



PRiSTiNE

**Innovative and versatile integrated solution to remove
contaminants of emerging concern in water treatment systems**



LIFE PRISTINE PROJECT OVERVIEW AND MAIN RESULTS

Open Day

Aina Soler Jofra, ACCIONA, Innovation Department

4th June 2025

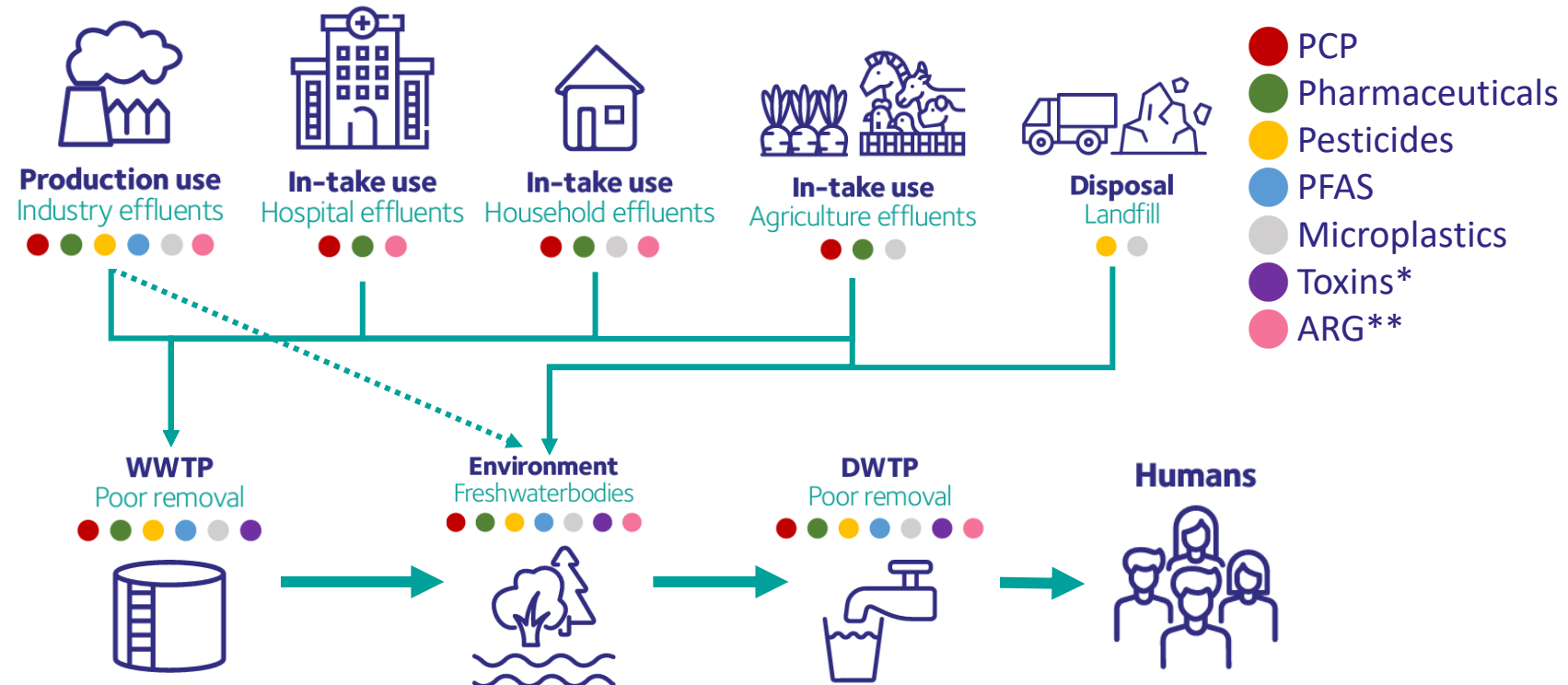
PROBLEM: CONTAMINANTS OF EMERGING CONCERN



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Contaminants of emerging concern (CECs) are compounds of different origin and chemical nature that are disseminated in the environment. In most cases they are unregulated contaminants, which may be candidates for future regulation, depending on monitoring data regarding their incidence and potential health and environmental effects.

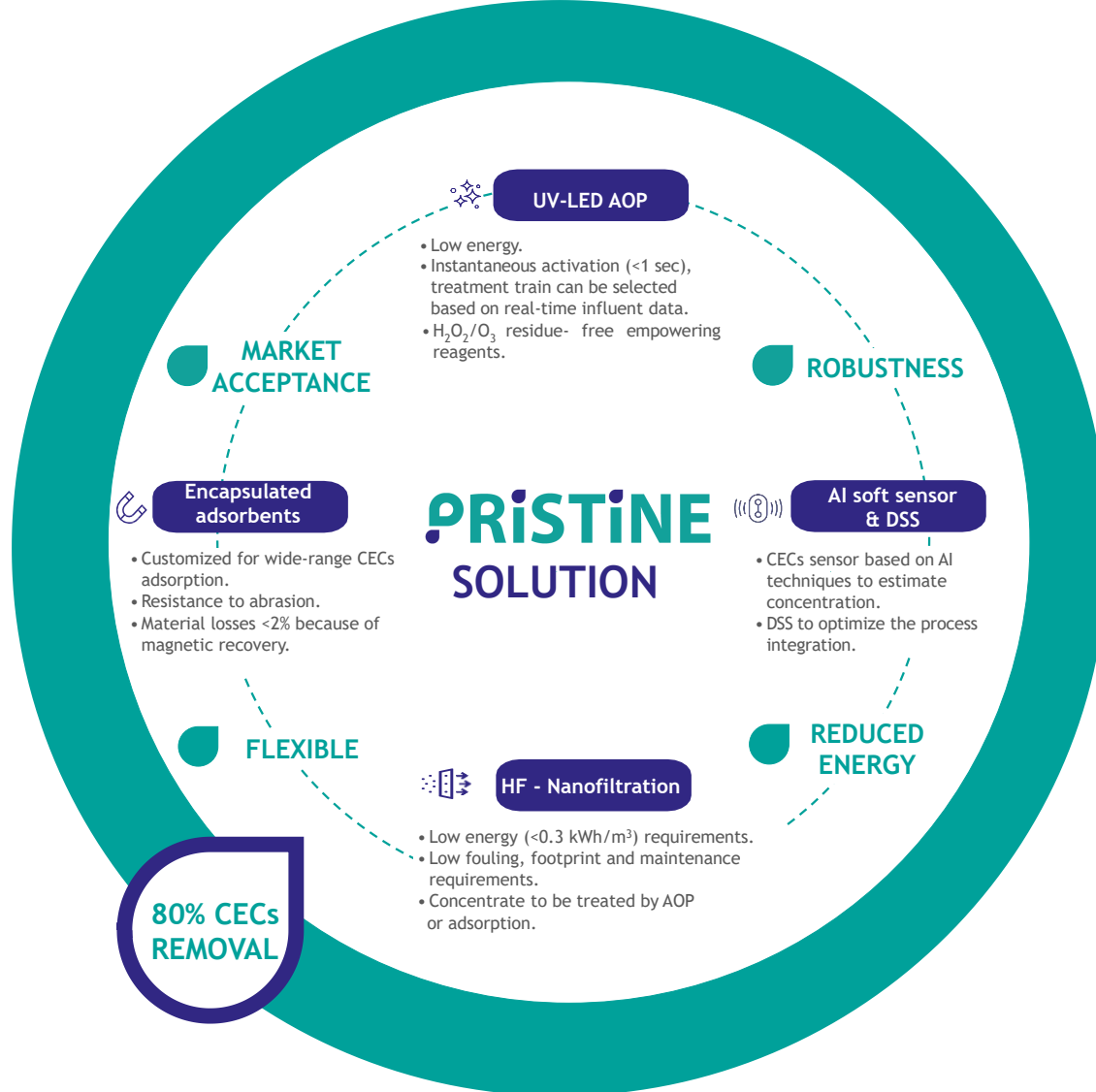
- ❖ Bioaccumulation
- ❖ Persistence
- ❖ Toxicity
- ❖ Risks for the immune system
- ❖ Endocrine disrupting effects
- ❖ Carcinogenicity and/or mutagenicity



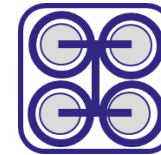
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PRISTINE



DEMONSTRATION



WASTEWATER

WWTP Murcia Region
PRISTINE as quaternary treatment
& water reclamation



DRINKING WATER

Advanced Centre for Water Treatment
Bilbao-Bizkaia (CATABB)
PRISTINE as principal drinking water
treatment



xylem
Let's Solve Water

esamur
Entidad de Saneamiento y Depuración de la Región de Murcia

nx

filtration

eurecat

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APPROACH



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- Policies and legislation
- Literature & previous data

CECs LONGLIST (29)

- Approach definition
- Similar strategy for both sites

PRIORITIZATION

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DEMONSTRATION

CHARACTERIZATION CAMPAIGN

- 1 year
- Data AI softsensor
- 134 CECs, MPs, ARG
- Physicochemical parameters

CECs SHORTLIST & AI SOFT SENSOR

- According to prioritization
- Define CECs PRISTINE focus
- Develop AI soft sensor

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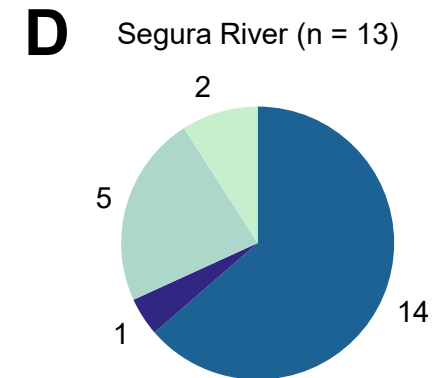
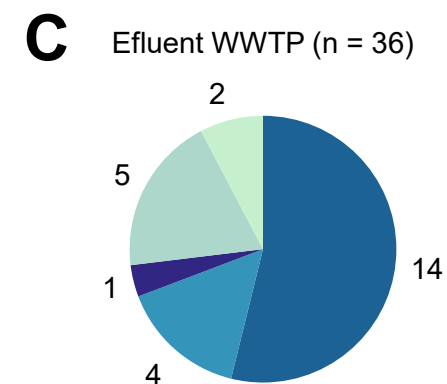
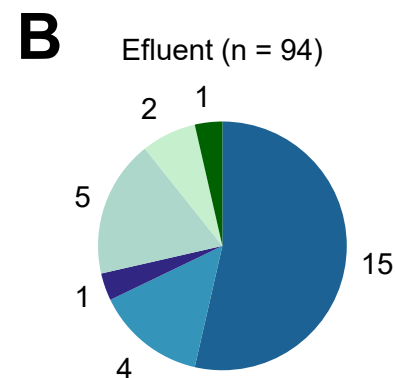
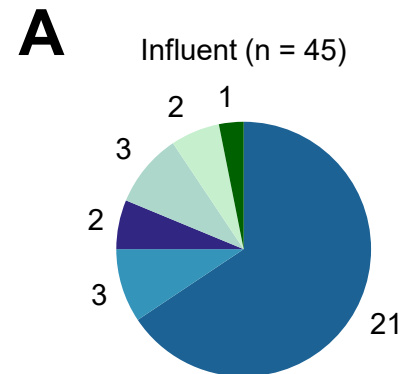
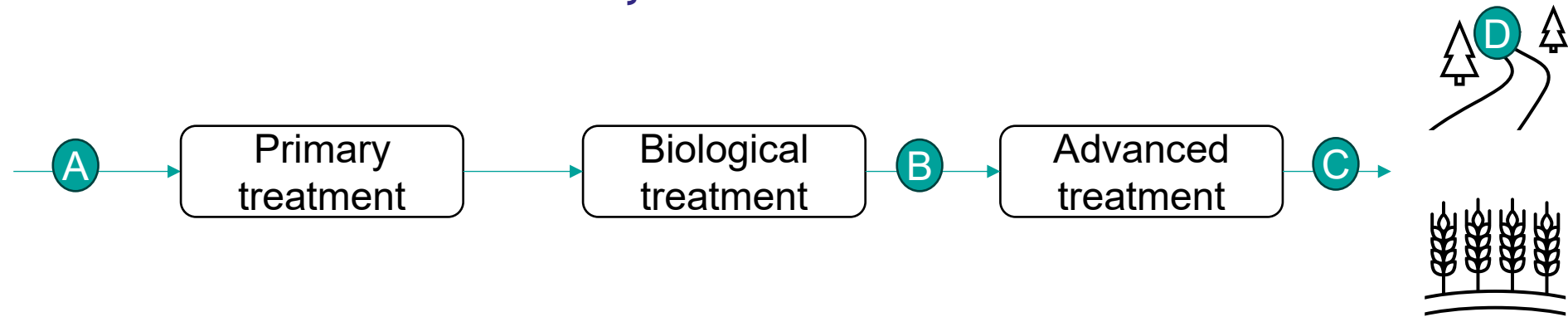
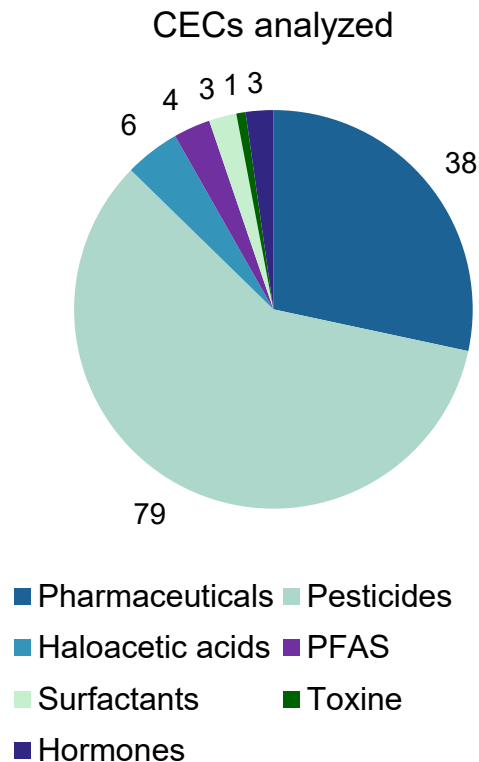
- What CECs will need to be treated by the PRISTINE Integrated Solution and under which conditions?
- Can regular online process parameters be used to estimate CECs concentrations using an AI Soft sensor?

CHARACTERIZATION CAMPAIGN RESULTS



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From the 134 CECs analyzed, 34 were detected in the WW site and 28 in the effluent of the secondary clarifier (future influent of the pilot demonstration). Pharmaceuticals and pesticides were the most abundant, persistent and occurrent CECs detected in the effluent of the secondary clarifier






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PRISTINE CECs SHORTLIST



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A prioritization strategy was used to select the CECs shortlist among the compounds detected

			
Detection frequency	> 75%	25-75%	< 25%
Concentration	> 1 µg/L	0.1 – 1 µg/L	< 0.1 µg/L
Legislation	Yes		No
Removal efficiency	< 50%	50%-75%	> 75%
Risk ($C_{av}/PNEC_{fw}$)	> 1	0.1 – 1	< 0.1



PHARMACEUTICALS

1. Ibuprofen
2. Caffeine
3. Ampyrone
4. Naproxen
5. Ofloxacin
6. Ciprofloxacin



PESTICIDES

7. Venlafaxine
8. Diclofenac
9. Sulfamethoxazol
10. Ketoprofen
11. Acetaminophen
12. Glyphosate
13. Imazalil
14. Pyrimethanil



OTHERS

15. Nonylphenol
16. Bisphenol A
17. Haloacetic acids
18. Microplastics
19. ARG

➤ What CECs will need to be treated by the PRISTINE Integrated Solution and under which conditions?

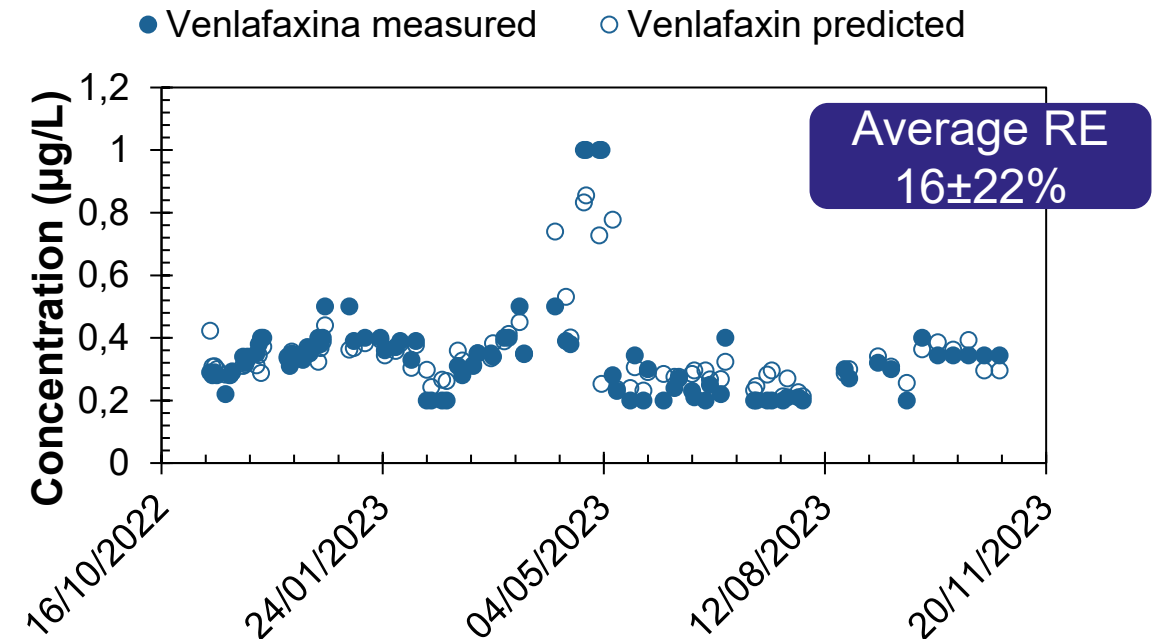
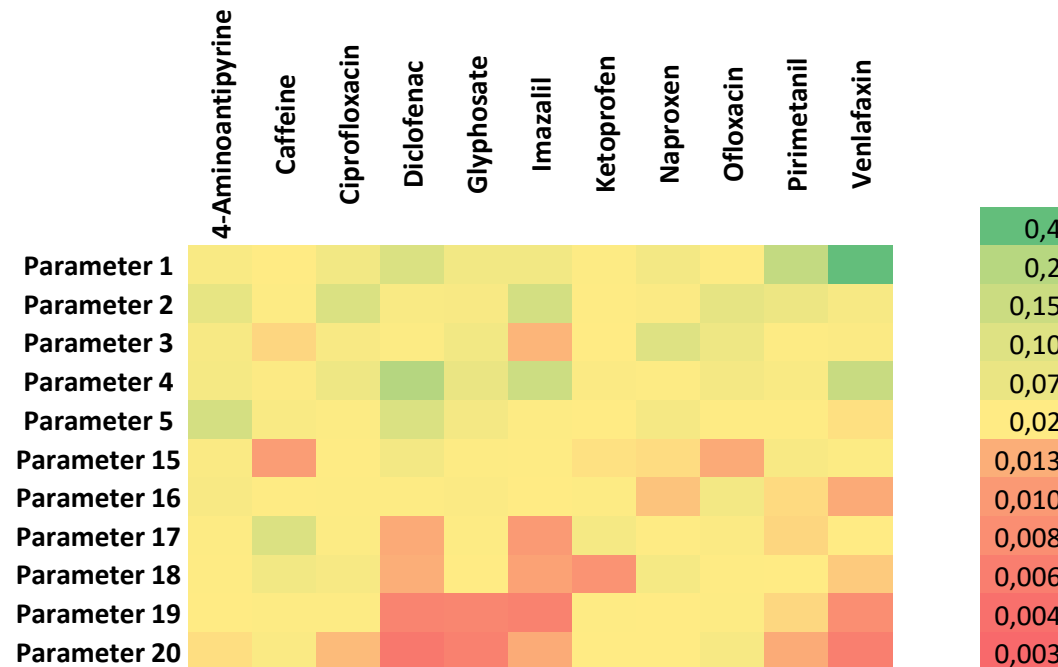
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AI SOFT SENSOR DEVELOPMENT



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The AI softsensor using a random forest algorithm were developed based on online process parameters for the selected CECs with relative errors between 15-40%, which will be improved during the demonstration



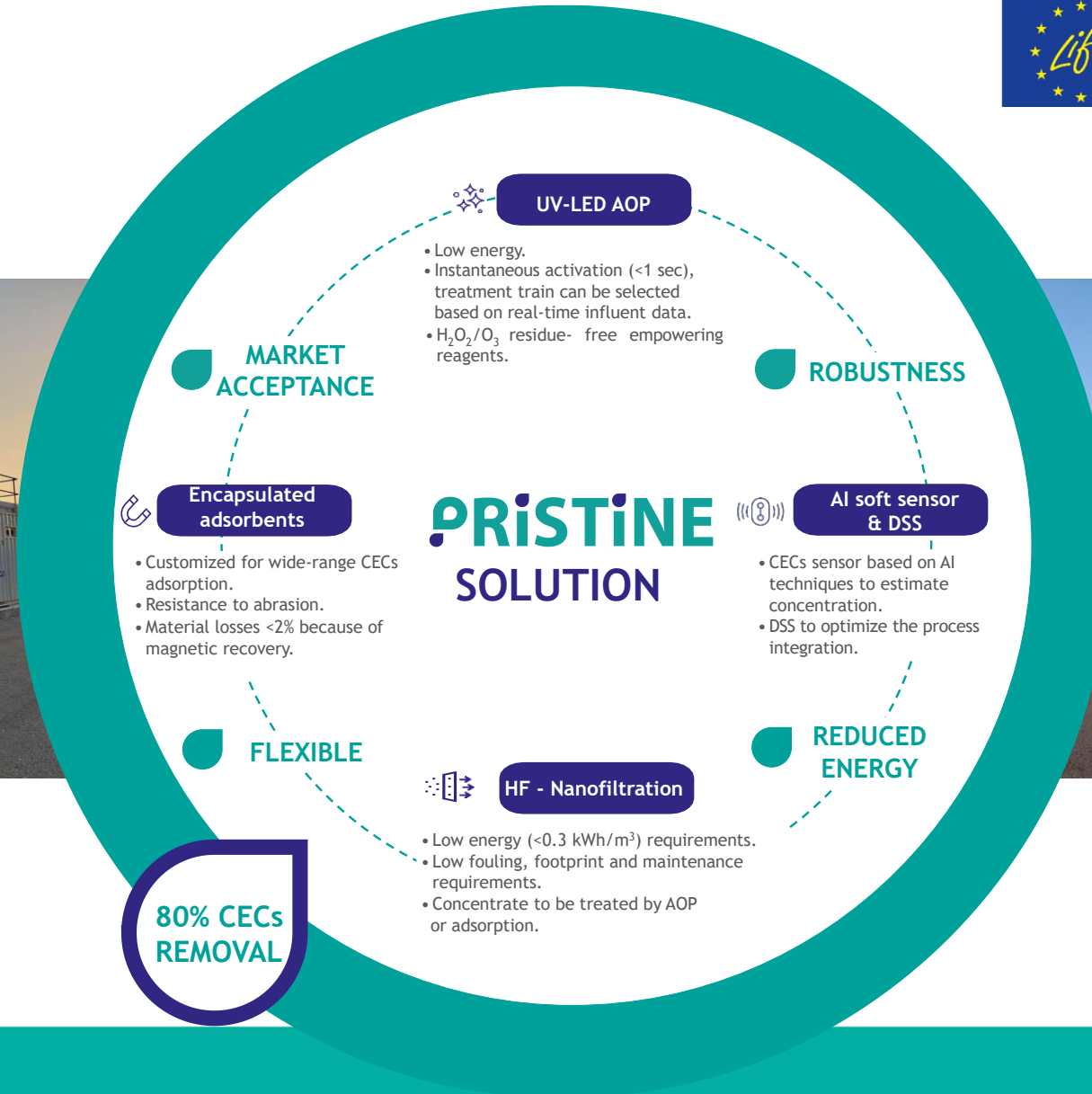
➤ Can regular online process parameters be used to estimate CECs concentrations using and AI Soft sensor?

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THE PILOT



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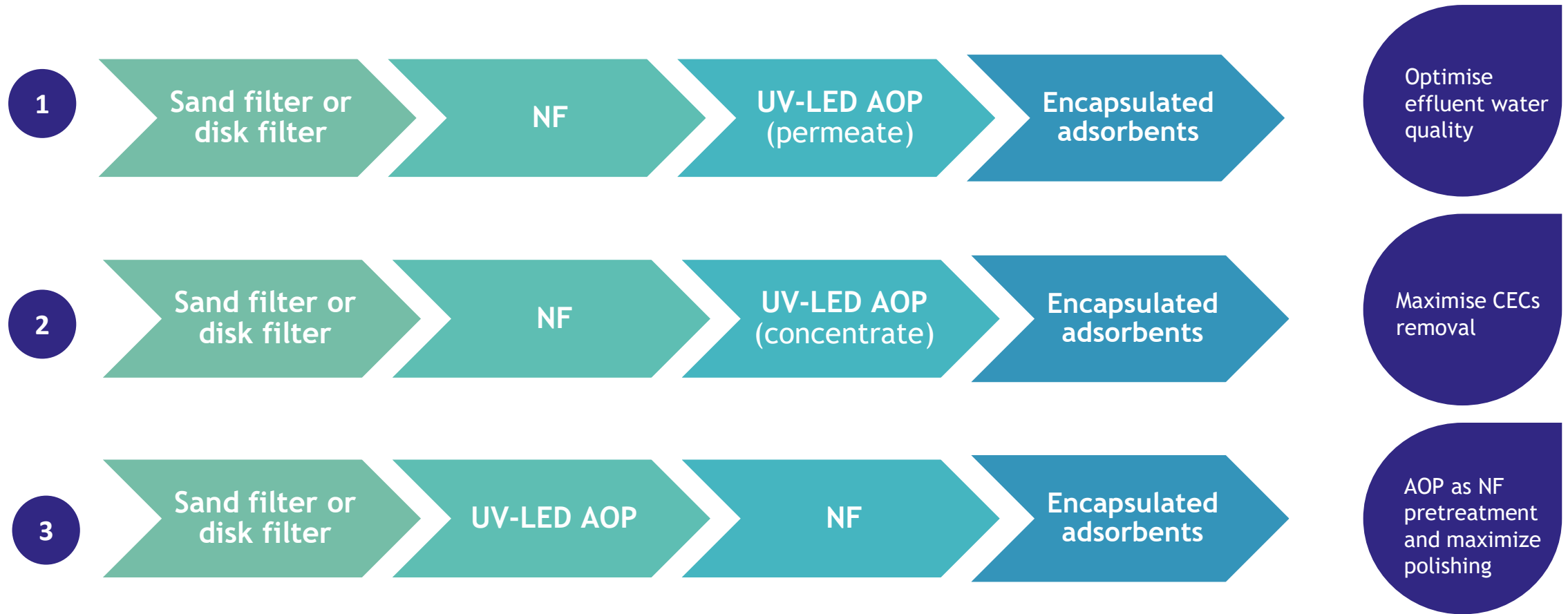
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THE DEMONSTRATION



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Different treatment configurations will be assessed to optimize CECs elimination and costs



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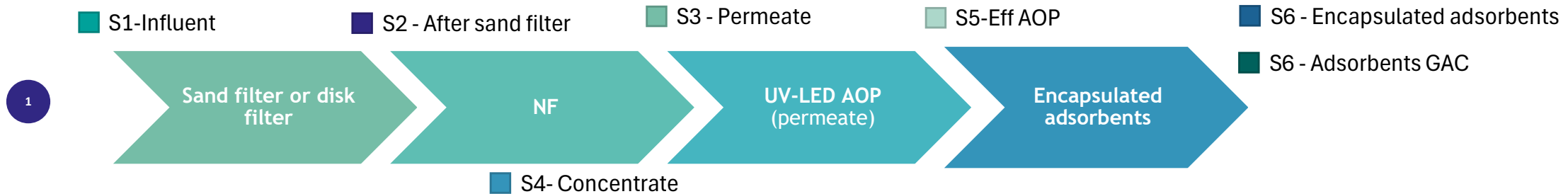
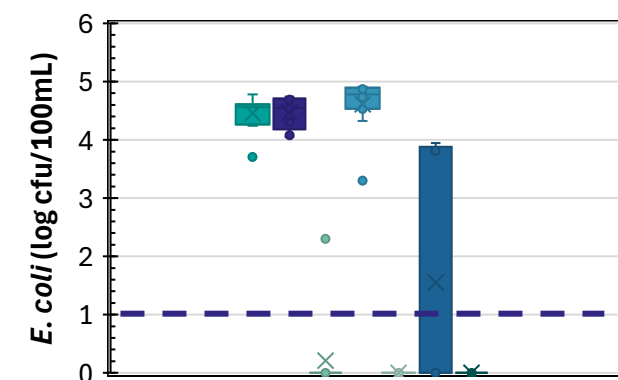
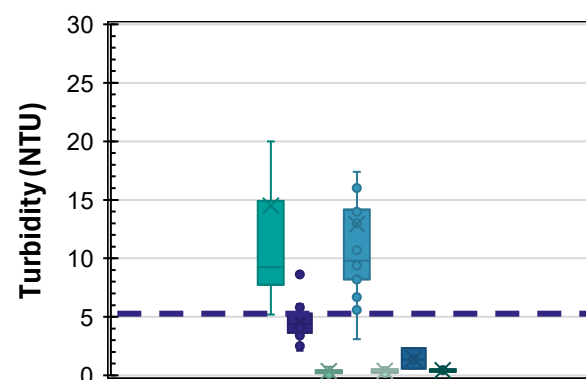
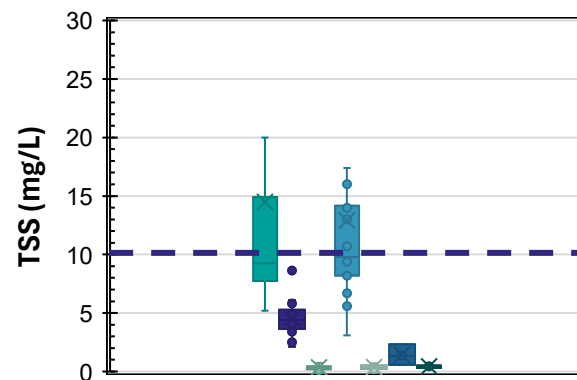
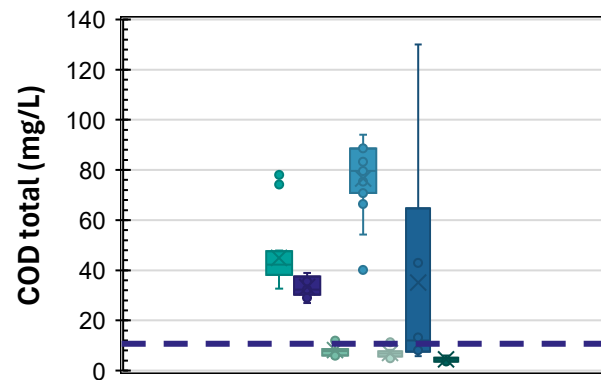
RESULTS CONFIGURATION 1



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Quality A water was achieved according to requirements of reuse directive EU 2020/741

QUALITY A ✓ BOD5 < 10 mg/L ✓ TSS < 10 mg/L ✓ NTU < 5 ✓ E. coli < 10 number/100 mL



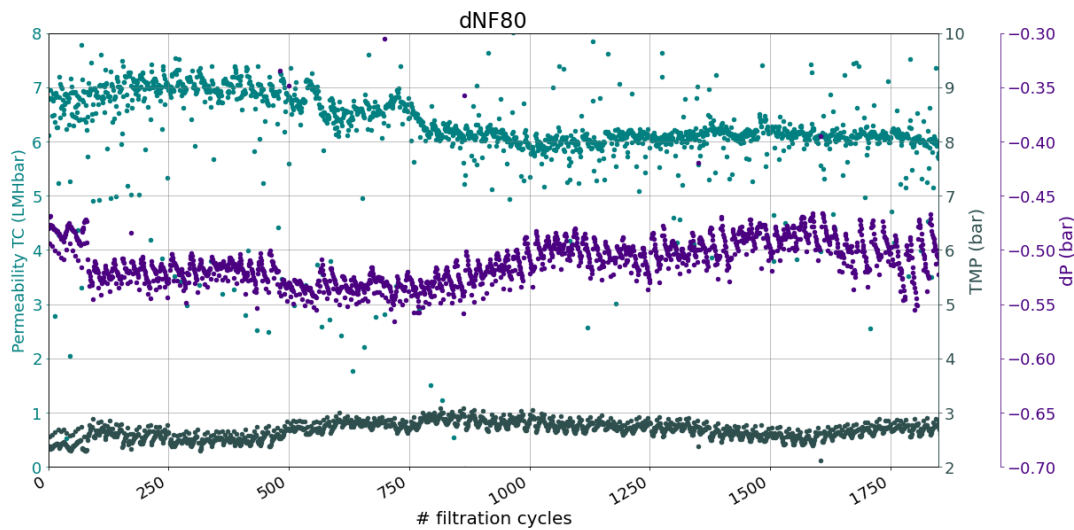
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RESULTS CONFIGURATION 1

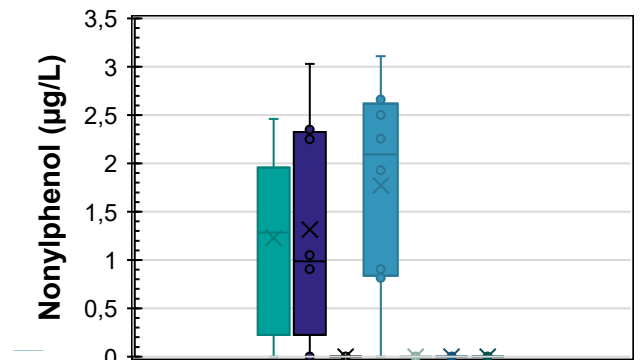
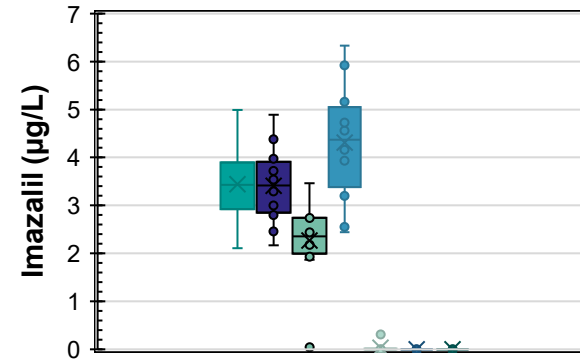
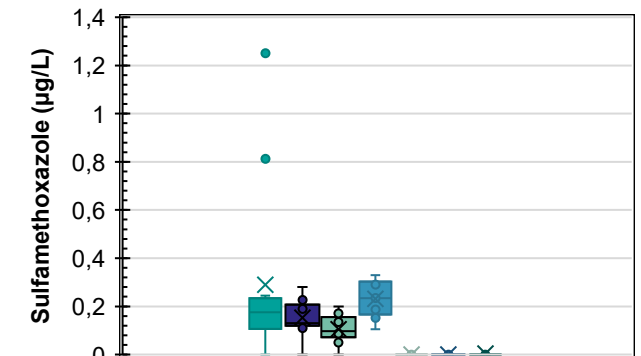
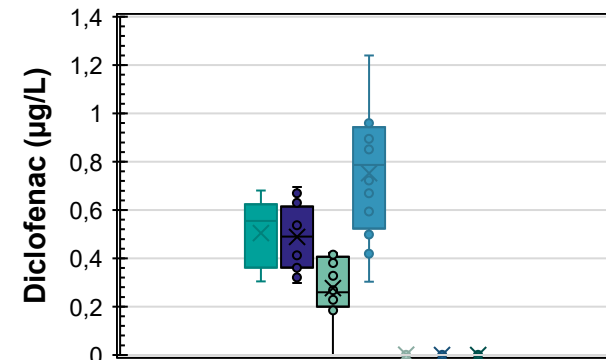


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NF membrane operated stable allowing quality A water and reducing the CECs in the permeate



- Recovery - 70%
- Permeability - 6-7 lmh/bar
- Crossflow velocity- 0,5 m/s
- Flux - 20 lmh



■ S1-Influent ■ S2 - After sand filter ■ S3 - Permeate ■ S4- Concentrate
■ S5-Eff AOP ■ S6 - Encapsulated adsorbents/ GAC

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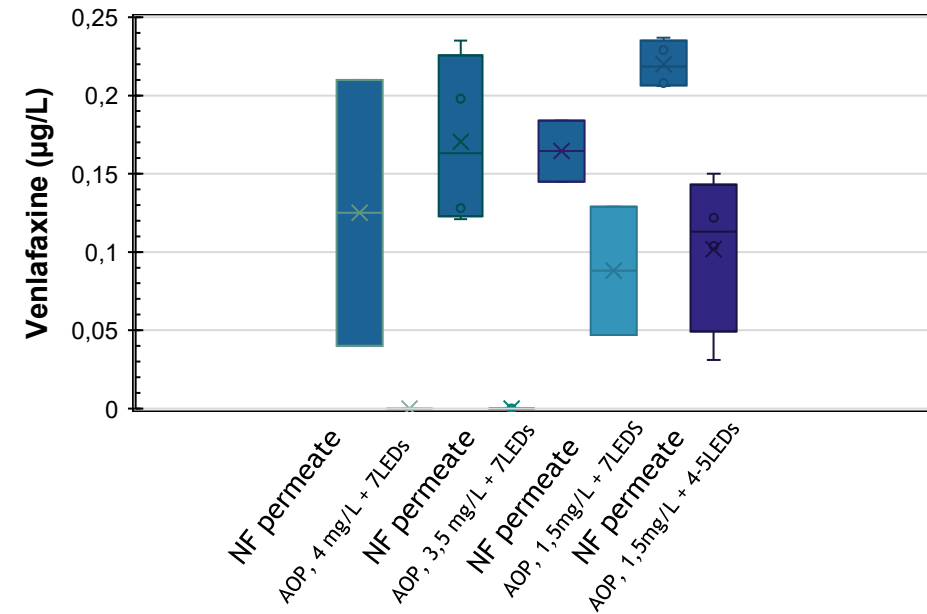
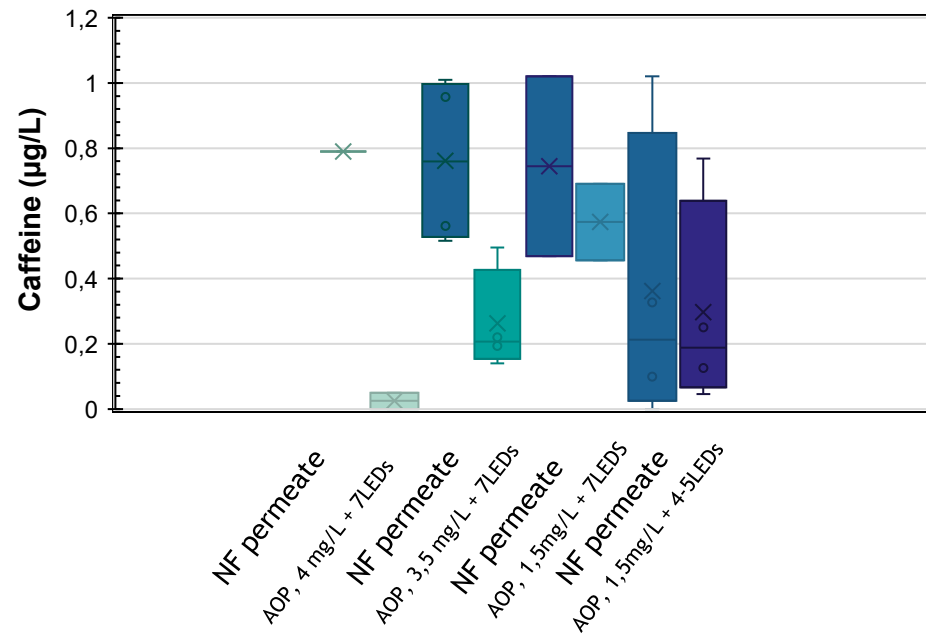
RESULTS CONFIGURATION 1



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UV-LED AOP was tested at different configurations allowing for >75% CECs removal from the permeate

- Different ozone doses (4, 3,5 and 1,5 g O₃/m³) were tested in combination with LEDs turned on (7, 4, 5, 2).
- When ozone dose used was below 1,5 g/m³, not all CECs were removed, but O₃ could not be activated by UV.
- Still, UV - LED +AOP removal was >75% for all compounds reaching up to 100% for some of them, except for ibuprofen and caffeine.

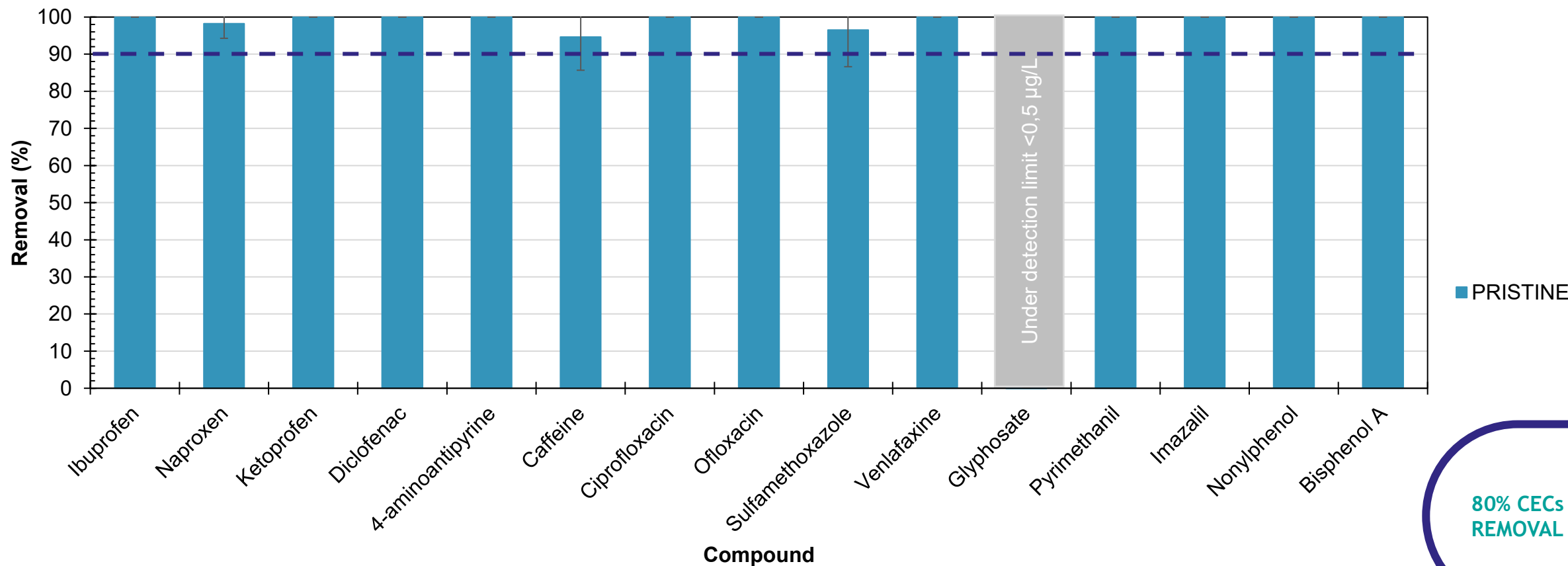


RESULTS CONFIGURATION 1



PRISTINE

PRISTINE solution allowed for >90% CECs removal when operating at different operational set points



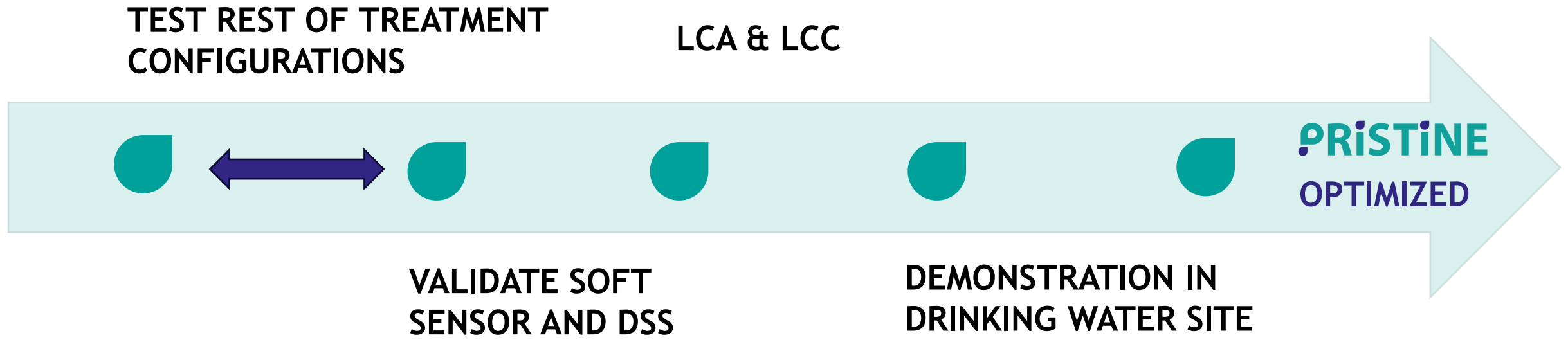
80% CECs
REMOVAL

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NEXT STEPS



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PRiSTiNE

Innovative and versatile integrated solution to remove
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Thank you!

Aina Soler Jofra

ACCIONA, Innovation
Department

04/06/2025



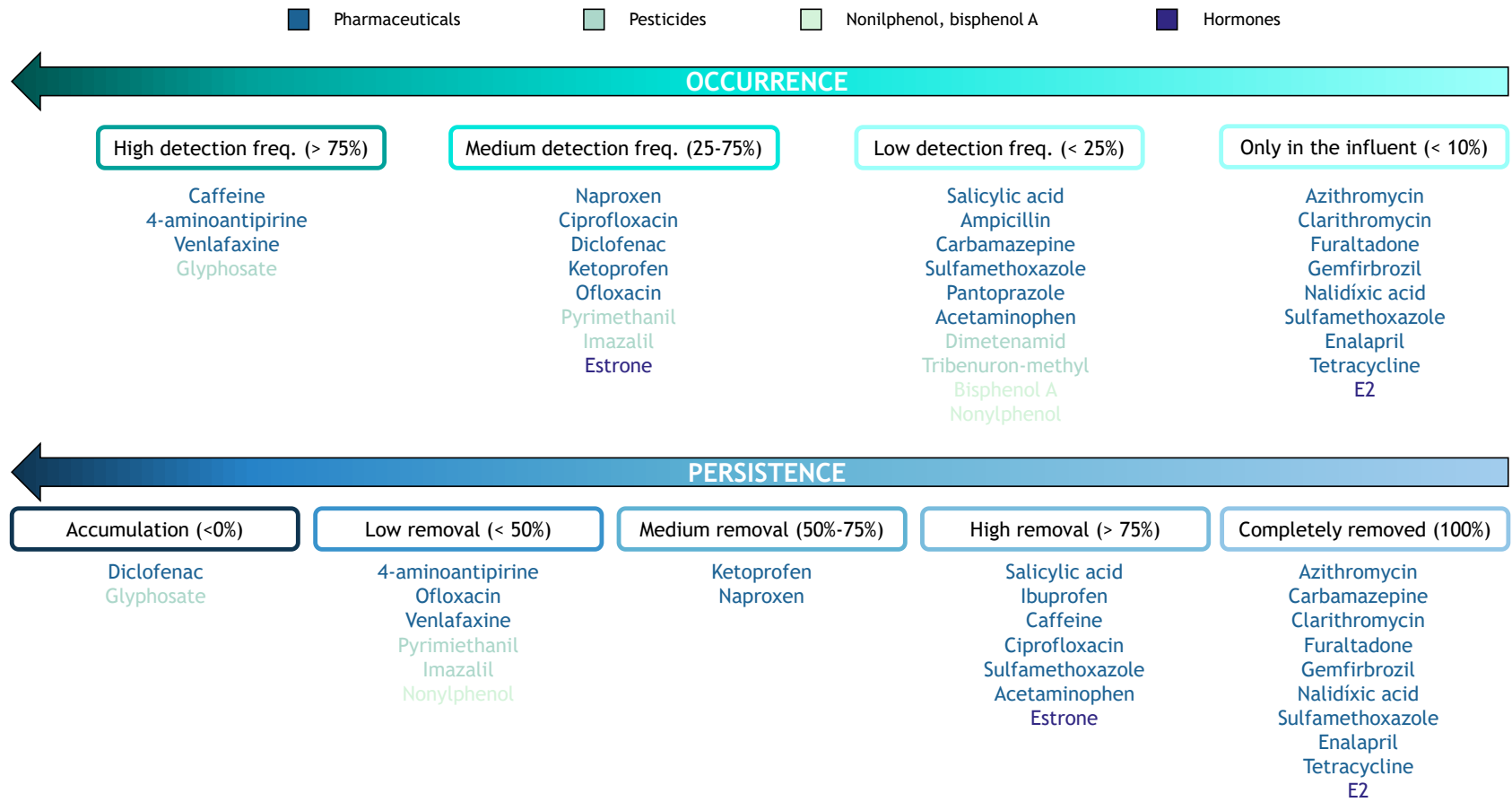
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CHARACTERIZATION CAMPAIGN RESULTS



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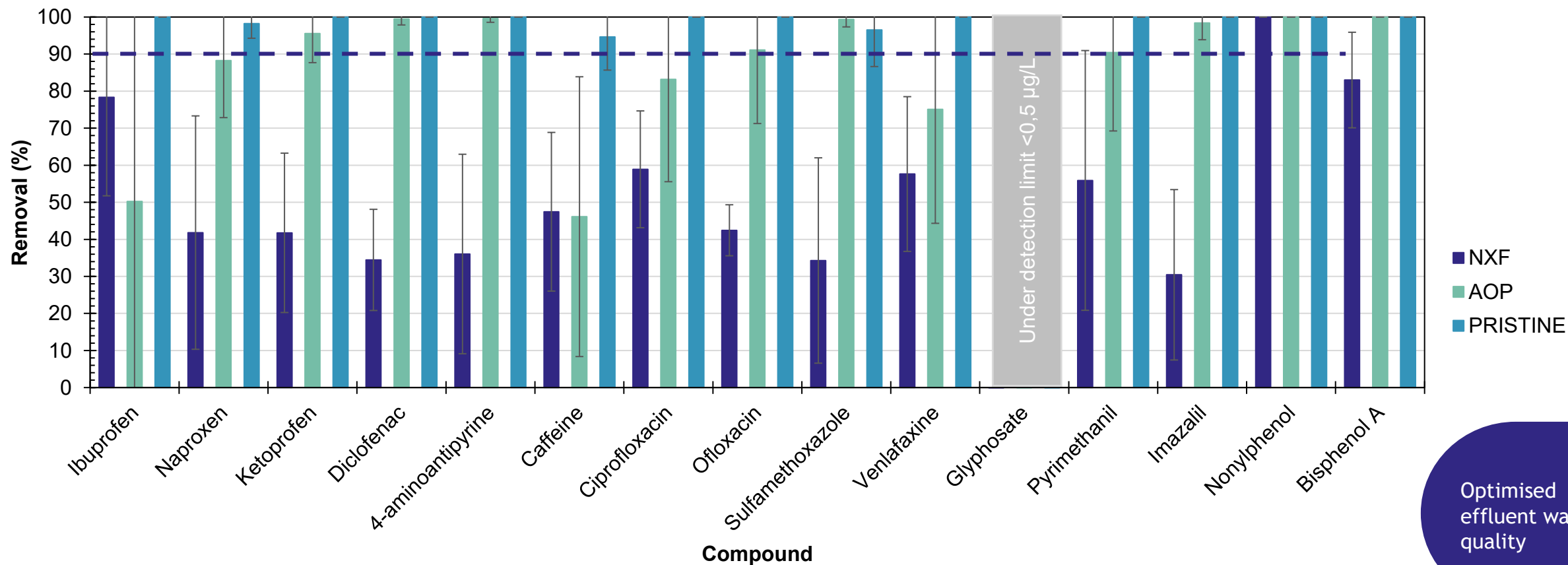


RESULTS CONFIGURATION 1



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Optimised
effluent water
quality

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