre-washing	G.3.1: Pre-washing after mercerizing			223	9,65	913	39,51			0	0,00	31	21,83
		G.3.2: Pre-washing after bleaching			157	6,81					11	7,75		
		G.3.3: Pre-washing after bleaching w/ anti-pilling			313	13,53					0	0,00		
		G.3.4: Raw fabric pre-washing			220	9,52					20	14,08		
	G.4: Pre-washed centrifugation	G.4.1: Pre-washed centrifugation			693	29,98	693	29,98			0	0,00	0	
	Total (Equipment):		156	549	2311	100,00	2311	100,00	0	0	142	100,00	142	100,00

Department			METERS [m]						WEIGHT [kg]					
			eq.1	eq.2	TOTAL process	% OF TOTAL	TOTAL process type	% OF TOTAL	eq.1	eq.2	TOTAL processes	% OF TOTAL	TOTAL	OF TOTAL
	Process type	Process												
Preparation	G.1: Mercerizing	G.1.1: Mercerizing	10		1000	100,00	1000	100,00			0	0,00	0	
	G.2: Bleaching	G.2.1: Bleaching			0	0,00	0				0	0,00	2000	100,00
		G.2.2: Bleaching with anti-pilling treatment			0	0,00			###		2000	100,00		
	G.3: Pre-washing	G.3.1: Pre-washing after mercerizing			0	0,00	0				0	0,00	0	
		G.3.2: Pre-washing after bleaching			0	0,00					0	0,00		
		G.3.3: Pre-washing after bleaching w/ anti-pilling			0	0,00					0	0,00		
		G.3.4: Raw fabric pre-washing			0	0,00					0	0,00		
	G.4: Pre-washed centrifugation	G.4.1: Pre-washed centrifugation			0	0,00	0				0	0,00	0	
	Total (Equipment):		10	0	1000	100,00	1000	100,00	###	0	2000	100,00	2000	100,00

PROCESS TYPE

Department	Process type
General Facilities	A.1: Softening
	A.2: Steam Production
	A.3: Industrial uses
Preparation	B.1: Thickener preparation
	B.2: Paste preparation
	B.3: Emulsion preparation
	B.4: Inkjet fabric preparation
	B.5: Tubs washing
	B.6: Kids washing
Printing	C.1: Acid printing
	C.2: Reactive printing
	C.3: Disperse printing
	C.4: Cylinders washing
	C.5: Squeegees washing
	C.6: Screens washing

Department	Process type
Steaming	D: Steaming
Fabric washing	E.1: Rope acid washing
	E.2: Rope reactive washing
	E.3: Rope disperse washing
	E.4: Open width acid washing
	E.5: Open width reactive washing
Finishing	F: Finishing

PROCESS SCHEME

E.2.2: Rope reactive traditional printed washing – WR

Department	Fabric washing
Fabric	CF – VF
Process	Rope reactive traditional printed washing
Equipment	Washing machine
Item	WR _{rope}
Operating	Continuous
Number of h/y	139
Cycle time (h)	1
Processed fabric (kg/y)	35'170
Processed fabric per hour (kg)	253

Water type W1: 417 l/d
Reintegration W1: 1'320 l/h

Water type W1: 417 l/d
Reintegration W1: 1'320 l/h

1 st washing T=30°C	Discharge type D1: 417 l/d T [°C] = 27; pH [-] = 6; Conductivity [mS/cm] = 5'010; COD [mg/l] = 2'678; TKN [mg/l] = 2'068; N-NH₄ [mg/l] = 32; SST [mg/l] = 86; P [mg/l] = 65.01; Colour [Abs_{mean}^{VIS}] = 1.591. Overflow discharge type D1: 1'294 l/h T [°C] = 27; pH [-] = 6; Conductivity [mS/cm] = 5'010; COD [mg/l] = 2'678; TKN [mg/l] = 2'068; N-NH₄ [mg/l] = 32; SST [mg/l] = 86; P [mg/l] = 65.01; Colour [Abs_{mean}^{VIS}] = 1.591.
2 nd washing T=40°C	Discharge type D1: 417 l/d T [°C] = 42; pH [-] = 4.7; Conductivity [mS/cm] = 2'530; COD [mg/l] = 3'216; TKN [mg/l] = 1'181; N-NH₄ [mg/l] = 27; SST [mg/l] = 90; P [mg/l] = 31.01; Colour [Abs_{mean}^{VIS}] = 1.397. Overflow discharge type D1: 1'294 l/h T [°C] = 42; pH [-] = 4.7; Conductivity [mS/cm] = 2'530; COD [mg/l] = 3'216; TKN [mg/l] = 1'181; N-NH₄ [mg/l] = 27; SST [mg/l] = 90; P [mg/l] = 31.01; Colour [Abs_{mean}^{VIS}] = 1.397.

WATER CONSUMPTIONS

Fabric Washing							Meters [m]			Weight [kg]		
Process	Equipment	Step	Type W/D	l/(run or hour)	Operating run/cycles tot-year	Operating hours tot-year	mfcted	re-mfcted	total	mfcted	re-mfcted	total
E.1.2: Rope acid traditional printed washing	B1	Bath	W1	2'000	192	0	13'839	0	13'839	2'355	0	2'355
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000	192	0	13'839	0	13'839	2'355	0	2'355
E.1.2: Rope acid traditional printed washing	B1	Rinse	W1	2'000	192	0	13'839	0	13'839	2'355	0	2'355
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000	192	0	13'839	0	13'839	2'355	0	2'355
E.1.2: Rope acid traditional printed washing	B1	Rinse	W1	2'000	192	0	13'839	0	13'839	2'355	0	2'355
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000	192	0	13'839	0	13'839	2'355	0	2'355
E.1.2: Rope acid traditional printed washing	B1	Bath	W1	2'000	192	0	13'839	0	13'839	2'355	0	2'355
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000	192	0	13'839	0	13'839	2'355	0	2'355
E.1.2: Rope acid traditional printed washing	B1	Rinse	W1	2'000	192	0	13'839	0	13'839	2'355	0	2'355
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000	192	0	13'839	0	13'839	2'355	0	2'355
E.1.2: Rope acid traditional printed washing	B1	Rinse	W1	2'000	192	0	13'839	0	13'839	2'355	0	2'355
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000	192	0	13'839	0	13'839	2'355	0	2'355
E.1.2: Rope acid traditional printed washing	B1	Rinse	W1	2'000	192	0	13'839	0	13'839	2'355	0	2'355
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000	192	0	13'839	0	13'839	2'355	0	2'355

Process	Equipment	Step	Type W/D	l/(run or hour)	Water type W1				Water type W2				Total water consumption			
					m³ tot	% m³	l/mt	l/kg	m³ tot	% m³	l/mt	l/kg	m³ tot	% m³	l/mt	l/kg
E.1.2: Rope acid traditional printed washing	B1	Bath	W1	2'000	385	0.16	27.82	163.49					385	0.11	27.82	163.49
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000									0	0.00	0.0	0
E.1.2: Rope acid traditional printed washing	B1	Rinse	W1	2'000	385	0.16	27.82	163.49					385	0.11	27.82	163.49
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000									0	0.00	0.0	0
E.1.2: Rope acid traditional printed washing	B1	Rinse	W1	2'000	385	0.16	27.82	163.49					385	0.11	27.82	163.49
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000									0	0.00	0.0	0
E.1.2: Rope acid traditional printed washing	B1	Bath	W1	2'000	385	0.16	27.82	163.49					385	0.11	27.82	163.49
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000									0	0.00	0.0	0
E.1.2: Rope acid traditional printed washing	B1	Rinse	W1	2'000	385	0.16	27.82	163.49					385	0.11	27.82	163.49
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000									0	0.00	0.0	0
E.1.2: Rope acid traditional printed washing	B1	Rinse	W1	2'000	385	0.16	27.82	163.49					385	0.11	27.82	163.49
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000									0	0.00	0.0	0
E.1.2: Rope acid traditional printed washing	B1	Rinse	W1	2'000	385	0.16	27.82	163.49					385	0.11	27.82	163.49
E.1.2: Rope acid traditional printed washing	B1	Discharge	D1	2'000									0	0.00	0.0	0

WATER CONSUMPTIONS

	<i>Water type W1</i>	<i>Water type W2</i>	<i>Total water consumption</i>			
	<i>m3 tot</i>	<i>m3 tot</i>	<i>m3 tot</i>	<i>% m3</i>	<i>l/mt</i>	<i>l/kg</i>
General facilities	3'245	24'536	27'781	7.7	2.3	13.3
Preparation	1'048	2'910	3'958	1.1	0.5	3.1
Printing	100'700	0	100'700	28	11	64.3
Steaming	0	0	0	0	0	0
Fabric washing	137'289	87'319	224'608	62.5	21.5	126.5
Finishing	1'539	550	2'089	0.6	0.2	1.3
Total	243'821	115'315	366'238	100.0	29.3	171.9

WATER DISCHARGES

Finishing								Discharge type										
								D1										
Fabric (yarn)	Process	Equipment	Step	Type W/D	l/(run or hour)	Operating run/cycles tot-year	Operating hours tot-year	m³ tot	% m³	COD [mg/l]	COD [kg]	COD [%]	TKN [mg/l]	TKN [kg]	TKN [%]	N-NH4 [mg/l]	N-NH4 [kg]	N-NH4 [%]
	F.1: Softener finishing	WR	Doping	W2	60	4'581	0											
	F.1: Softener finishing	WR	Reintegration	W1	280	0	2'545											
	F.1: Softener finishing	WR	Washing	D1	60	4'581	0	275	0.08	15'000	4'122.79	1.26	1'000	274.85	0.47	50	13.74	0.84
	F.2: Antistatic finishing	WR	Doping	W2	60	3'665	0											
	F.2: Antistatic finishing	WR	Reintegration	W1	280	0	2'443											
	F.2: Antistatic finishing	WR	Washing	D1	60	3'665	0	220	0.07	10'000	2'198.82	0.67	500	109.94	0.19	20	4.40	0.27
	F.3: Other finishing	WR	Doping	W2	60	916	0											
	F.3: Other finishing	WR	Reintegration	W1	280	0	509											
	F.3: Other finishing	WR	Washing	D1	60	916	0	55	0.02	5'000	274.85	0.08	100	5.50	0.01	10	0.55	0.03
Total Dept:								550	0.17	12'000	6'596.47	2.02	710	390.29	0.67	34	18.69	1.14

WATER DISCHARGES

	<i>m³ tot</i>	<i>% m³</i>	<i>COD [mg/l]</i>	<i>COD [kg]</i>	<i>COD [%]</i>
General Facilities	1'405	0.4	12	16	0.0
Preparation	1'048	0.3	2'767	2'899	0.9
Printing	100'700	31	611	61'486	18.3
Steaming	0	0.0	0	0	0.0
Fabric washing	221'185	68.1	1'186	262'388	78.2
Finishing	550	0.2	15'662	8'609	2.6
<i>Total</i>	<i>324'888</i>	<i>100.0</i>	<i>1'032</i>	<i>335'399</i>	<i>100.0</i>

WATER DISCHARGES

	<i>TKN [mg/l]</i>	<i>TKN [kg]</i>	<i>TKN [%]</i>	<i>N-NH4 [mg/l]</i>	<i>N-NH4 [kg]</i>	<i>N-NH4 [%]</i>
General Facilities	1	2	0.0	0	0	0.0
Preparation	625	683	1.3	17	17	1.2
Printing	15	1'554	3	2	210	13.9
Steaming	0	0	0.0	0	0	0.0
Fabric washing	255	49'856	95	6	1'270	84.3
Finishing	714	392	0.7	17	9	0.6
<i>Total</i>	<i>162</i>	<i>58'488</i>	<i>100.0</i>	<i>5</i>	<i>1'506</i>	<i>100.0</i>

$\text{N-NH}_4/\text{TKN} = 0.029$ hydrolysis in the buffer tank (0.66 out of the tank)

A1.4.1

Report on demonstration scenarios definition

TARGET: Define the demonstration scenario starting from data collected

SCENARIOS

- Scenario 0 → actual scenario
- Scenario 1 → treat the final discharge after the buffer tank
- Scenario 2 → treat only fabric washing discharge
- Scenario 3 → treat only those discharges from the fabric washing process with the nitrogen concentration above 350 mg/l
- Scenario 4 → treat only those discharges from the fabric washing process with the nitrogen concentration above 1'000 mg/l



	Scenario 0	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Direct SCR discharge into the sewer					
Volume m³/y	324.888	0	103.702	291.844	314.858
COD kg/y	335.327	0	73.010	271.239	301.679
COD mg/l	1.302	0	704	929	958
N kg/y	52.488	0	2.631	11.684	23.808
N mg/l	162	0	25	40	76
N-NH4 kg/y	1.506	0	237	1.045	1.335
N-NH4 mg/l	5	0	2	4	4
SCR discharge to the on-site treatment					
Volume m³/y	0	324.888	221.185	33.043	10.030
Volume m³/d	0	985	670	100	30
% on total SCR discharge volume	0	100,00	68,08	10,17	3,09
COD kg/y	0	335.327	262.317	64.087	33.647
COD kg/d	0	1016	795	194	102
COD mg/l	0	1.032	1.186	1.940	3.355
% on total SCR discharge COD load	0	100,00	78,23	19,11	10,03
N kg/y	0	52.488	49.856	40.804	28.680
N kg/d	0	159	151	124	87
N mg/l	0	157	190	637	852
% on total SCR discharge N load	0	100,00	94,99	77,74	54,64
N-NH4 kg/y	0	1.506	1.270	461	171
N-NH4 kg/d	0	5	4	1	1
N-NH4 mg/l	0	29	25	11	6
% on total SCR discharge N-NH4 load	0	100,00	84,29	30,62	11,37
Final SCR discharge into the sewer					
Volume m³/y	324.888	324.888	324.888	324.888	324.888
COD kg/y	335.327	184.430	217.284	306.487	320.185
COD mg/l	1.032	568	669	943	986
N kg/y	52.488	21.070	22.637	28.029	35.288
N mg/l	162	65	70	86	109
N-NH4 kg/y	1.506	7.948	7.779	7.189	5.646
N-NH4 mg/l	5	24	24	232	17

RESULTS



RESULTS

Livescia WWTP influent					
Volume m³/y	1.720.379	1.720.379	1.720.379	1.720.379	1.720.379
% of total SCR discharge volume on Livescia WWTP influent	18,88	18,88	18,88	18,88	18,88
COD kg/y	684.555	533.658	566.513	655.716	669.414
COD mg/l	398	310	329	381	389
% of total SCR discharge COD load on Livescia WWTP influent	48,98	34,56	38,35	46,74	47,83
 % COD load reduction on Scenario 0		-22,04	-17,24	-4,21	-2,21
N kg/y	108.916	77.499	79.066	84.457	91.717
N mg/l	63	45	46	49	53
% of total SCR discharge N load on Livescia WWTP influent	48,19	27,19	28,63	33,19	38,48
 % N load reduction on Scenario 0	-	-28,85	-27,41	-22,46	-15,79
N-NH4 kg/y	41.222	47.664	47.495	46.905	45.362
N-NH4 mg/l	24	28	28	27	26
% of total SCR discharge N-NH4 load on Livescia WWTP inf.	3,65	16,68	16,38	15,33	12,45
% N-NH4 load reduction on Scenario 0	-	+15,63	+15,22	+13,78	+10,04

CONCLUSIONS

- In all Scenarios (except the 4th) SCR respects the Total Nitrogen discharge limit;
- In Scenario 1 is feasible without changes in the company sewage system
- In Scenarios 2, 3 and 4 it is necessary to create a separate sewer system with a further storage tank and to plan an hydrolysis step for N_{org} to NNH_4
- High nitrogen load treated in on-site treatment with a low discharge volume

The demonstration scenario chosen is Scenario 1 which obtains the best results in nitrogen removal without modifications to the company sewer system and a specific phase of organic nitrogen.

Thank you

CONTACT

info@life-dentreat.eu



Martina Bargna
Giovanni Bergna

Via Laghetto 1 - 22073 Fino Mornasco (CO)

Tel. ++39 31 920518 - Fax ++39 31 921880

martinabargna@lariana.it
giovannibergna@lariana.it

