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LIFE SURFING PROJECT: CONTAMINATED EMULSION TREATMENT BY ADSORPTION IN GAC AND ADSORBENT REGENERATION

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Introduction:



Objective:



Experimental:



Results:



Conclusions:



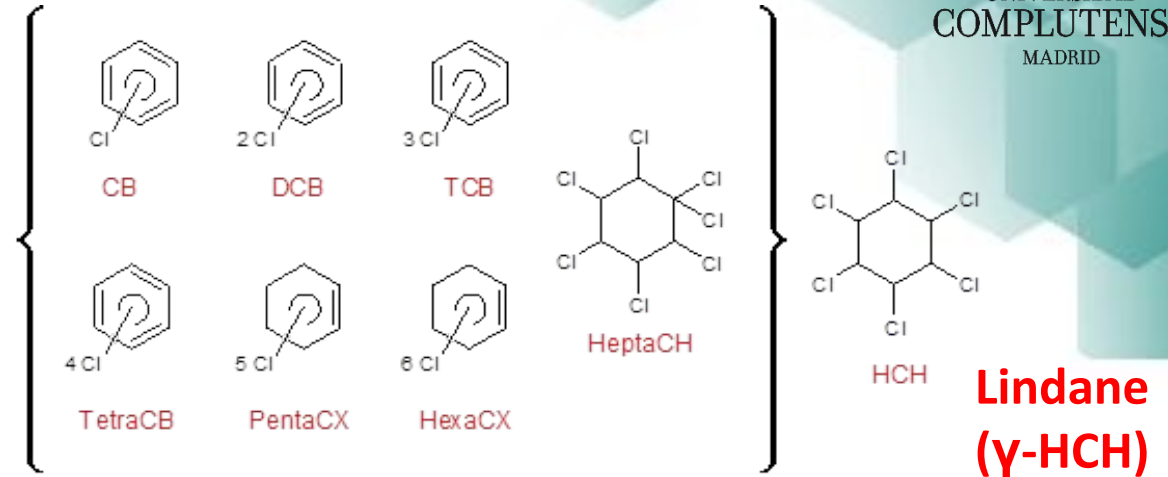
INTRODUCTION

INQUINOSA



Lindane production
(1975-1989)

28 Chlorinated Organic
Compounds
(COCs)



DNAPL

Dense Non Aqueous Phases Liquid

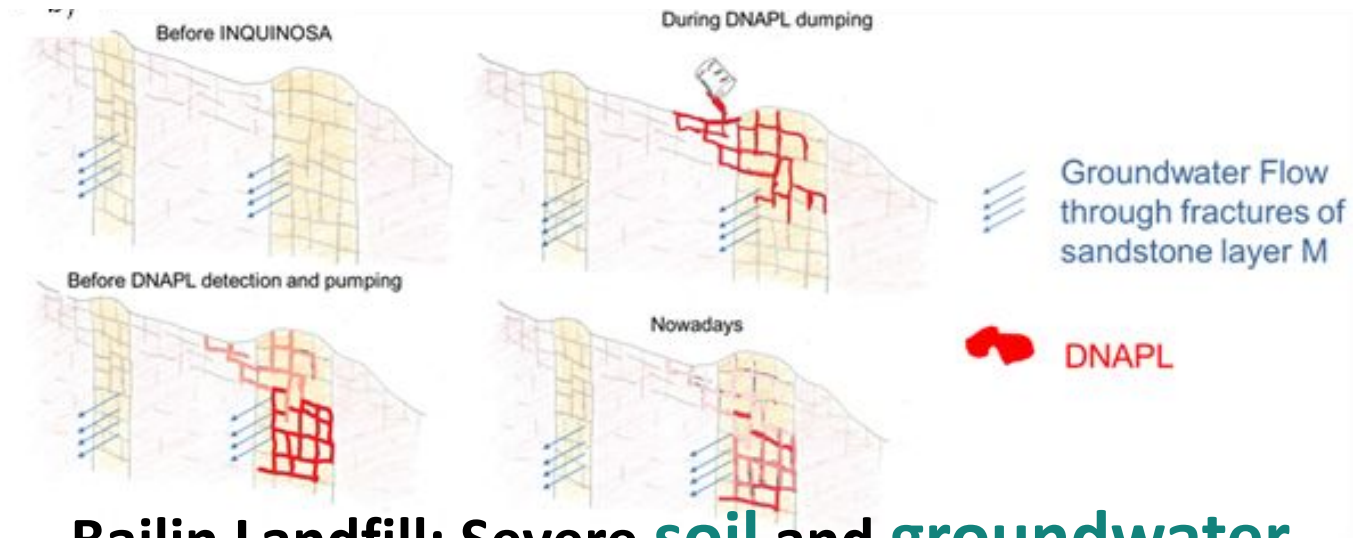


Dumping of untreated waste

at **Sabiñánigo**

Landfills:

Sardas and **Bailin**



Bailin Landfill: Severe **soil** and **groundwater**

CONTAMINATION

LIFE SURFING PROJECT

“SURFactant enhanced chemical oxidation for remediating DNAPL”

Demonstration project for the application of S-ISCO techniques
(combination of surfactants and oxidants) in fractured media
with the presence of DNAPL

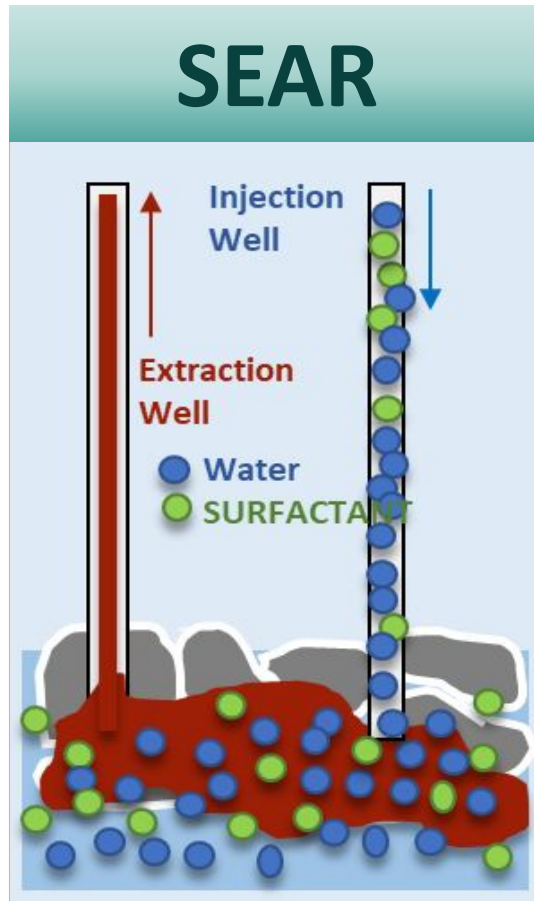
Proyecto demostrativo para la aplicación de técnicas S-ISCO
(combinación de surfactantes y oxidantes) en medios
fracturados con presencia de DNAPL

E-Mulse®3
Non-ionic
SURFACTANT

Phase 0: PREPARATORY WORK

Phase 1: Surfactant Enhanced Extraction (SEAR)

Phase 2: Surfactants + oxidants (S-ISCO)



SEAR: Surfactant-enhanced aquifer remediation LIFE SURFING: Surfactant selected Emulse®3

Surfactant Injection

Solubilisation and mobilisation of DNAPL

Extraction of DNAPL and polluted emulsion

Management?

OBJECTIVE

Selective Pollutant adsorption of GAC, Surfactant and Adsorbent Recovery

COCs ADSORPTION
from the EMULSION on GAC

Polluted SEAR Emulsions
COCs + Surfactant



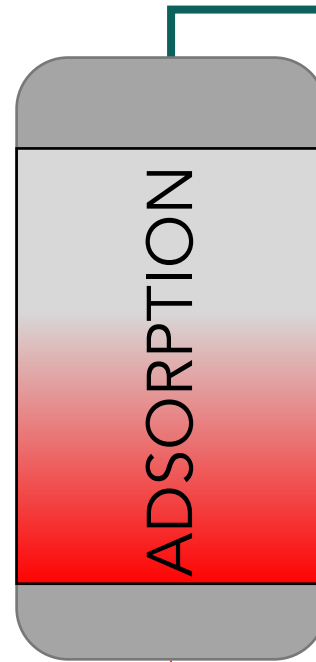
Efluent with
Surfactant and
clean of COCs

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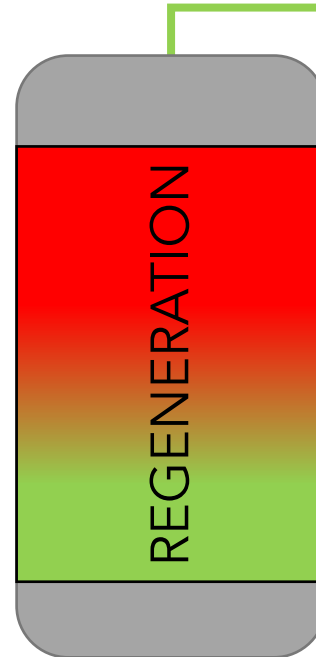
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OBJECTIVE

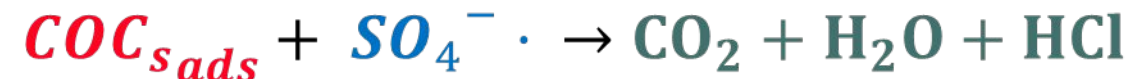
Selective Pollutant adsorption of GAC, Surfactant and Adsorbent Recovery

REGENERATION:
THERMAL ACTIVATED PERSULFATE
TAP

PERSULFATE
SOLUTION +
TEMPERATURE



Efluent with
Sulfates



OBJECTIVE

Selective Pollutant adsorption of GAC, Surfactant and Adsorbent Recovery

REGENERATION:
THERMAL ACTIVATED PERSULFATE
TAP

PERSULFATE
SOLUTION +
TEMPERATURE



Efluent with
Sulfates

EXPERIMENTAL

RESIDUAL
SULFATE
GENERATION

OBJECTIVE

Selective Pollutant adsorption of GAC, Surfactant and Adsorbent Recovery

GAC WASHING AFTER
REGENERATION

H₂O milliQ
WATER +
TEMPERATURE

WASH
GAC

RECOVERY OF
SULFATE DEPOSITED
IN THE GAC

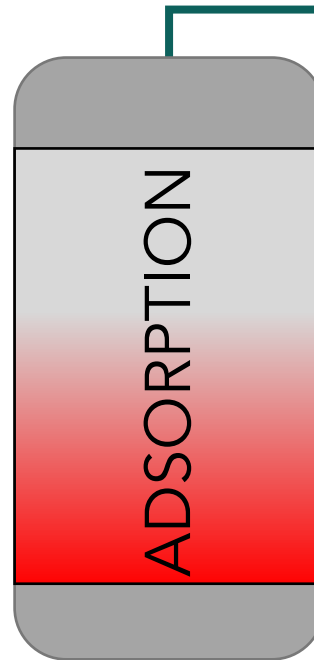


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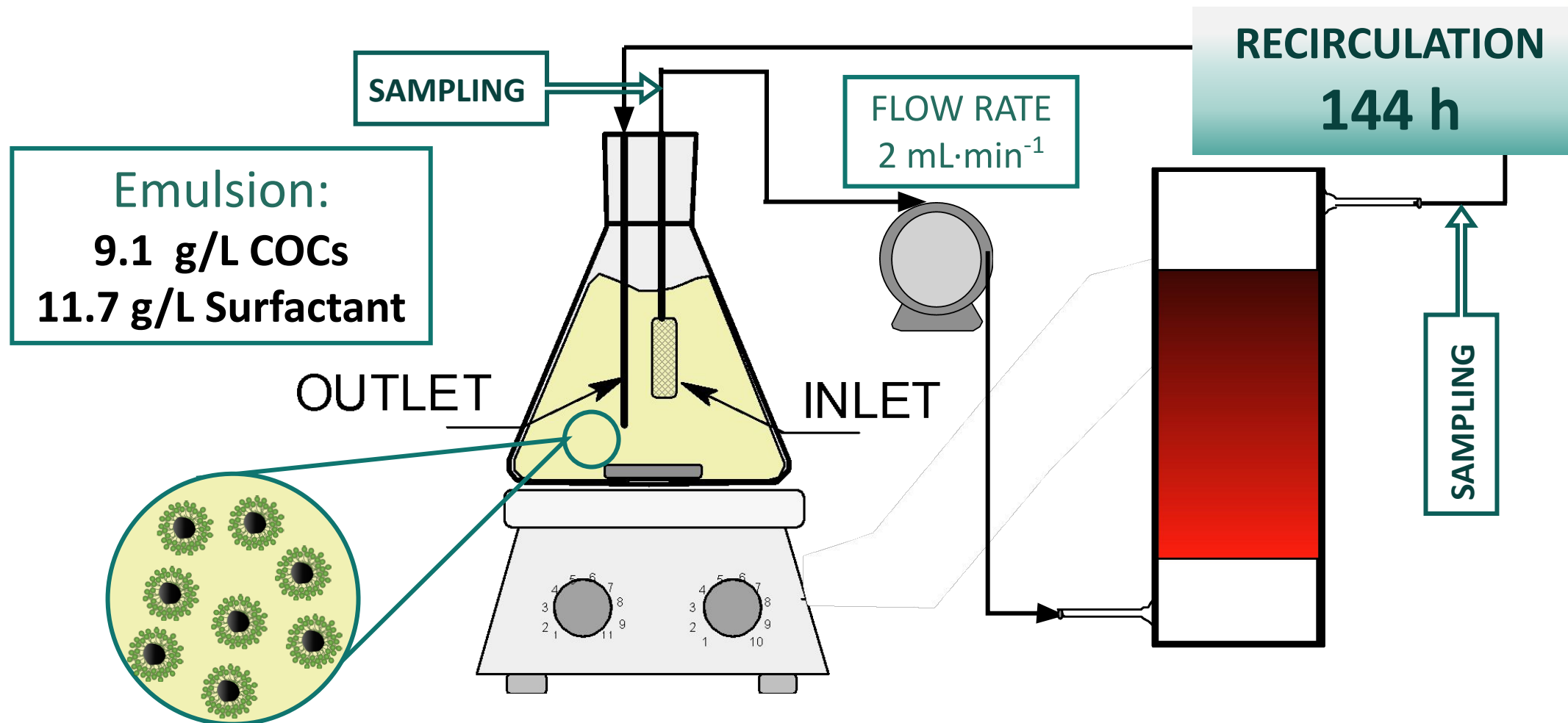
Efluent with
Surfactant and
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**3 CYCLES OF
ADSORPTION AND
REGENERATION**

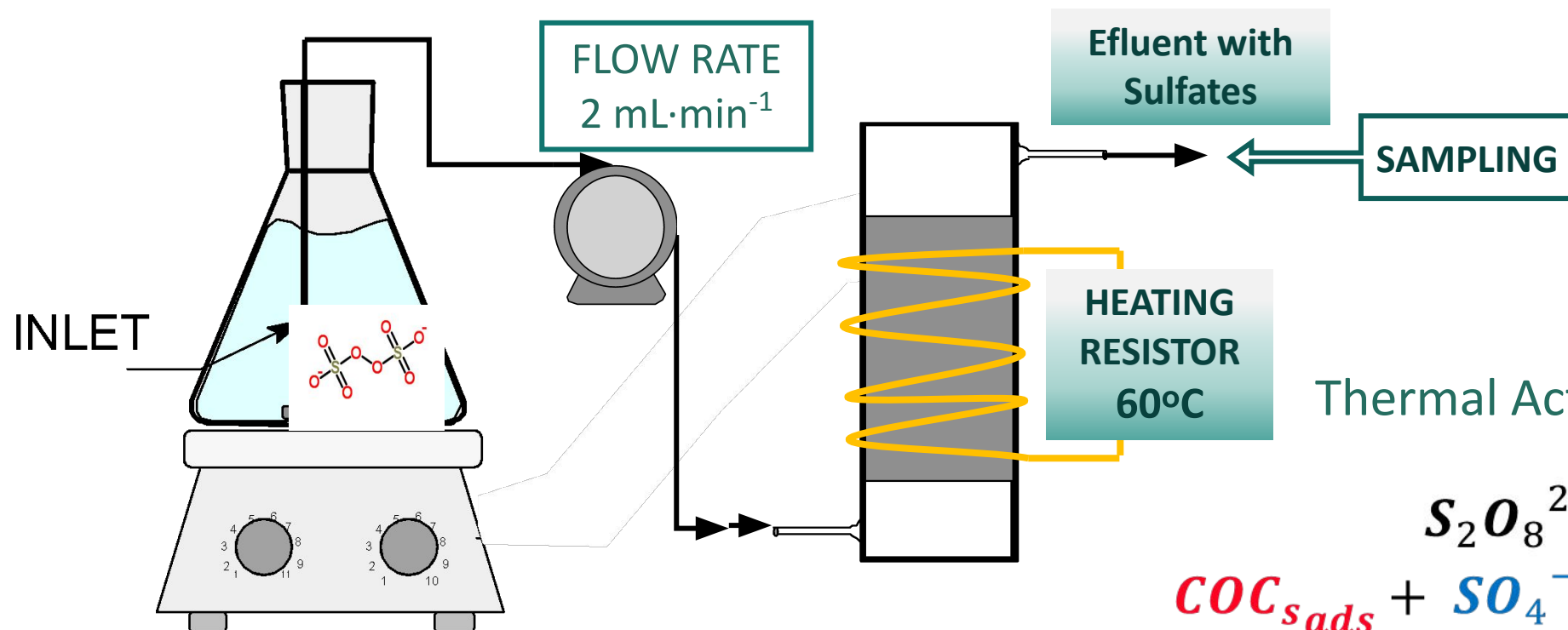


EXPERIMENTAL

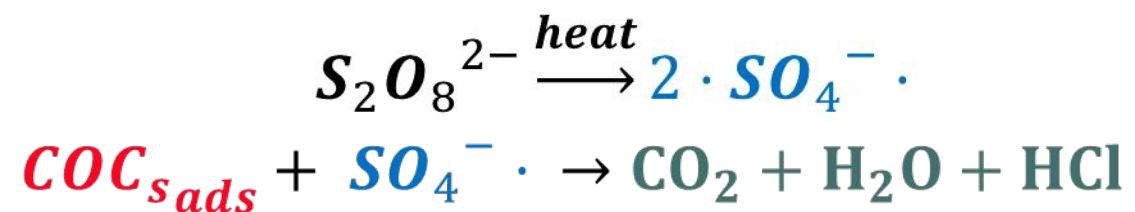
COCs ADSORPTION from the EMULSION on GAC



GAC REGENERATION



Thermal Activated Persulfate (TAP)



250 mL solution of
PS (40 g·L⁻¹) at 60°C

ANALYTICAL METHODS:

AQUEOUS PHASE

COCs

**Dilution 1:10 (MeOH)
GC-FID/ECD**



GC-FID/ECD

SURFACTANT

**Without Oxidant
TC/TOC/IC analyzer**

**With Oxidant
ESC**



TOC

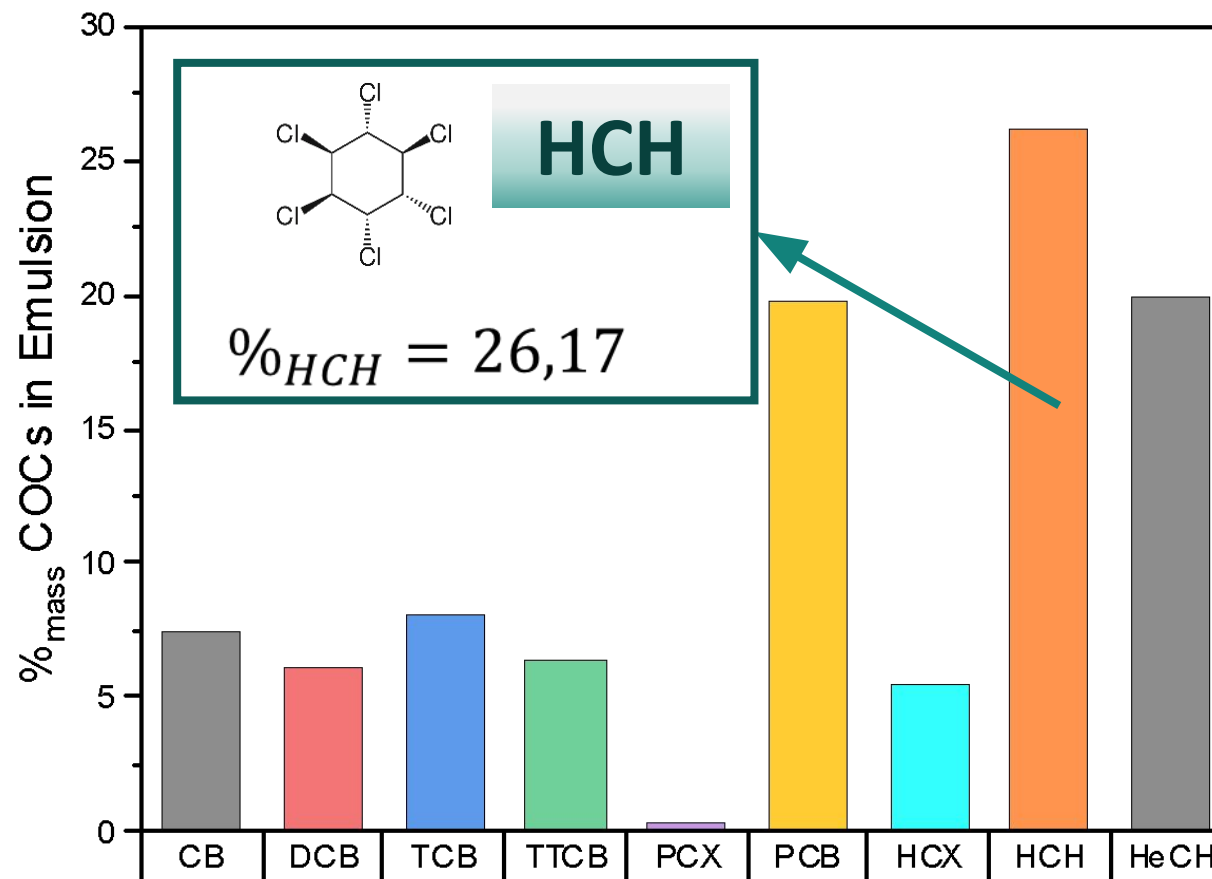
PS

**Potentiometric
titration analyzer**



TITRATOR

RESULTS: EMULSION CHARACTERIZATION

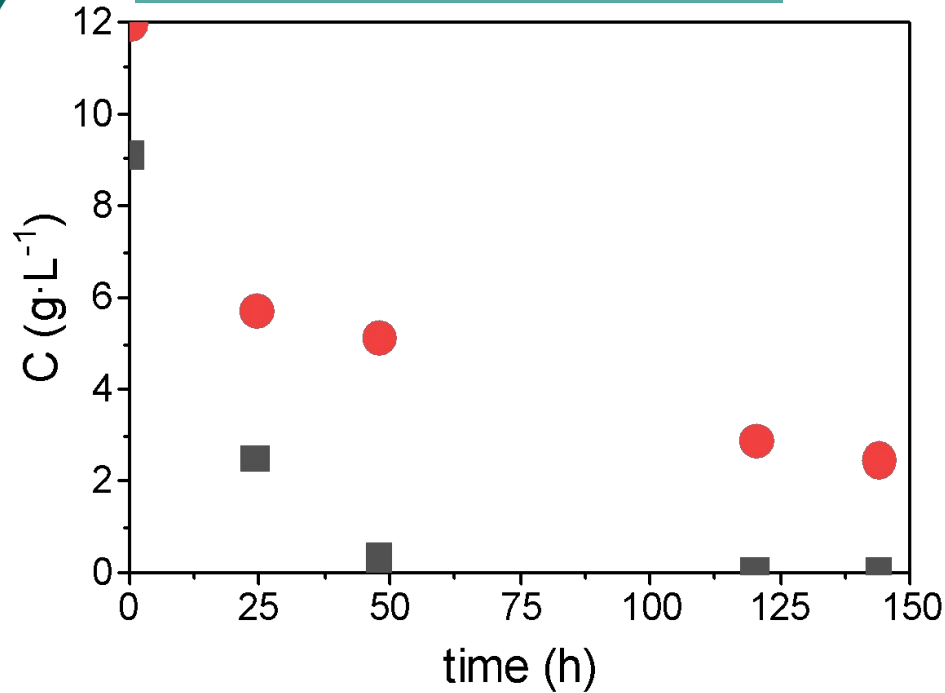


$$C_{COCS} = 9.1 \text{ g}_{COCS} \cdot L^{-1}$$

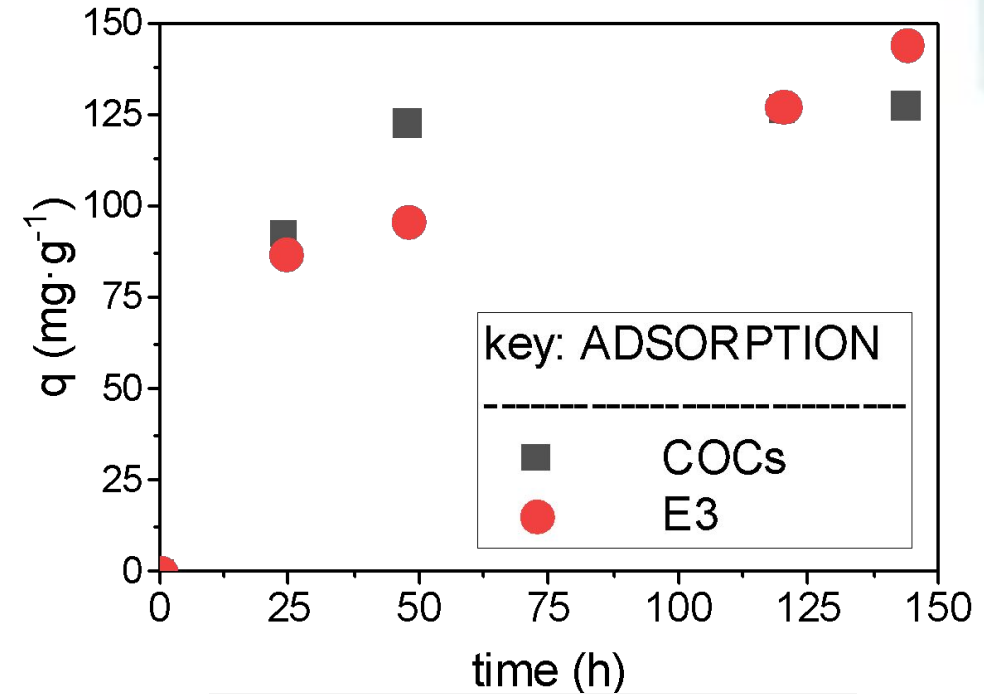
$$C_{E3} = 11.7 \text{ g}_{E3} \cdot L^{-1}$$

RESULTS: COCs and E3 ADSORPTION

First Adsorption Cycle



Aqueous Concentration



Adsorbed on GAC

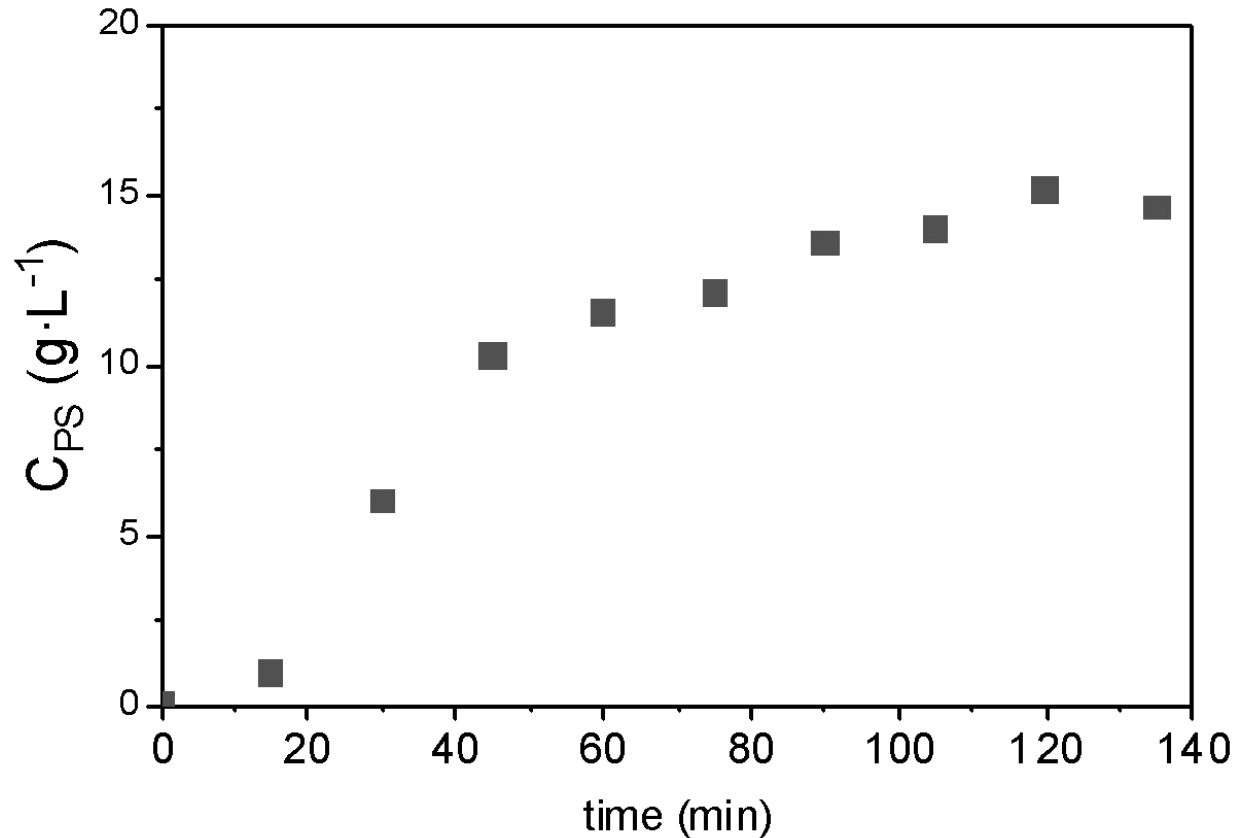
99% of COCs in the emulsion were adsorbed
20% of E3 was recovered

127.13

144.02

RESULTS: Regeneration of Spent GAC

First Regeneration Cycle



PS concentration at column outlet

$$PS_{CONSUMED} = 75.3\%$$

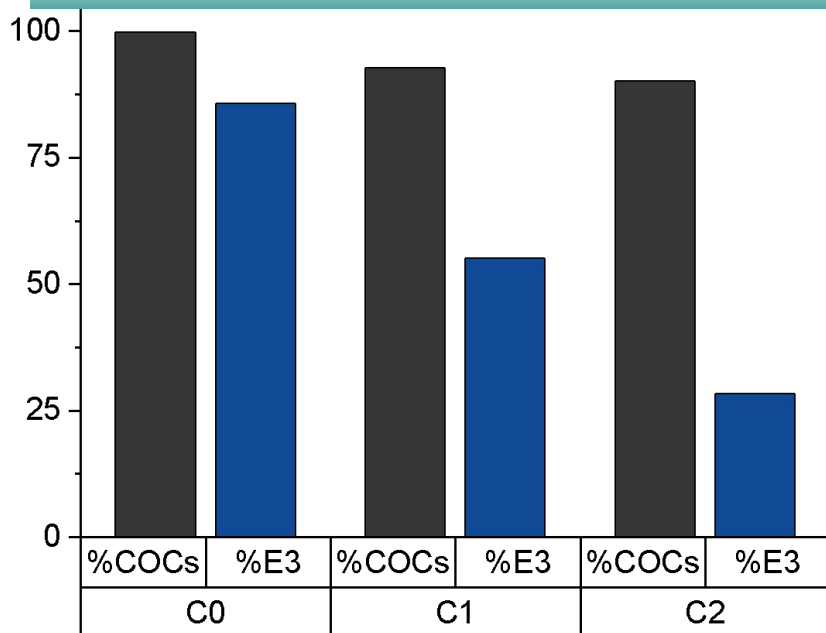
0.64

Sulfate Recovered

- After regeneration, 76% of the sulphates were recovered in washing with water.

RESULTS: Adsorption & Regeneration Cycles: Adsorption Capacity Recovery

COCs & E3 Adsorption Capacity



- COCs Adsorption capacity is maintained in successive cycles
- Surfactant Adsorption capacity decreases in successive cycles
- PS consumption decreased with the increase in the number of cycles performed.
- The concentration of COCs in the aqueous after regeneration was less than 1.5% of those adsorbed.

	Cycle 1	Cycle 1	Cycle 1
	0.64	0.55	0.49
	0.88	1.24	2.42

↑ *Cycles* ↔ ↓ *PS_{Consumed}*

↑ *Cycles* ↔ ↑ *E3_{Recovery}*

CONCLUSIONS:



- The polluted emulsions of SEAR treatment in the LIFE SURFING project were successfully managed by cycles of adsorption in GAC and successive regeneration with TAP process.
- A selective adsorption and oxidation of COCs was observed in the successive adsorption-regeneration cycles. The recovery of the surfactant that could be reused for a new extraction of COCs with the SEAR technology.
- A circular economy scenario is promoted for GAC and surfactant use.
- The decrease of PS consumption at each regeneration cycle maintaining the COCs adsorption capacity indicates a better efficiency of the oxidant in the COCs degradation with each cycle.

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THANK YOU FOR YOUR ATTENTION

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COMPLUTENSE
MADRID**



INPROQUIMA