EU Green Week
PARTNER EVENT

Demonstration of water management in the industry by EU-funded and LIFE projects

Online (via Teams)
Mon June 17th, 2024
Register here

#WaterWiseEU

Being divided in 3 main thematic areas, this webinar is focused on **demonstration of water management technologies and valorisation processes implemented and replicable in several industrial sectors:**

- Textile and cosmetic companies, as well as industrial districts.
- Laundries and water-intensive domestic activities.
- Agricultural and greenhouses.
- Metal manufacturing and hard-surfaces finishing industries.
- Design and manufacturing of water filtration and purification systems.

Exchange of knowledge for inspiring new projects, learning about good practices developed at EU level and promotion of synergies for boosting the water resilience of the EU industry are the main goals of this webinar organized by LIFE ANHIDRA, a closed-loop system for re-using water from garment finishing processes.

AGENDA (17/6/24, 10:00 – 12:45, CEST time)

10:00 OPENING SESSION: Water scarcity and impacts in the EU industry. *Oscar Calvo (AITEX, ES)*

SESSION 1. MANAGEMENT OF WATER: CLOSED-LOOP SYSTEMS AND SMART TOOLS

10:05 Unique and sustainable system for producing garments without water discharges
LIFE ANHIDRA. Víctor Herraez (AITEX, ES)

10:20 Helping the textile industry reduce its water footprint
REWAFT. Rick Hogeboom (WATER FOOTPRINT NETWORK. University of Twente, NL)

10:35 Reuse of laundry wastewater
LIFE RECYCLO. Lisa Rouvière (TREEWATER SAS, FR)

SESSION 2. REMEDIATION AND REMOVAL OF POLLUTANTS FROM WATER

10:50 Multimodal orchestrated removal of emerging pollutants from textile wastewater
LIFE CASCADE. Carla Joana Silva (CITEVE, PT)

11:05 Efficient removal of perfluorooctanoic acid (PFOA) from water with magnetic fluids
LIFE FOUNTAIN. Luca Magagnin (POLITECNICO DI MILANO, IT)

11:20 Multidimensional integrated quantitative approach to safety and sustainability of nanomaterials. Applications to real case scenarios in water treatment
INTEGRANO. Massimo Perucca (PROJECT HUB360, IT)

SESSION 3. RECOVERING AND VALORIZATION OF ENERGY AND WASTE STREAMS

11:35 Anaerobic and autotrophic bioprocesses to transform a WWTP into a resource-generating biofactory with a positive energy balance
LIFE ZERO WASTE WATER. Marta Elvira Castaño (FCC AQUALIA S.A, ES)

11:50 Water smart industrial symbiosis
ULTIMATE. Joep van den Broeke (KWR WATER BV, NL)

12:05 Innovation for water reuse & resource recovery. AnMBR technology in SYMSITES EcoSites
SYMSITES. Emma Pérez (AITEX, ES)

12:20 Brine and metal waste valorization to produce coagulants for wastewater treatment
LIFE WASTE2COAG. Laura Grima Carmena (AIDIMME, ES)

12:35 10-min Q&A SESSION AND CLOSING REMARKS *(Moderator: Òscar Calvo – AITEX, Spain*

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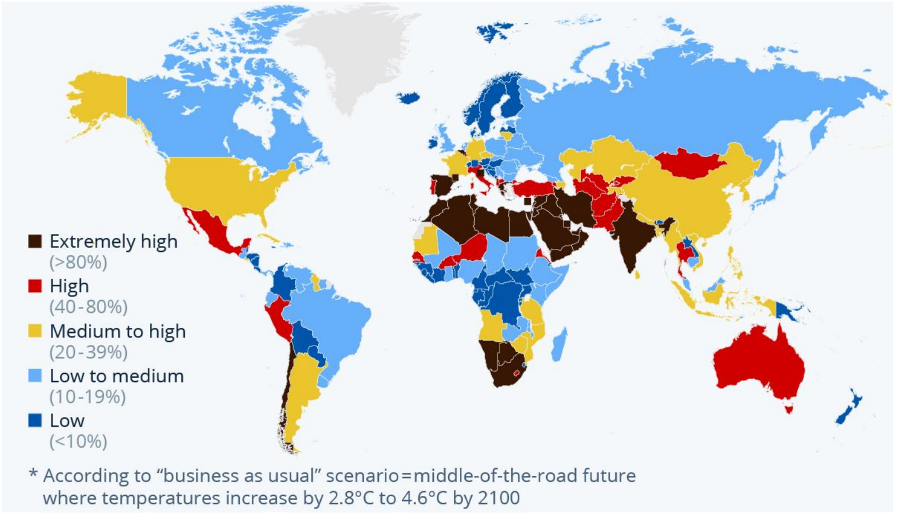
PIZARRO

Water scarcity and impacts in the EU industry



Projected water stress at worldwide level for 2050. From WRI, Aqueduct and Statista (2024).

- Europe experienced its most severe drought in 500 years during summer 2022 (*Source: CEFIC, 2022*).

- Water scarcity affects 30% of Europeans and 20% of land annually (*Source: EC - #WaterWiseEU campaign, 2024*).

- The interplay between climate change, water availability fluctuations, and energy, food, and industrial needs exacerbates the situation.

Impacts on people and manufacturing

- The whole manufacturing sector, including those industries highly dependent about water (chemical, textile, food, ceramics, metal/surface treatments…), faces challenges due to water scarcity.
- Inland waterways are crucial for transporting goods in Europe, but droughts directly affect this ability.
- Operational risks rise as droughts become more frequent.

Droughts may cost up to EUR 9 billion every year

Water scarcity affects 30% of Europeans and 20% of land each year

48% of Europeans think that droughts and water shortages are the main threat to water in their country

EU GREEN WEEK PARTNER EVENTS

Legislative Framework & Industry Response

- EU policies like the ‘Industrial Emissions Directive’ and ‘Eco-design for sustainable products’ promote water efficiency and reuse.

Bathing water
EU rules to ensure clean and high-quality bathing water across Europe

Drinking water
Improving access to drinking water for all

Floods
EU measures to manage flood risk and the risks floods pose to human health and the environment.

Groundwater
EU action to ensure good quantity and quality of groundwater.

Marine waters
EU action to protect Europe’s coasts, seas and oceans.

Nitrates
Protecting waters against pollution caused by nitrates from agricultural sources

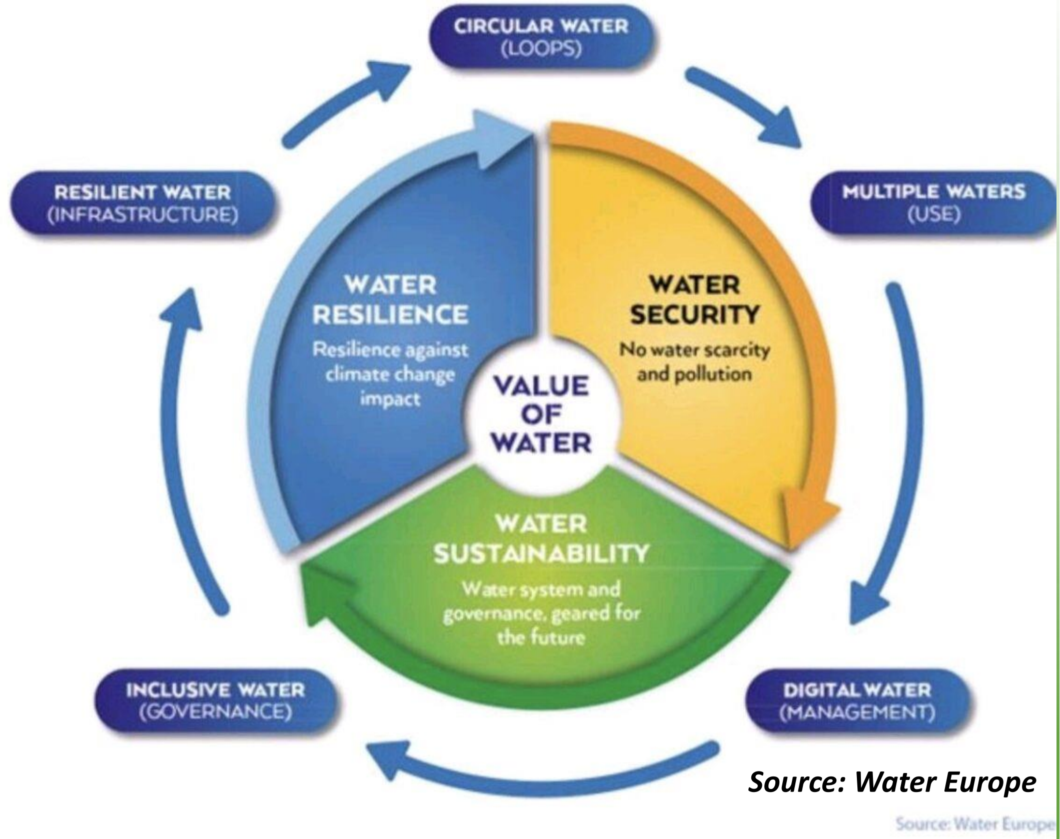
Surface water
EU rules protecting surface waters from chemical pollution.

Urban wastewater
EU rules to ensure that urban wastewater is properly dealt with.

Water Reuse
Managing water resources more efficiently and facilitating water reuse in the EU

Water scarcity and droughts
Preventing and mitigating water scarcity and droughts in the EU

EU efforts on the global water agenda
It is essential to sustain the political momentum of the UN 2023 Water Conference, to accelerate actions for clean water and sanitation for all by 2030.



Source: Water Europe

EU GREEN WEEK PARTNER EVENTS

Industry Response – Innovation in water

SESSION 1. MANAGEMENT OF WATER: CLOSED-LOOP SYSTEMS AND SMART TOOLS

10:05 **Unique and sustainable system for producing garments without water discharges**
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LIFE WASTE2COAG. Laura Grima Carmena (AIDIMME, ES)

How companies, research entities and academia are pivoting to improve efficiency and eco-friendliness during water scarcity?

EU GREEN WEEK PARTNER EVENTS

aitex

LIFE anhidra UNIQUE AND SUSTAINABLE SYSTEM FOR PRODUCING GARMENTS WITHOUT WATER DISCHARGES

European Commission

Víctor Herráez
R&D Project Technician
victor.herraez@aitex.es

EU GREEN WEEK PARTNER EVENTS

aitex

LIFE anhidra

PIZARRO Guimarães, Portugal

Textile finishing company

Jeanologia THE SCIENCE OF FINISHING Valencia, Spain

Development of sustainable technologies for the finishing textile industry

aitex Alcoy, Spain

Textile research institute, with laboratory servicies and R&D projects

https://pizarro.pt/servicos/#producao

PIZARRO

Textile finishing company

Laundry, dyeing, finishing and printing

Denim Washing

Denim garments require special colour/effect looks

- Stone washing
- Enzime washing
- Acid washing
- Bleaching
- Sand blasting
- Whisker

ENVIRONMENTAL PROBLEM TARGETED

WATER SCARCITY

Affects 11% of EU
Grow to 30% in 2030

INTENSIVE WATER CONSUMPTION IN TEXTILE INDUSTRY

4% of global consumption
30% of production in EU

AQUATIC POLLUTION

High chemical use in textile industry
Most of them end in wastewater (WW) streams

OBJECTIVES

LIFE ANHIDRA project aims to demonstrate new sustainable garment's finishing processes thanks to the innovate water regeneration loop.

The water is conditioned "in situ" for being reused in the process, avoiding the 98% of the WW discharge to the environment.

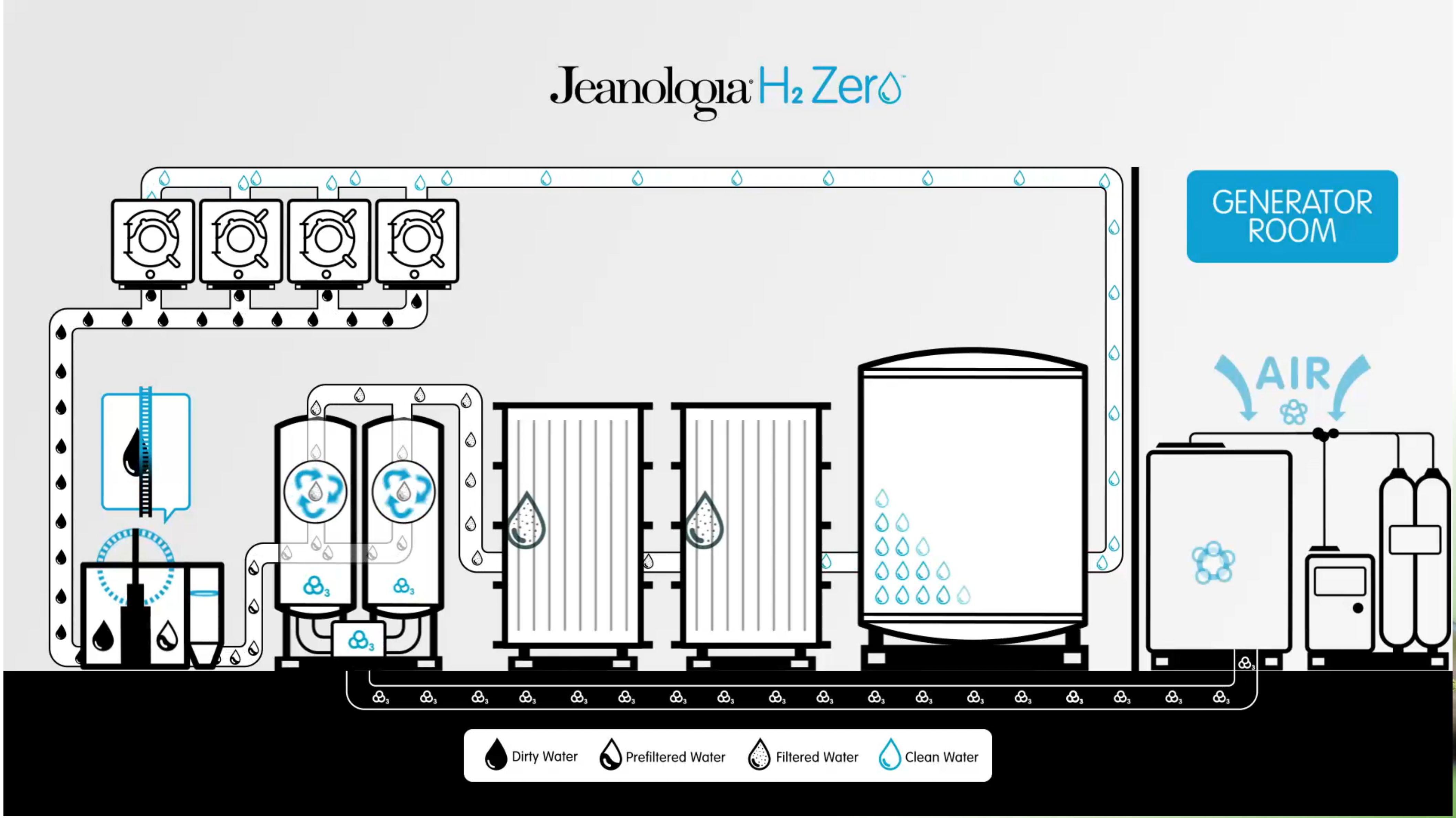
Water treatment of ANHIDRA system

Environmental benefits:

- Dehydrate textile finishing industry
- Water reuse
- Avoid discharges
- Re-use of textile fiber waste
- Operational good practices

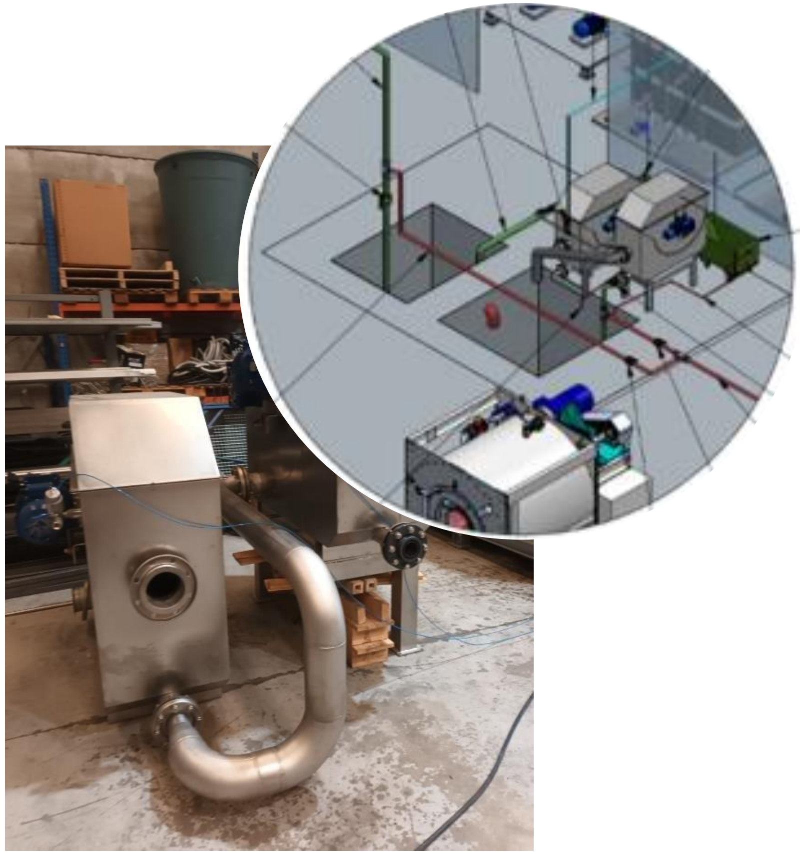
Expected resources consumption

INDICATOR	SAVINGS
WATER INLET	92%
WATER DISCHARGE	98%
ENERGY	15.7%
GHG EMISSIONS	15.7%

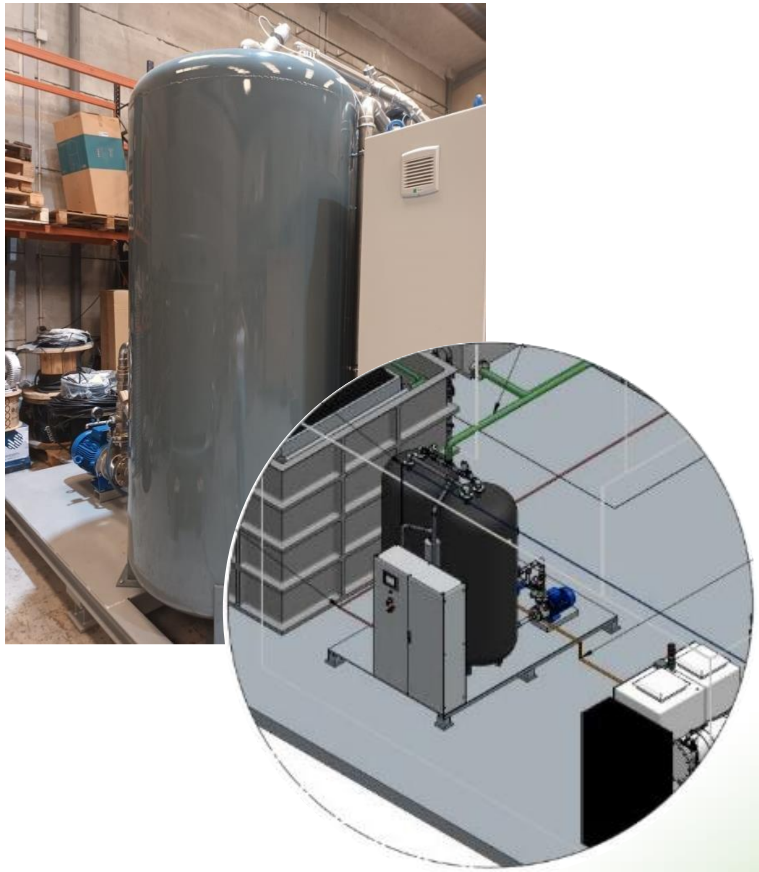

Jeanologia H2 Zero
GENERATOR ROOM
AIR
Dirty Water
Prefiltered Water
Filtered Water
Clean Water

DESIGN AND CONSTRUCTION OF THE ANHIDRA TECHNOLOGY

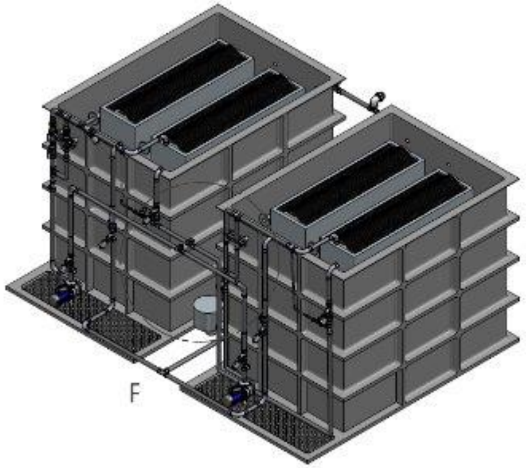
ROTARY FILTERS



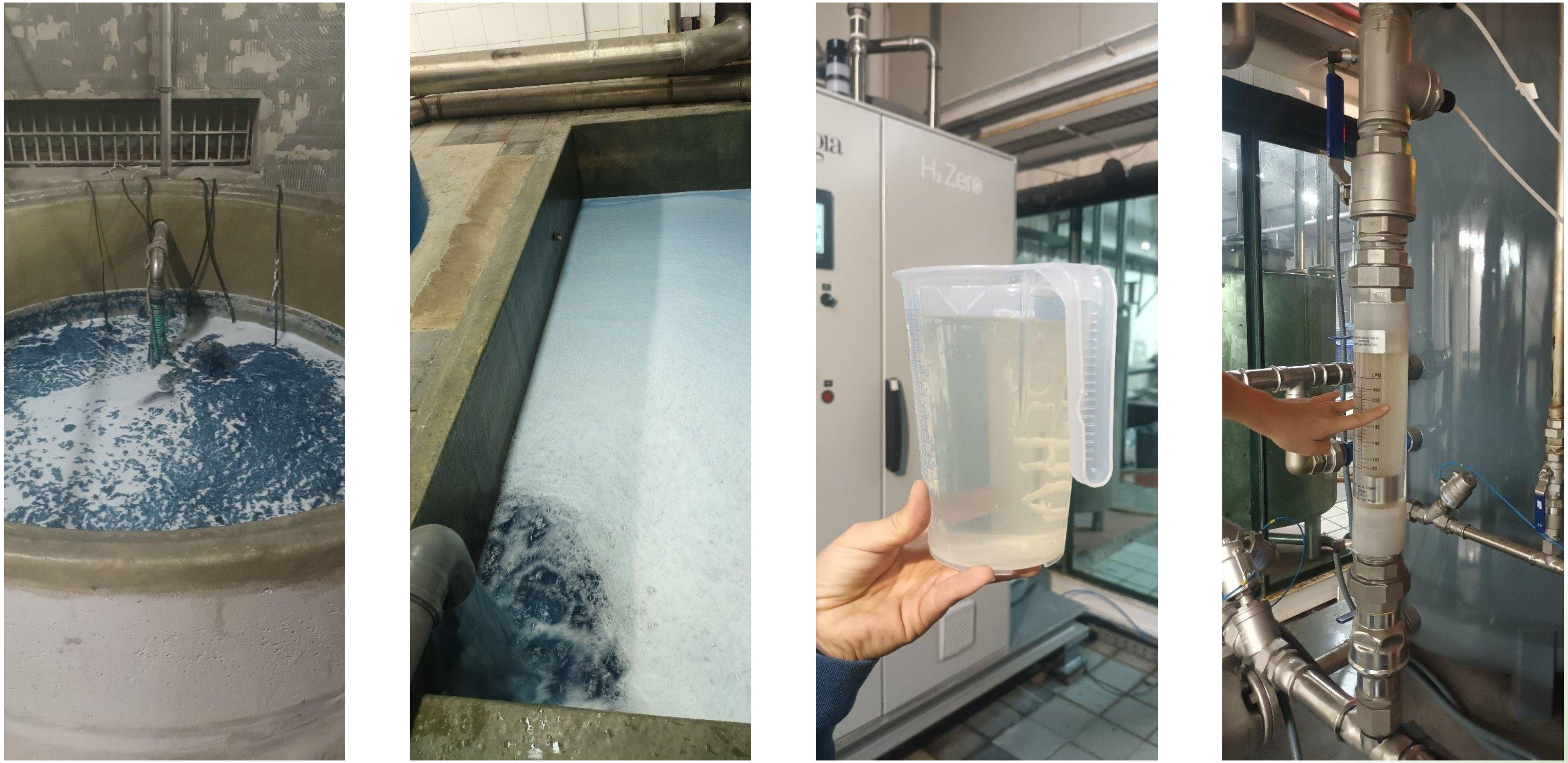
OZONE TREATMENT



ULTRATILTRATION TREATMENT



DESIGN AND CONSTRUCTION OF THE ANHIDRA TECHNOLOGY



Elimination of pollutants throughout the ANHIDRA system

VALORIZATION OF FIBERS BASED ON CIRCULAR ECONOMY

Main fiber-based wastes generated and collected along the ANHIDRA system. What could we do with them???

	COLLECTING POINT		
	FIRST MODULE (mechanical separation)	PRIOR TO OZONE GENERATORS	FROM THE ADVANCED FILTRATION DEVICES
Format of the textile waste	Not dried. Very high moisture. Liquid state or paste. Part of the wastewater. Very high concentration in solid content and colour.	Not dried. Very high moisture. Liquid state or paste. Part of the wastewater. High concentration of colour (expected).	Not dried. High moisture. Part of the filter cake.
Fiber length (estimated)	From microns to cm	From microns to mm	Microns / powder
Main critical steps for waste conditioning	Isolation of the solid part from the 'wet' part of the waste. Drying. Hygienization/autoclave (to be explored). Chopped / cut or pulverization (to be explored). Identification and separation of non-valuable parts (plastics, zippers)	Isolation of the solid part from the 'wet' part of the waste. Drying. Hygienization/autoclave (to be explored). Chopped / cut or pulverization (to be explored).	Separation from the filter media. Drying. Hygienization/autoclave (to be explored). Pulverization. Accumulation of chemicals can interfere negatively

Anhidra dried fiber waste

VALORIZATION OF FIBERS BASED ON CIRCULAR ECONOMY

Pigment-like powder for coating, printing or dyeing

Size reducing in stirred ball mill

Anhidra dried fiber waste

Dry Process

Stirred ball mill

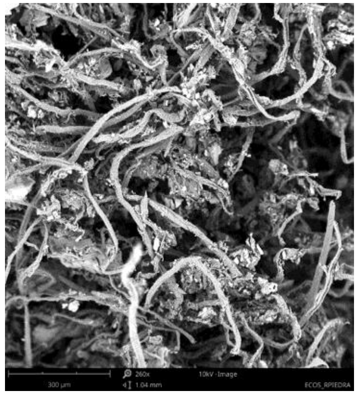
Wet Process

Wet milling paste

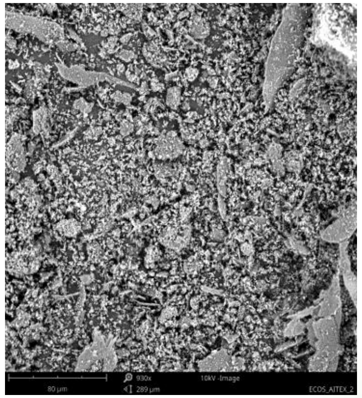
Spray drying

Size particle reduction:

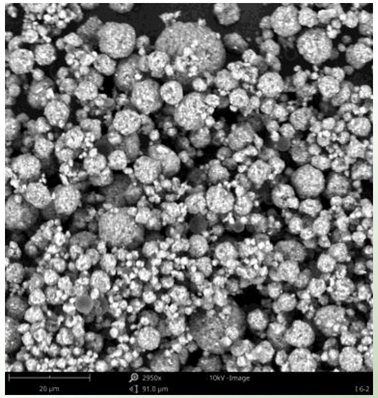
- Dry process: 55%
- Wet process: 98%



Anhidra waste SEM image



Dry process SEM image



Wet process SEM image

Sample	Dx (10) (µm)	Dx (50) (µm)	Dx (90) (µm)
ANHIDRA fiber waste	17.6	66.8	393
Dry process	8.59	34.5	177
Wet process	0.97	3.33	7.42

VALORIZATION OF FIBERS BASED ON CIRCULAR ECONOMY

Pigment-like powder for coating, printing or dyeing

Pigment Dyeing

Fabric dyed with pigment from Anhidra waste

- Use of pigment for dyeing in exhaution processes
- Replacement of synthetic pigments
- Distressed-look garments

Commercial pigment-dyed garments

Coating Process

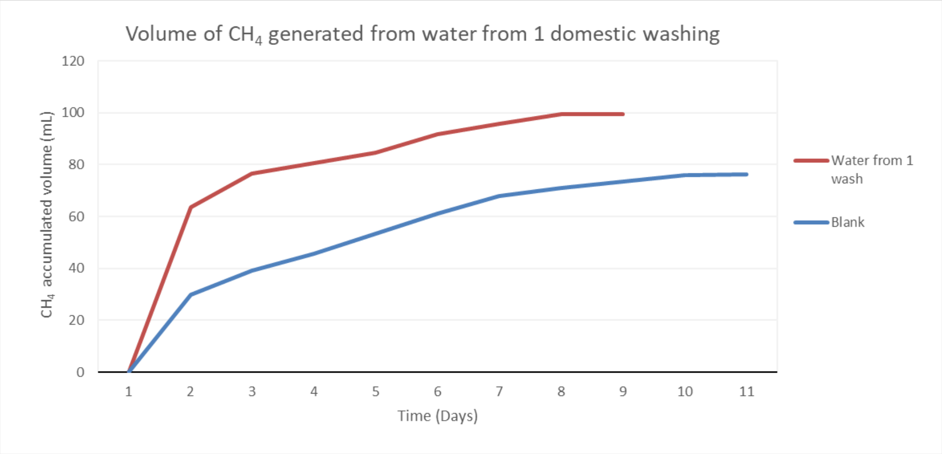
Fabric coated with Anhidra pigment

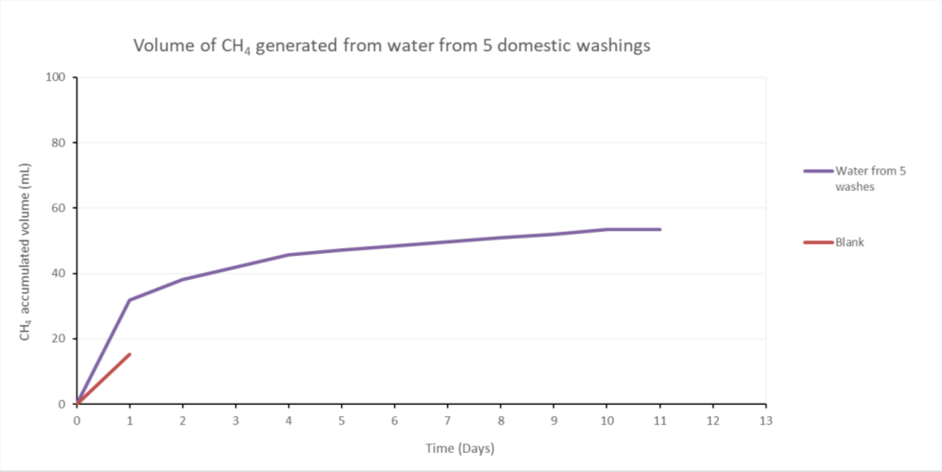
- Application of pigment in printing paste
- Use in coating or screen printing
- Replacement of synthetic pigments

Printing paste

VALORIZATION OF FIBERS BASED ON CIRCULAR ECONOMY

Biogas/methane generation (first approach, on a diluted sample)





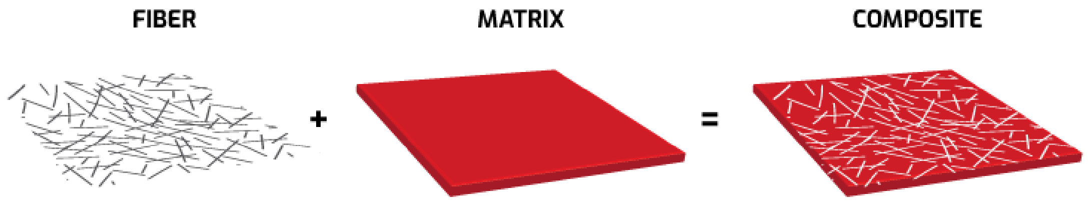
BMP test in anaerobic digestor

	1 wash	5 washes
Methane production value (mL CH_4)	26,05	16,70

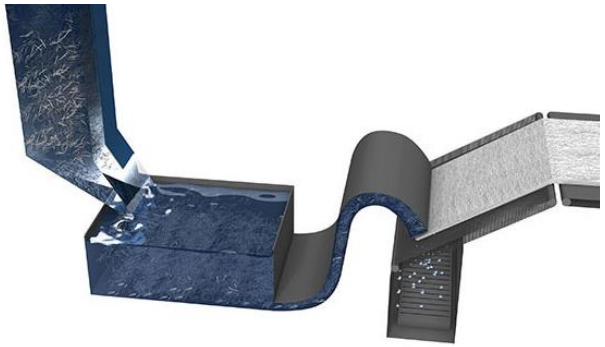
As the "fiber-based" sludge is enriched in cellulosic fibers, next concentrated samples will provide higher ratios of CH_4 production.

VALORIZATION OF FIBERS BASED ON CIRCULAR ECONOMY

Other considered routes:



Composite formation



Wet laid technology

Viscose fiber

- Cutting/gringind and panels by **hot press plates.**
- Nonwovens for composites and panels (by **wet-laid technology**).
- Reinforcement for **composites.**
- Chemical transformation to obtain new **cellulose based yarns.**

EU GREEN WEEK PARTNER EVENTS

LIFE anhidra

THANK YOU FOR YOUR ATTENTION

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PIZARRO

https://pizarro.pt/

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LIFE anhidra

https://www.jeanologia.com/es/life-anhidra/

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EU GREEN WEEK PARTNER EVENTS

REWAFT

Funded by the European Union

The REWAFT project: Helping the textile industry reduce its water footprint

Rick Hogeboom, PhD

Executive Director
Water Footprint Network
The Netherlands

Asst Professor Multidisciplinary Water Management
University of Twente
The Netherlands

EU GREEN WEEK PARTNER EVENTS

REWAFT

At a glance

Funding: Erasmus+ Partnerships in Higher Education (KA220)

Objective: REducing the WAter Footprint of the Textiles industry

Duration: 1/11/2022 → 31/10/2024

Partners: LT & ES & GR & NL

ktu 1922 kaunas university of technology

water footprint network

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

idec

ΠΑΝΕΠΙΣΤΗΜΙΟ ΔΥΤΙΚΗΣ ΑΤΤΙΚΗΣ UNIVERSITY OF WEST ATTICA

LaTIa

Water Footprint Network

- Knowledge center based in the Netherlands:

  Mission: to promote fair and smart use of water worldwide

  Basis: the water footprint concept

  Core activities:

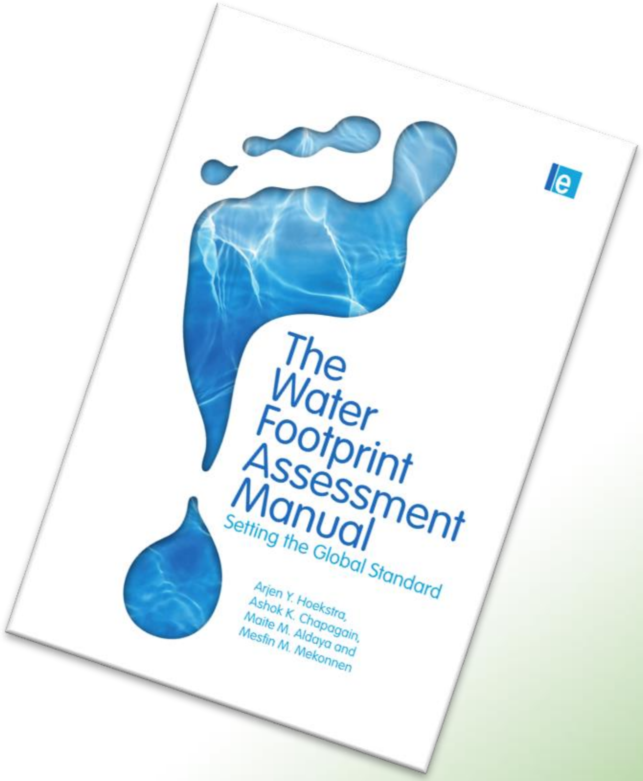
  - Network and exchange (training)
  - Data and dissemination (WaterPub database, WFA global standard)
  - Water stewardship (Science-Based Targets for Water, CDP questionnaires)

REWAFT Output

- In-person series of **seminars**
  - Training and awareness raising for higher education students
  - Supported by industry representatives
- Online self-paced **e-course**
  - Building capacity for industry professionals to reduce water footprints
  - Develop corporate water strategy (Action Plans)
- Various **dissemination** activities
  - Most of the team is at AUTEX now ☺

REWAFT Output

- Water Footprint of Textiles **Calculator**
  - Online interactive web application
    - For students and industry professionals
  - Methodology based on WFA principles →
  - Informing corporate water strategies



REWAFT Project

The water footprint of textiles pr

https://calculator.textilewaterfootprint.eu

REWAFT

- English
- Greek
- Lithuanian
- Español

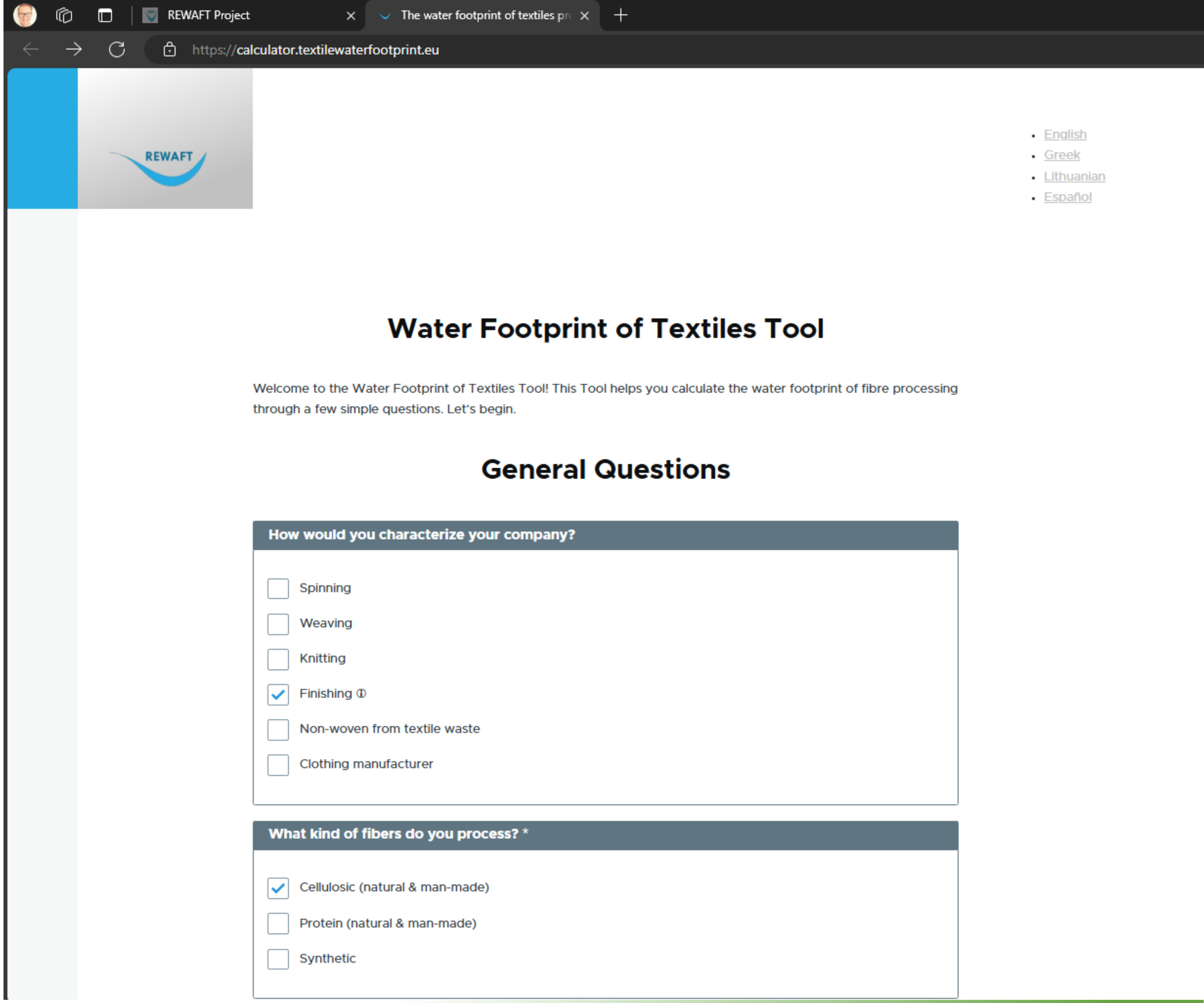
Water Footprint of Textiles Tool

Welcome to the Water Footprint of Textiles Tool! This Tool helps you calculate the water footprint of fibre processing through a few simple questions. Let's begin.

General Questions

How would you characterize your company?

- [ ] Spinning
- [ ] Weaving
- [ ] Knitting
- [ ] Finishing ⓘ
- [ ] Non-woven from textile waste
- [ ] Clothing manufacturer


REWAFT Project
The water footprint of textiles pr
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REWAFT
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General Questions
How would you characterize your company?
Spinning
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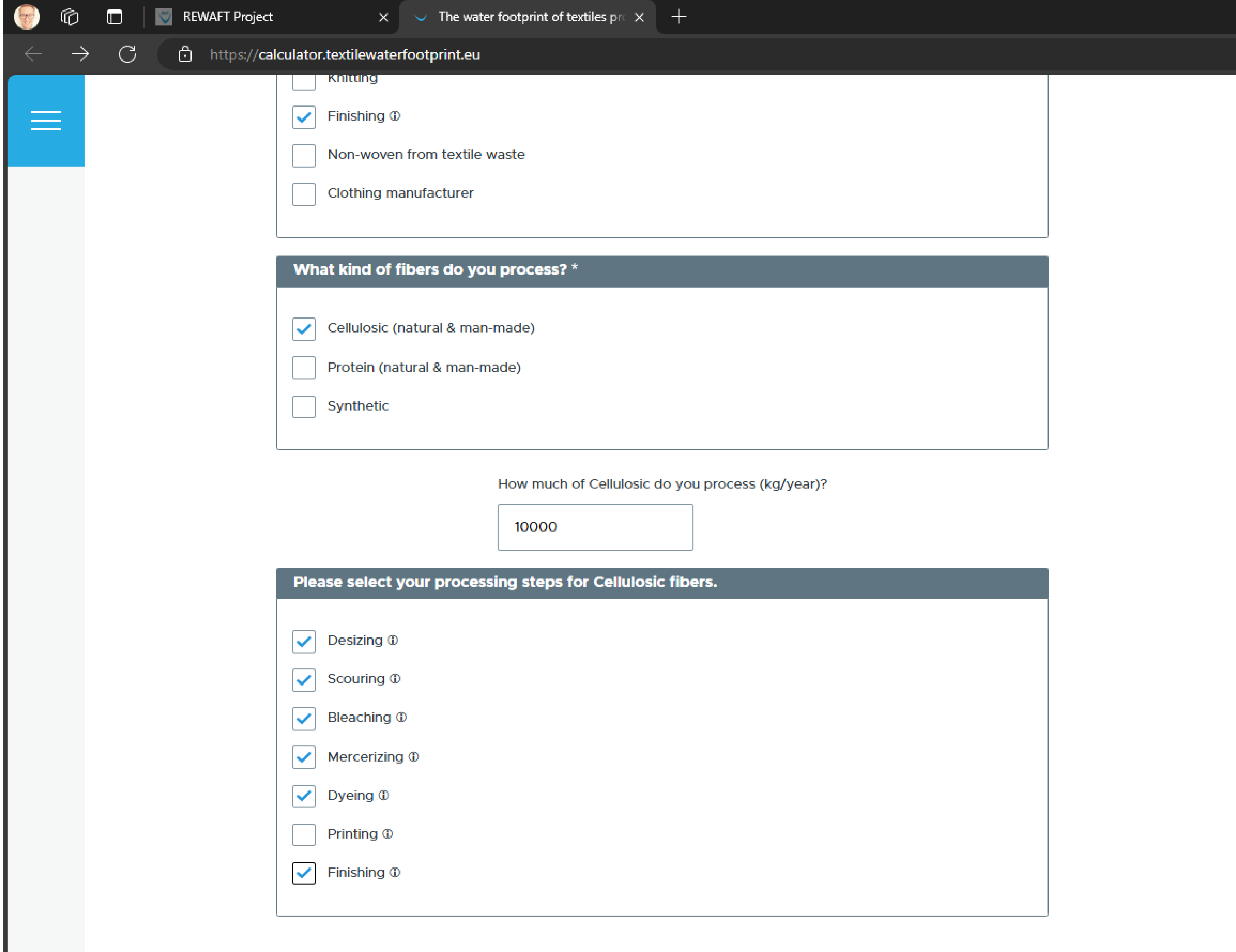
Knitting
Finishing
Non-woven from textile waste
Clothing manufacturer
What kind of fibers do you process? *
Cellulosic (natural & man-made)
Protein (natural & man-made)
Synthetic

EU GREEN WEEK PARTNER EVENTS



REWAFT Project | The water footprint of textiles pr

https://calculator.textilewaterfootprint.eu

Water Use and Blue Water Footprint

The following questions will help you calculate your water use and your blue water footprint. Although often used interchangeably, water use and water consumption are two different indicators that are both relevant to understand.

Water use refers to gross volumes of water, such as the (metered) intake from taps or wells. Water consumption refers to net volumes of water (water that does not or cannot be returned to the water system) and can be calculated by subtracting water discharge from water intake. Water consumption is measured by the blue water footprint.

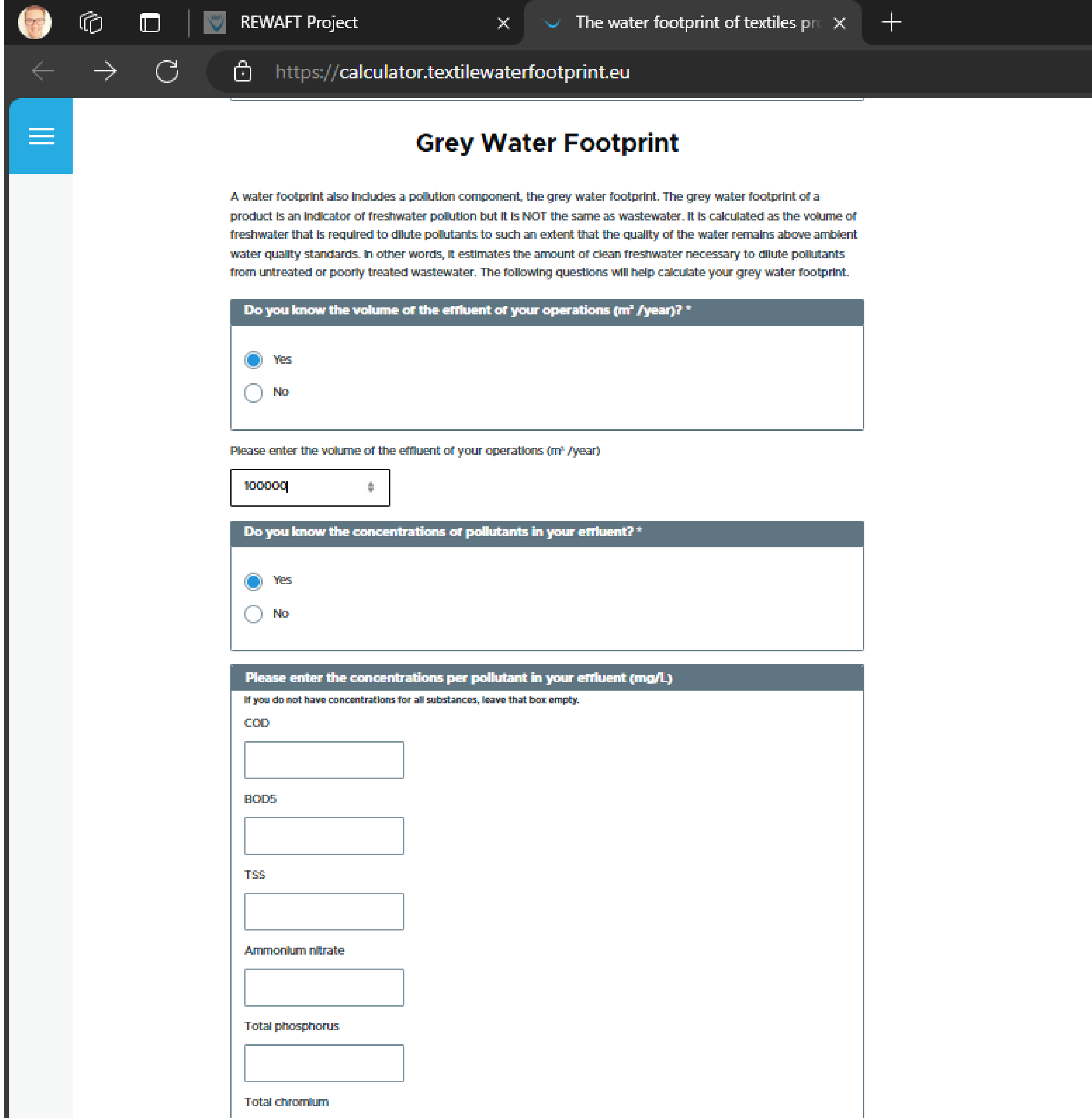
The blue water footprint gives a more accurate measure of the appropriation of fresh water by a user such as a textile processor.

Do you know your water use? *

- ○ Yes, at the level of each processing step
- ○ Yes, at the level of my entire operations (e.g. factory)
- ● No

Do you know your water consumption? *

- ○ Yes, at the level of each processing step
- ○ Yes, at the level of my entire operations (e.g. factory)
- ○ No


REWAFT Project
The water footprint of textiles pr
https://calculator.textilewaterfootprint.eu

Grey Water Footprint

A water footprint also includes a pollution component, the grey water footprint. The grey water footprint of a product is an indicator of freshwater pollution but it is NOT the same as wastewater. It is calculated as the volume of freshwater that is required to dilute pollutants to such an extent that the quality of the water remains above ambient water quality standards. In other words, it estimates the amount of clean freshwater necessary to dilute pollutants from untreated or poorly treated wastewater. The following questions will help calculate your grey water footprint.

Do you know the volume of the effluent of your operations (m^3 /year)? *

- (•) Yes
- ( ) No

Please enter the volume of the effluent of your operations (m^3 /year)

100000

Do you know the concentrations of pollutants in your effluent? *

- (•) Yes
- ( ) No

Please enter the concentrations per pollutant in your effluent (mg/L)

If you do not have concentrations for all substances, leave that box empty.

COD

BOD5

TSS

Ammonium nitrate

Total phosphorus

Total chromium

RESULTS

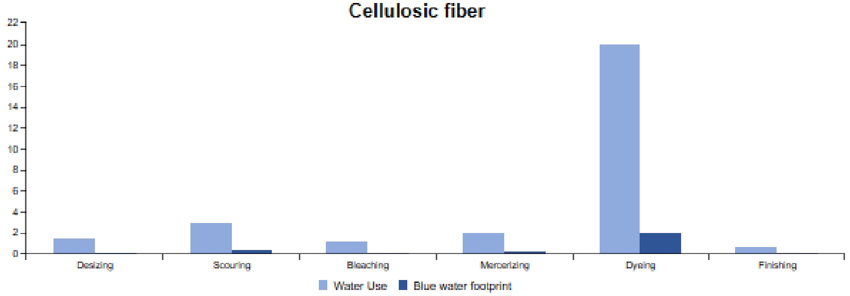
The results generated by this tool are intended to provide preliminary insights and should be regarded as approximate indications of the water footprint. A more comprehensive and detailed analysis, incorporating site-specific data and robust methodologies, is necessary to obtain a more precise estimation of the water footprint associated with the specific activities or processes being evaluated. By providing more specific input and obtaining tailored results, the user can gain a better understanding of its water footprint and its potential impact. Customized assessments can enable the user to identify areas for improvement, implement targeted strategies, and make informed decisions towards reducing its water footprint.

Water use and the blue water footprint

This section presents the water use and blue water footprint results for each fiber throughout the processing steps. The water use indicates the amount of water withdrawn, while the blue water footprint represents freshwater consumption.
To reiterate the difference between water use and water consumption: Water use refers to gross volumes of water, such as the (metered) intake from taps or wells. Water consumption refers to net volumes of water (water that does not or cannot be returned to the water system) and can be calculated by subtracting water discharge from water intake.

Water use and blue water footprint per processing step for each fiber type

Cellulosic fiber

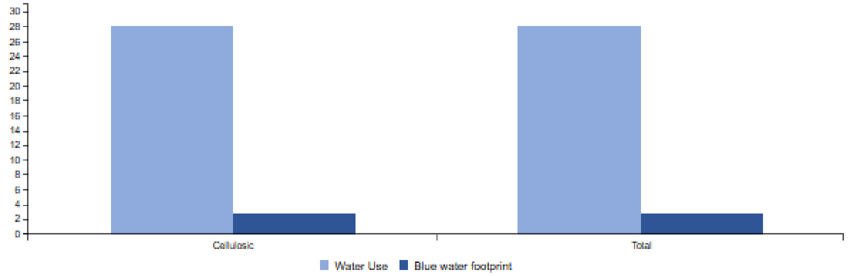


Processing step	Water use (m³ /year)	Blue water footprint (m³ /year)
Desizing	1.400	0.140
Scouring	3.000	0.300
Bleaching	1.200	0.120
Mercerizing	2.000	0.200
Dyeing	20.000	2.000
Finishing	0.600	0.060

| Finishing | 0.600 | 0.060 |

Total water use and blue water footprint per fiber

Total fiber



Fiber	Water use (m³ /year)	Blue water footprint (m³ /year)
Cellulosic	28.200	2.820
Total	28.2	2.82

Grey water footprint

Grey water footprint is the amount of fresh water required to assimilate pollutants to meet specific water quality standards. The grey water footprint considers point-source pollution discharged to a freshwater resource directly through a pipe or indirectly through runoff or leaching from the soil.

In this Tool, the grey water footprint is calculated at factory level as a function of total effluent volume and a predetermined dilution factor. The grey water footprint is displayed in the graph below. The more data is available on effluent pollutant loads, the more precise a grey water footprint estimation can be provided.

GWF

What are the implications of these results?

A water footprint value in itself provides an insight into the water consumption. However, understanding the context

EU GREEN WEEK PARTNER EVENTS

REWAFT Project | Results | waterfootprintcalculator

https://calculator.textilewaterfootprint.eu/waterfootprintcalculator/results?node_id=379

What are the implications of these results?

A water footprint value in itself provides an insight into the water consumption. However, understanding the context of a water footprint value is crucial for accurate interpretation and meaningful decision-making. By analyzing the context of water footprint values, informed choices can be made and effective strategies for sustainable water management and resource conservation can be developed.

Is my water footprint too large?

For water consumption to be economically sustainable, it should be used as efficiently as possible. A way of understanding if your water footprint is efficient is to compare it to a product or sector benchmark.

In the table(s) below you can find and compare the water footprint per processing step for each fiber, as calculated by the tool, and the corresponding benchmark value as found through literature review. The last column displays the deviation from the benchmark. A negative percentage (in green) indicates the actual water footprint is lower than the benchmark and a positive percentage (in red) indicates an exceedance of the benchmark. If your calculated water footprint exceeds the benchmark value you should take action to increase the efficiency of your water consumption.

Fiber Cellulosic

	Benchmark (L/kg)	Actual (L/kg)	Deviation from benchmark
Desizing	1.18	1.2	1.69%
Scouring	3.25	3	-7.69%
Bleaching	1.38	1.5	8.7%
Mercerizing	2.45	2	-18.37%
Dyeing	15.5	20	29.03%
Finishing	0.6	0.6	0%

Is my water footprint impacting the local environment?

In addition to economic efficiency, a water footprint should be environmentally sustainable, allowing ecosystems to satisfy their water requirement and socially equitable, ensuring basic human water needs are met. Evaluating the sustainability of the total water footprint can best be done at the level of a catchment area or river basin. When problems of water scarcity, pollution or conflict for water occur in certain locations at specific times of the year (e.g. dry season), the (sub)-catchment is categorized as a hotspot.

The geographical location of a textile processing factory is essential in order to establish its water footprint sustainability and set reduction targets. Simple map-based tools exist to identify if your factory is in a hotspot area.

Check if the collective water footprint at the location of your factory/workshop is negatively impacting the environment and if you need to reduce: SBTN Water Targets

Additional water footprint information

Did you find this tool useful and wish to understand more about your water footprint?

More information

REWAFT project

https://textilewaterfootprint.eu/

Textiles water footprint tool

https://calculator.textilewaterfootprint.eu/

Water Footprint Network

https://www.waterfootprint.org || rick.hogeboom@waterfootprint.org

SCAN ME

EU GREEN WEEK PARTNER EVENTS

LIFE20 ENV/FR/000205

LIFE-RECYCLO project: Reuse of laundry wastewater

Lisa Rouvière – Treewater

GRUP fundació Ramon Noguera · BSJ · treewater KEEPING ON THE CYCLE · klin.lu · POP' SCIENCES Université de Lyon · ICRA Catalan Institute for Water Research

Treewater

Treewater is a start-up created in 2017, with 15 people

Supplier of industrial wastewater treatment/recycling technology

Specialized in advanced oxidation technologies

Treewater has a research and development unit

Life

recyclo by treewater

Reuse of laundry wastewater

Life project RECYCLO started on septembre 2021
Duration 4 years and half → end 02/2026

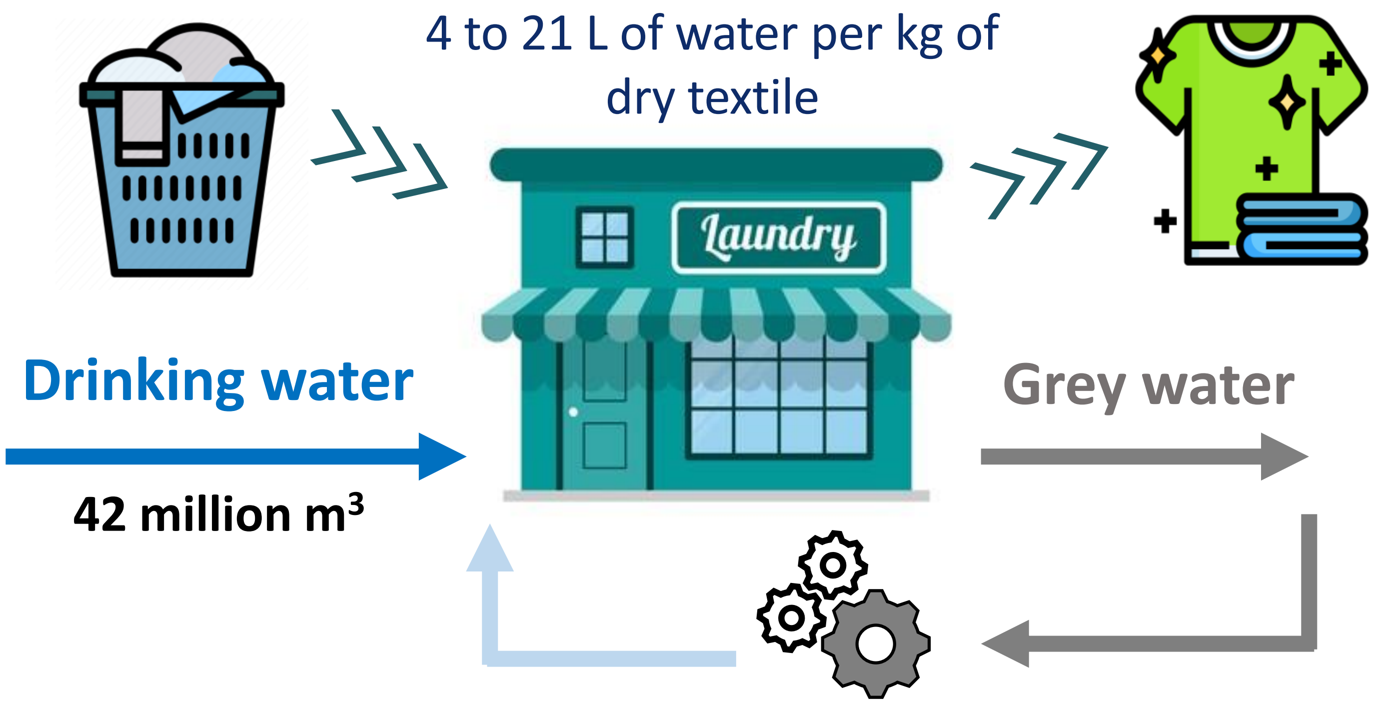
Budget:

Total: **€ 1 484 159**

EU co-funding: **€ 806 112** (54,31 %)

European Commission

LIFE-RECYCLO Reuse of laundry wastewater



Pollutants in wastewater:

- Allergenic fragrance compounds
- Phthalates (DEP, DEHP)
- Surfactants (Nonylphenols)
- PFAS
- PBDEs

LIFE RECYCLO aims to develop a technology for recycling wastewater in laundries

- Eliminate at least 90% of emerging pollutants (AOX, PBDE, PAH...)
- Complete water disinfection
- Valorisation of the sludge produced by composting or methanisation

EU GREEN WEEK PARTNER EVENTS

LIFE-RECYCLO Reuse of laundry wastewater

- **Locations**:

  France - Luxembourg - Spain

- **Partner:**

➢ Laundries: ★

- Fundacio Max Xirgu (GRUPFRN) → 4 m^3/d
- KLIN SARL → 20 m^3/d
- Blanchisserie Saint Jean (BSJ) → 40 m^3/d

➢ University of Lyon – Pop'Sciences ★

➢ TREEWATER SAS ★

➢ Catalan Institute for Water Research (ICRA) ★

LIFE-RECYCLO Reuse of laundry wastewater

Fundacio Max Xirgu (GRUPFRN) → October 2023

12-month follow-up

KLIN SARL → begining 2025

Saint Jean laundry (BSJ) → Spring 2025

- 6-month follow-up

LIFE-RECYCLO Reuse of laundry wastewater

Principle of the RECYCLO process

3 majors building blocks

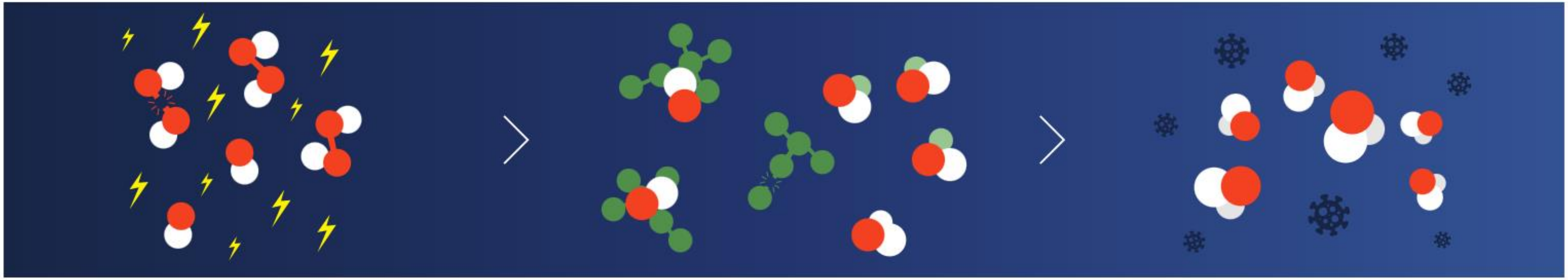
Advanced oxidation process
UV/H_2O_2

Dissolved COD removal
Organic pollutant removal
Disinfection

LIFE-RECYCLO Reuse of laundry wastewater

Principle of the RECYCLO process

UV/H_2O_2 technology combines treatment with ultraviolet rays and hydrogen peroxide



1- UV rays transform hydrogen peroxide into highly reactive hydroxyl radicals (HO°)

2- Hydroxyl radicals attack and break down pollutants

3- UV rays disinfect water at the same time

LIFE-RECYCLO Reuse of laundry wastewater

Principle of the RECYCLO process

3 majors building blocks

Coagulation/flocculation

Suspended solids removal
Particular & colloidal COD removal
Transmittance increased

→

Advanced oxidation process
UV/H_2O_2

Dissolved COD removal
Organic pollutant removal
Disinfection

EU GREEN WEEK PARTNER EVENTS

LIFE-RECYCLO Reuse of laundry wastewater

Principle of the RECYCLO process

3 majors building blocks

Coagulation/flocculation

Suspended solids removal
Particular & colloidal COD removal
Transmittance increased

→

Advanced oxidation process UV/H_2O_2

Dissolved COD removal
Organic pollutant removal
Disinfection

→

Polishing treatment
Activated carbon or reverse osmosis

Refractory organic pollutant removal
Inorganic pollutant removal

EU GREEN WEEK PARTNER EVENTS

LIFE-RECYCLO Reuse of laundry wastewater

Characterisation of the effluent

Analysis of wastewater

	Unity	GRUPFRN
pH	-	8,5 ± 1,2
Trans. UV	%	12 ± 10
COD	mg/L	1100 ± 325
SS	mg/L	114 ± 35
Anionic surfactant	mg/L	62 ± 30
Cationic surfactant	mg/L	0,95 ± 0,61
Non ionic surfactant	mg/L	122
AOX	µg/L	290 ± 15
DEHP	µg/L	0 - 51,71
Hydrocarbon C10-C40	µg/L	444 - 3707
PFBA (PFAS)	µg/L	0,16

- Cloudy water
- COD of around 1 g/L
- Systematic presence of surfactants
- Large diversity of organic pollutants

➢ Slight variability according to the garments cleaned (Hydrocarbon, DEHP…)

LIFE-RECYCLO Reuse of laundry wastewater

Prototype at GRUPFRN / Spain

Implementation in October 2023

In GRUPFRN laundry

Girona, Spain

Ground surface area : ~ 10 m^2

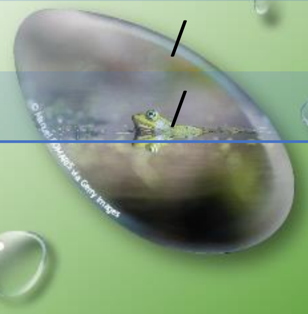
Treatment of 2-4 m^3 per day

LIFE-RECYCLO Reuse of laundry wastewater

Prototype at GRUPFRN / Spain

- COD reduction to < 15 mg O_2/L
- Surfactant reduction
- Water disinfection
- Heavy metals and organic pollutants removal

Parameters	Wastewater	Treated water	% Removal
pH	7,43	7,65	/
UV Transmittance (%)	7	98	/
COD (mg O_2/L)	962	< 15	> 98 %
Anionic surfactants (mg/L)	71,5	< 0,05	> 99 %
Cationic surfactants (mg/L)	0,552	0,048	91 %
Non ionic surfactants (mg/L)	122	< 0,2	> 99 %
COT (mg/L)	338,6	26,4	92 %
AOX (µg/L)	321	29	91 %
Hydrocarbon C10-C40 (µg/L)	3707	200	95 %
Coliformes bacterial	unreadable	< 1	/
Intestinal Enterococcus	unreadable	< 1	/

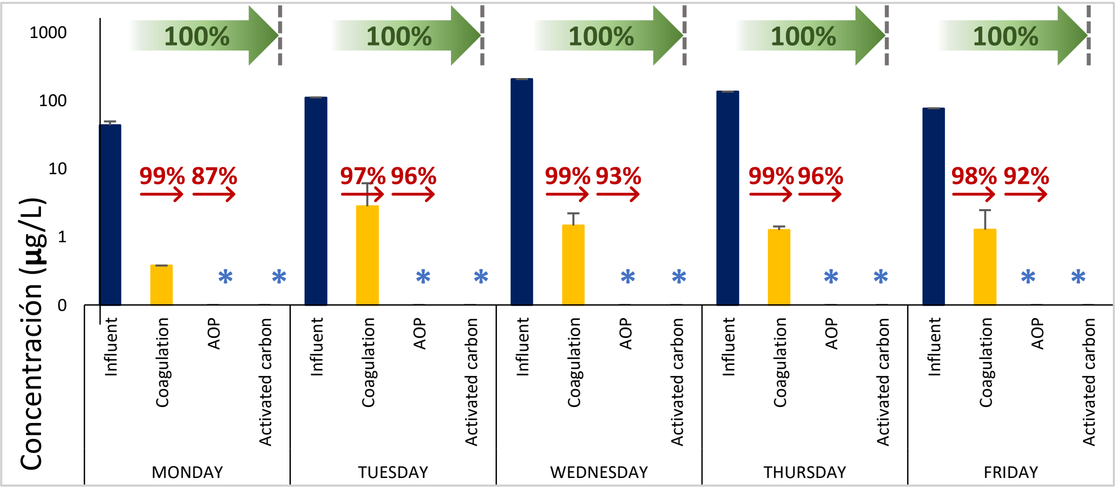


EU GREEN WEEK PARTNER EVENTS

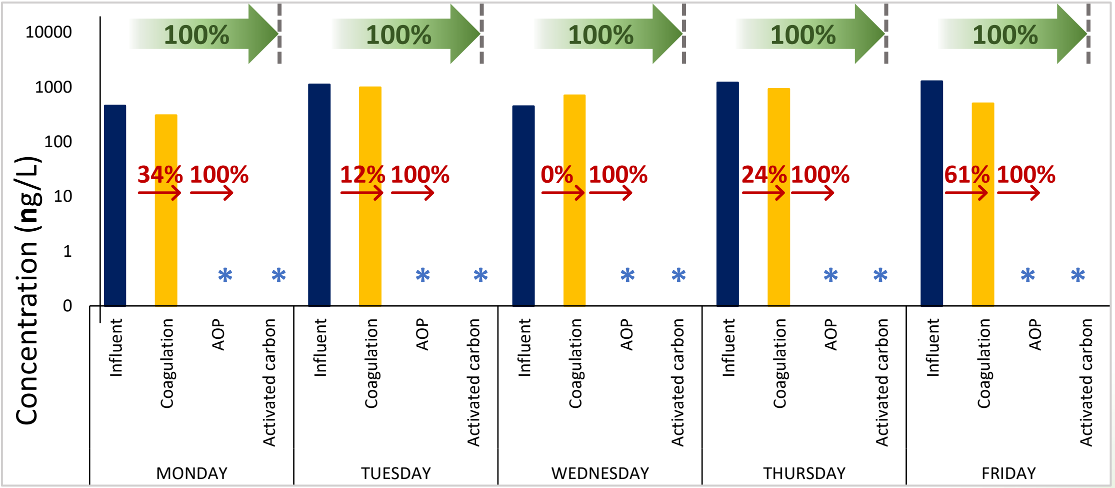
LIFE-RECYCLO Reuse of laundry wastewater

Prototype at GRUPFRN / Spain

DEHP



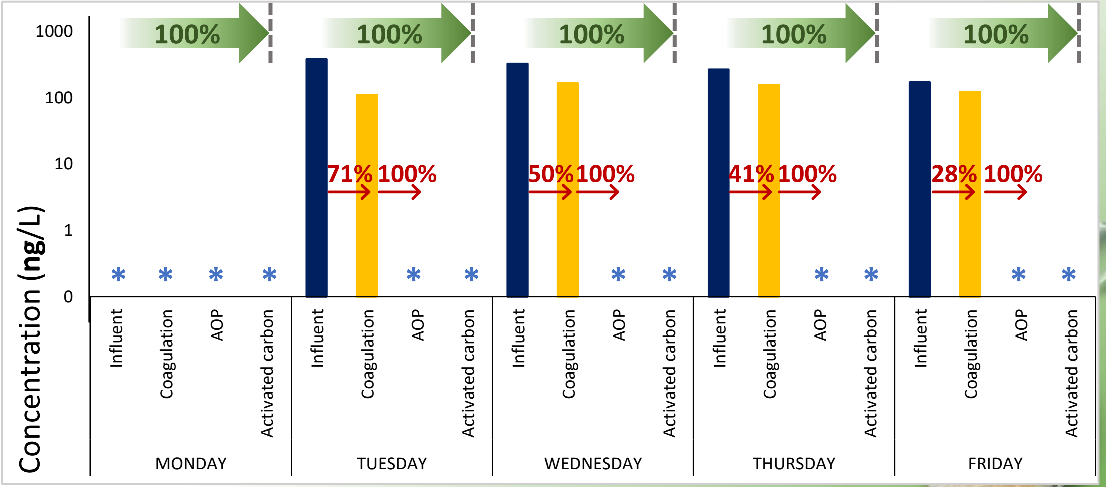
Diclofenac



* <LOD

Institut Català de Recerca de l'Aigua
www.icra.cat

LOD DEHP = 0,1 µg/L
LOD diclofenac = 8 ng/L
LOD 1-H benzotriazol = 3 ng/L



1-H Benzotriazol

LOD= limit of detection.

LIFE-RECYCLO Reuse of laundry wastewater

- ✓ Removal of micropolluants by RECYCLO process
- ✓ Disinfection of the water
- ✓ Characterisation of the sludge → valorisation by composting
- ✓ Efficiency of treated wastewater for washing laundry

- ❑ Identification of microplastic and removal efficiency
- ❑ PFAS removal efficiency
- ❑ Installation of the other two pilots

LIFE-RECYCLO Reuse of laundry wastewater

GRUPFRN Laundry
Javier Pérez, Fran Sanchéz and Marina Molina

PopScience
Samantha Dizier and Isabelle Bonardi

BSJ Laundry
Cyrille BIGEY

ICRA
Sara Rodriguez-Mozaz, Gianluigi Buttiglieri, Sara Insa, Diana Alvarez, Maria Pau Garcia-Moll, Lúcia Helena Santos, Marta Turull

KLIN Laundry
Pit Zen

Follow us www.treewater.fr/fr/recyclo LinkedIn @life-recyclo

Thank you for your attention

Questions ?

EU GREEN WEEK PARTNER EVENTS

SESSION 2. REMEDIATION AND REMOVAL OF POLLUTANTS FROM WATER

Carla Silva

citeve TEXTILE TECHNOLOGY

Author: Carla Silva, Augusta Silva

citeve
TEXTILE TECHNOLOGY

Technological Centre for the Textile and Clothing Industries of Portugal

Commitment to Quality, Compliance and Innovation

PORTUGAL | BRASIL | TUNISIE | CHILE | ARGENTINA | PAKISTAN | INDIA

CITEVE Worldwide

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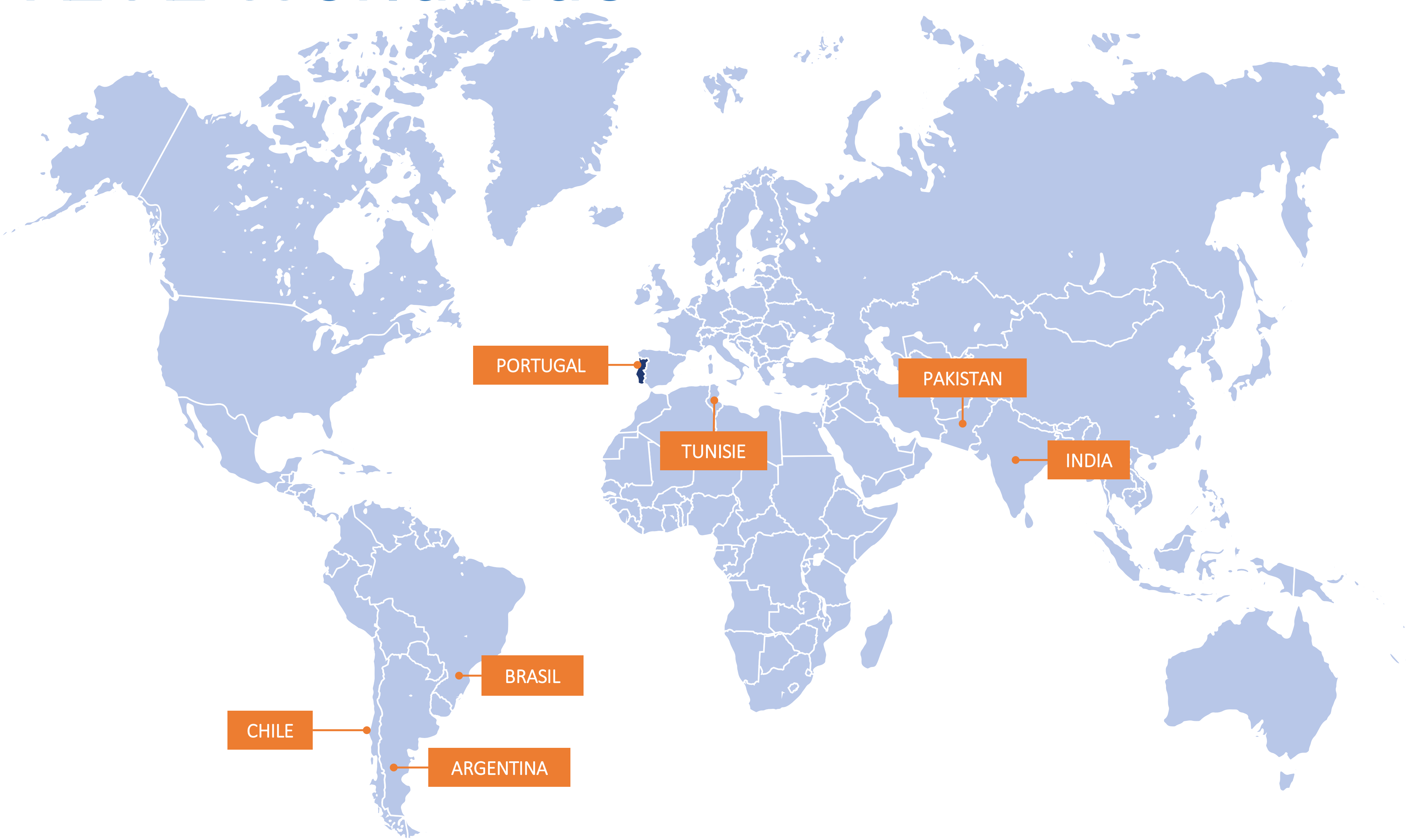
TEXTILE TECHNOLOGY



Services

Testing

Product & Process Certification

Research, Technology Development & Engineering

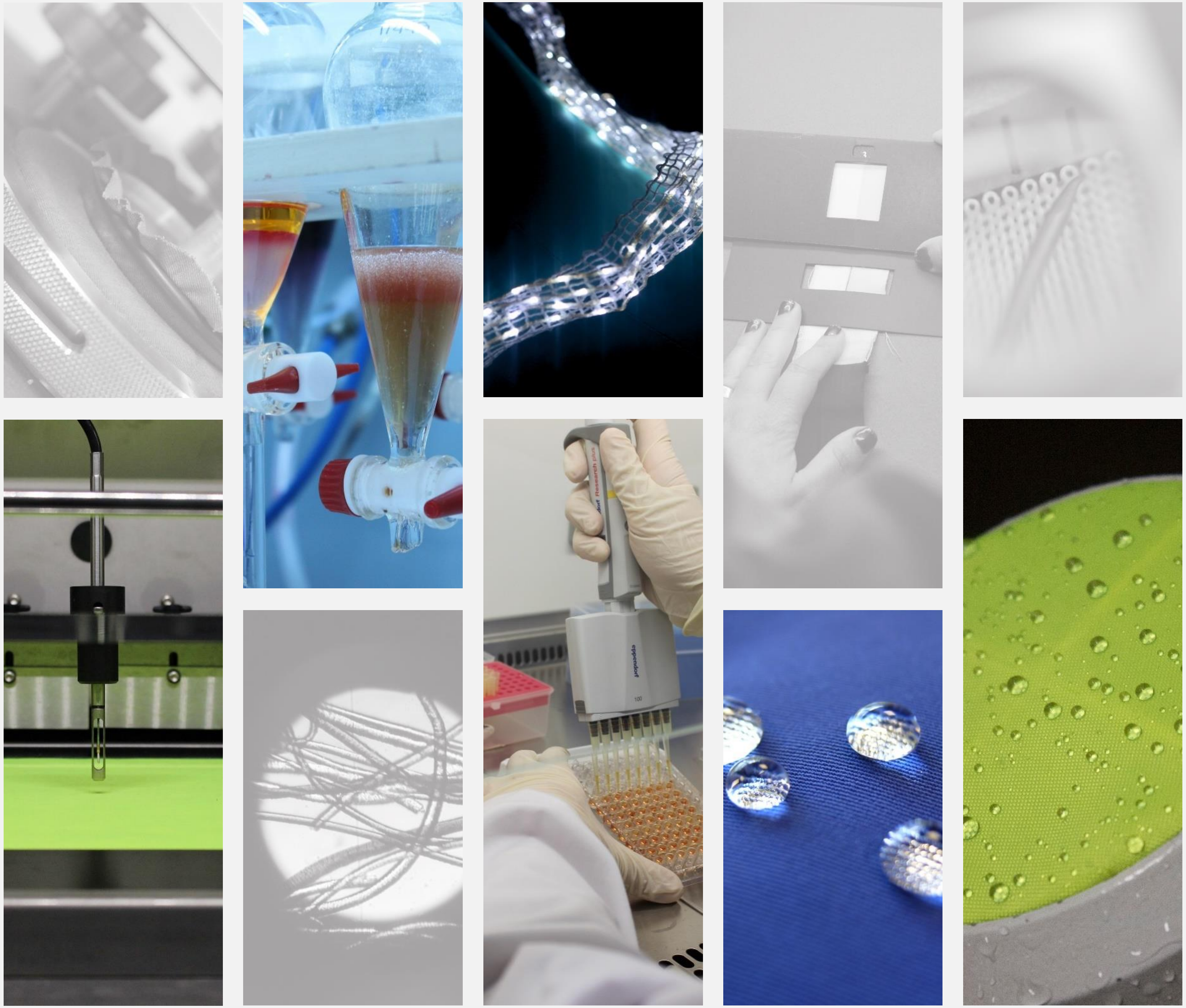
Sustainability, Bio & Circular Economy

Manufacture Digitalization & Industry 4.0

High Level Training & Coaching

Support to Innovation Capacities & Entrepreneurship

International Consultancy



Market oriented

Sports

Defence and PPE

Workwear

Mobility & Transport

Health & Well-being

Architecture & Construction

LIFE CASCADE

Start date: 1st October 2023

Duration: 48 months

Consortium

Coordinator: Centro Tessile Serico Sostenibile (CTSS)

Partners:

Politecnico di Milano
Università degli Studi dell’Insubria
Università degli Studi di Brescia
AquaSoil
Acquedotto Industriale
Biochemie
CITEVE
COMO ACQUA
De Nora
Lariana Depur
ZDHC

Motivation

- Emerging **contaminants** (broad category of chemical substances that are **persistent and biologically active**) have been a focus of attention for many years, both at the European and national levels
- A prevention strategy has been **limiting the use of these substances** to reduce their presence in the environment
- However, for some products, this is difficult to implement and therefore both **prevention and control strategies** should be pursued in parallel
- Important to study **methods and tools for removing diffused micro-pollutants** from the environment and water (in particular, from wastewater treatment plants)

Motivation

- In the CASCADE project, two categories of emerging (micro) pollutants of great interest in the textile sector have been selected: poly- and per-fluorinated compounds (**PFAS**) and **Microplastics (MPs)**.
- **PFAS** are among the most persistent emerging micropollutants due to their impact on the environment and on human health; they have been used as repellents for a wide range of functional applications within textiles, upholstery, leather apparel, and carpets
- **MPs** (particles ranging from 1 to 1000 μm) have been found in various environments, being originated due to the production cycle and deterioration during the use of products containing synthetic polymers

Aim

The LIFE CASCADE project aims the laboratory-scale evaluation and demonstration-scale testing of a series of treatment technologies to remove PFAS and Microplastics (MPs), from wastewater both at the level of **textile companies** and at the level of **centralized wastewater treatment plants**.

CITEVE has an important role in the qualitative and quantitative assessment of **Microplastics (MPs)** in wastewater from industrial textile finishing processes.

Developments and outputs

Main output:

Level 1 - Analyze

Level 2 - Remove

Level 3 - Measure

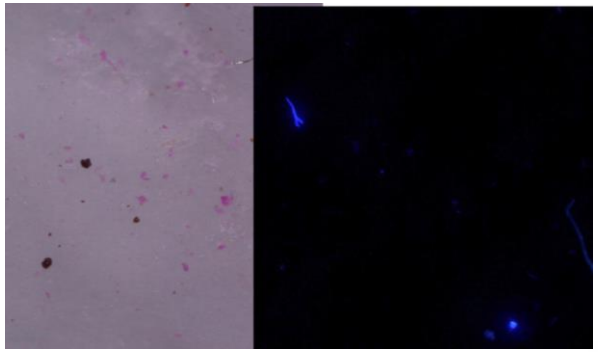
Level 1 - Analyze

- Targets the analytical phase (PFAS and MPs) in the different types of waters and wastewaters to be used both within the project as a support for technological development decision making, and downstream of the project.

- Application of surveys to characterize processes, raw materials, chemical products and emissions in terms of MPs and PFAs, in Portuguese and Italian companies.

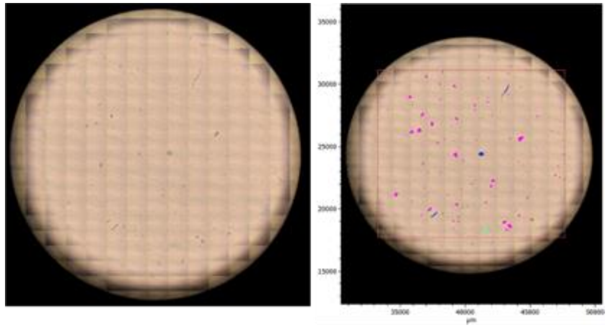
Methods of analysis and quantification of MPs in wastewater

- ✓ Nile Red - this dye imparts colour to microplastics, but in some cases it leads to false positives with natural organic materials.



@ UNINSUBRIA

- ✓ MicroFTIR



@ CITEVE

- ✓ Pyrolysis

Level 2 - Remove

- To develop individual technologies for wastewater treatment (suitable for the removal of PFAS and MPs, at the companies/equipment level and at a centralised WWTP level):
    - MPs
    - PFAS removal technologies
        - microfiltration and nanofiltration separation
        - adsorption on activated carbon

Level 3 - Measure

To assess the impact and ecological value of mitigation measures employed to reduce the load of PFAS and MPs from the textile sector:

1. **Monitoring campaign**: Evaluating PFAS and MP levels in water from Como WWTP to Lake water.
2. **Laboratory experiments**: Evaluation of ecotoxicity (acute, and chronic) of effluents from WWTPs using different organisms.
3. **Mesocosm studies** in WWTP2: Evaluation of ecotoxicity of treated WWTP effluents, as well as the response of the macrobenthos community to PFAS and MP presence.

Expected results

- **Analytical methodologies** for characterization of PFAS and MPs;
- Developing **wastewater treatment technologies** to remove the two most critical categories of emerging micropollutants for the textile sector: PFAS and MPs.
- Evaluating the **ecological impact** on receiving water bodies of PFAS and MPs.
- **Demonstration solutions** that will be **installed and tested**: in the COMO Textile District and lab-scale experiments in cooperation with the Portuguese Textile District.

EU Green Week
PARTNER EVENT

Thank you!

Carla Silva

cjsilva@citeve.pt






#WaterWiseEU

Author: Carla Silva, Augusta Silva

INTEGRANO-multidimensional integrated quantitative approach to safety and sustainability of nanomaterials. Applications to real case scenarios in water treatment

Massimo Perucca
Project HUB360

PROJECT IDENTITY CARD

MULTIDIMENSIONAL INTEGRATED QUANTITATIVE APPROACH TO ASSESS SAFETY AND SUSTAINABILITY OF NANOMATERIALS IN REAL CASE LIFE CYCLE SCENARIOS USING NANOSPECIFIC IMPACT CATEGORIES

13	**8**	**48M**	**3.985.648,75**
PARTNERS	COUNTRIES	DURATION	EU FUNDING

INTEGRANO coordinates

Call: **HORIZON-CL4-2023-RESILIENCE-01**
(RESILIENT VALUE CHAINS 2023)

Topic: HORIZON-CL4-2023-RESILIENCE-01-22
Type of Action: HORIZON-RIA

Grant Agreement: Project n. 101138414 - INTEGRANO

Duration: 48M
Starting date: January 1, 2024
End date: December 31, 2027

INTEGRANO CONSORTIUM

SAFE AND SUSTAINABLE BY DESING

Environmental Health & Safety

INTEGRANO **SSbD**

Sustainability

To Nanomaterials and microplastics biological effects and safety and sustainability assessment

From tire particles analysis ..and toxicity

Particle and Fibre Toxicology

Research

Impact of tire debris on in vitro and in vivo systems

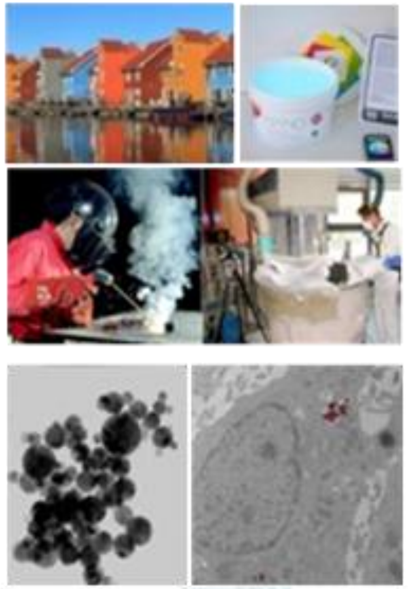
Maurizio Gualtieri, Manuela Andrioletti, Paride Mantecca, Claudio Vismara and Marina Camatini

Particle and Fibre Toxicology 2005, 2:1 doi:10.1186/1743-8977-2-1

Through PM characterization & health effects

Toxicology Letters

Winter fine particulate matter from Milan induces morphological and functional alterations in human pulmonary epithelial cells (A549)



Toxicology Letters

The modality of cell-particle interactions drives the toxicity of nanosized CuO and TiO_2 in human alveolar epithelial cells

PROJECT BACKGROUND

protect

Pre-commercial lines for production of surface nanostructured antimicrobial and anti-biofilm textiles, medical devices and water treatment membranes

ASiNA

Anticipating Safety Issues at the Design Stage of NAno Product Development

BIOMAT

An Open Innovation Test Bed for Nano-Enabled Bio-Based PUR Foams and Composites

JPI OCEANS NANOTHECABA

CECs and AMR bacteria pre-concentration by ultra-nano filtration and Abatement by ThermoCatalytic Nano-powders implementing circular economy solution

INTEGRANO

ReInvent

Novel Products for Construction and Automotive Industries Based on Bio Materials and Natural Fibres

Novel Products for Construction and Automotive Industries Based on Bio Materials and Natural Fibres

AMROCE

Nano enabled strategies to reduce the presence of contaminants of emergent concern in aquatic environments

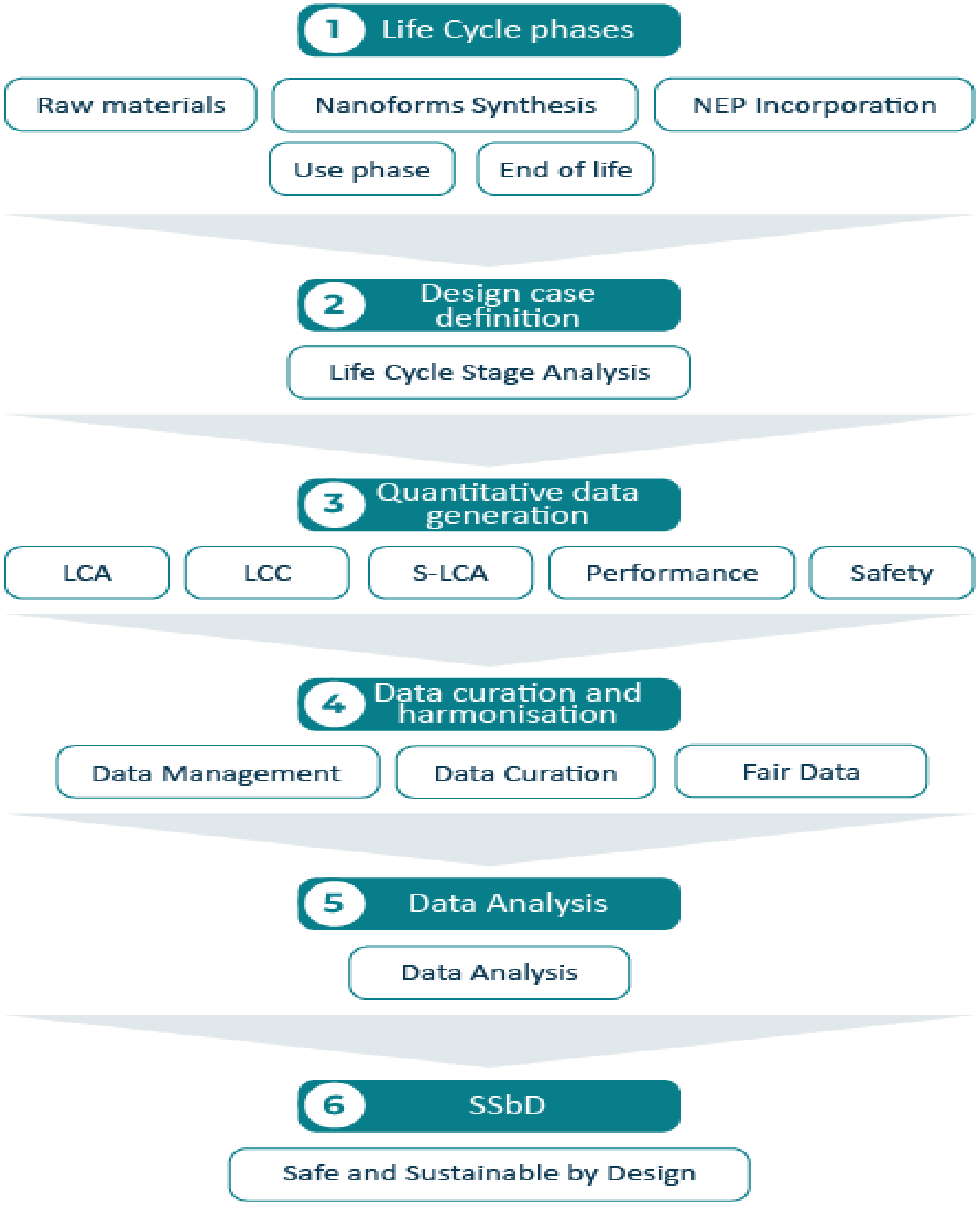
Bionanopolys

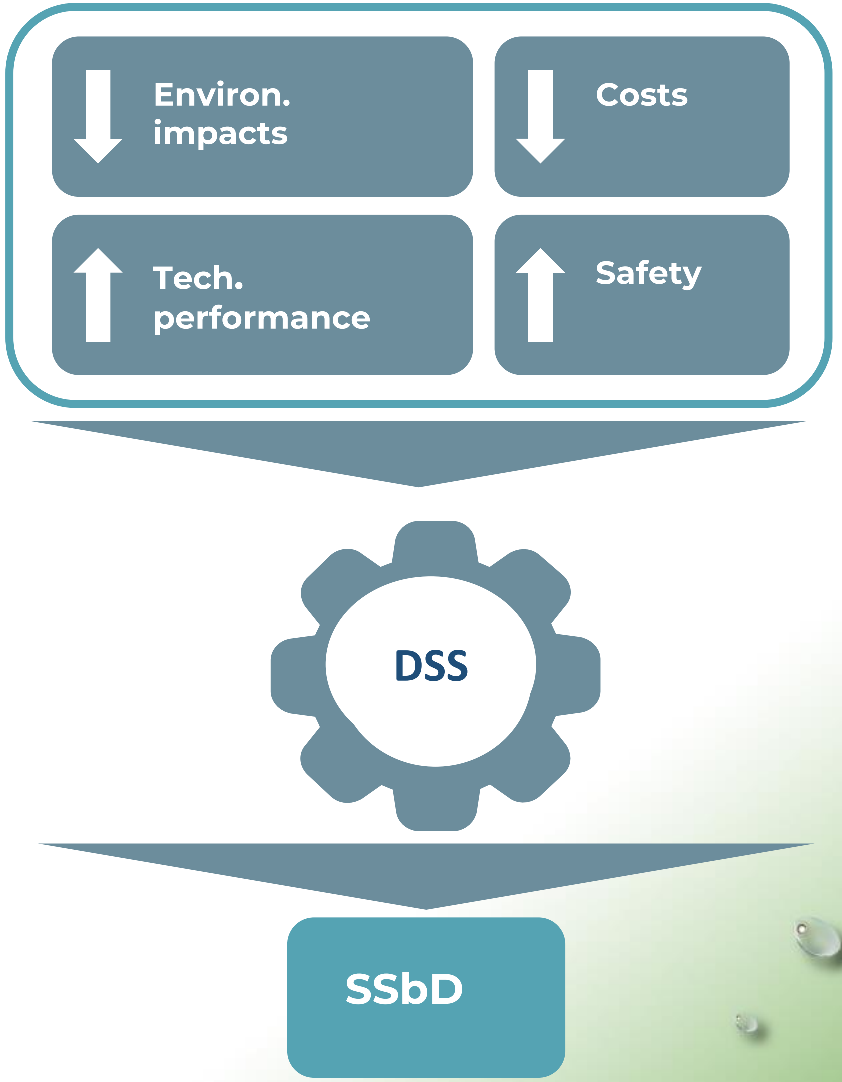
Development of safe nano-enabled bio-based materials & polymer bionanocomposites

INTEGRANO Key Concepts

- Follow **SSbD** Framework and Guidelines (JRC)
- **Quantitative** based assessment to SSbD ⇔ metrics, measurement
- **Relative** & contextual approach: **more** sustainable, saf**er** based on **BATs**
- **Specific characterization and assessments** based on experimental DoE campaigns
- Sustainability and safety assessment methodology based on **existing frameworks and standards** (when available)(e.g. LCA - ISO14040-44)
- Addressing the development of **nanospecific** (human and eco-) toxicity **indicators**
- Definition of **KDFs** and **KPIs** and deriving functional **dependence**
- Apply **MCDA** algorithms to identify design cases compliant with safety and sustainability

Workflow towards SSbD solutions





INTEGRANO Project Goals

- **Support** decision making in NMs development;
- Promote the design of **advanced materials** (NMs and nano-enabled products (NEPs)) by **reducing** R&D and approval lead time, **minimising** costs and **increasing** data transparency;
- **Sustain** the EU Strategic Research and Innovation Plan for Chemicals and Materials and **implement** the SSbD framework;
- Support industry by **reducing** research and technological development and innovation risk.

INTEGRANO Case Studies

The INTEGRANO assessment approach will be applied to nanomaterials (NMs) design cases within 6 case studies. NM incorporation will endow the resulting nano-enabled products with a diverse range of functionalities.

- Antimicrobial textiles – antimicrobial properties
- Water membranes – thermocatalytic properties
- Bio-based PU Composite Foams – structural reinforcement
- Air filters – photoluminescence/entrapment of microorganisms
- Food packaging – antibacterial properties
- Cosmetics

Nanomaterials selected within the case studies originate from across the organic, inorganic and carbon-based categories. They cover a range of morphologies and span the 0D, 1D and 2D NM classifications.

INTEGRANO Case Studies

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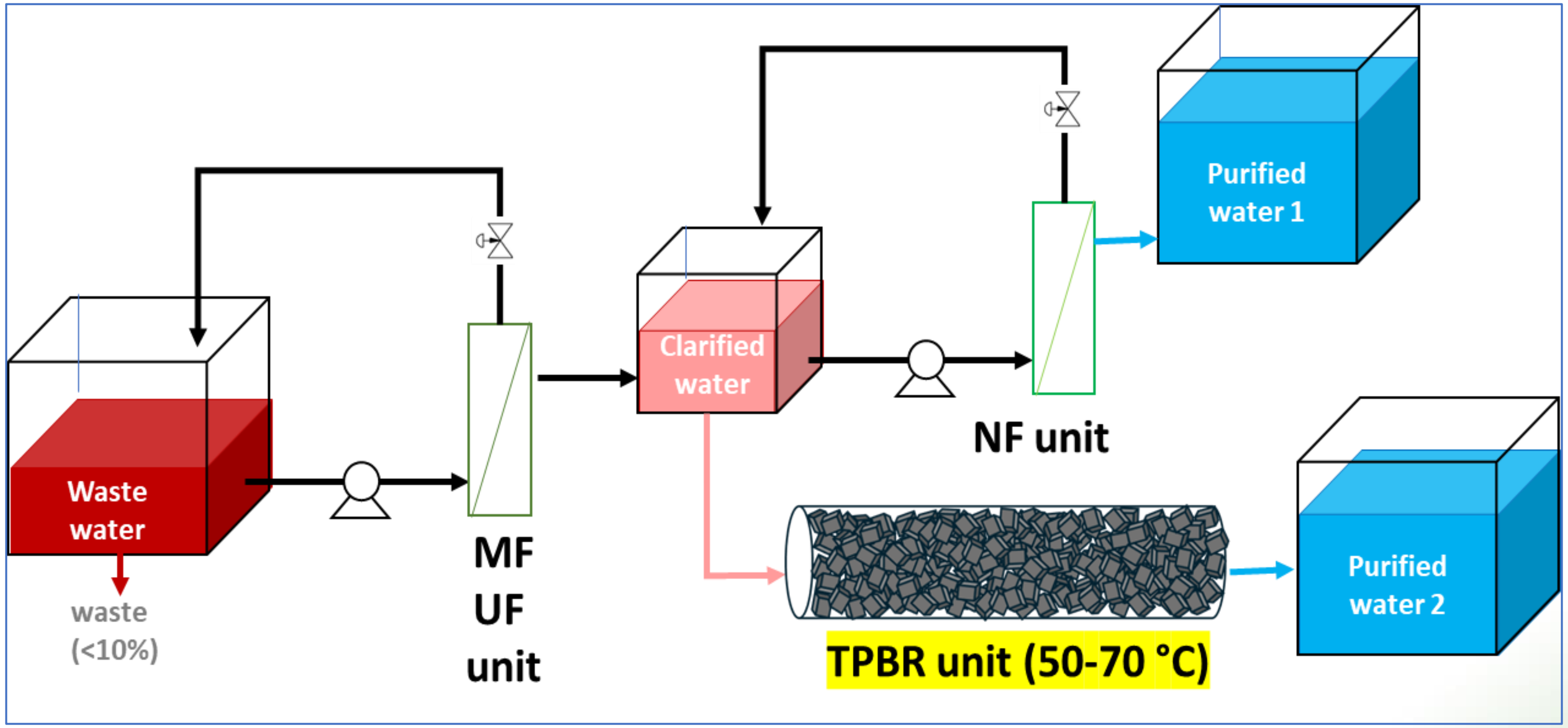
Thermocatalytic nanocoatings for waste water treatment

Synthesis → Incorporation → Use/Operation



Materials:

- Ce-doped SrFeO3-silica nanopowders
- bio-SiO2@TiO2

Circularity:

- Use post industrial materials fro substrates to be coated for the TPBR

INTEGRANO for integrating SSbD knowledge and best practices

A free Knowledge and Data Exchange Hub for SSbD applied to advanced materials targeted to industrial applications

Coming in September 2024 - the INTEGRANO project will launch a Knowledge and Data Exchange Hub

The platform will:

- Serve to **promote** application of the **SSbD** framework **for advanced materials** across diverse value chains (e.g. textile, biomedical, water purification, air filtration, packaging, cosmetics).
- Be targeted at a **broad range of stakeholders** – universities and researchers, companies and industries, organizations and institutions.
- **Host SSbD-related webinars, workshops and training courses**, with events tailored to the different stakeholder groups.
- Promote **knowledge exchange** – including stakeholder matchmaking, will enable data sharing, will be a repository for results and documentation produced by EU-funded projects.

Let’s keep in touch!

www.integrano.eu

info@integrano.eu

@Integrano

UNIVERSITA' DEGLI STUDI DI MILANO BICOCCA

aitex® textile research institute

ARCHE CONSULTING

B4C

Bar-Ilan University אוניברסיטת בר־אילן

CENTI Centre for Nanotechnology and Smart Materials

Consiglio Nazionale delle Ricerche

dermatest®

Joint Research Centre JRC

PROJECT HUB360

REDOFVIEW R&D AND COSMETICS PRODUCTION MADE IN ITALY OEM

UNIVERSITÀ DI TORINO

Venus Roses labsolutions®

Anaerobic and autotrophic bioprocesses to transform a WWTP into a resource-generating biofactory with a positive energy balance.

Marta Elvira Castaño
marta.elvira@fcc.es

BACKGROUND

Solid biowaste

Each person generates around 200 kg of biowaste per year

CO2 emissions

Transport of biowaste

Wastewater treatment energy consumption

0.5 – 0.7 kWh/m3

$$C_{10}H_{19}O_4N + 12\ O_2 \rightarrow 10\ CO_2 + 8\ H_2O + NH_3$$

Conventional treatment

3% of the total Europe electricity consumption

60% of the total energy consumption in a WWTP airation systems for nitrogen removal

Resources

Phosphorus for ferrigation

non-renewable

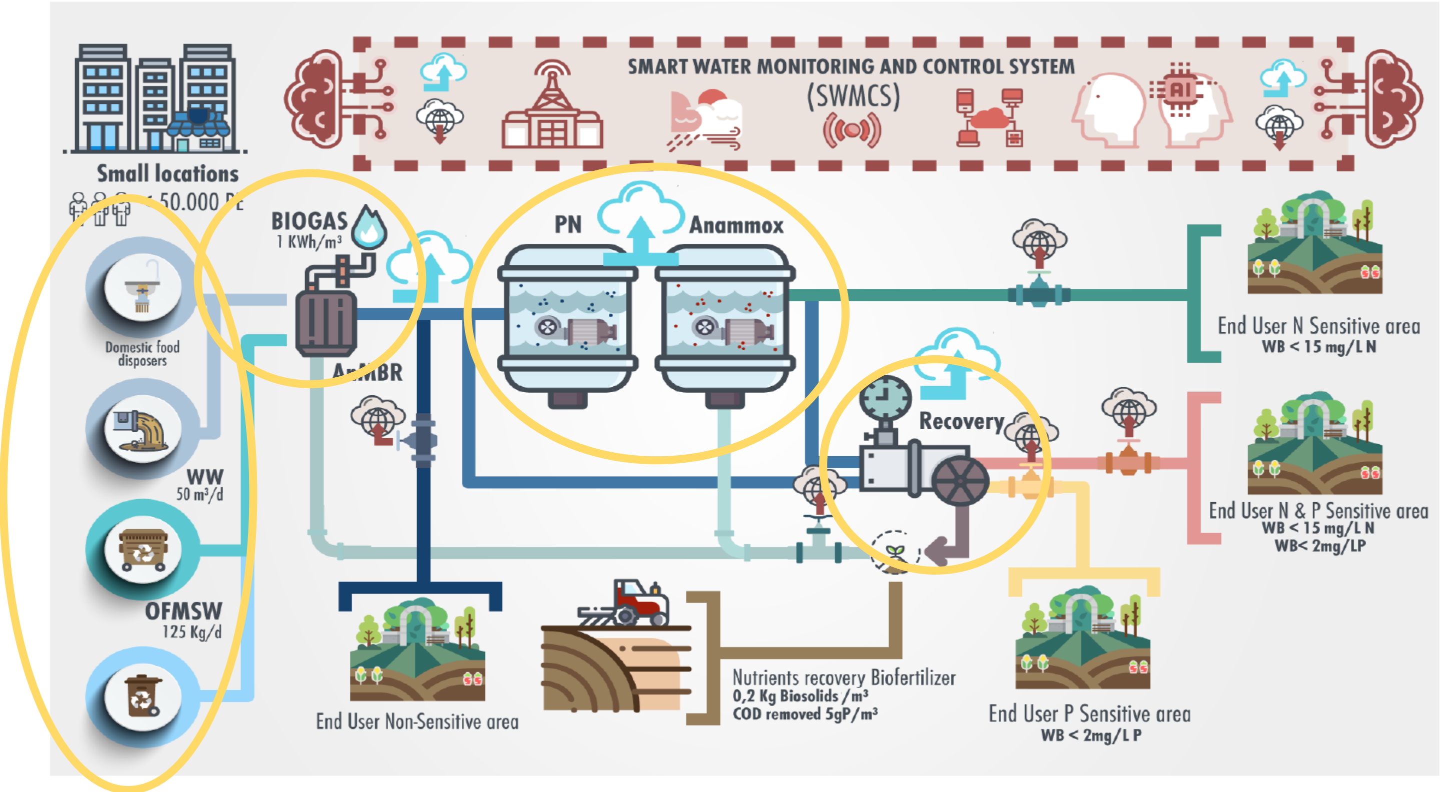
Water scarcity

Non-renewable energy sources

WASTEWATER = RESOURCE

EU GREEN WEEK PARTNER EVENTS

LIFE ZERO WASTE WATER



Combined treatment of Urban Waste Water (WW) and the Organic Fraction of Municipal Solid Waste (OFMSW) in WWTPs with positive energy balance for small populations (less than 50,000 IE).

Inicio - Life Zero Waste Water

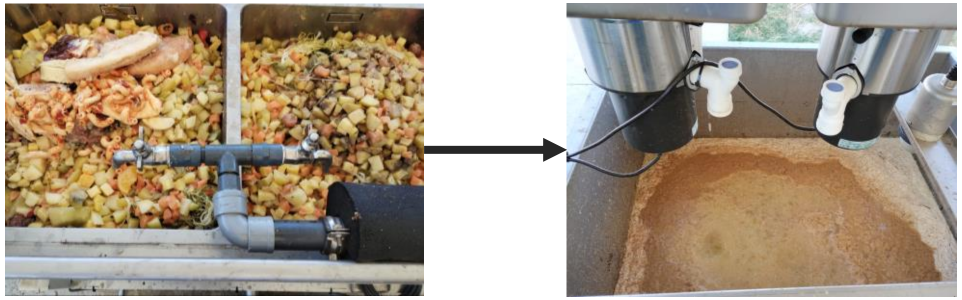
aqualia | Canal de Isabel II | simbiente | USC | VWM | Universitat de València

Valdebebas WWTP (Madrid) **El Bobar WWTP (Almería)**

PROJECT OBJECTIVES

- The collection of **125 kg/day of OFMSW**
- Treatment capacity of **50 m^3 /day**
- Production of **0.3 Nm3 CH4(biomethane)/m3** in AnMBR $\rightarrow$ **3 kWh/ m^3**
- **50% reduction in biosolids compared to the baseline (0.2 kg SS/m^3)**
- **Recovery of 95% pathogen-free water** for use in ferigation or environmental purposes
- **Recovery of 5 g P/m^3**
- **Obtaining 0.2 kg of soil fertilizer per m^3**
- **Positive energy balance of 1.0 kWh/ m^3**, considering energy produced in the AnMBR (Anaerobic Membrane Bioreactor) and consumed for wastewater treatment plant operation.
- **Process control and monitoring software**.

DEMO PLANT – OFMSW treatment



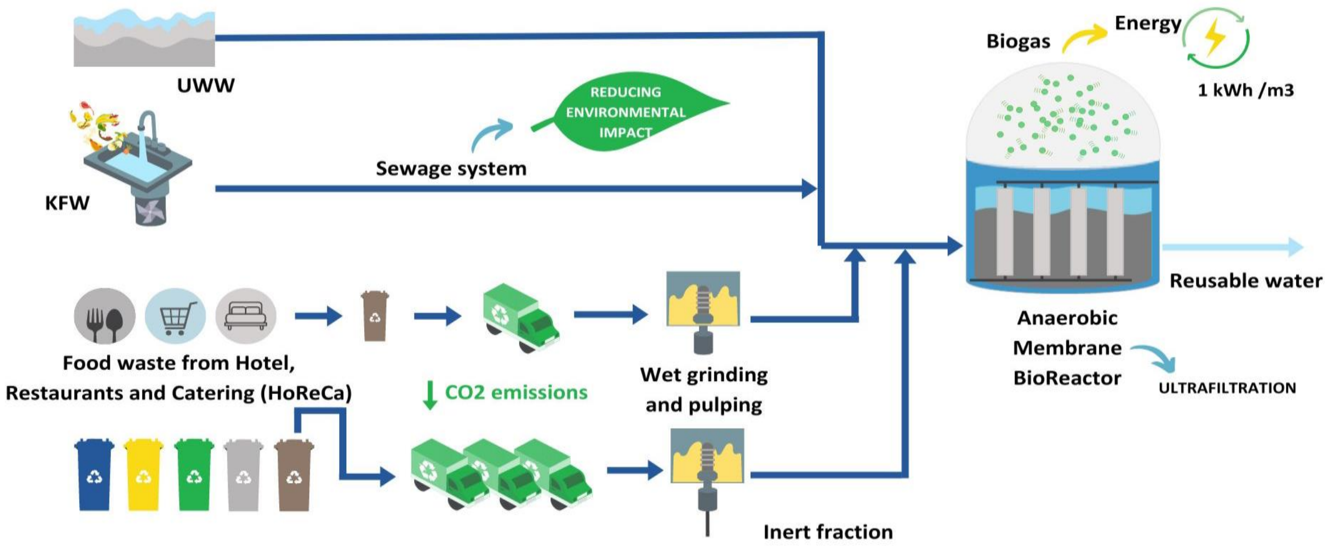
Food waste (OFMSW):

1. Increases organic content.
2. Enhances anaerobic biodegradability.
3. Does not affect nutrient content.
4. After grinding, 90% of particles are smaller than 0.5 mm.

In the AnMBR (Anaerobic Membrane Bioreactor) incorporating FORSU and increasing the TRC (Total Reactor Cycle):

1. Induces a population shift → ↑ hydrolytic and fermentative bacteria.
2. Increases methane (**CH_4**) production (from 49.2 to 144 LCH_4 / Kg COD removed).
3. Reduces sludge production (from 0.614 to 0.142 KgSSV / Kg COD removed).
4. The population shift persists even after FORSU removal

DEMO PLANT – AnMBR unit



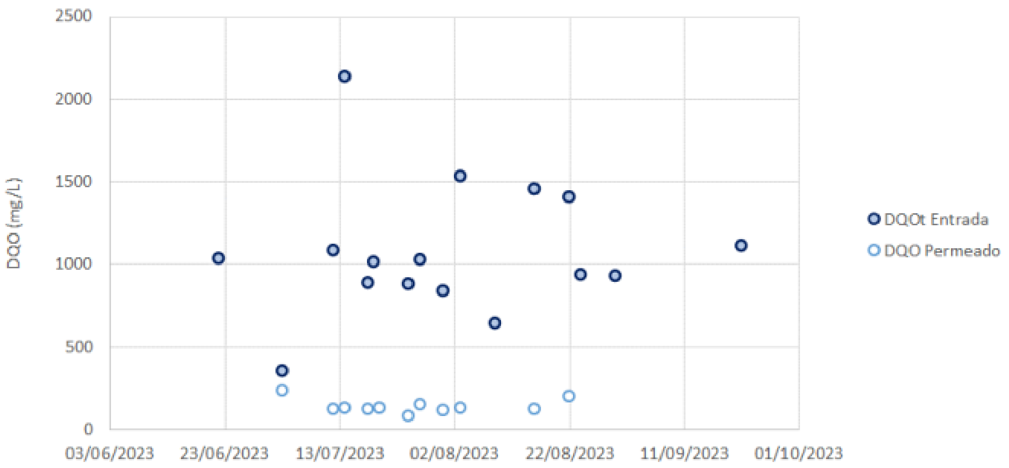
- **Anaerobic reactor with a volume of 100 m3**
- **Filtration flow using KOCH membrane: 10 m3/day**
- **Excellent removal of Chemical Oxygen Demand (COD) and solids**

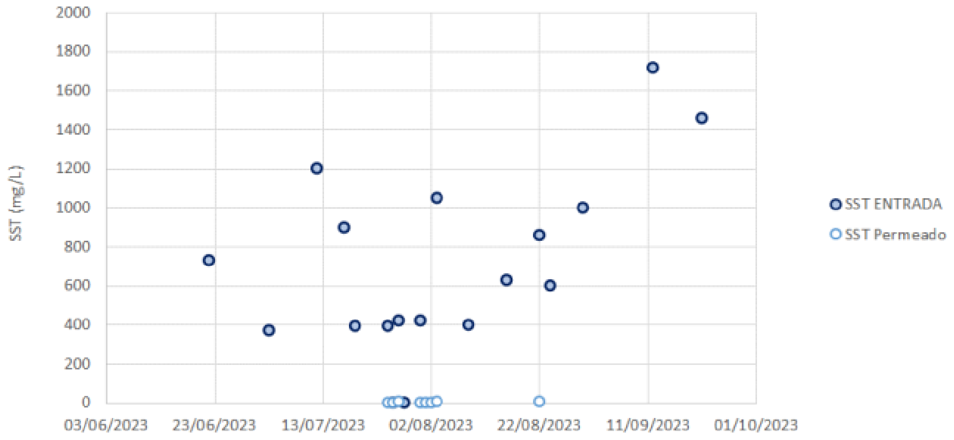
ColiMinder: pathogens measurements on-line
Smart system water monitoring

ULTRAFILTRATION MEMBRANES

MODULE A: PURON®, KMS 41 m^3 filtration área, 0.03 µm pore size
MODULE B: ZENmbr2-S, LITREE, 40 m^3 filtration área, 0.02 µm pore size
MODULE C: IMMEM®, POLYMEM, 40 m^3 filtration área, 0.03 µm pore size

DEMO PLANT – AnMBR unit





VNIVERSITAT DE VALÈNCIA

aqualia

Joint patent (EP3225596B1)

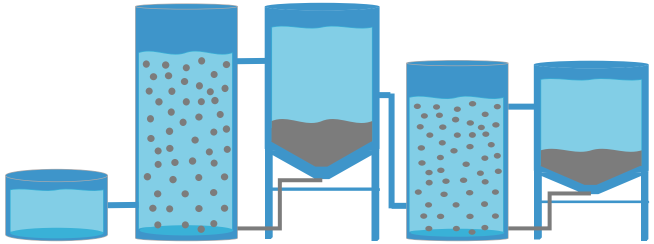
Anaerobic process with filtration procedure for treating wastewater at room temperature

DEMO PLANT-PN/AMX unit

NITROGEN REMOVAL

Partial Nitrification Reactor

$$50\% \, NH_4 \rightarrow NO_2$$



Anammox Reactor

$$NH_4 + NO_2 \rightarrow N_2$$

(19) Europäisches Patentamt European Patent Office Office européen des brevets

(11) EP 3 255 016 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication: 13.12.2017 Bulletin 2017/50

(51) Int Cl.: C02F 3/30 (2006.01) C02F 3/28 (2006.01) C02F 3/34 (2006.01) C02F 3/00 (2006.01)

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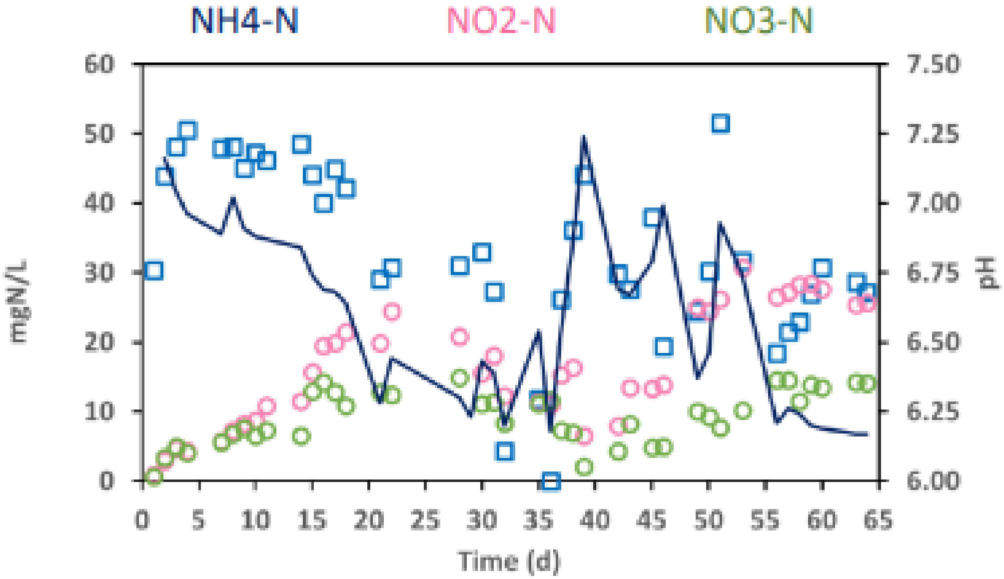
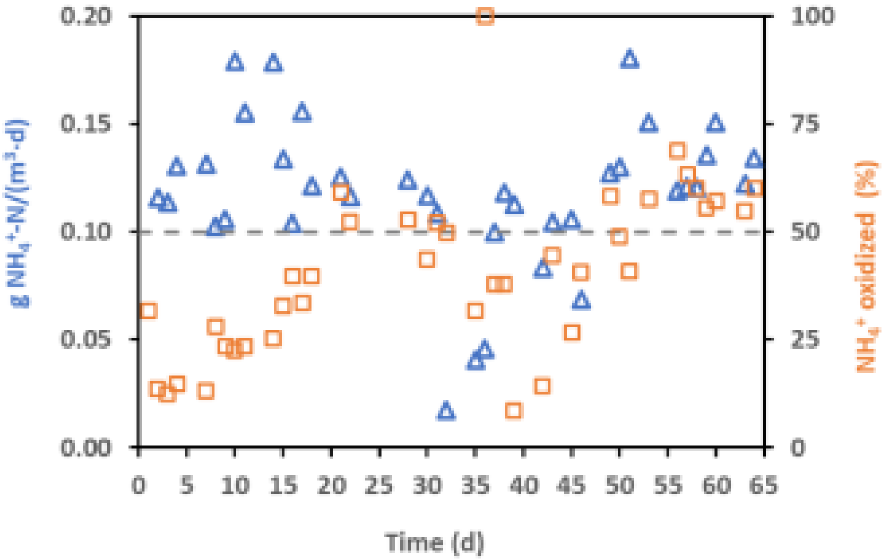
(74) Representative: Ungria López, Javier Avda. Ramón y Cajal, 78 28043 Madrid (ES)

(54) METHOD FOR STARTING UP AND CONTROLLING A BIOLOGICAL PROCESS FOR AMMONIUM REMOVAL AT LOW AMMONIUM CONCENTRATIONS AND LOW TEMPERATURE THROUGH THE USE OF A TWO STAGE AUTOTROPHIC NITROGEN REMOVAL PROCESS

https://worldwide.espacenet.com/patent/search/family/056131484/publication/EP3255016A1?q=pn%3DEP3255016A1

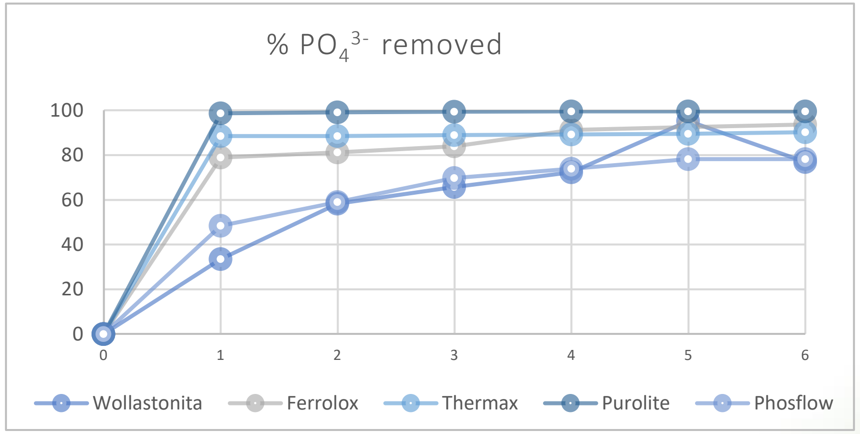
DEMO PLANT-PN/AMX unit



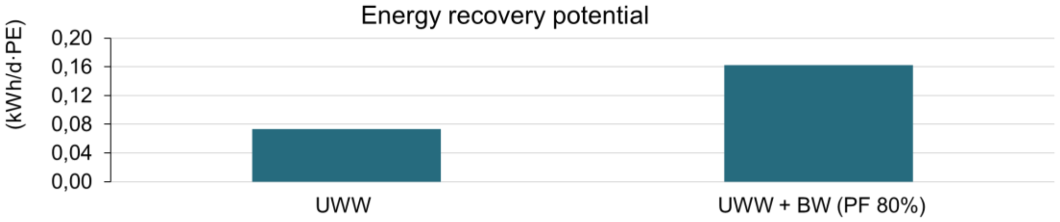


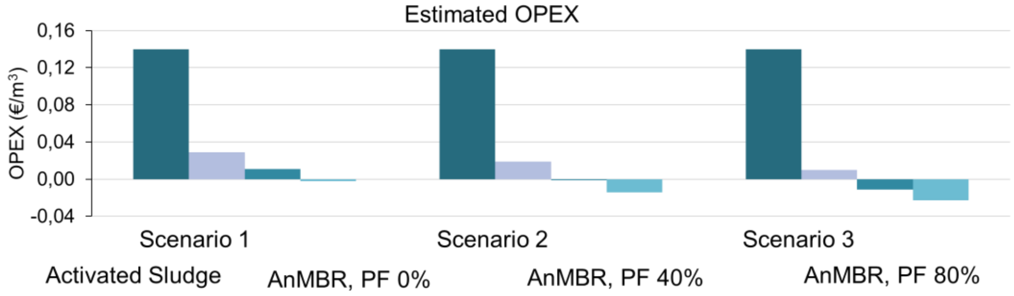
- **60% reduction in oxygen demand.**
- **100% reduction in required organic matter.**
- **90% reduction in produced biomass**

DEMO PLANT-Nutrients Recovery unit



ENERGY AND ECONOMICAL BALANCE





	Activated Sludge	IRR LIFE ZWW
Energy consumption (kWh/m3)	0.5	-1.0
Emissions (kgCO2/m3)	0.15	-0.30
Water rentability (%)	0 (without consider terciary treatments)	95 (without terciary treatments)
N2O emissions	36.0	7.2
Area	++	+

[1] Moñino, P., Jiménez, E., Barat, R., Aguado, D., Seco, A., & Ferrer, J. (2016). Potential use of the organic fraction of municipal solid waste in anaerobic co-digestion with wastewater in submerged anaerobic membrane technology. Waste Management, 56, 158–165.

[2] Favoino, E., & Giavini, M. (2020). Bio-waste generation in the EU : Current capture levels and future potential.

[3] Pretel, R., Moñino, P., Robles, A., Ruano, M. v., Seco, A., & Ferrer, J. (2016). Economic and environmental sustainability of an AnMBR treating urban wastewater and organic fraction of municipal solid waste. Journal of Environmental Management, 179, 83–92.

EU GREEN WEEK PARTNER EVENTS

Anaerobic and autotrophic bioprocesses to transform a WWTP into a resource-generating biofactory with a positive energy balance.

ZERO WASTE WATER

Inicio - Life Zero Waste Water

Marta Elvira Castaño
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ULTIMATE

WATER SMART INDUSTRIAL SYMBIOSIS

ULTIMATE promoting water smart industrial symbiosis

Joep van den Broeke & Gerard van den Berg | KWR Water Research Institute, NL

EU Green Week – LIFE ANHIDRA webinar, 17 june 2024

CIRSEAU
Building a water-smart economy and society

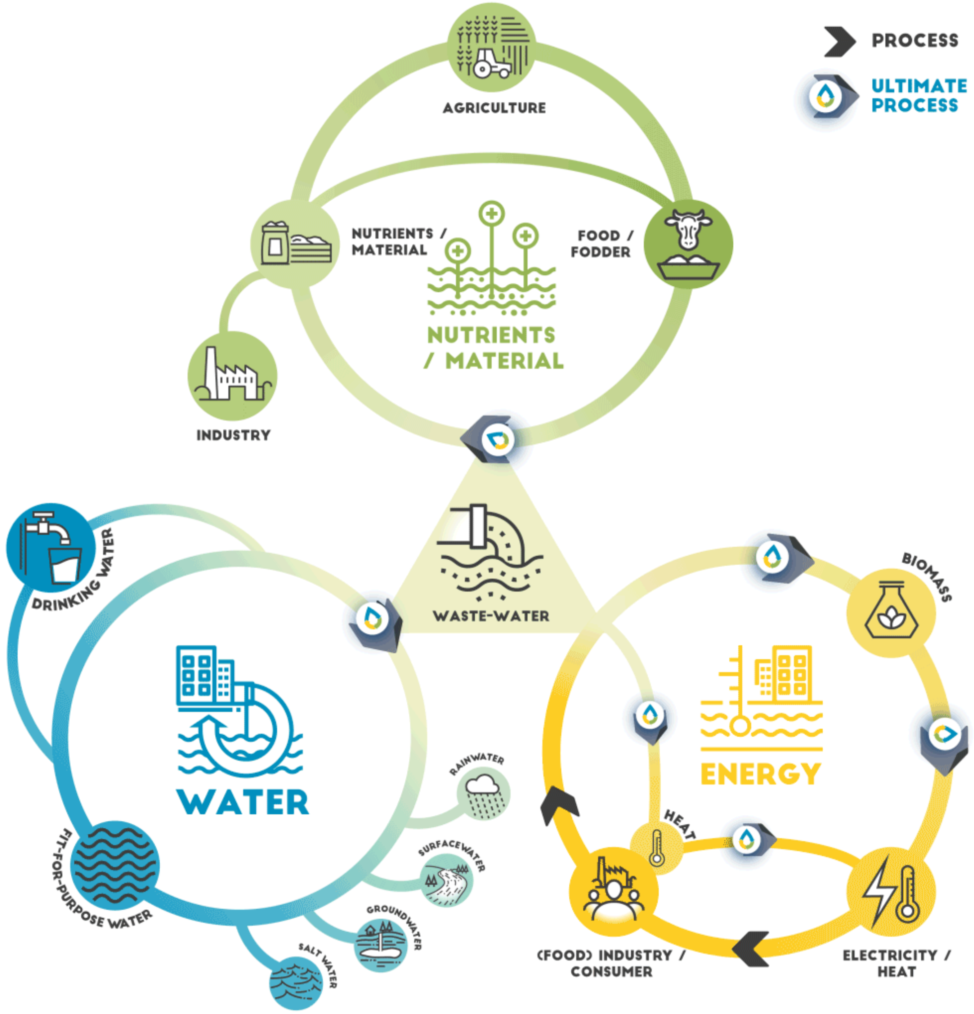
Introducing ULTIMATE

indUstry water-utiLiTy symbIosis for a sMarter wATer society

Develop, optimize, and demonstrate ***Water-Smart Industrial Symbiosis*** technologies and solutions for:

- **Water reclamation and reuse** (recovery, refining, and reuse of municipal and industrial wastewater)
- **Exploitation of energy and heat** (extraction of energy, combined water-energy management, water enabled heat transfer, storage and recovery of heat)
- **Nutrient and material recovery/reuse** (nutrient mining, extraction/reuse of high-added value exploitable compounds)

Technological innovations are made available and shared through the **Water Europe MarketPlace**



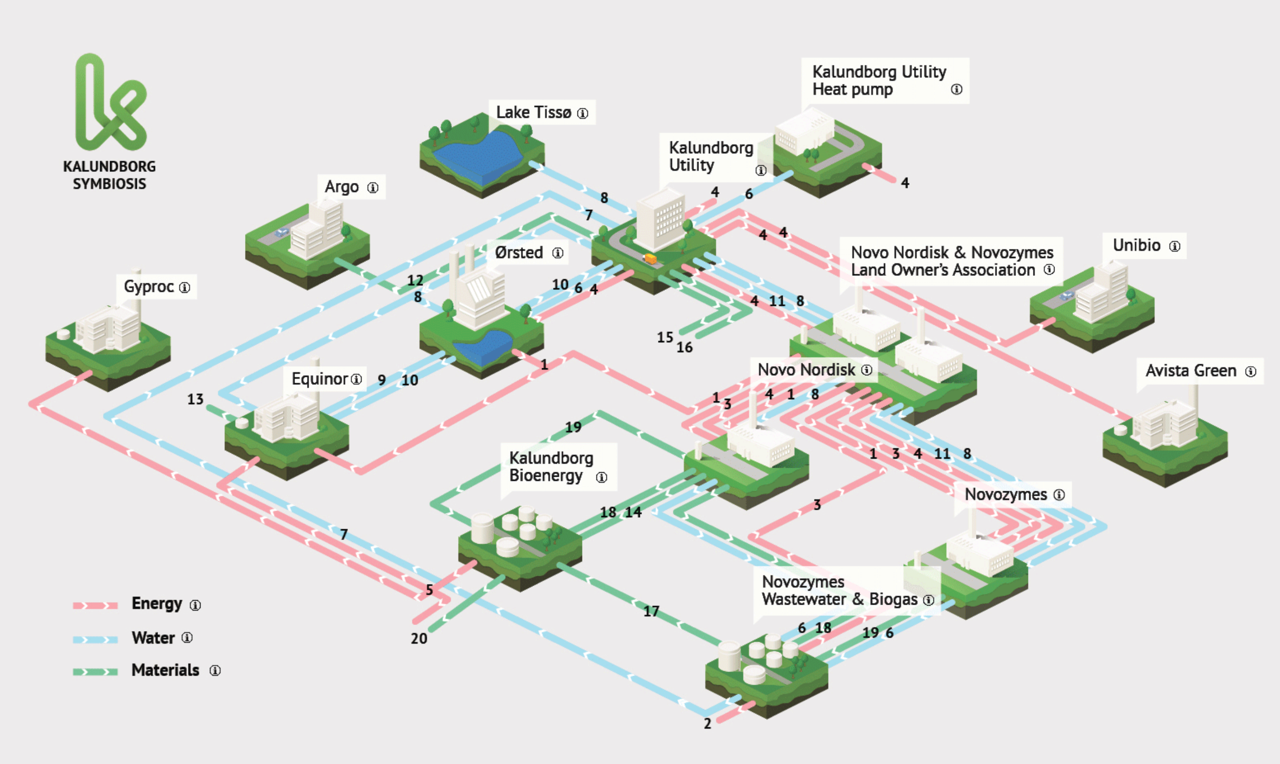
The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Industrial symbiosis

First industrial symbiosis plant worldwide in Kalundborg (since 1972).

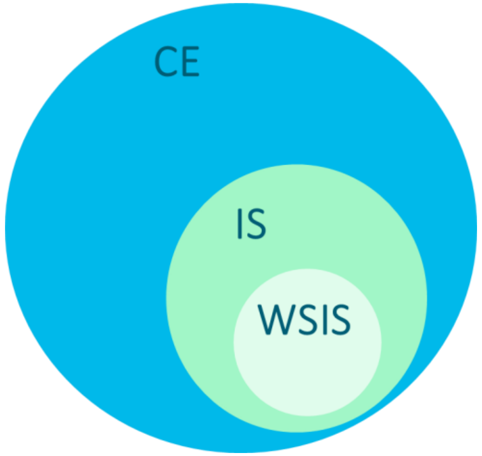
The cooperation between the companies in the symbiosis provides mutual benefits, economical as well as environmental.

The main principle is that a residue from one company becomes a resource in another.



From: http://www.symbiosis.dk/

Water Smart Industrial Symbiosis (WSIS) aims to create economic value and increased sustainability by introducing circular symbiotic arrangements between industry and water service provider.



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We leverage much more than “just’ technologies to achieve these objectives!

DEMONSTRATING WIN-WIN SYMBIOTIC OPPORTUNITIES …

… FOR WATER-SMART INDUSTRIAL SYMBIOSIS (WSIS)

ENABLING TECHNOLOGIES
Demonstrating novel (TRL 5-7) technologies at meaningful scales achieving quantifiable impacts (economic, environmental, social)

SYMBIOTIC PARADIGMS
Showcasing 9 WSIS ‘modes’ between water providers (municipal or industry owned utilities, service-providing SMEs) and key industries

SMART TOOLS
Leveraging the power of Ontologies, Hybrid Modelling and Simulation, Gamified Visualisation and immersive Mixed Reality Storytelling

WATER-ENERGY-MATERIALS
Demonstrating circular solutions for water as both resource and vector of energy and materials with millions invested and decades of experience

INNOVATOR ECOSYSTEM
Open Innovation and co-creation with industry and the public meets start-ups and established players in B2B, B2G, B2C CoPs and Living Labs

WSIS MARKET BUILDING
WSIS matchmaking supported by start-ups, ontologies and financial engineering linking investments to KPIs for business innovation

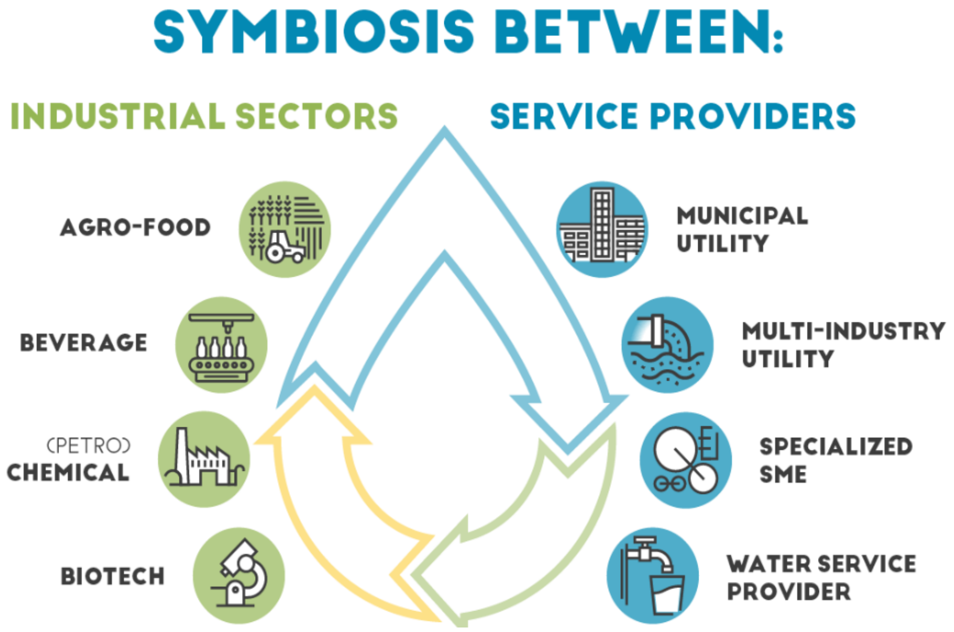
GLOBAL OUTREACH
Engaging EU and global networks of industries, water companies, SMEs, business innovators and media to disseminate, influence, broker, transfer

STRONG PARTNERSHIP
A team of 8 technology & service providers (of which 6 SMEs), 8 utilities (incl. 2 multinationals), 4 industries, 9 Research Centres and Water Europe

The project leading to this application has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 869318

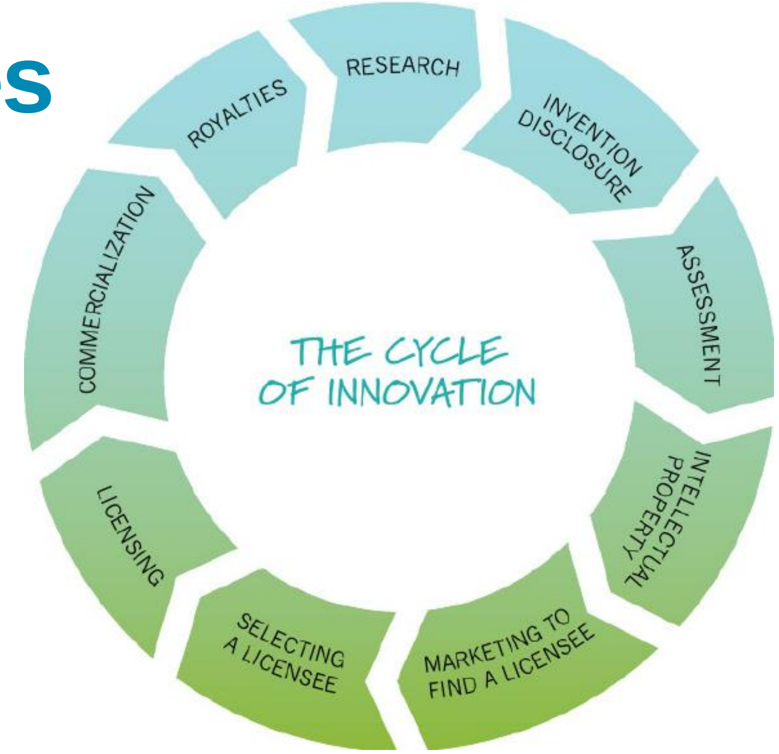
The core of ULTIMATE – integrated case studies

Concepts are developed for and validated in 9 case studies across Europe



The project leading to this application has received funding from tl
Horizon 2020 research and innovation programme under grant agı

Exploitation / valorisation schemes



Develop new exploitation and valorisation schemes based on business models and services tailored to WSIS

Value chains for recovered resources are exploited by symbiotic arrangements between industries and water service providers:

- **Partnerships** between industries and municipal water utilities looking for symbiotic gains
- **Co-ownership** of water service providers by co-located industries to catalyse symbiosis
- **WSIS service provision** to industries by commercial companies of various scales: from niche SMEs to multinational corporations

Supported by:

- assessing the impact with life cycle (LCA, LCCs) and risk (QMRA, QCRA) analysis
- performance validation and certification schemes

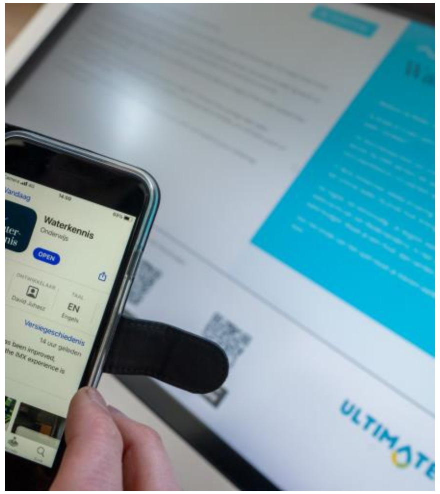
Stakeholder Engagement

Promote active stakeholder engagement, innovation, co-creation and public awareness **to accelerate socio-economic and business transformation** towards a WSIS

Novel approaches include a.o.:

- Communities of Practice (COPs)\
- Co-creation
- Living labs
- Multi-use playspaces

ULTIMATE stakeholder approaches



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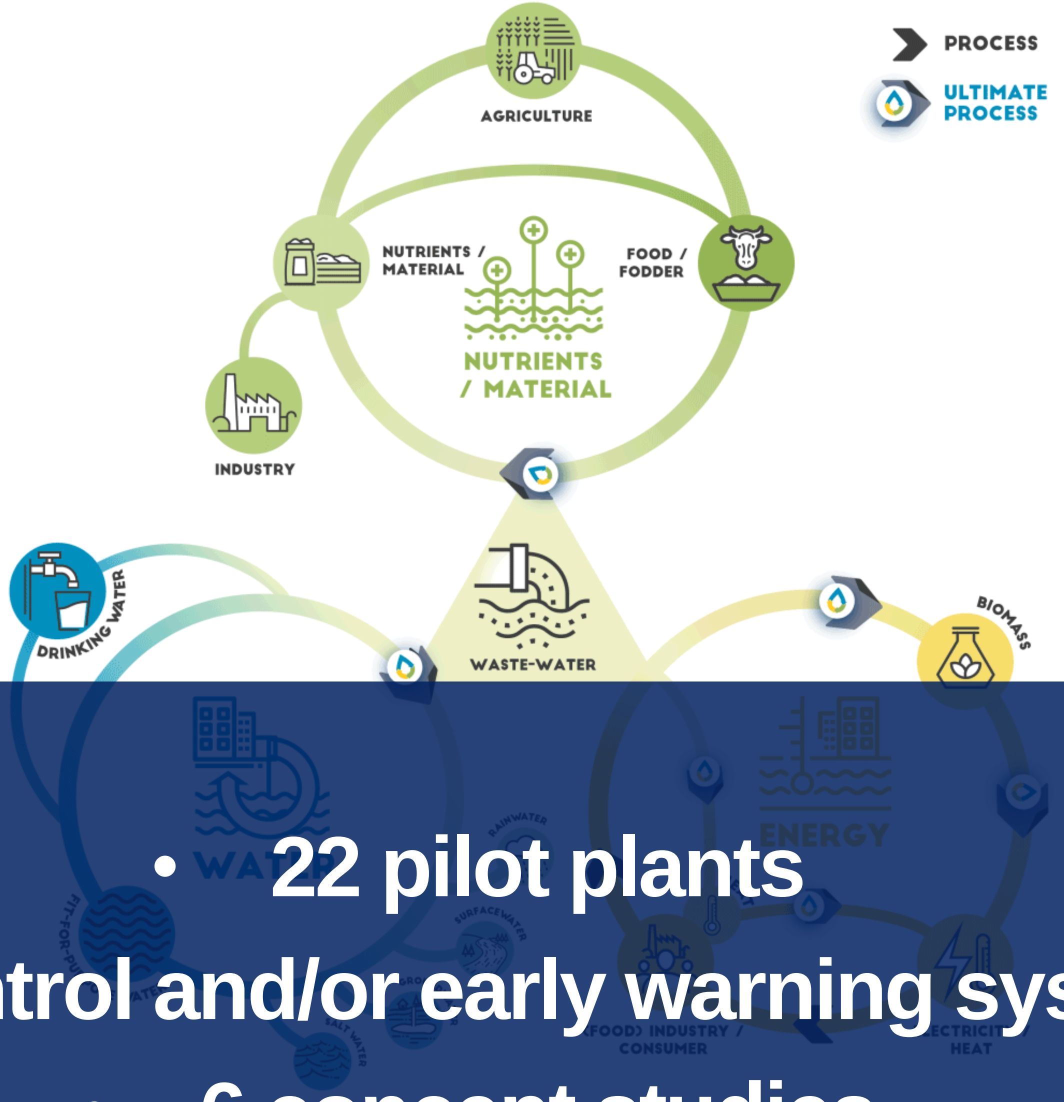
Ultimate solutions involve circular economy technologies



- Membrane technologies
- Adsorption technologies
- Electrostimulated systems

- Biogas technologies
- Heat recovery
- Digitalization

- 22 pilot plants
- 3 control and/or early warning systems
- 6 concept studies

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

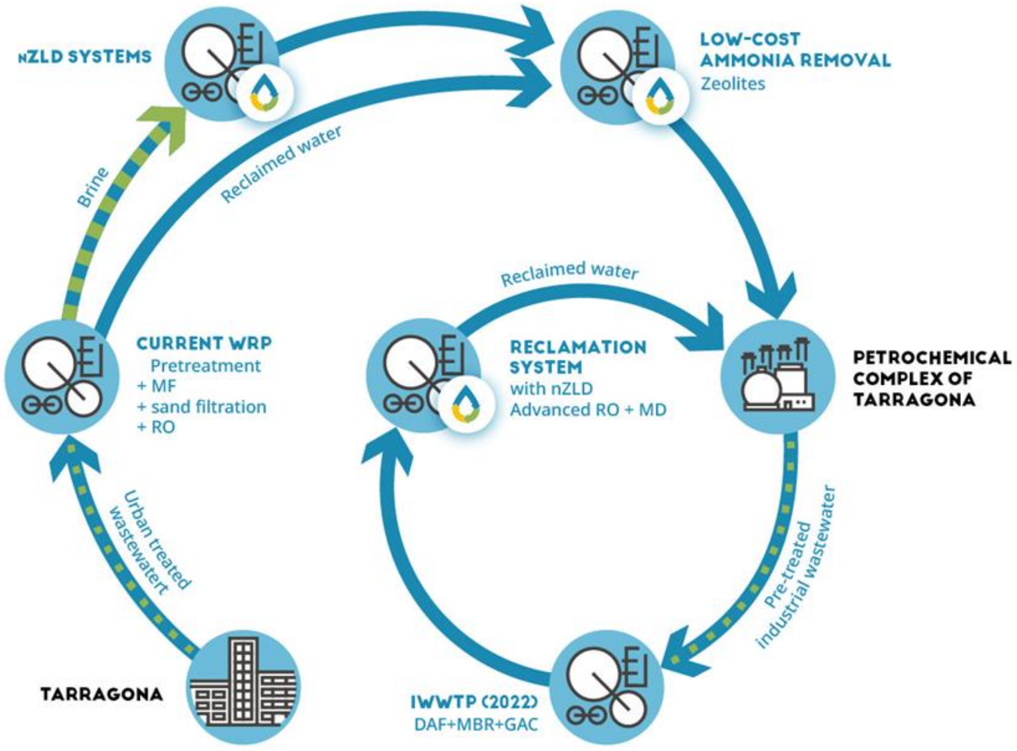
CS1 Tarragona (ES)

- Petrochemical complex (> 100 chemical companies) & municipal WWTPs
- Fit-for-purpose water for industrial reuse
- Long experience with water reuse

Membrane distillation

BRINE

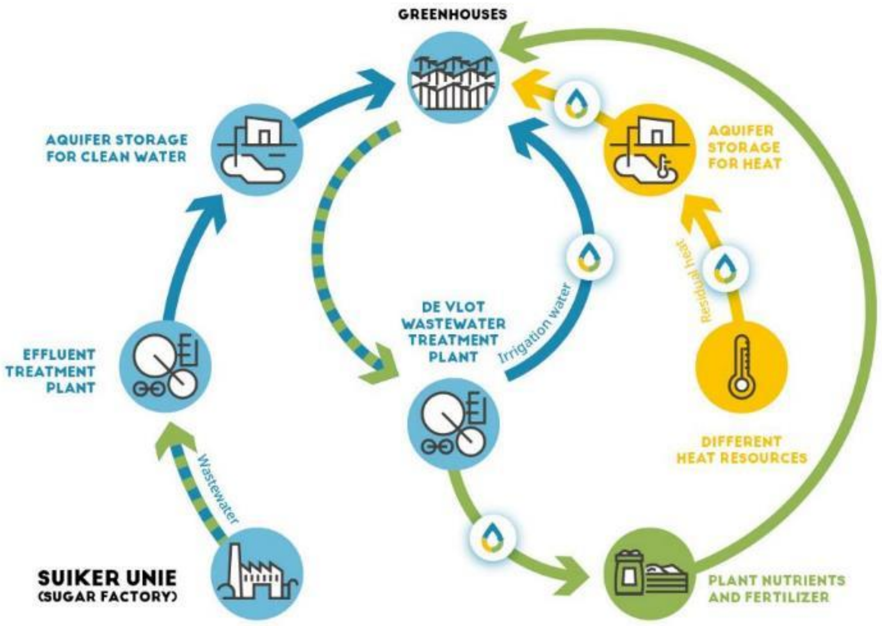
Ultrafiltration & Reverse osmosis



Zeolite column for NH_4 removal

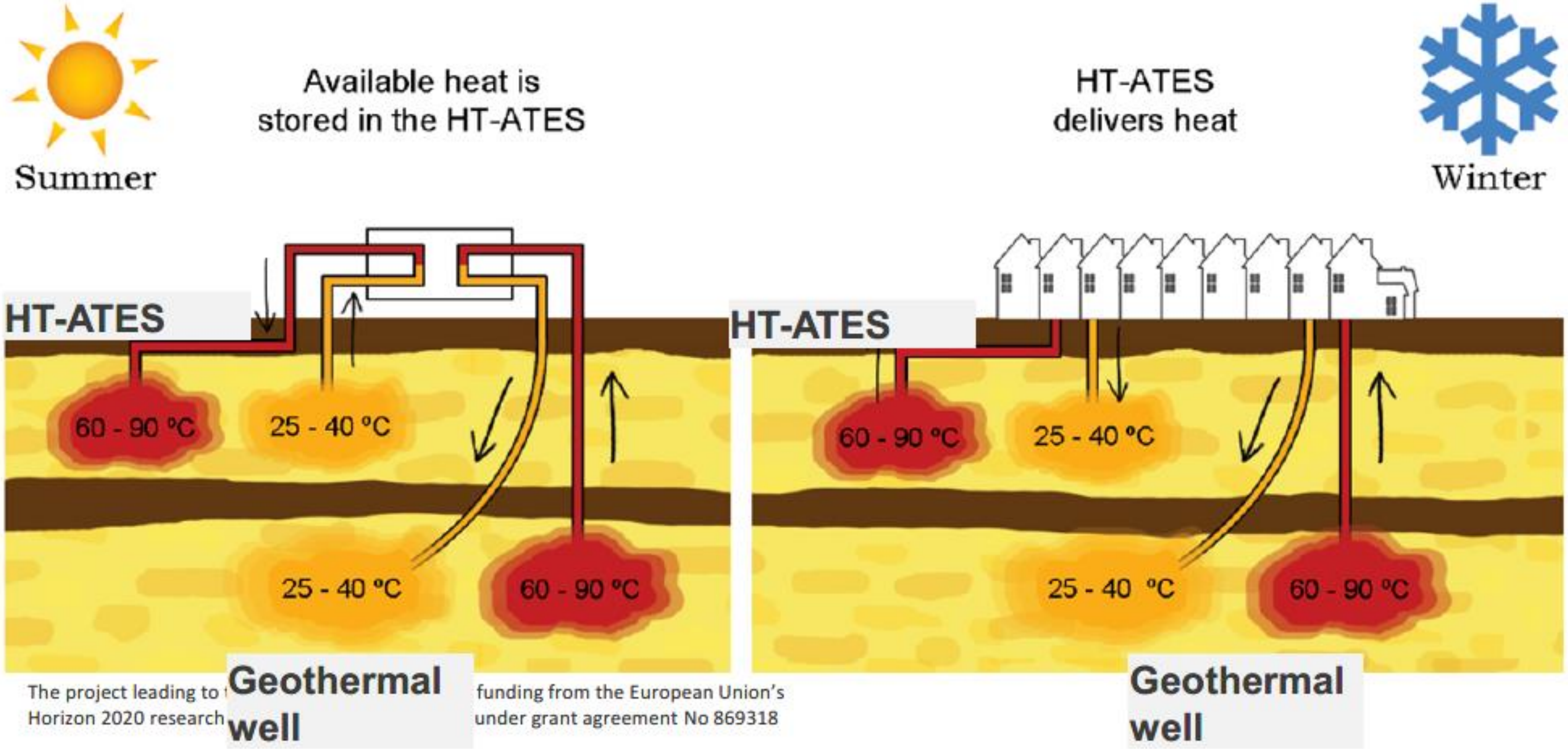
CS2 Nieuw Prinsenland (NL)

- **Greenhouses**
- **Feasibility study: Heat management via high temperature aquifer thermal energy storage**
- **Fit-for-purpose water for irrigation incl. nutrients**



Electrodialysis to remove salts

High Temperature Aquifer Thermal Energy Storage (HT-ATES)



The project leading to … funding from the European Union's Horizon 2020 research … under grant agreement No 869318

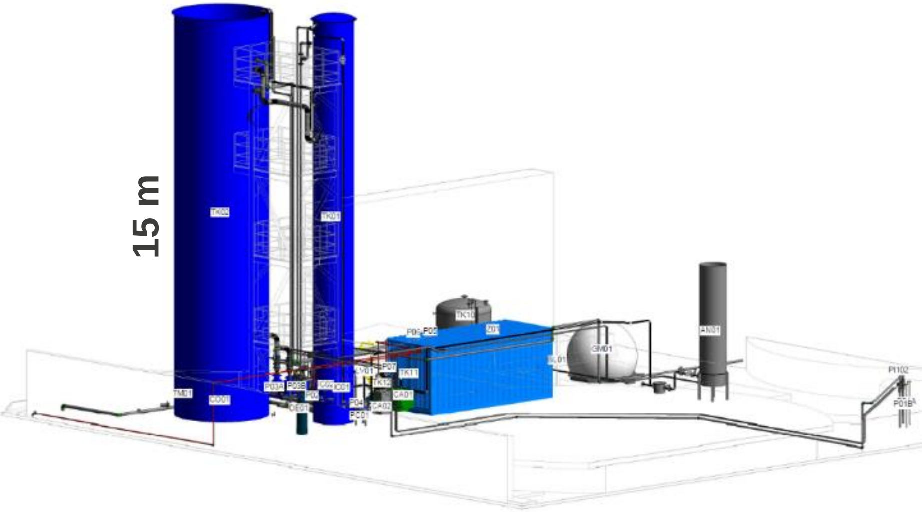
CS5 Lleida (ES)

- Brewery
- Biogas production
- Heat & electricity production
- Fit-for-purpose water for industrial reuse and irrigation

Pilot: electrostimulated anaerobic reactor

Anaerobic membrane bioreactor

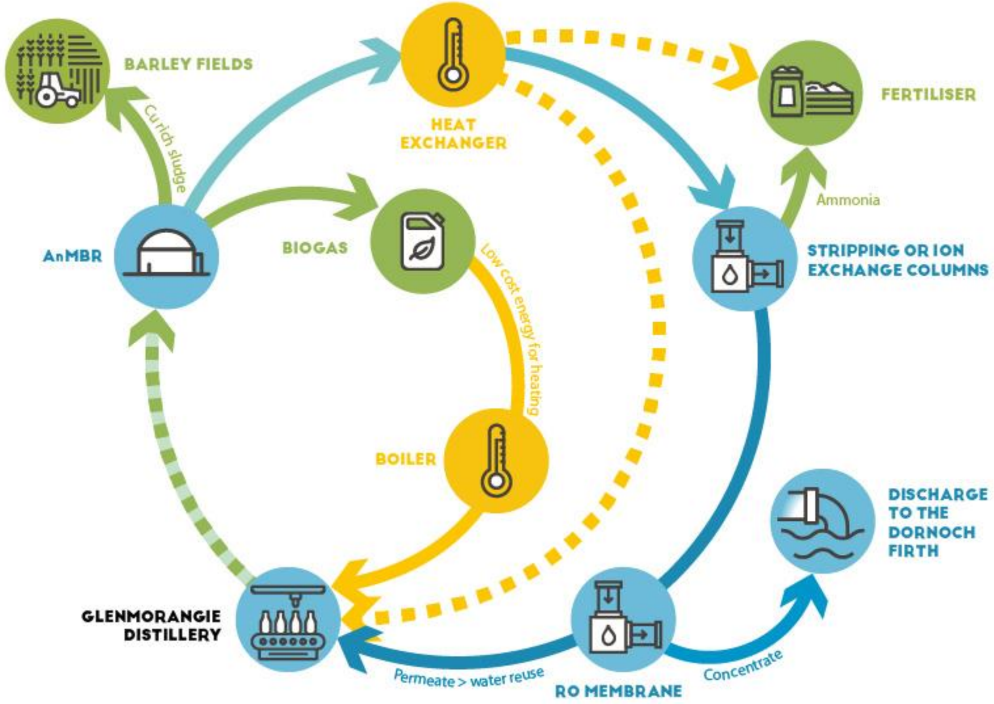
Full-scale: electrostimulated anaerobic reactor



CS7 Tain (UK)

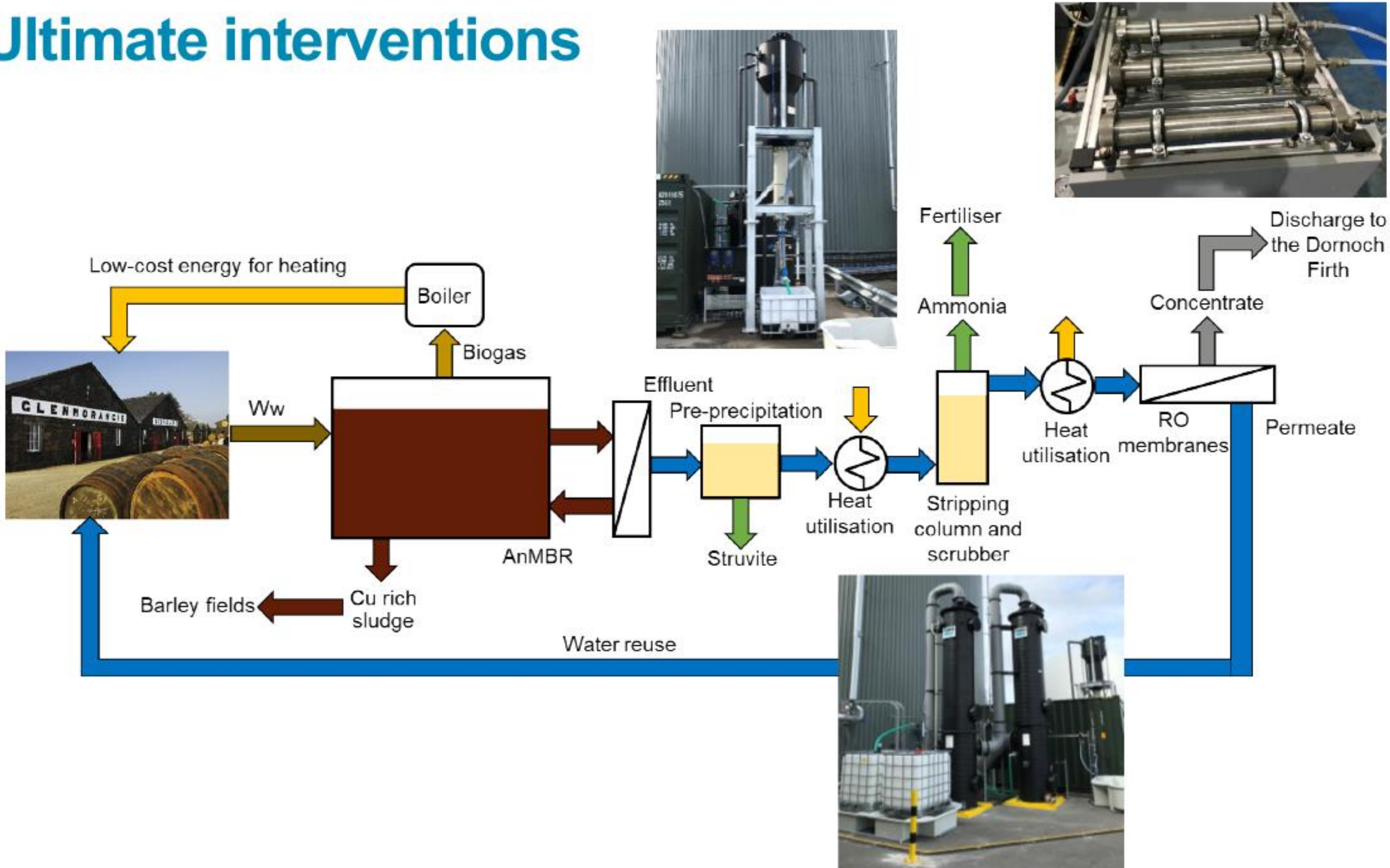
- Whiskey distillery
- Biogas production, heat recovery
- Struvite and ammonium sulphate production (P and N removal and recovery)
- Fit-for-purpose water for industrial reuse

Struvite & ammonium sulphate production

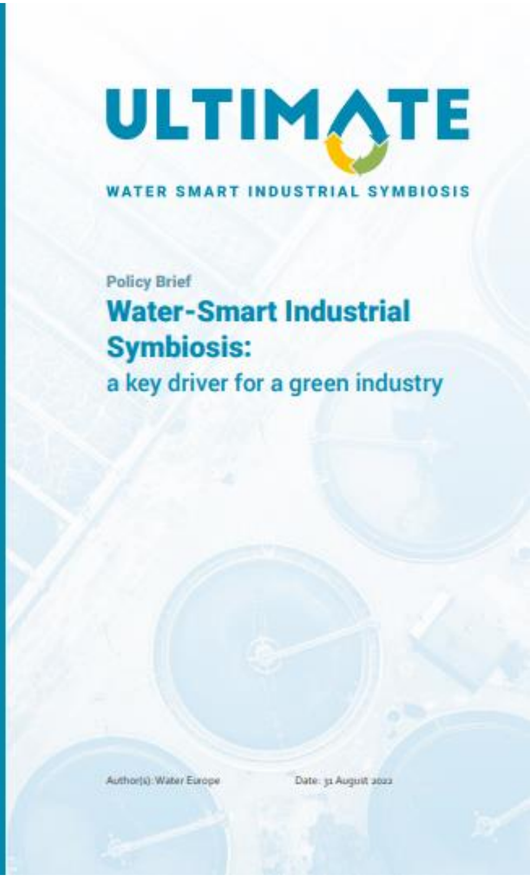


Reverse osmosis unit

Ultimate interventions



Policy support for


ULTIMATE

WATER SMART INDUSTRIAL SYMBIOSIS

Policy Brief

Water-Smart Industrial Symbiosis:

a key driver for a green industry

Author(s): Water Europe

Date: 31 August 2022

Main Recommendations

- Adopt a risk-based approach for reused water and recovered materials in Europe.
- Encourage financial incentive for circular economy systems.
- Consider the opportunities of digital tools within the revision of the directive to support water-smart industrial symbiosis.
- Familiarise citizens with circular economy systems.
- Companies may provide a more transparent overview also of their non-circular activities.

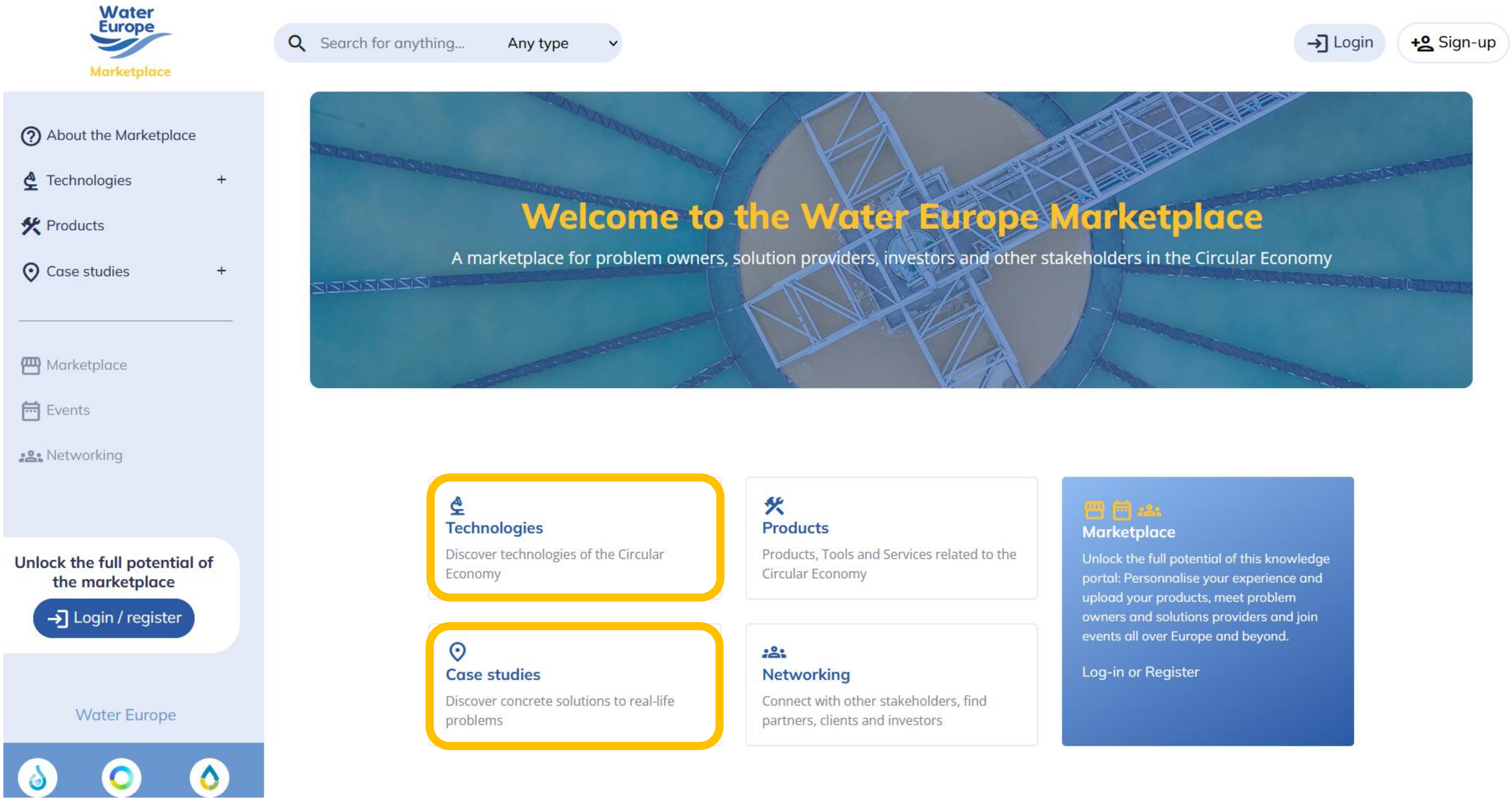
The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Final messages

- Water Smart Industrial Symbiosis (WSIS) is a special type of Industrial Symbiosis in which **water, energy and materials** from municipal and industrial wastewater **are recovered and reused**
- Successful circular transitions depend on **systematically addressing technological, digital, socio-economic, governance and business systems interdependencies**.
- Showcasing WSIS cases (in living labs) with emphasis on **cross synergies, transferability and applicability** of the concept may contribute to a further acceptance and understanding.
- **Transformation** of linear production-consumption-disposal chains in industrial processes to circular systems may reduce the vulnerability to climatic changes and environmental degradation and **contribute to a more competitive industry**.

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

Water Europe Marketplace: Technology Evidence Base



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Funded by the European Union

Innovation for water reuse and resource recovery

Implementing AnMBR technology in SYMSITES EcoSites

Emma Pérez Hernández
Project Manager, R&D Department, AITEX

This project has received funding from the European Union's Horizon Europe program under GA Project 101058426.

SYMSITES

INDUSTRIAL-URBAN SYMBIOSIS

THE PROBLEM

THE SOLUTION

THE OPORTUNITY

SYMSITES

Funded by
the European Union

SYMSITES

HORIZON-CL4-2021-TWIN-TRANSITION-01-14: Deploying I-U symbiosis solutions for the utilization of energy, water, industrial waste and by-products at regional scale (Processes4Planet Partnership) (RIA)

12.404.455 €

Industrial-Urban Symbiosis

New technologies

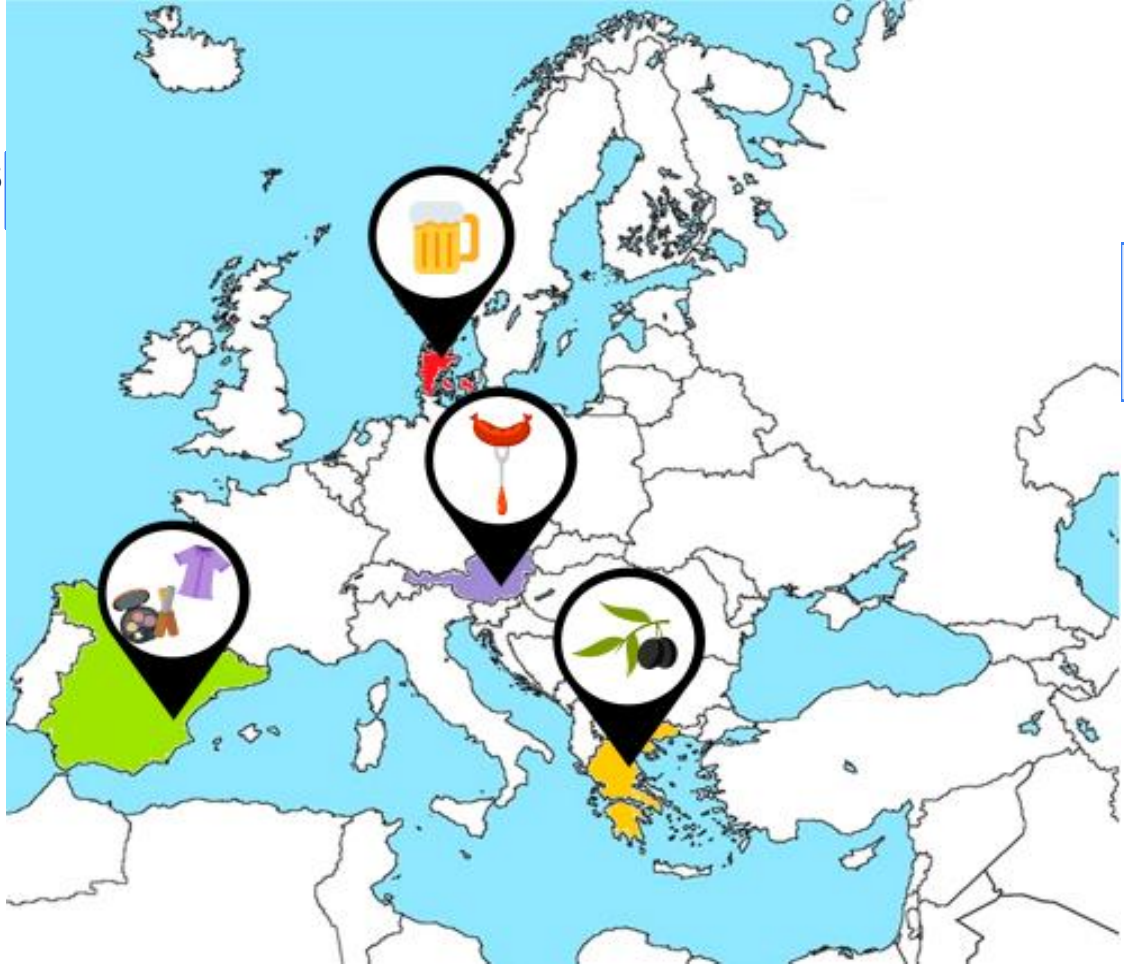
Stakeholders’ engagement methodologies

Four European regions

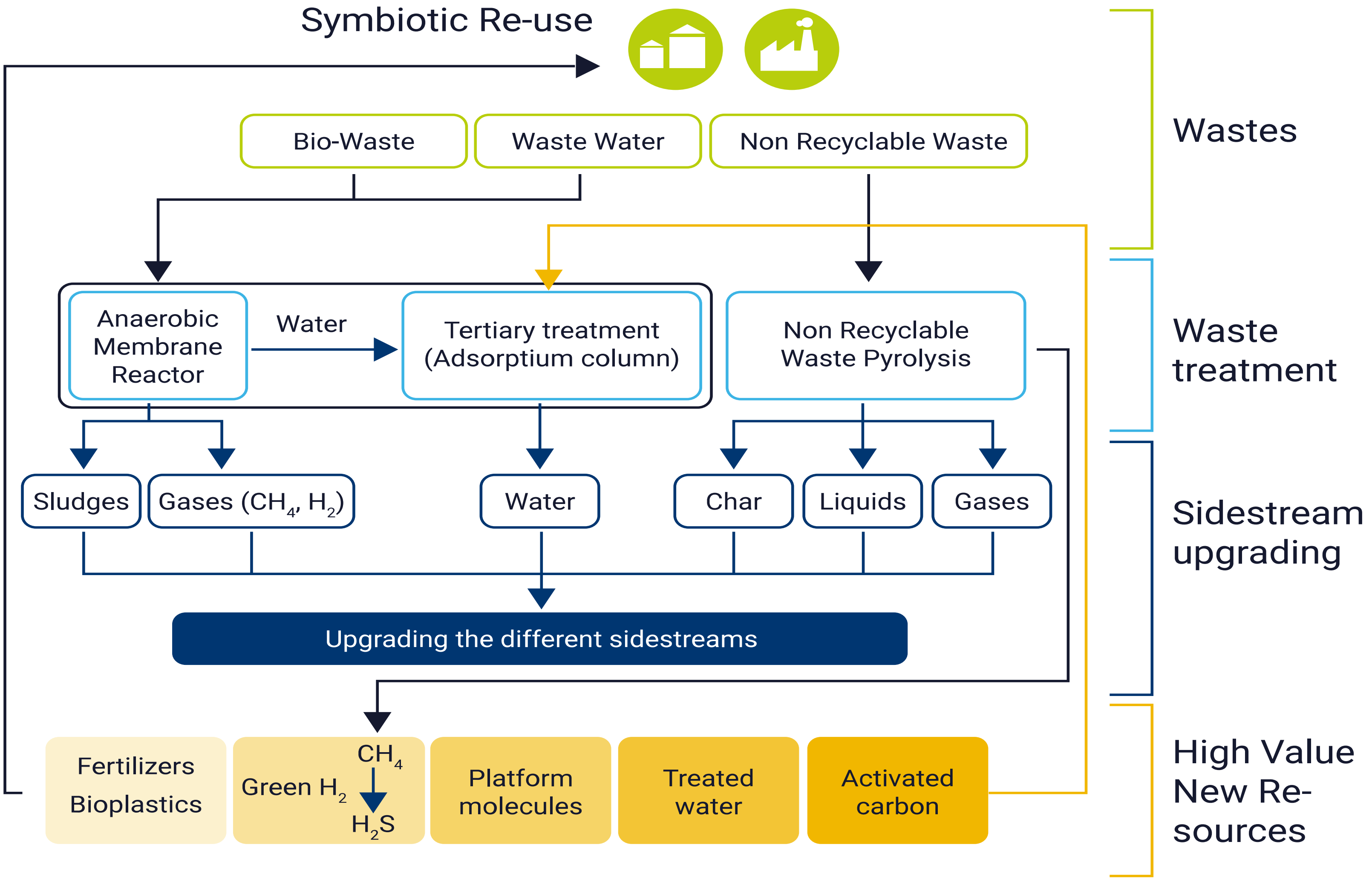
EcoSite concept

Funded by the European Union

WHERE TO FIND THE ECOSITES?



SYMSITES



Symbiotic Re-use
Bio-Waste
Waste Water
Non Recyclable Waste
Anaerobic Membrane Reactor
Water
Tertiary treatment (Adsorptium column)
Non Recyclable Waste Pyrolysis
Sludges
Gases (CH_4, H_2)
Water
Char
Liquids
Gases
Upgrading the different sidestreams
Fertilizers
Bioplastics
Green H_2
CH_4
H_2S
Platform molecules
Treated water
Activated carbon
Wastes
Waste treatment
Sidestream upgrading
High Value New Re-sources

Wastes

Bio-Waste | Waste Water | Non Recyclable Waste

Waste treatment

Anaerobic Membrane Reactor → (Water) → Tertiary treatment (Adsorptium column)

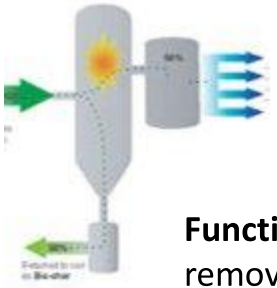
Non Recyclable Waste Pyrolysis

Energy from CH_4 and H_2 via metabolic route

Antifouling treatment

- Nano structured coatings
- Carbon dots coatings
- Magnetically induced membrane vibration

Pyrolysis optimization of NRW using CH_4 as an energy source.



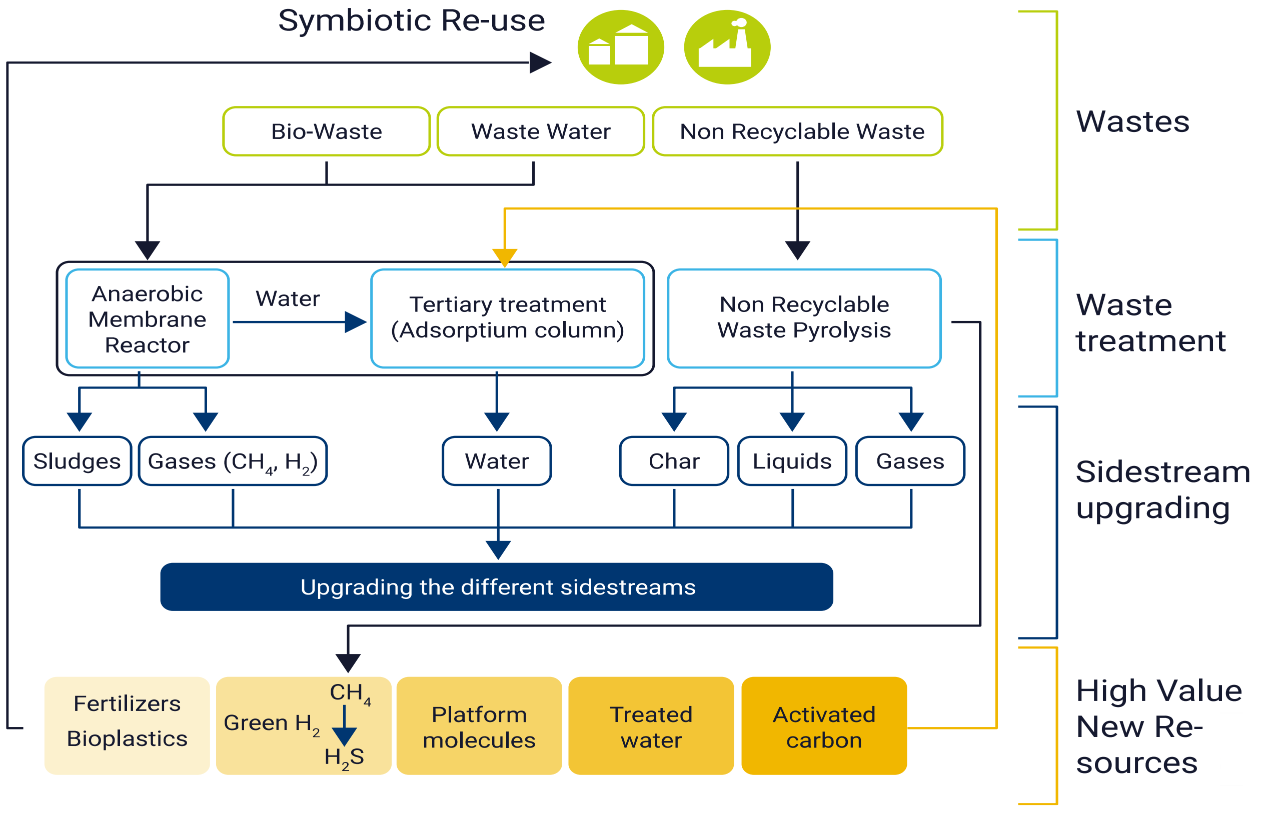
Functionalized AC with LigNPs and/or CDs to remove emerging pollutants.

SYMSITES

4 EcoSites WITH THE SAME GOAL

Enhance recovery of resources, energy and reclaimed water from wastes

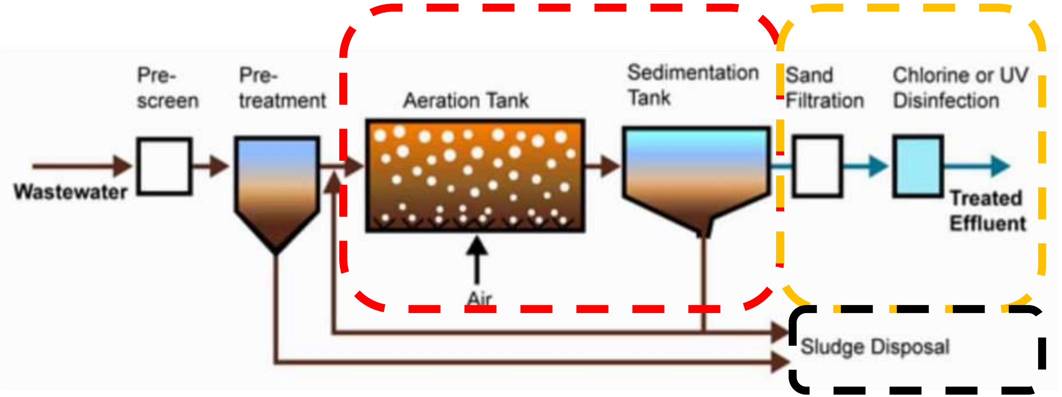
Technologies for water reuse with an I-U Symbiosis perspective

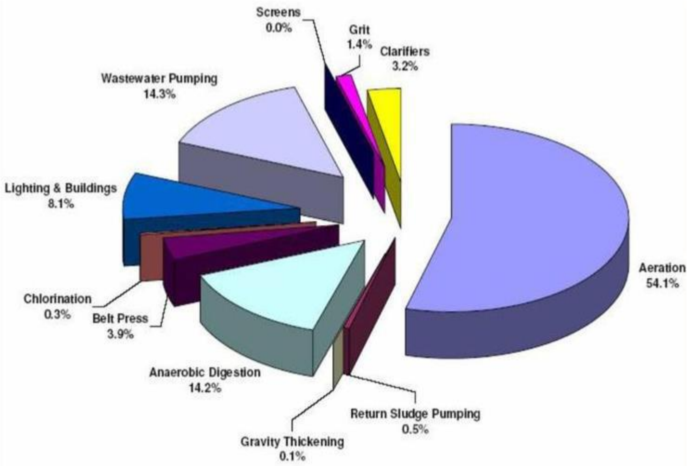


ENERGY PERSPECTIVE OF WASTEWATER TREATMENT

Should we directly apply anaerobic technologies for urban WWT?

Energetic demands in WWTP





Management and regulation restrictions

Funded by the European Union

INTRODUCING ANAEROBIC MEMBRANE BIOREACTORS

Pros and cons:

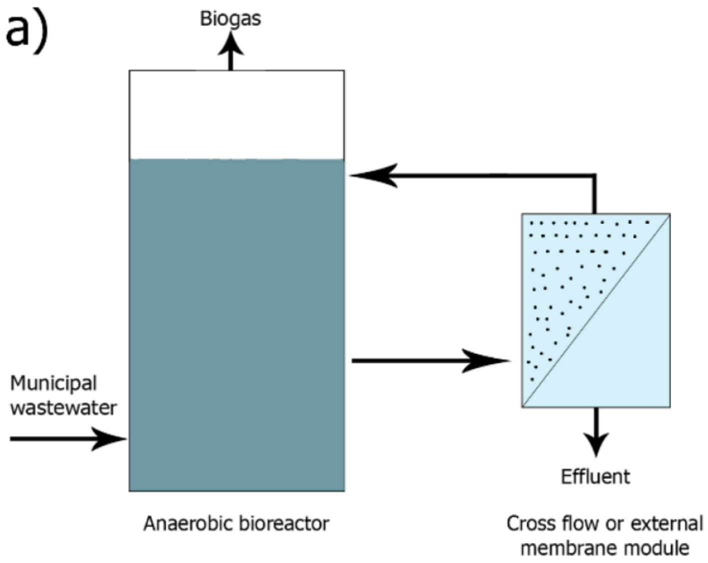
- ✓ Low sludge production due to anaerobic kinetics of the biomass.
- ✓ No need of aeration with air supply.
- ✓ Biogas is produced and can be converted into electricity

- x Large reactors
- x Low efficiency in the separation of biomass

Funded by the European Union

INTRODUCING ANAEROBIC MEMBRANE BIOREACTORS

Different configurations:



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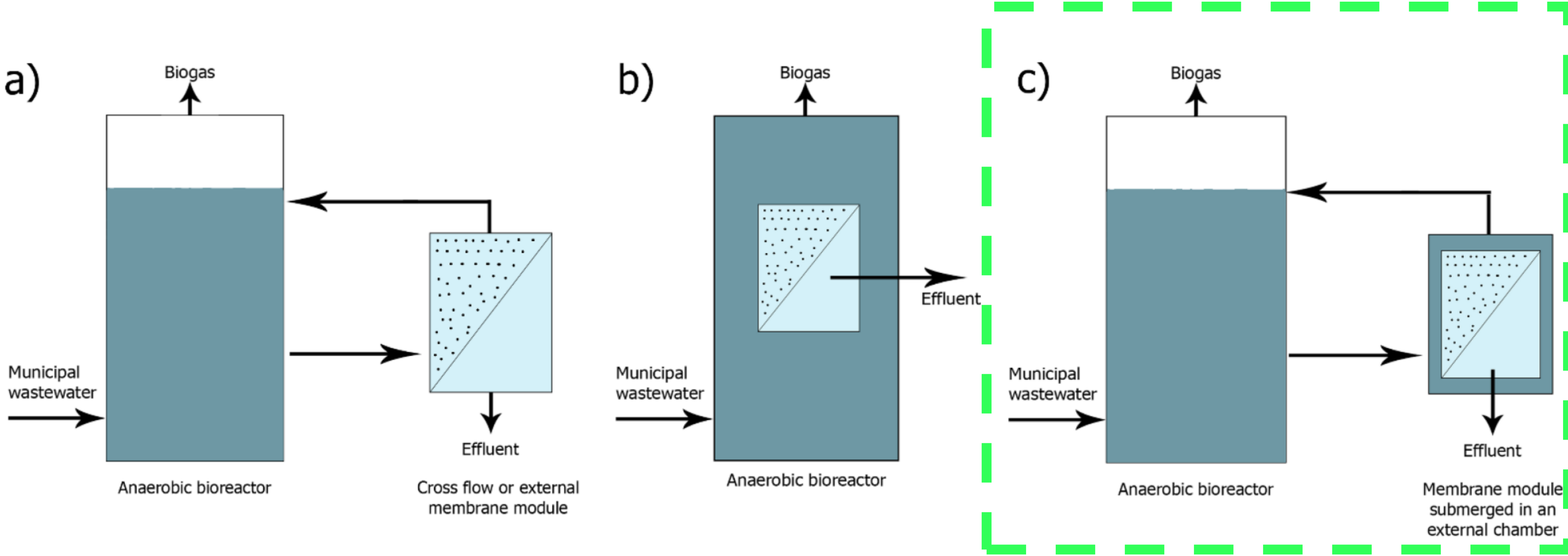
INTRODUCING ANAEROBIC MEMBRANE BIOREACTORS

SYMSITES

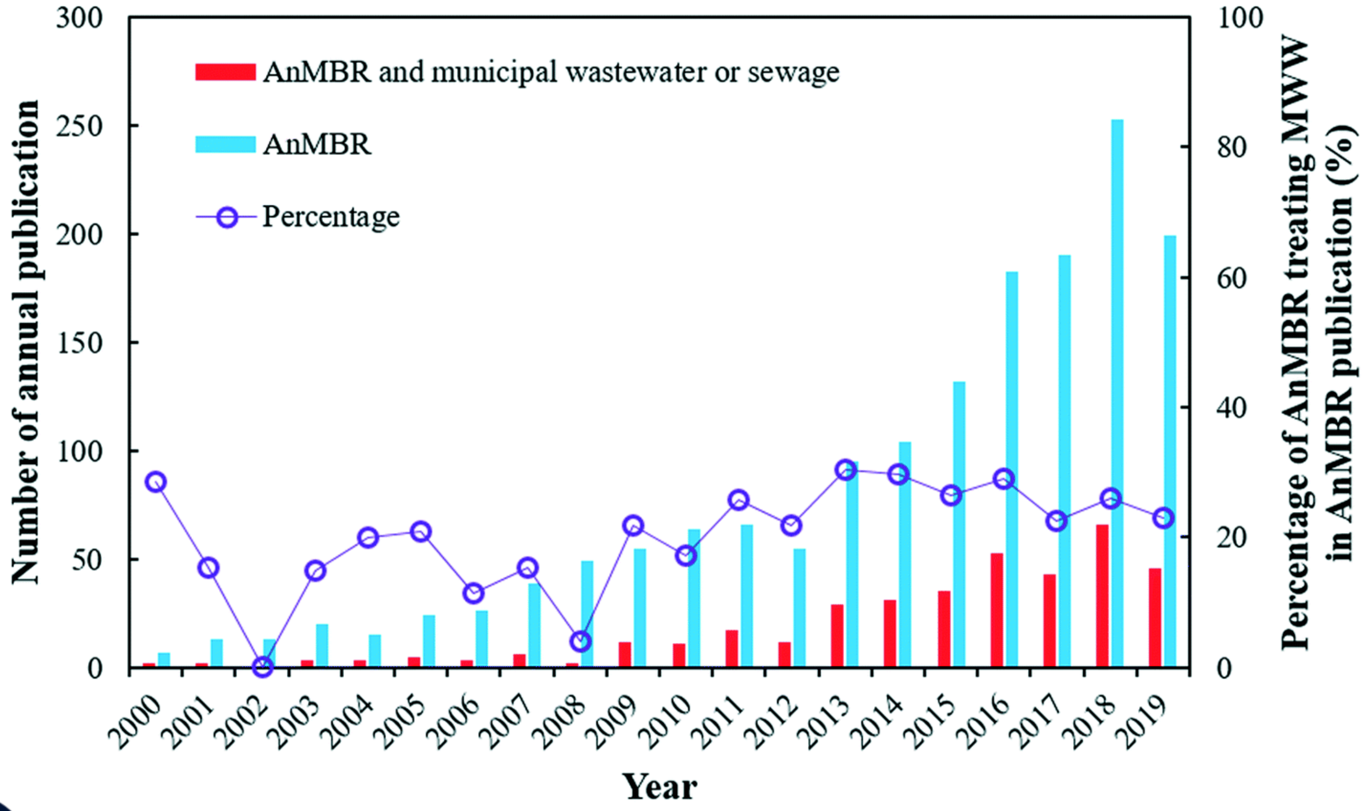
Different configurations:



Funded by the European Union

Does AnMBR need "further research"?

SYMSITES



Hu et al., 2020. Environmental Science: Water Research and Technology

A REVIEW OF AnMBR PERFORMANCE

SYMSITES

Application to municipal wastewater treatment

↑ Energy if up-grading to H_2

Reference	COD ($g \cdot m^{-3}$)	BOD ($g \cdot m^{-3}$)	TN ($g\ N \cdot m^{-3}$)	TP ($g\ P \cdot m^{-3}$)	$\%CH_4$	$\%VSS_{sludge}$
14	59	14	47.9	6.7	57.2	67.0
121	81	n.a.	44.9	3.9	62.0	59.3
36	70-100	n.a.	38.0-62.1	5.1-10.2	55.0-70.0	66.5-72.4
1	80-116	n.a.	34.2-54.3	6.1-10.3	74.1-77.5	65.8-73.0
38	91	n.a.	47.9	7.7	76.9	70.3
39	58	25	37.0	4.2	68.0	n.a.
37	50	n.a.	34.2	6.5	50.0-70	63.0-75.0
187	39-54	8-16	n.a.	n.a.	70.0-79.6	82.0-84.0

(n.a.: not available)

Fertirrigation or liquid fertilizer production

Biofertilizers
Reduce reagents and management costs

A. Robles, J. Serralta, N. Martí, J. Ferrer and A. Seco, Environ. Sci.: Water Res. Technol., 2021

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DOES AnMBR NEED "FURTHER RESEARCH"?

SYMSITES

Limitations of AnMBR technology

- Municipal wastewater has low COD
- Remaining COD in the effluent
- Dissolved methane losses in the effluent
- Energy recovered from biomethane
- Chemical reagents need for membrane cleaning
- High mineralization of the effluent
- Ultrafiltration membranes mainly retain bacteria

Innovation challenges in SYMSITES project

- Co-digestion in wastewater stream (I-U symbiosis)
- Adsorption column with pyrolised wastes
- Recovery using membrane contactors
- Up-grading to hydrogen
- Magnetic membrane vibration system
- Fertirrigation strategies
- Assessment of microbial risk associated to effluent reuse (virus, bacteria, other pathogens) and new disinfection materials

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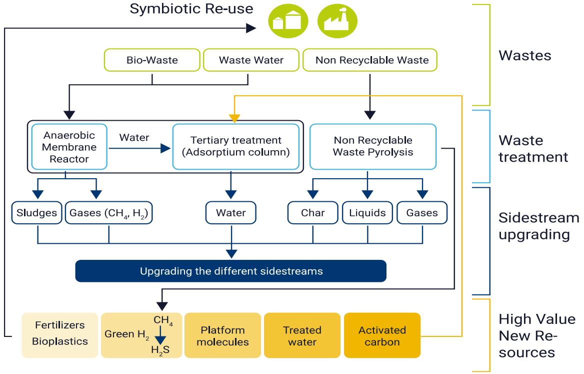
4 EcoSites WITH THE SAME GOAL

SYMSITES

Innovations are needed to maximize AnMBR benefits



AnMBR + Adsorption Column + Biogas upgrading

SPAIN

- Magnetic membrane Vibration (MMV)
- Lignin Nanoparticles
- Methane plus nitrogen recovery as ammonia sulphate

DENMARK

- Coated membranes
- Lignin Nanoparticles

AUSTRIA

- Carbon Dots
- H_2S used for nitrogen recovery as ammonia sulphate

GREECE

- Direct H_2 production
- Carbon Dots
- Coated Membranes

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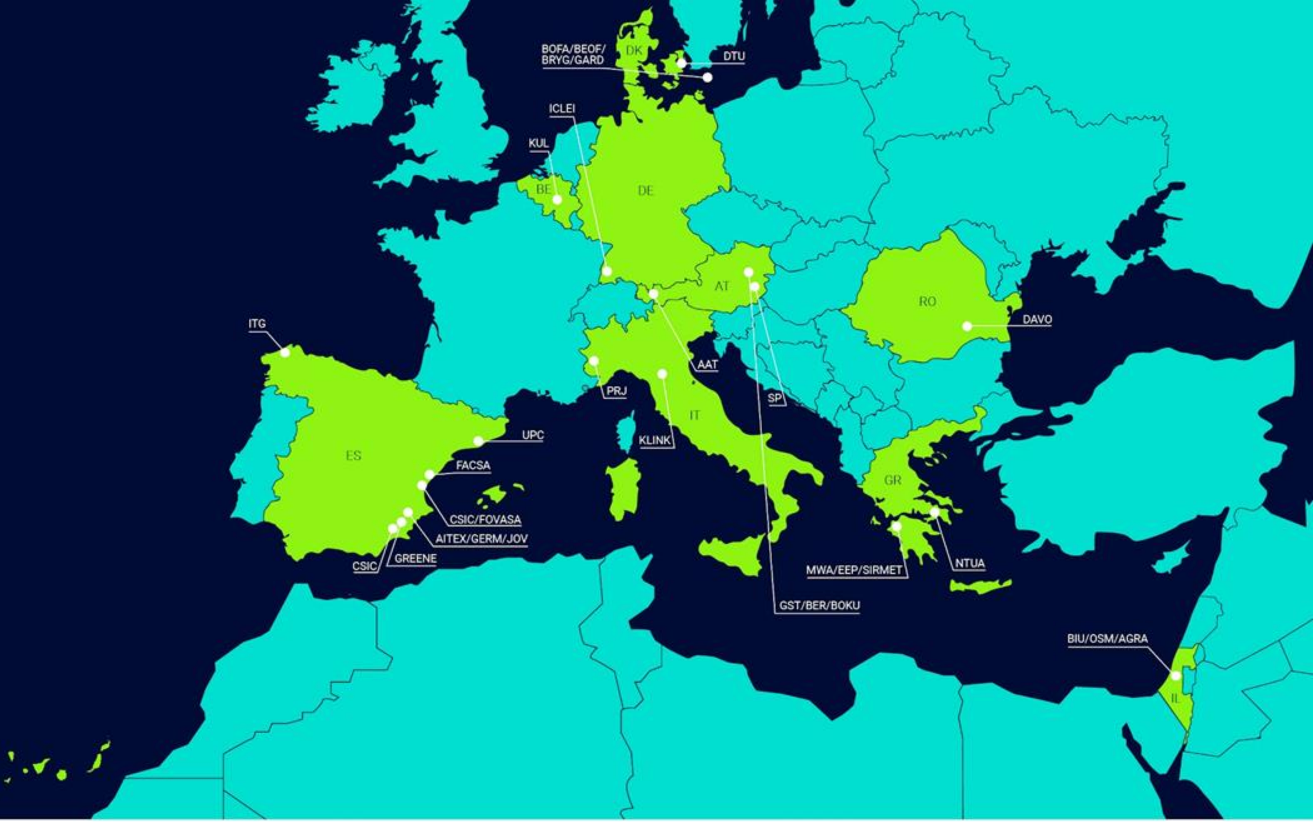
SYMSITES

CONSORTIUM MAP

info@symsites.eu



THANKS FOR YOUR ATTENTION

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WASTE2COAG

Brine and Metal Wastes Valorisation to Produce Coagulants for Wastewater Treatment

Brine and metal waste valorization to produce coagulants for wastewater treatment

Laura Grima Carmena

June 2024

AIDIMME TECHNOLOGY INSTITUTE

The project LIFE WASTE2COAG has received funding from the LIFE programme of the European Union under the Grant Agreement no LIFE20 ENV/ES/000430

Content

- Context: Problem to solve
- Waste2Coag solution
- Technical overview
- Results and demo plant

Project partners

LIFE W2C

Start: 01/10/2021

End: 30/09/2025

Total amount: 1,564,295 €

global omnium Medioambiente S. L.

AIDIMME INSTITUTO TECNOLÓGICO

JOVIAR global solutions for projects in zamak

Aquafin

isle

Context

Problem to solve

Wastes

Brines & Scrap metals

Valorisation

Reagents

Coagulants

Brines

High generation (desalination plants >100M m^3/d worldwide)

Discharged without treatment - Environmental impact

Metals

Scarcity of resources

Price

Coagulants

High consumption worldwide (Urban and industrial WWTP)

Outsource - Continuous price increments – expected to increase

W2C SOLUTION

Based on electrolysis

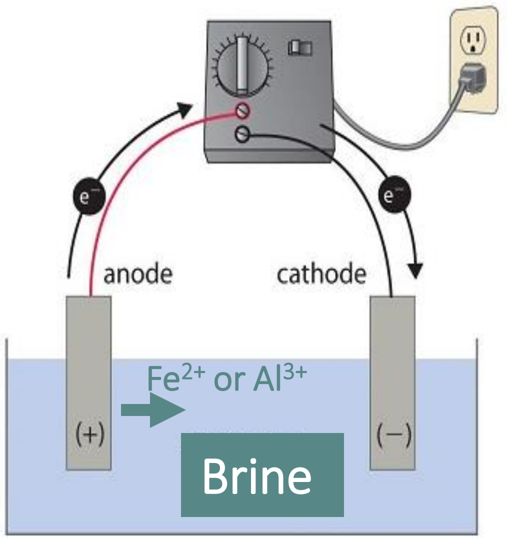
- Apply a continuous electrical current to two metal electrodes immersed in a solution to cause a non-spontaneous chemical change.
- Anode (sacrificial electrode):

Steel: substitute of commercial $FeCl_3/FeCl_2$.

$$Fe - 2e \rightarrow Fe^{2+}$$

Aluminium: substitute of commercial PAC.

$$Al - 3e \rightarrow Al^{3+}$$



Lower electrical consumption

The higher conductivity of brines allows the application of lower voltages

W2C SOLUTION

WASTE 2COAG

Multi-sector approach

INPUTS

Scraps metals (Fe and Al)

Brines (Desalination and industrial)

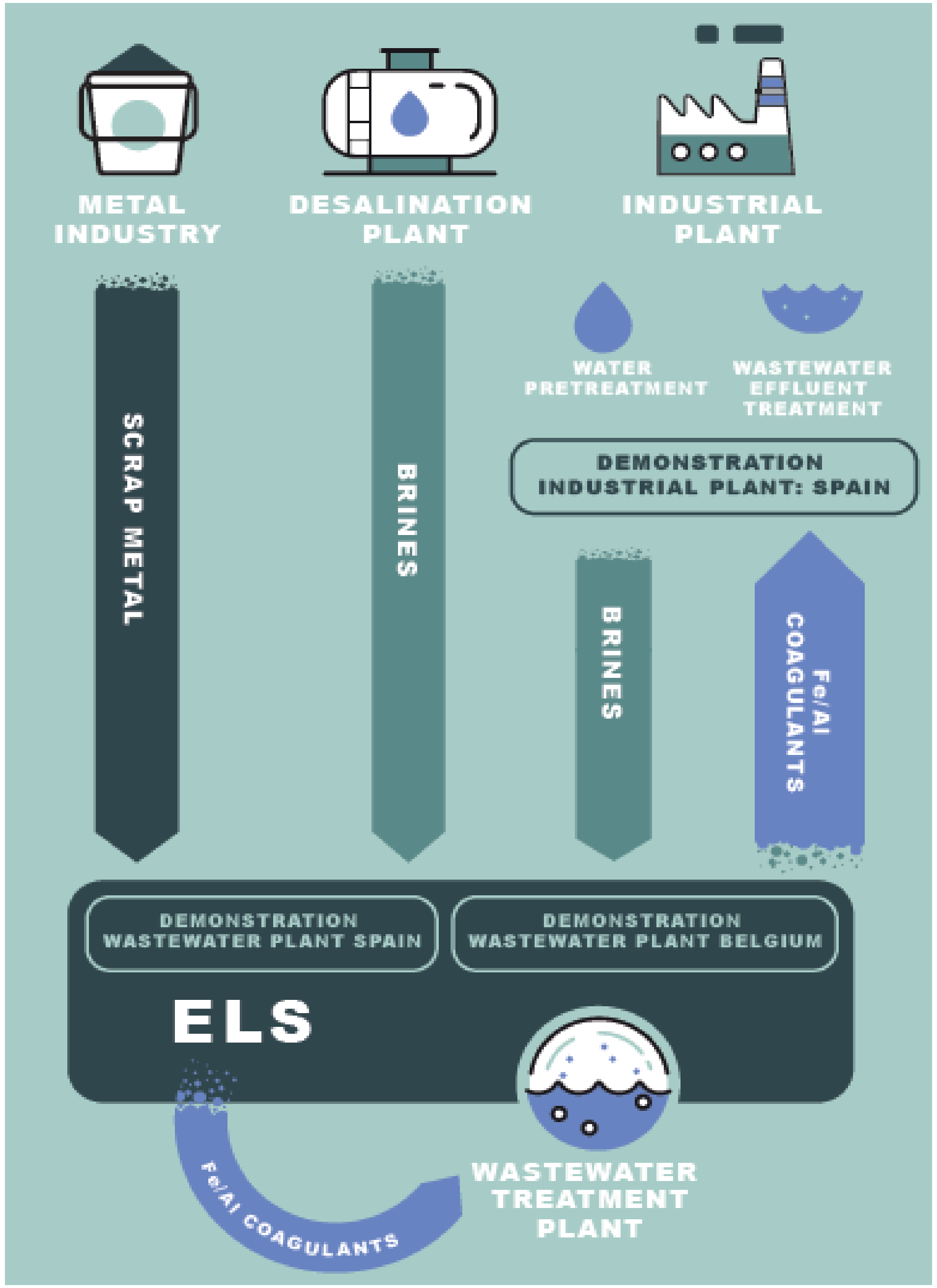
PROCESS

ELectrolytic System (ELS)

OUTPUT:

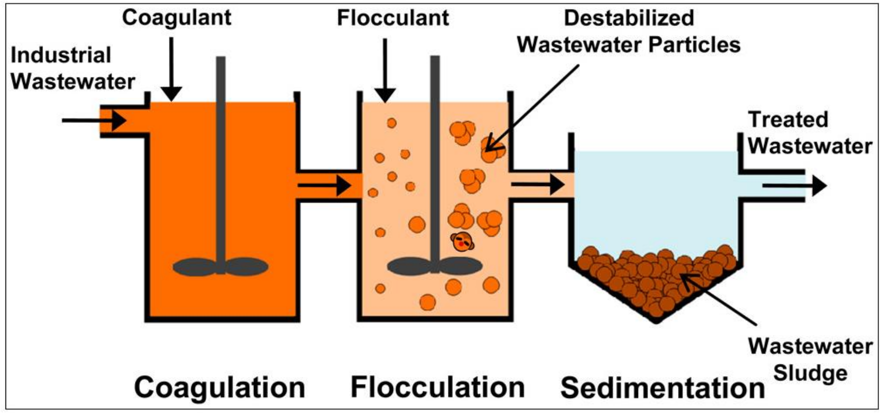
WWTPs Reagents

Valorization of brines and scraps



Technical overview

Coagulation for WWT

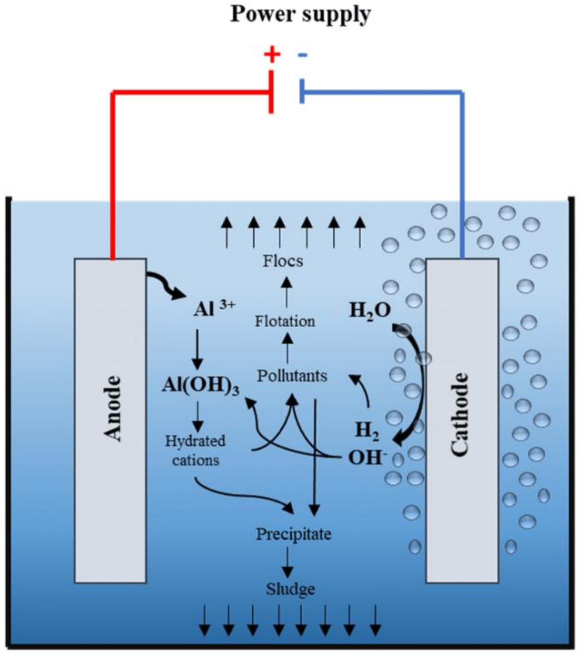


COAGULATION

Addition of reagents

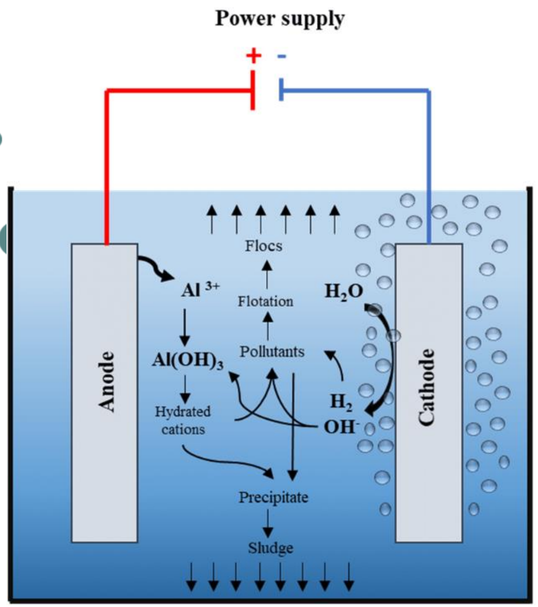
ELECTROCOAGULATION (EC)

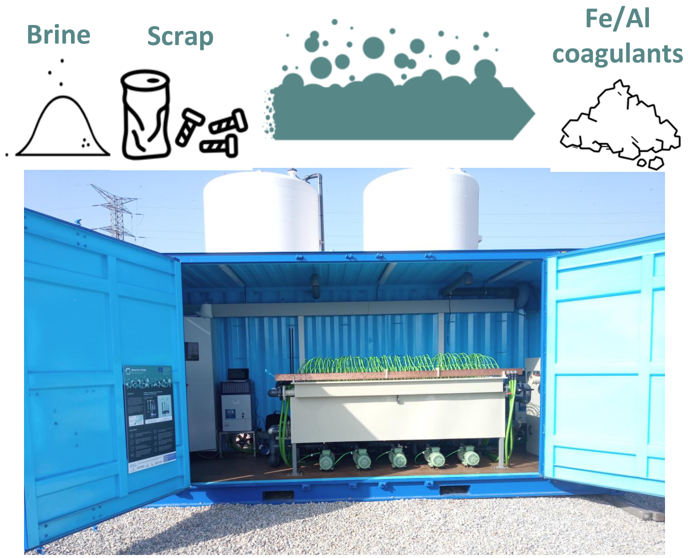
Electrochemical coagulation



Technical overview

EC vs. ELS





		Electrocoagulation (EC)	LIFE W2C Electrolytic System (ELS)
≠	Objective	WW treatment	Produce coagulants, valorise wastes
	Electrodes	Commercial	Metal Scraps (cheaper+environment)
	Electrolyte	Waste water	Brines (conductivity+environment)
	Versatility	Standard	Wide range qualities received/delivered
=	Easy to operate	✓	✓
	No reagents (less sludge)	✓	✓
>	Commercial coagulant	No	✓
	Waste valorisation	No	✓
	Low power consumption	No	✓

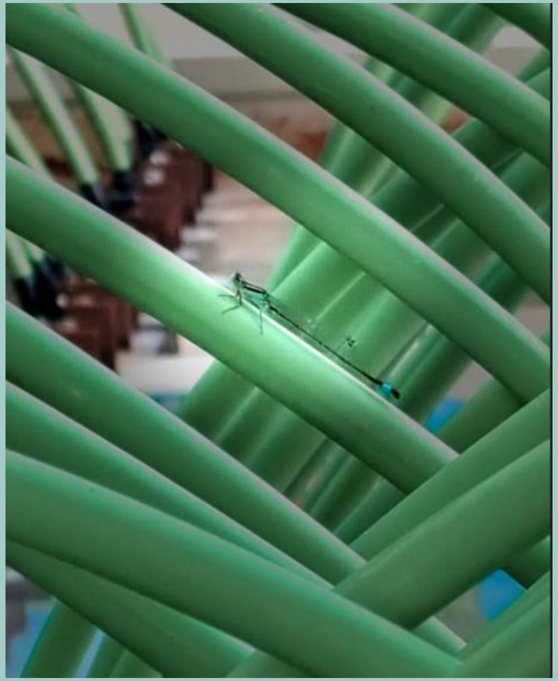
ELS pilot

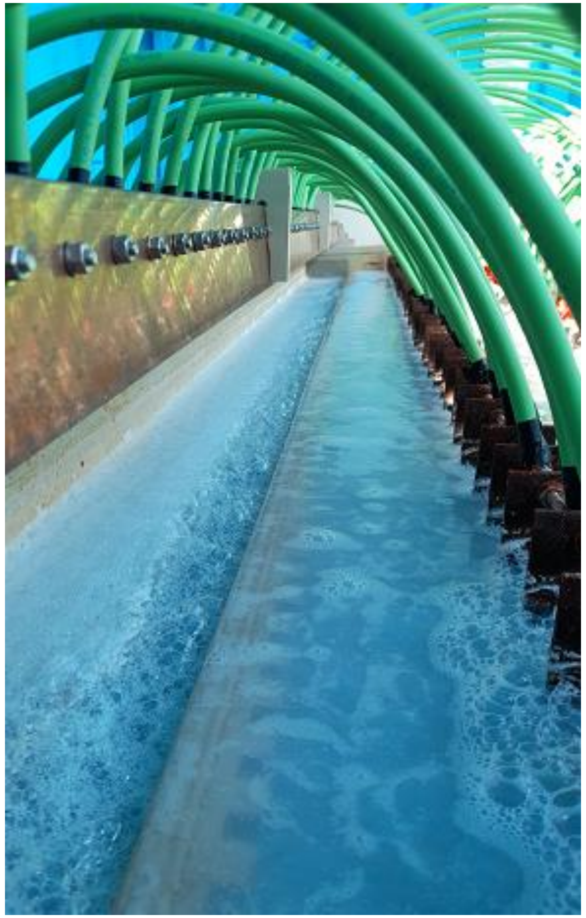
Demo plant

ELS pilot

Fe & Al Coagulants

Coagulant production in the ELS system





Conclusions

- Problem: Brines, metals and coagulants
- Valorization of wastes into reagents
- Overview of the Electrolytic System
- Coagulant production


WASTE2COAG
Brine and Metal Wastes Valorisation to Produce
Coagulants for Wastewater Treatment
THANKS FOR YOUR ATTENTION
17/06/2024
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