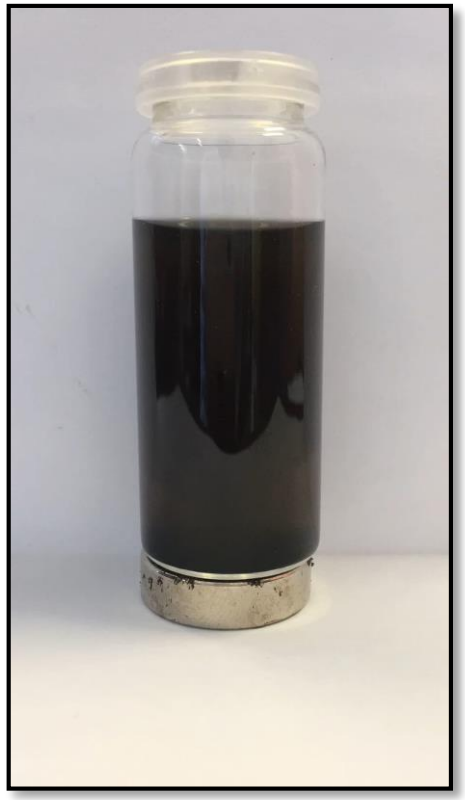
CAPTIVE SYSTEMS

spin off
POLITECNICO DI MILANO

MagnetoSponges

A Key Enabling Technology for waste water and gas stream management and treatment

The Solution



Magnetic fluids with a customizable surface functionalization

WIPO | PCT

(10) International Publication Number
WO 2015/177710 A1

INTERNATIONAL PATENT

Gruppo GASER · CHIMEC · TECNOCHIMICA

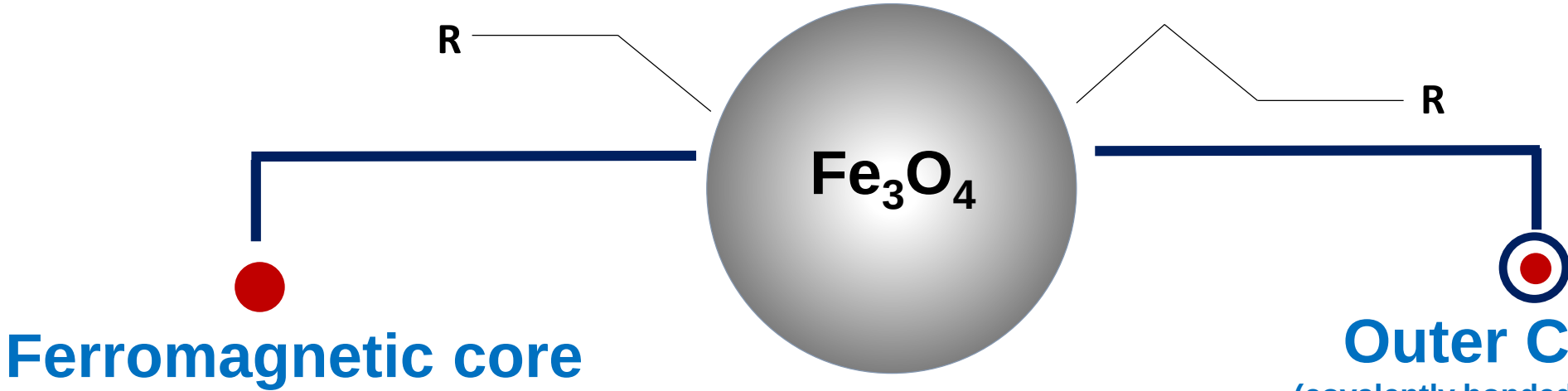
IMPORTANT INDUSTRIAL GROUPS AS PARTNERS

POLITECNICO DI MILANO · POLIHUB INNOVATION DISTRICT & STARTUP ACCELERATOR BY FONDAZIONE POLITECNICO DI MILANO

PoliMI SPIN OFF AND POLIHUB SUPPORT

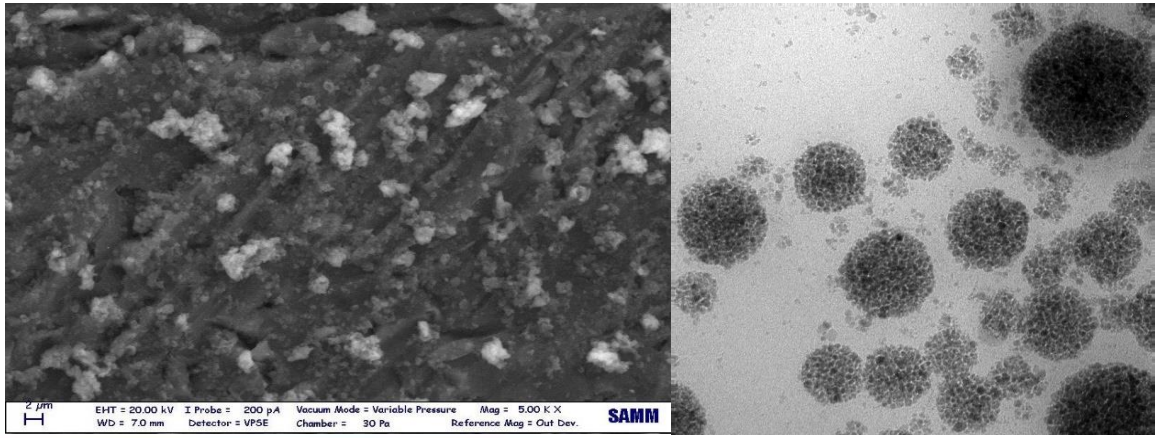
Captive Systems' Technology

Nanoparticles which aggregate into micro-sponges through a co-precipitation reaction



Ferromagnetic core

Outer Coating
(covalently bonded on the surface)

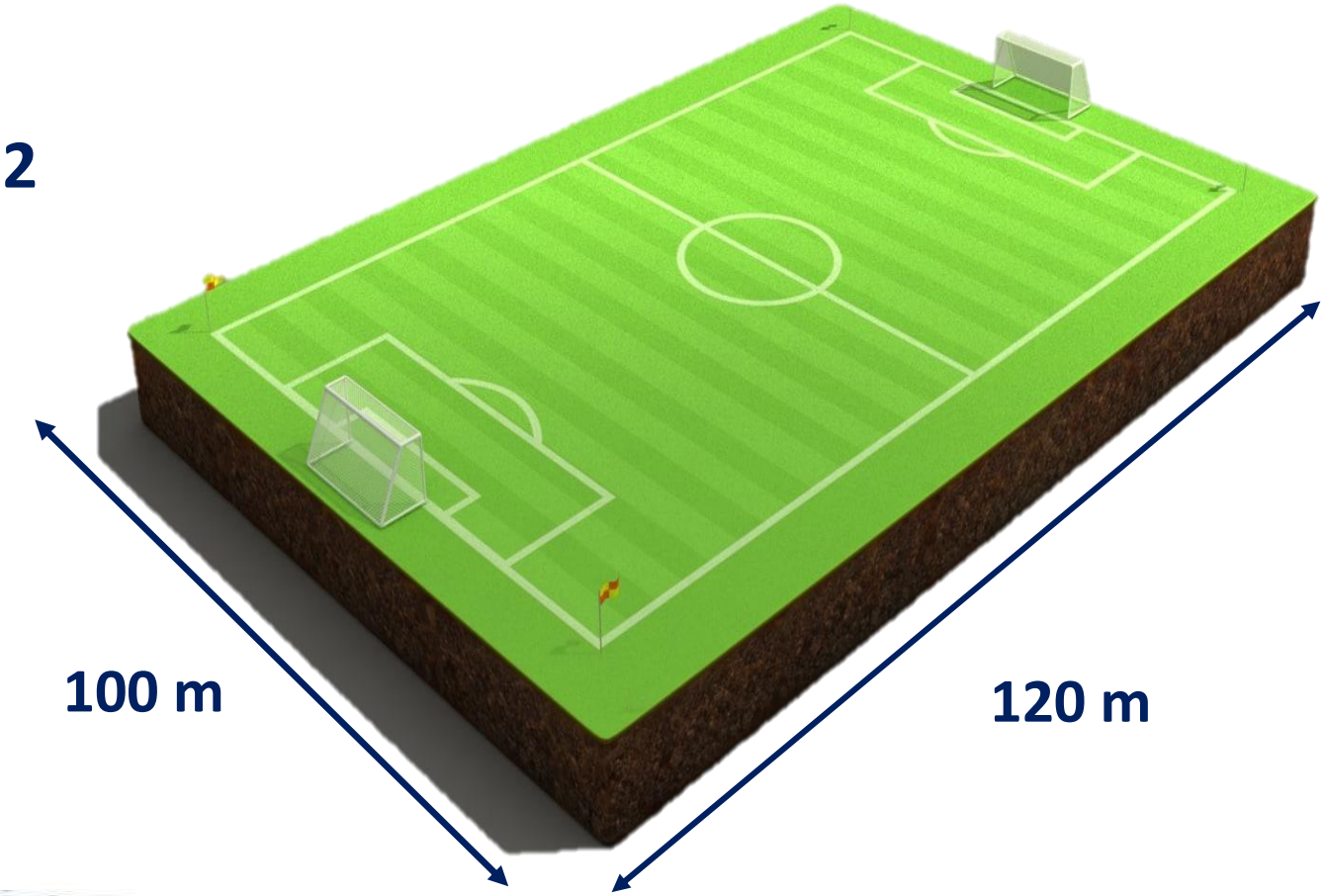


Patent : WO 2015177710 A1 2015.

Captive Systems' Technology

Specific Surface: 6000 m^2/g

12000 m^2

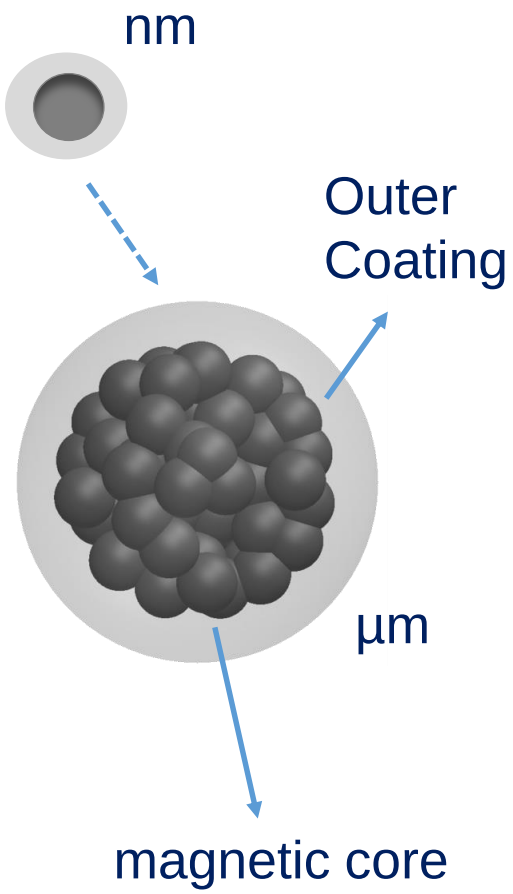


2 g of micro-sponges

Captive Systems' Technology

Easy tunable outer coating

- **Anionic fluids**: possibility to remove and recover cationic products (Ni^{2+}, Zn^{2+}, Cu^{2+},etc…)
- **Cationic fluids**: possibility to remove and recover anionic products (phosphate, chromate, arsenate, etc...)
- **Lipophilic fluids**: possibility to remove and recover lipophilic substances (emulsifier, lubricants , hydrocarbons, fuel etc…)
- **Combined Coatings**: possibility to customize the coating to customer requests.

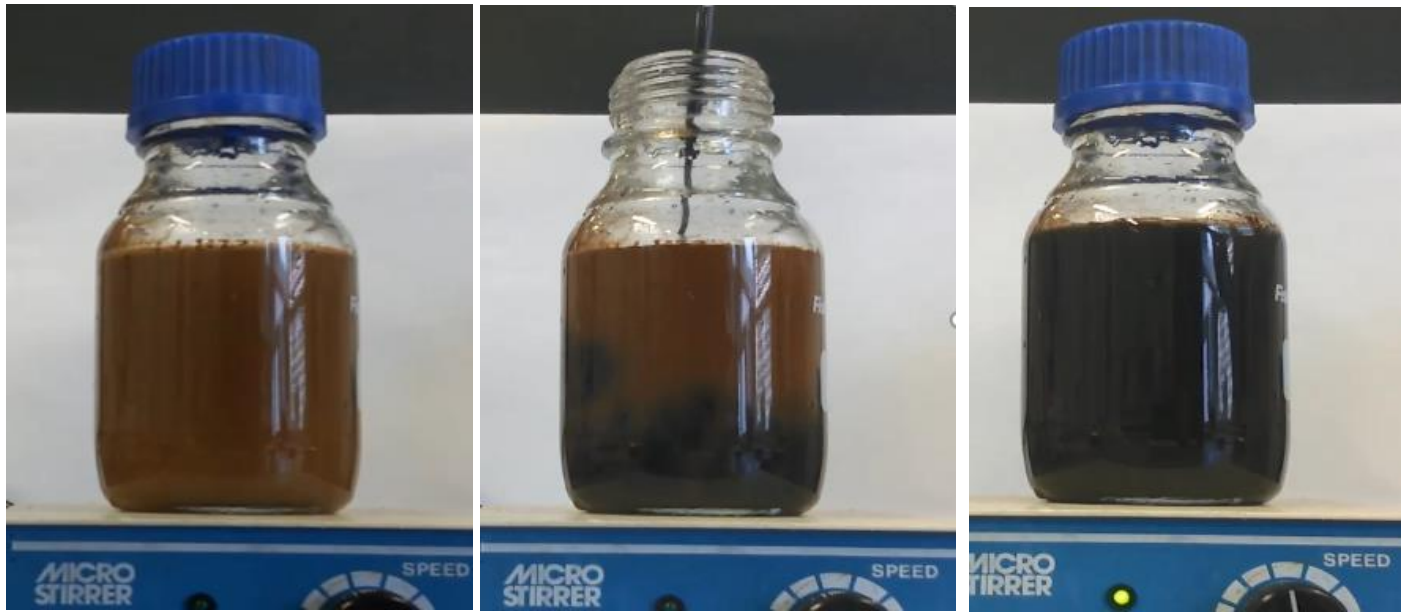


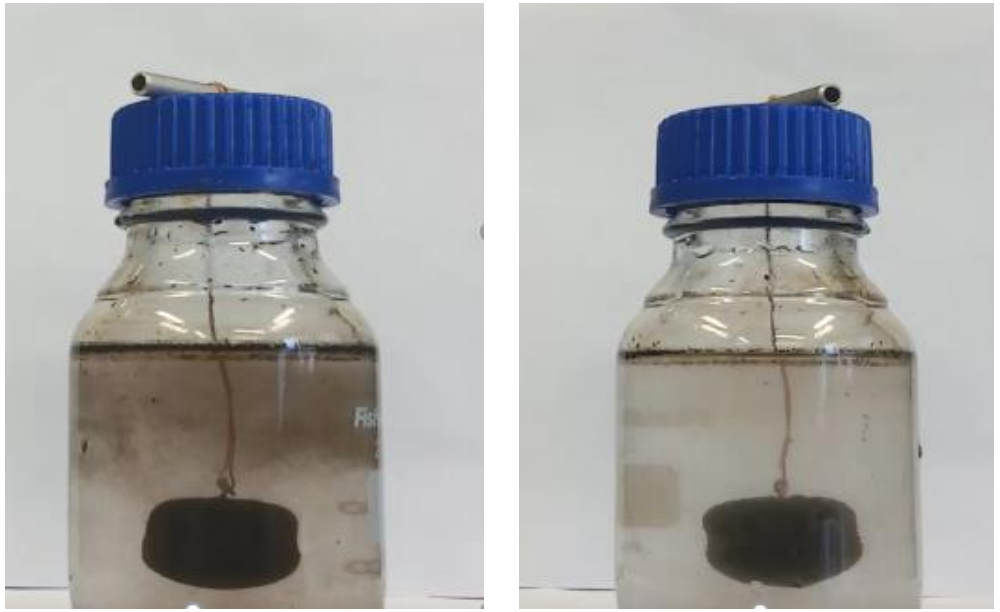
INTERNATIONAL PATENT

ITALY	AUSTRALIA
EUROPE	UNITED STATES
TUNISIA	JAPAN
SAUDIARABIA	CANADA
QATAR	NIGERIA
NEW ZELAND	EGYPT
CHINA	UNITED ARAB EMIRATI
BAHRAIN	SOUTH AFRICA

The Process

- BULK TREATMENT
- MIXING
- SEPARATION
- DISPOSAL





Addressable Market

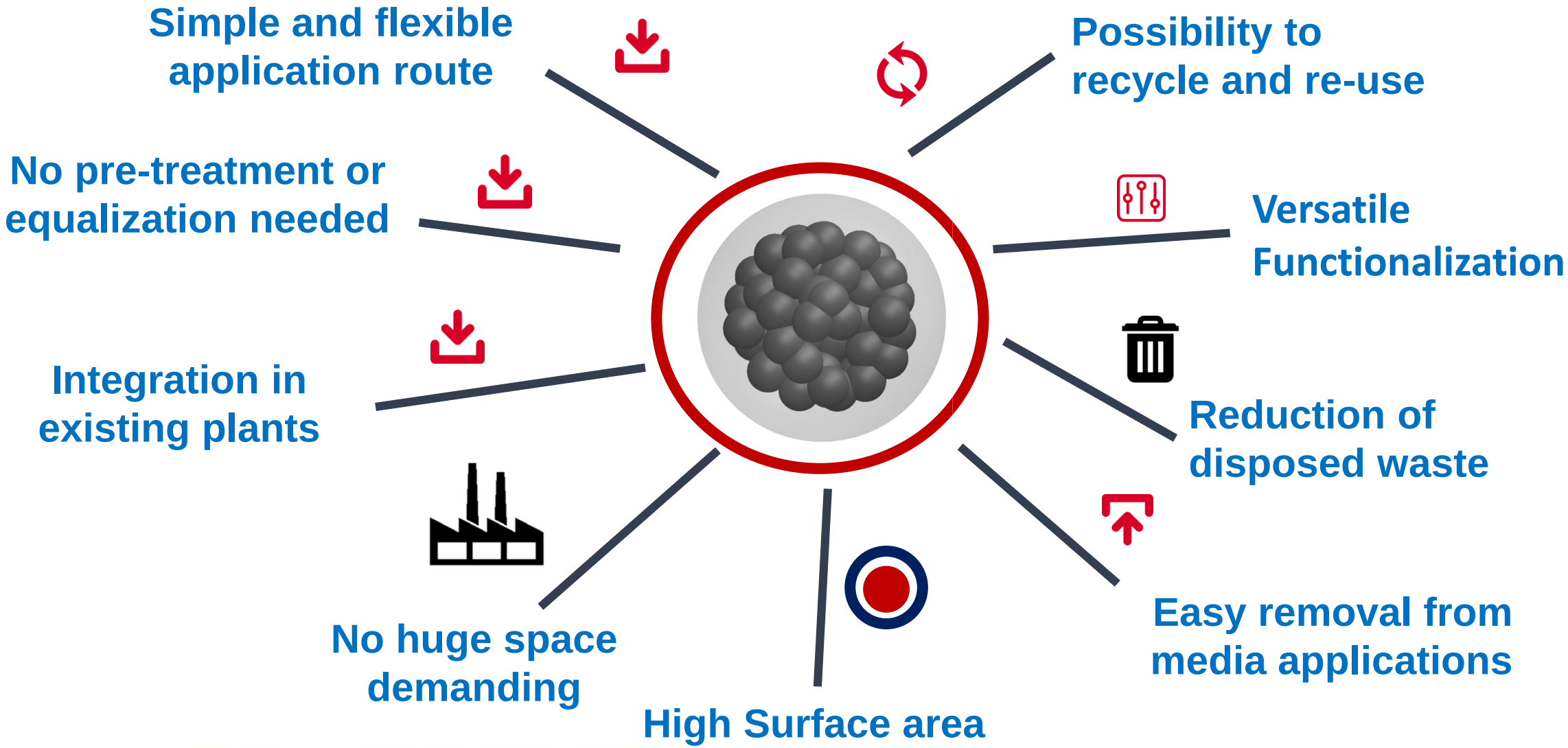
Waste Liquid Stream

- Removal of hydrocarbons, oils, surfactants
- Reduction of COD
- Remediation from metals (Ni, Zn,Cu, Pb, Li, Cr)
- Purification of ground water (Ar, V, Fe)
- Removal of MTBE, Butadiene

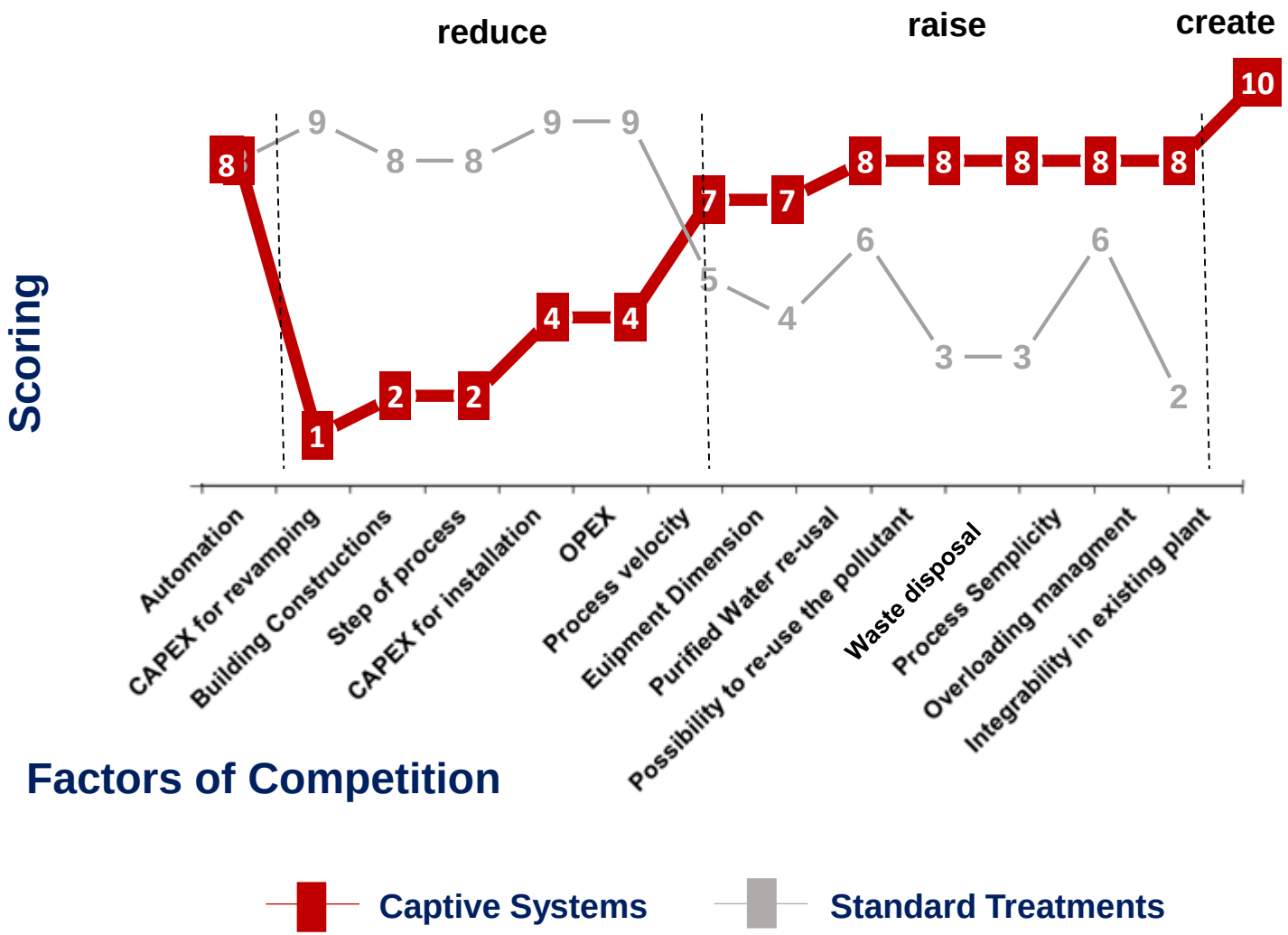
Gas Stream

- VOC and odorigenic compounds reduction

Features & Advantages



Value Curve Proposition



- Flexibility in managment of variable flow rate and type of pollutants
- Customizable according to customer needs
- No considerable space demanding
- Easy integration in exhisting plant
- Reduction of the waste to be disposed after treatment
- Possibility to be regenated recovering the pollutant for obtaining raw materials of second generation

Purification of Ground Water

Removal of Arsenic and Vanadium

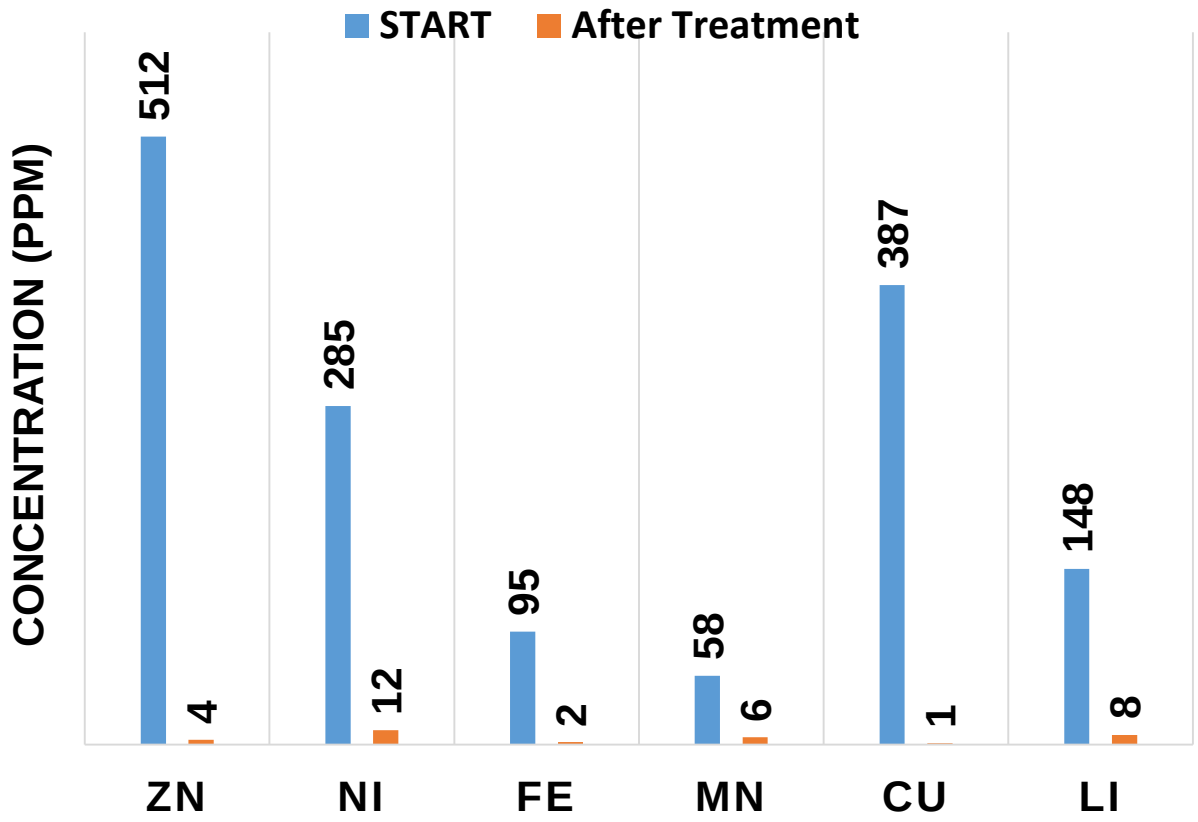
Treatment: 500mg MPs x L, Contact time : 5 min

Pollutant	[START]	[AFTER TREATMENT]
ARSENIC	15 ppm	45 ppb
VANADIUM	20 ppm	18 ppb
ARSENIC	148 ppb	< 10 ppb
VANADIUM	150 ppb	< 10 ppb

Electroplating waste water

Treatment: 1g MPs x L, Contact time : 5 min

	START (ppm)	After TREAT (ppm)	% removal
Zn	512	4	99,2
Ni	285	12	95,8
Fe	95	2	97,9
Mn	58	6	89,7
Cu	387	1	99,7
Li	148	8	94,6



Oil&Refinery waste water

Before API	START	After treatment
COD mg O_2/l	316400	120

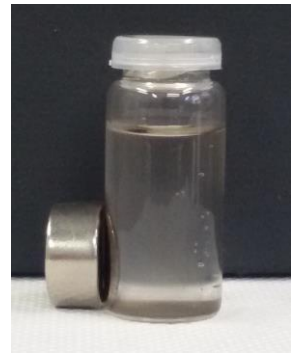
Treatment:

- 2 g MPs x L
- Contact time : 3 min

Before bio-reactors	START	After treatment
COD mg O_2/l	658	82

Treatment:

- 0,25 g NPs x L
- Contact time : 2 min



Tank Cleaning Operation

TANK 1	START	After treatment
COD mg O_2/l	35000	246

Treatment:

- 0,5 Kg MPs x m^3
- Contact time : 5 min

TANK 2	START	After treatment
COD mg O_2/l	12800	166

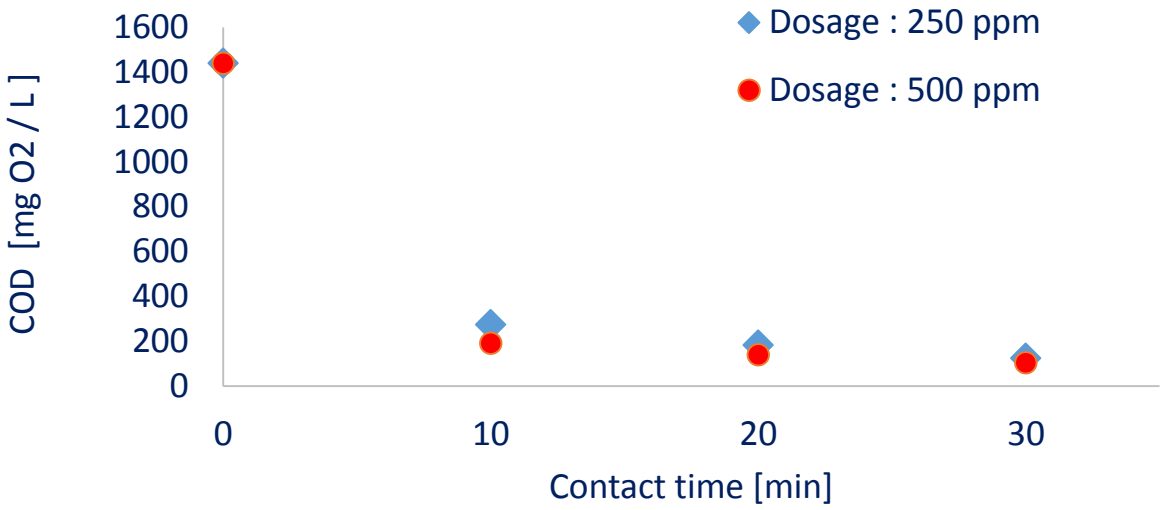
Treatment:

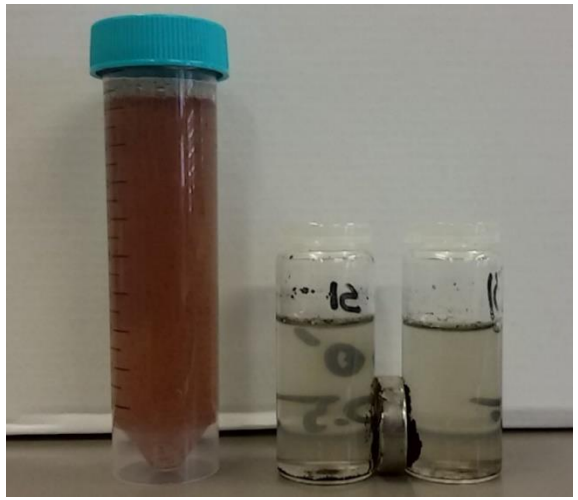
- 0,3 Kg NPs x m^3
- Contact time : 2 min

Slaughterhouse waste water

Tank n° 1

COD START : 1100 mg O_2 / L				
Dosage : 250 ppm				
Contact time [min]	COD after treatment mg O_2 / L			
10	310	312	318	308
20	291	294	290	288
30	288	284	291	284
Dosage : 500 ppm				
10	284	281	283	288
20	280	278	284	283
30	278	279	284	281

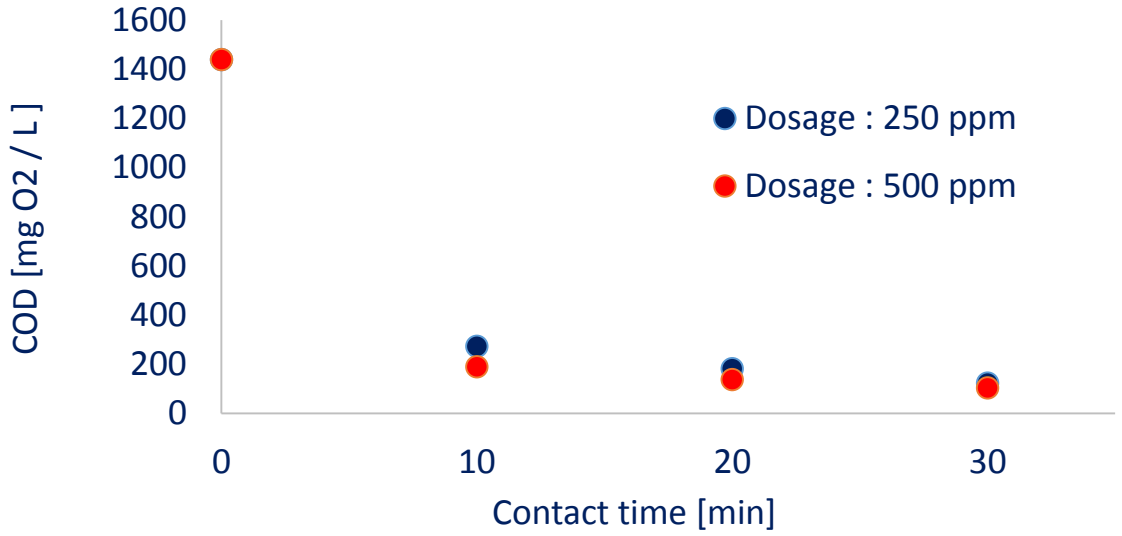




Slaughterhouse waste water

Tank n° 2

COD START : 1440 mg O_2 / L				
Dosage : 250 ppm				
T di contattamento [min]	COD post Trattamento mg O_2 / L			
10	275	281	271	269
20	180	188	184	179
30	115	128	131	121
Dosage : 500 ppm				
10	198	194	178	191
20	148	135	133	139
30	99	104	102	112



Case Study #1: food industry

CURRENT PROBLEMS

- COD value at drain into sewer above law limits
- Not enough space for installation of standard waste water treatment plant
- **Payng of expensive fines**
- **RISK of shutting down the plant**

USING OF CAPTIVE SYSTMES TECHNOLOGY

- ✓ Easy integration in the law space available on the site
- ✓ COD value at drain into sewer **UNDER** law limits
- ✓ **NO fines at all**
- ✓ **Plant management without problems**

Case Study #2: Air treatment during tank cleaning

PROBLEMS

- Potentially explosive atmospheres
- High concentration of volatile organic compounds (VOC)
- Odor emission problem

STANDARD TREATMENT

- Leaking problem of VOC and odorigenic compounds
- Risky operations
- High time and personnel demanding operation

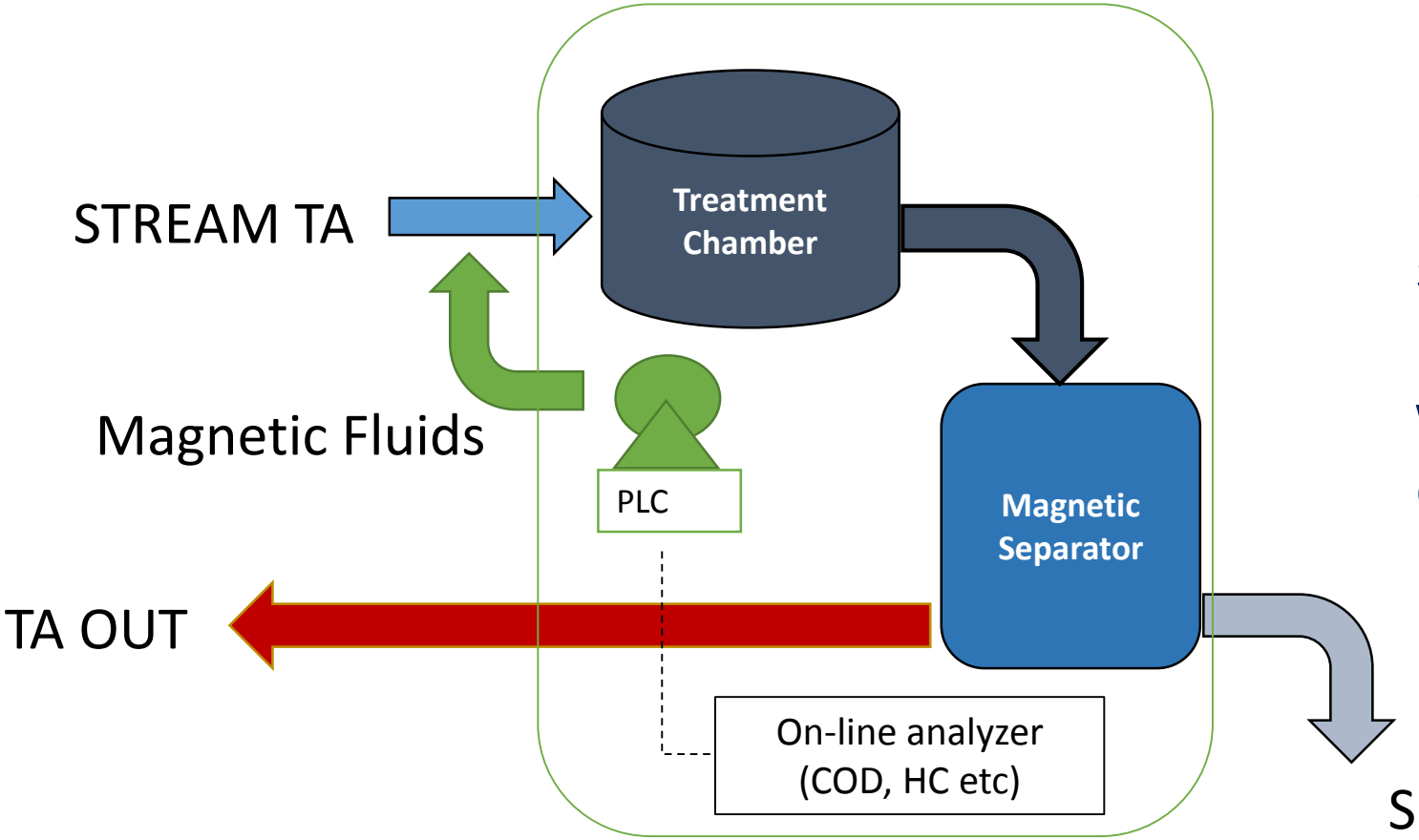
USING OF CAPTIVE SYSTMES TECHNOLOGY

- ✓ Total abatement of VOC
- ✓ Containment of odorigenic compounds
- ✓ No odor emission problems
- ✓ Non-flammable atmosphere
- ✓ **Reducing the time of the operation**
- ✓ **Reducing the personnel needed**
- ✓ **Reducing environmental and human risk of the operation**

Work in progress

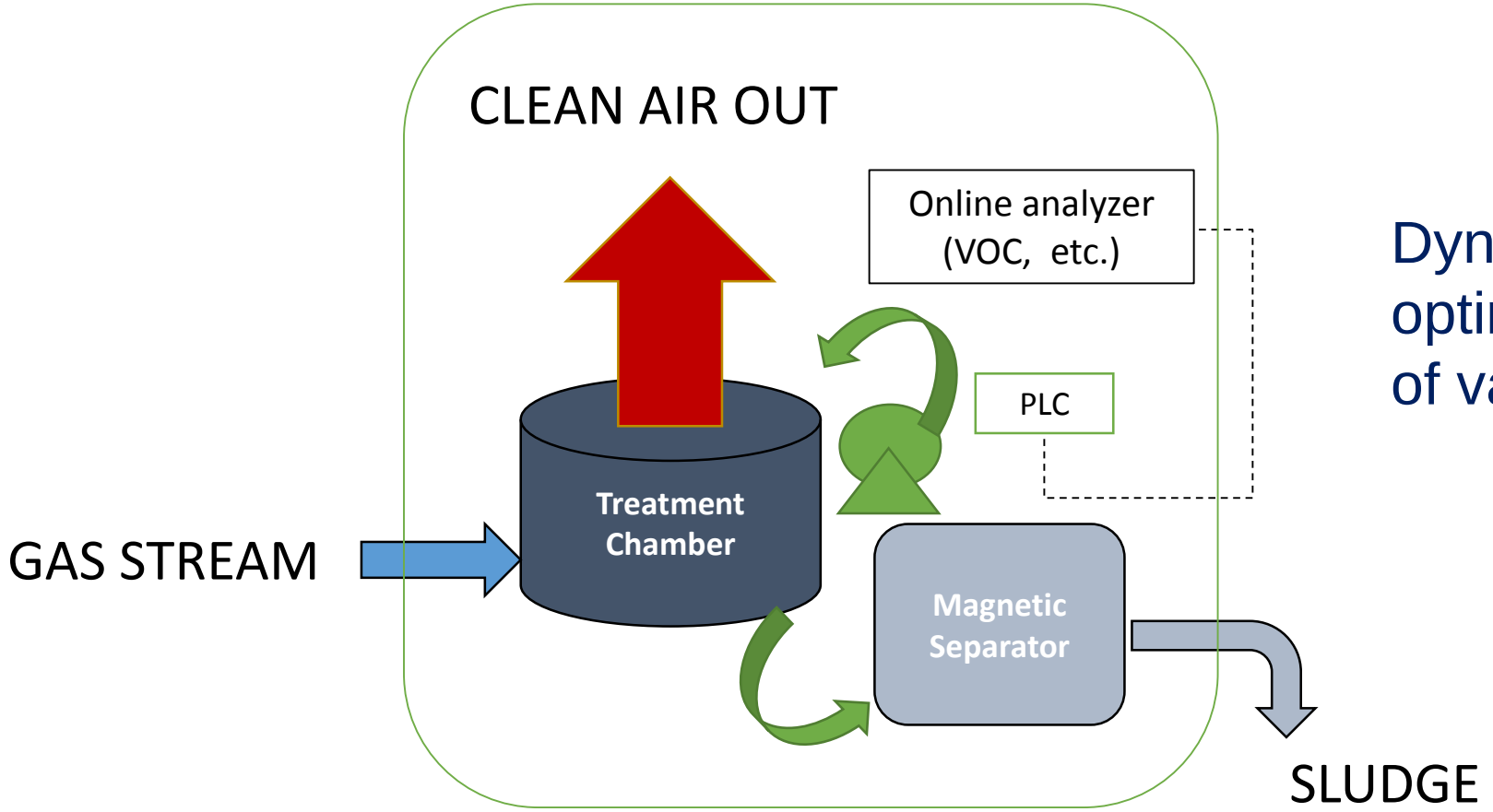
- HC/COD reduction in OIL&Refinery
- COD reduction in food and textile sectors
- MTBE and BUTADIENE reduction
- Waste water treatment after tank cleaning operation
- Waste water treatment in oilfield activities
- Remediation from metals
- Chemical purification for drinking water
- VOC and odorigenic compounds from gas stream

Waste Water Line



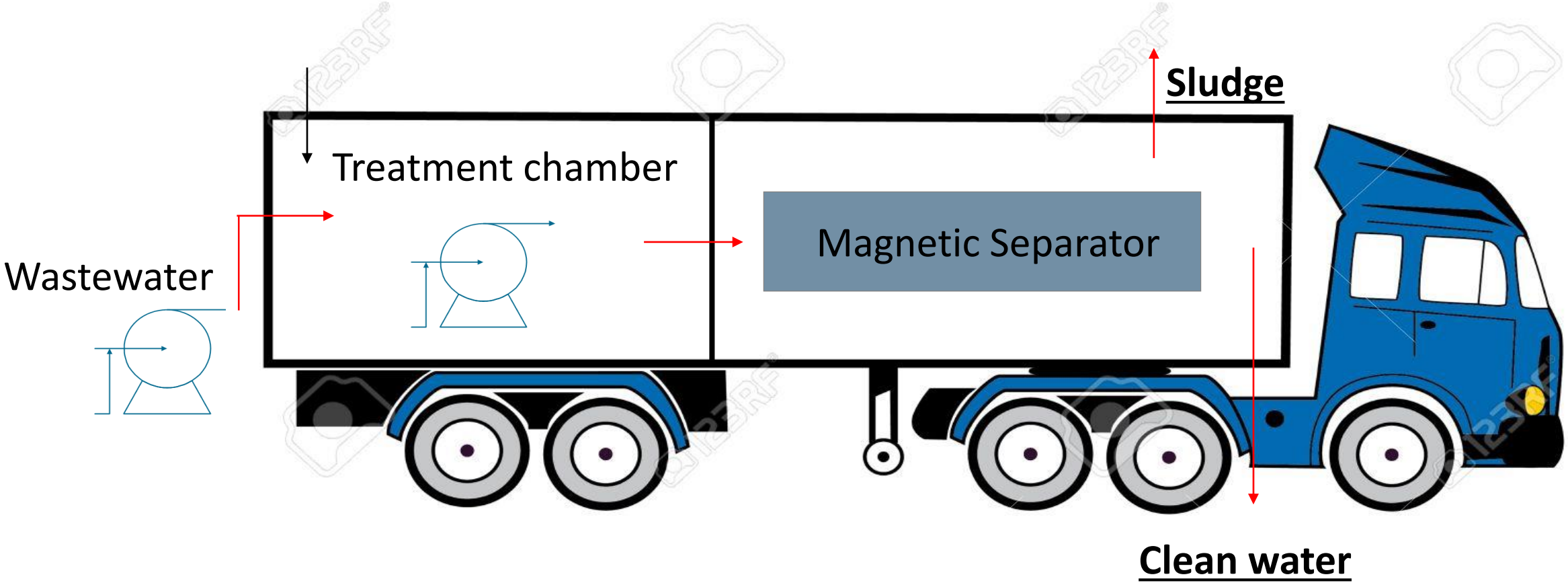
Compact SKID for safety treatment even in the case of loads with variable pollutants concentration

Gas Stream Line



Dynamic filter capable of optimally handling loads of variable pollutants

Mobile Skid


Sludge
Treatment chamber
Magnetic Separator
Wastewater
Clean water

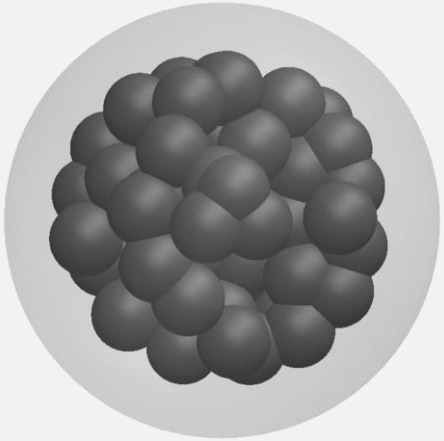
The Team

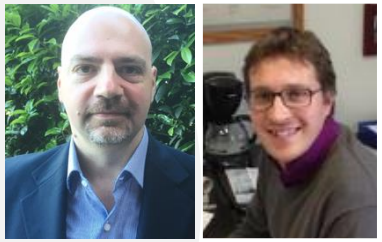
CEO : Gianni Franzosi
Founder of a *startup now employing 250 people, holder of several trademarks in electroplating sector*

CTO: Ruggiero Pesce
Experience in production process, scale up and field test

Supply Chain: Sergio Farina
30ys of experience in chemical formulations and selling

Lab test and screening: M. Sponchioni & A. Accogli
Executive PhD at PoliMI





R&D Supervisor: Profs. L. Magagnin & D. Moscatelli, PoliMI
Expertise in development of nano and smart materials for industries

CFO: Marco Parati
Expertise in financial and business planning for IPP and start-up

Industrial Partner: CHIMEC
Italian company active worldwide in oilfield and waste water management

CHIMEC

AWARDS

16 November 2018.

Seal of Excellence from European Commission managing HORIZON 2020

" THE PROJECT WAS SCORED AS A HIGH-QUALITY PROJECT PROPOSAL IN A HIGHLY COMPETITIVE EVALUATION PROCESS "

Ref. Ares(2018)5875995 - 16/11/2018

European Commission

SEAL OF EXCELLENCE

Certificate delivered by the European Commission,
as the institution managing Horizon 2020,
the EU Framework Programme for Research and Innovation 2014-2020

The project proposal **848755, Magnetic Fluids**

Efficient and cheap waste water and air treatment for oil&gas industry based on functionalized magnetic NanoParticles

Submitted under the Horizon 2020's **SME instrument phase 2** call **H2020-EIC-SMEInst-2018-2020 (H2020-SMEInst-2018-2020-2)** of **10 October 2018** in the area of **EIC-SMEInst-2018-2020**

SME instrument
by
CAPTIVE SYSTEMS SRL
VIA GIOVANNI PASCOLI 7
24121 BERGAMO
Italy

following evaluation by an international panel of independent experts

WAS SCORED AS A HIGH-QUALITY PROJECT PROPOSAL IN A HIGHLY COMPETITIVE EVALUATION PROCESS*

This proposal is recommended for funding by other sources since Horizon 2020 resources available for this specific Call were already allocated following a competitive ranking.

* This means passing all stringent Horizon 2020 assessment thresholds for the 3 award criteria (excellence, impact, quality and efficiency of implementation) required to receive funding from the EU budget Horizon 2020.

Corina Cretu,
Commissioner for Regional Policy

Carlos Moedas
Commissioner for Research Science and Innovation

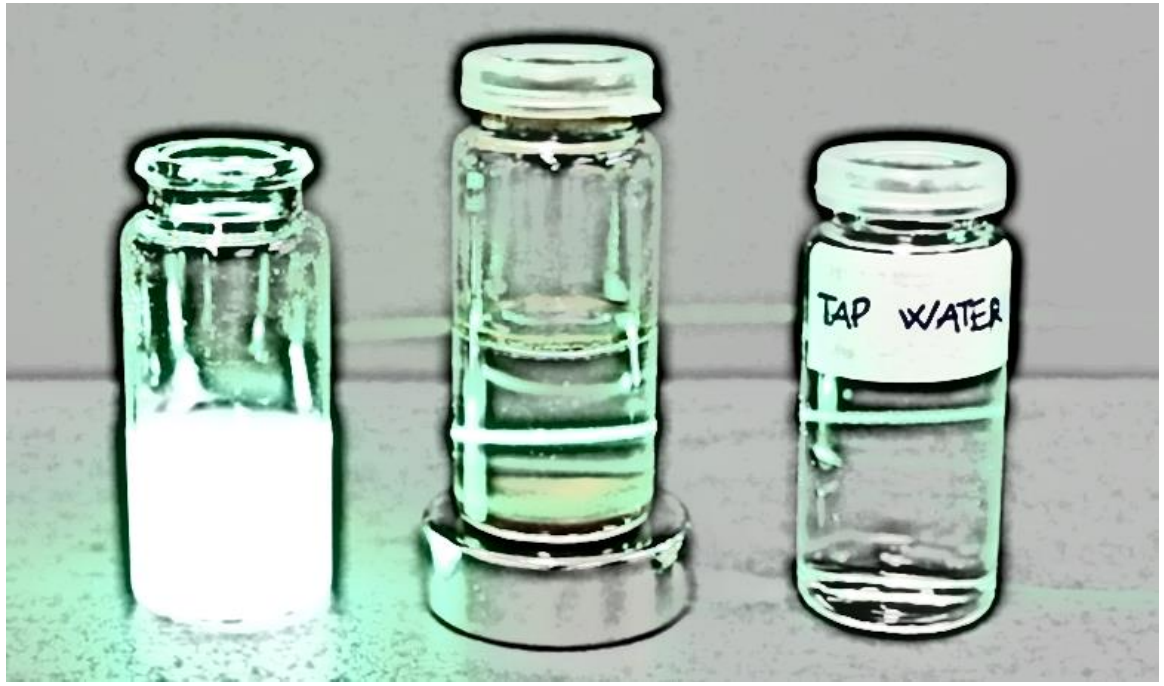
Brussels, 16/11/2018

CAPTIVE SYSTEMS

AWARDS

- **November 2018.** Finalist at **Startup4Good** - Fondazione Deutsche Bank – PoliHub.
- **October 2018.** Won free pass as expositor at **ECOMONDO 2018**.
- **September 2018.** Selected to partecipate at the **BASF Innovation Day 2018.**
- **June 2018.** Italian candidate for the **Everis Awards 2018**, Award for entrepreneurship, innovation and talent.
- **March 2018-stand by**. Selected for **SHELL GAME CHANGER 2018.**
- **January 2018. BANDO INNODRIVER MISURA A,** Lombardy Region. Won 2 calls for funding a team project with two Lombardy PMIs
- **October 2017.** One of the 10 finalists of the **IREN Startup Award** promoted by Banca **Intesa San Paolo.**
- **July 2017.** Recognized as **QuESTIO research center** from Lombardy Region.
- **January 2017. EIT RAW MATERIALS STARTUP BOOSTER PROGRAM.**

Contacts



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ruggiero.pesce@captivesystems.it