The role of slags and other by-products within circular economy in the steel industry

- Treatment for valorization of Zn containing residues in dust and sludge: Hydrocyclone treatment
- Damiano Capobianco; RINA CSM

5.–6. MARCH 2025

ESTEP Focus Group Circular Economy & FEhS-Institute

ESTEP
European Steel Technology Platform

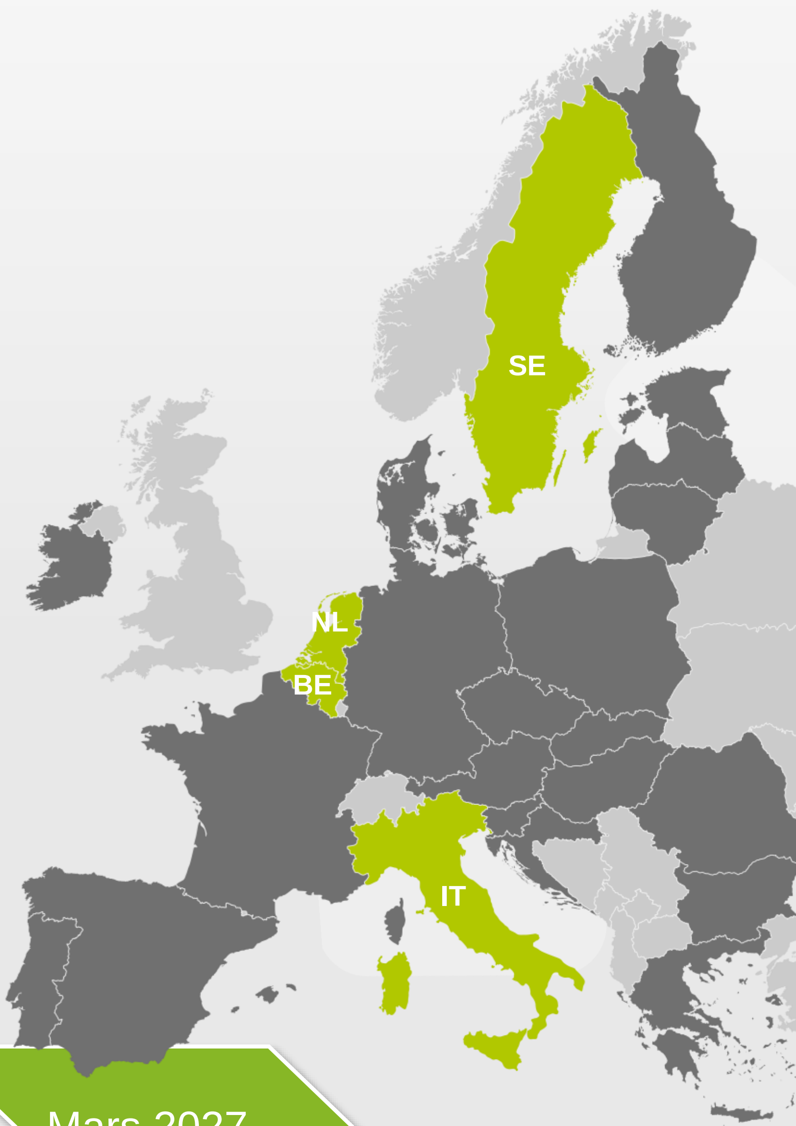
INSTITUT FÜR BAUSTOFF FORSCHUNG
FEhS

ZincVal Project key facts

Consortium – 7 partners from 4 EU countries

- ► Swerim (coordinator), Sweden
- ► Acciaierie d'Italia, Italy
- ► Centre de Recherches Métallurgiques, Belgium
- ► Linde, Sweden
- ► ORI Martin, Italy
- ► RINA Consulting Centro Sviluppo Materiali, Italy
- ► Tata Steel Nederland Technology, Netherlands

Duration: 42 months | Budget: 3.0 MEuro | Call topic: RFCS-02-2022-RPJ



Oct. 2023 → 2024 → 2025 → 2026 → Mars 2027

This project has received funding from the Research Fund for Coal and steel (RFCS) under project No. 101112631

Background

The steel industry contributes greatly to the global economy, but at the same time generates significant amounts of emissions and residues.

Most residues are valorised by internal recycling or external use. Still significant values in terms of carbon and iron units can't be recycled – the zinc content in the dust and sludge is too high, but too low to be sent to zinc producers.

Zinc content of EAF dust will be lower in the future as DRI/HBI partly or fully will replace steel scrap.

Dust and sludge that is not recycled, causes both raw materials losses and additional costs for preparing safe deposits and conducting landfilling.

Background

BF and BOF Dust and Sludge

- Composition of the BF and BOF dusts varies significantly depending on the process conditions.
- According to literature data **iron oxides** are major component of mixture of oxides derived form blast furnace dust (BFD) .
- BF Dust also contain **Zinc, Silicon, Magnesium**.
- BF Sludge (BFS) containing 0.77–5 wt.% Zn has been reported in literature and confirmed by our residues characterizaztion

EAF Dust

- One ton of smelted steel scrap produces about **15–25 kg of dust**, in which the content of **zinc is 15–40%**
- The dusts additionally contain a significant amount of **iron (about 20%)** and other elements such as **cadmium, nickel, chromium, manganese, carbon, tin, antimony and copper**

Ref. Zinc recovery from blast furnace flue dust; B. Asadi Zeydabadi et al.; Hydrometallurgy 4t (1991) ll3-125
Ref. Oxidative Leaching of Zinc and Alkalis from Iron Blast Furnace Sludge; Ma. de Jesus Soria-Aguilar; Metals 2019, 9, 1015; doi:10.3390/met9091015
Ref. Zinc Recovery from Steelmaking Dust by Hydrometallurgical Methods; Piotr Palimaka et al; Metals 2018, 8, 547; doi:10.3390/met8070547

Objectives

<u>Is not possible to reject Dust and Sludge in landfill, is necessary to consider the recovery of the valuable elements contained in it.</u>

Project objectives: to develop technologies securing high raw material efficiency by extracting more from existing raw material streams, enabling the reuse of low-zinc residues produced in the current and future steelmaking routes.

- Improved material efficiency
- Less need for landfill
- Improved feed material flexibility

Development of technology for separation and treatment of low-zinc iron and steelmaking residues.

Improved knowledge regarding zinc containing residues and upgraded secondary materials from the iron- and steelmaking industry to realize valorisation of valuable contents in steelmaking or externally.

Evaluation of concepts for increased material efficiency/ reduced landfill by utilization of developed technologies.

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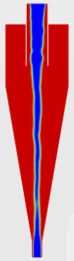
RINA CSM contribution to ZincVal Project

- **Characterizaztion of residue:** To map the amounts, characteristics, and the variation of dust and sludges generated.

- **Hydrocyclon design and operation:** To design, using CFD simulation followed by construction and experimental testing with BF sludges in a Hydrocyclone pilot prototype.

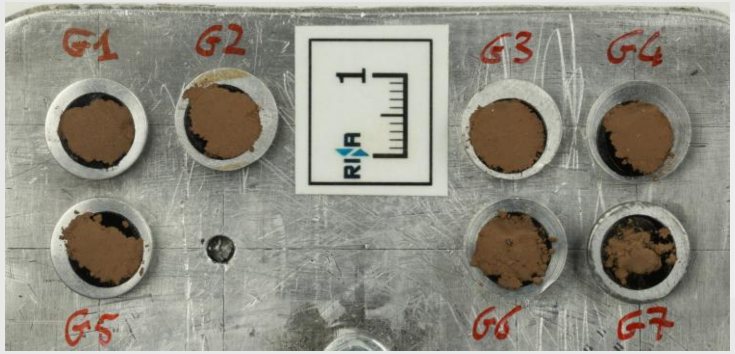


- **Collect knowledge on the selected treatment methods:** Leaching test

- **Design recipes and methods for producing Agglomerates of EAF dust for recycling back into process:** To reach zinc contents above the threshold set by zinc smelters.

RINA CSM contribution to ZincVal Project

Characterization of residues



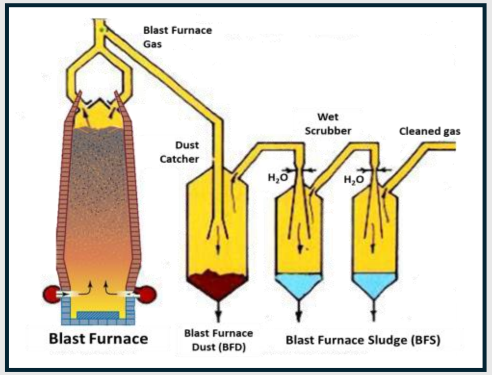
Characterisation of residues

First part of the project is focused on the collection and characterisation of BF, EAF dust and BF, BOF sludge:

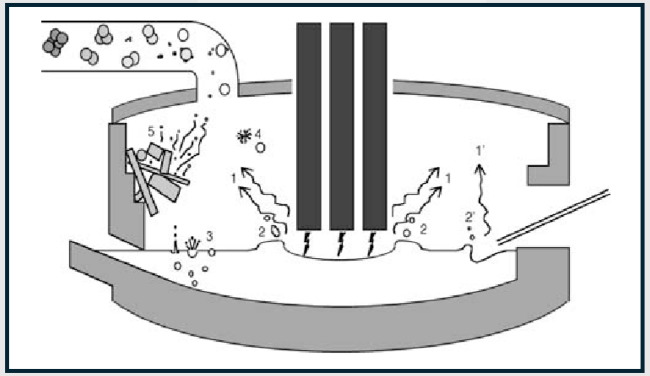
This initial part of the project is useful to describe; **Amounts, characteristics, and the variation of dust and sludges generated in BF, BOF and EAF**, but also useful as input for the sizing of all treatment processes considered for the recovery of Zinc

Physical and chemical characterization will be based on the determination of:

1. Grain size curve of BF, BOF Sludge and BF, EAF Dust
2. Particles distribution
3. Moisture content
4. Density
5. Zinc content correlated as a function of the grain size
6. Chemical composition of each fraction
7. Check if zinc is found in the form of oxide or ferrite



Schematic diagram of the blast furnace gas treatment and scrubbing process



Schematic representation of the mechanisms of dust formation in EAF

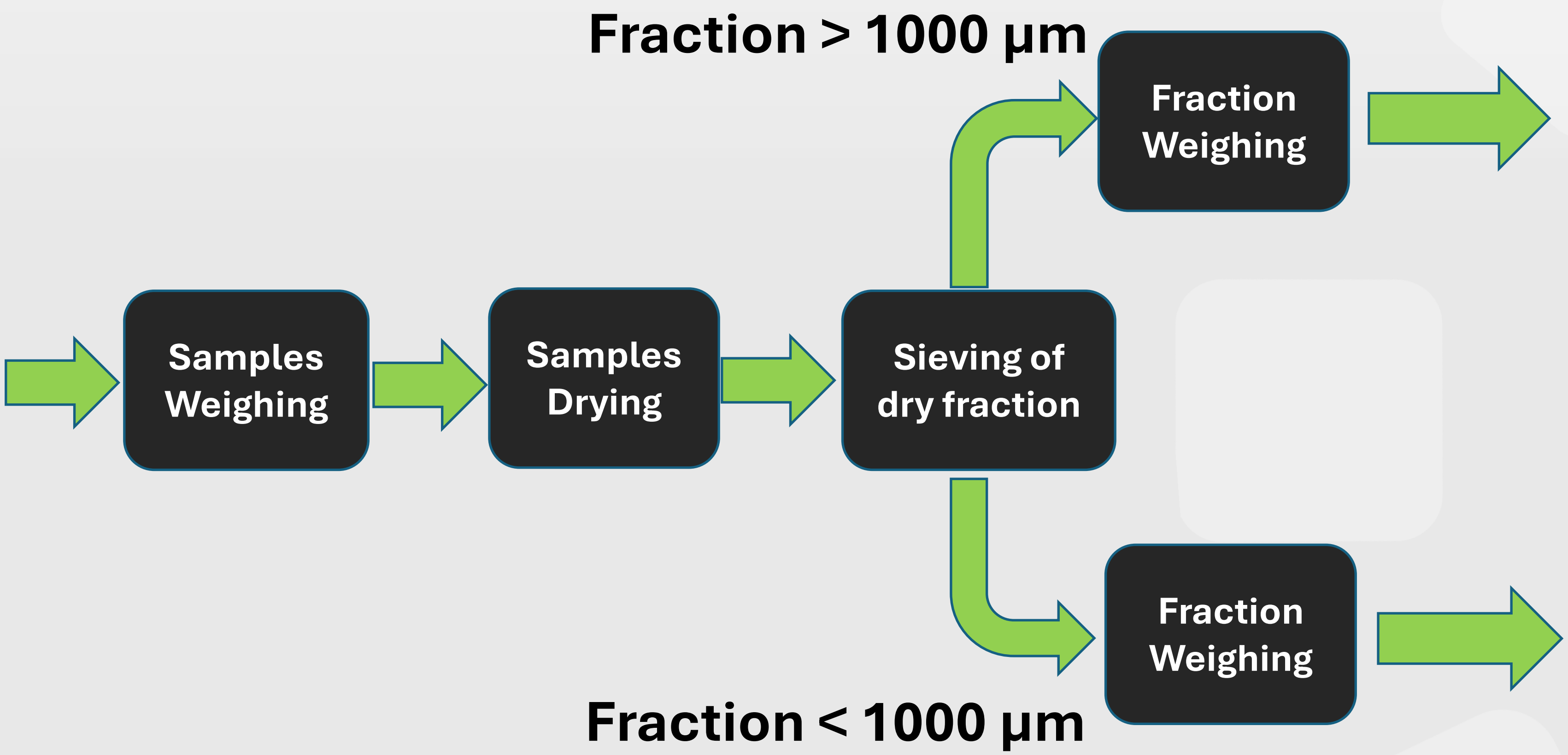
DOI:10.2355/isijinternational.44.1328

Characterisation of residues

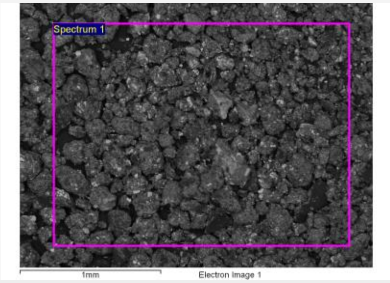
Collection and labeling of samples of BF and BOF Sludge and BF end EAF Dust

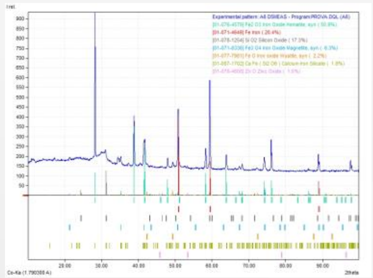
Sample	Type	Label
BF1	*SLU*	F
BF2	*SUL*	E
BF3	*SLU*	A
BF4	*SLU*	D
BOF	*SLU*	B
BF Dust	*DUS*	C
EAF	*DUS*	G

The sampling of BFS was done in four different points



Characterisation of residues

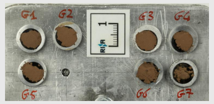




Fraction > 1000 µm

Fraction < 1000 µm

Sieving and weighing of fraction



Fraction < 1000 µm

Laser diffraction particle size analyzer

Dv 10
Dv 50
Dv 90

Particle distribution

- 0-22 µm
- 22-90 µm
- 90-150 µm
- 150-250 µm
- 250-500 µm
- 500-1000 µm

XRF;LECO SEM; XRD to charachterized Zn et.al per granular fraction

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Characterisation of residues

Sample Description	Moisture (%w)	Density (g/cm3)
Blast Furnace sludge	26.4	0.88
Blast Furnace Dust	16.5	1.16
Basic Oxygen Furnace Sludge	10.0	1.39

BFS samples	DRY density (g/cm^3)	WET density (g/cm^3)
BF1	1.04	0.98
BF2	0.81	0.85
BF3	0.87	0.83
BF4	0.79	0.88

Blast furnace sludge is best candidate to be pretreated through hydrocyclone process with the **highest concentration of zinc.**

Sample Description	Acronym	type	Zn content (% m/m)
Blast Furnace sludge (0 – 22 µm)	BFS	SOLID	1,61
Blast Furnace sludge (22 – 90 µm)	BFS	SOLID	1.75
Blast Furnace sludge (90 – 150 µm)	BFS	SOLID	0,48
Blast Furnace sludge (> 150µm)	BFS	SOLID	2.4
Blast Furnace Dust	BFD	SOLID	0.15
Basic Oxygen Furnace Sludge	BOFS	SOLID	0.25

Highest zinc content BFS fractions < 150 microns,

	particle size range	Elements	C	S	Ca	Fe	Zn	Fraction $\%_{m/m}$
BFS	0 - 22 µm	$\%_{m/m}$	28.78	1.18	6.04	45.93	1,61	4.2
	22 - 90 µm	$\%_{m/m}$	37.19	0.94	3.85	45.46	1.75	36.0
	90 - 150 µm	$\%_{m/m}$	51.62	1.26	3.62	32.02	0,48	21.5
	>150 µm	$\%_{m/m}$	42.95	2.53	5.15	35.73	2.4	38.3

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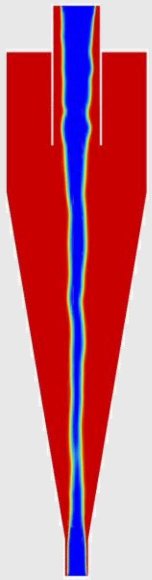
RINA CSM contribution to ZincVal Project

Hydrocyclon design and operation



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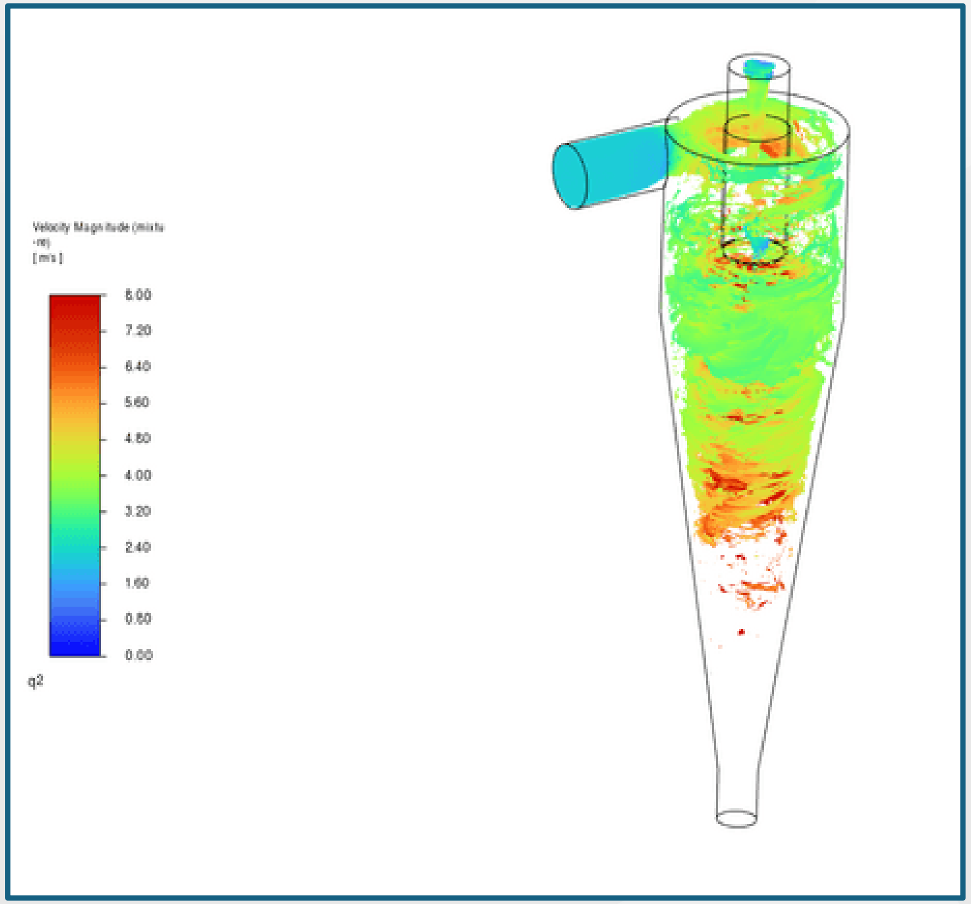
Hydrocyclone - introduction

Design a Hydro-cyclone pilot prototype, using CFD simulation

A part of ZincVal activities focuses on optimizing **Hydrocyclone design and operation** for improved separation efficiency based on particle size and composition.

- Hydrocyclone units are used to separate particles dispersed in a fluid via physical phenomena
- ***Efficiency depends on layout and operating conditions, to be identified based on the expected performance***



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Hydrocyclone - Technical Roadmap

Dust and Sludge Characterization

Data from Plant

Collection of literature data as reference

Set up of a reliable CFD model validated on literature data

Identification of the operating conditions (e.g., flow rates, target particles cut diameter)

Identification of a first ‘tailored’ design

CFD modelling referred to the configuration identified

Set up of a lab prototype for lab testing

Scaling up to industrial frame

Input for the design of CFD model of a hydro-cyclone capable to separate zinc fraction are:

1) Literature experimental data useful to validate a reliable CFD model.
2) Dust and sludge characterization
3) Data on plant

These 3 inputs are the input for the design of the first tailored CFD design.

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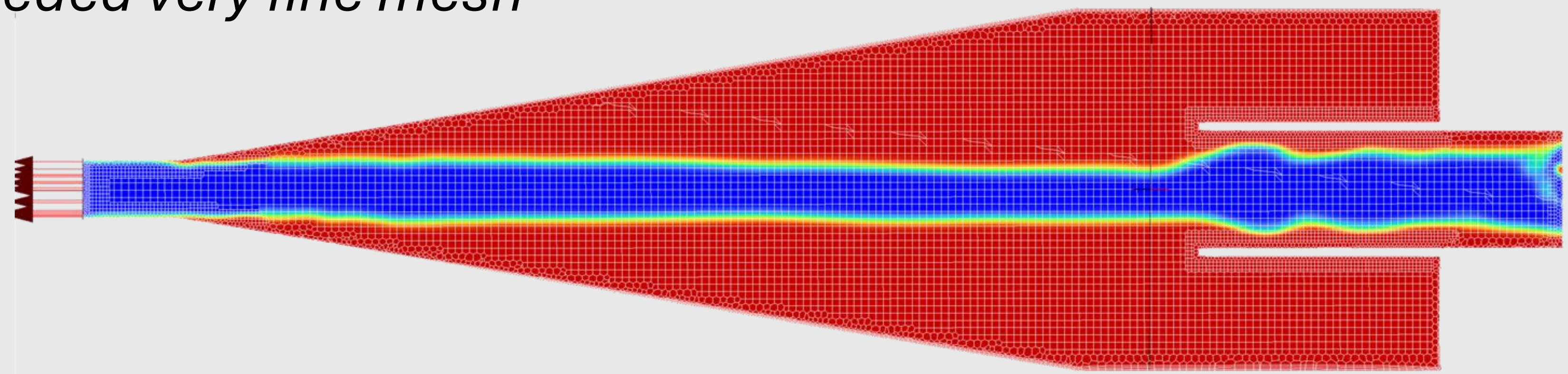
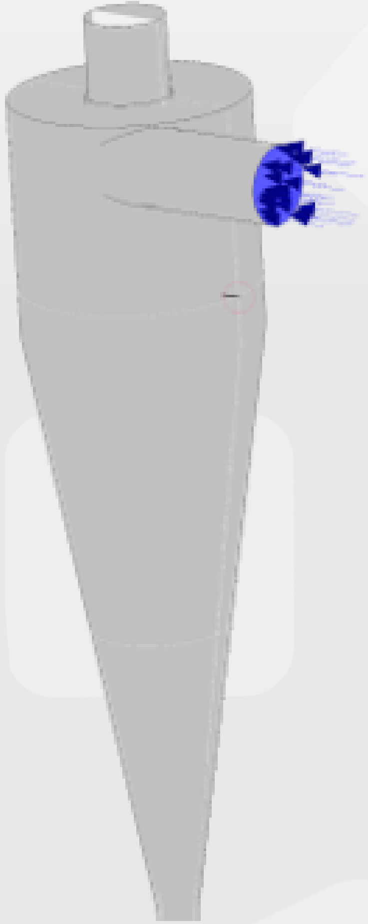
Hydrocyclone – Reference case

Reference for validation: Hsieh et al., AIChE Journal - May 1991 Vol. 37, No. 5 pp. 735 - 746	
Diameter of the Hydrocyclone	75 mm
Diameter of the tangential inlet	25 mm
Diameter of vortex finder	25 mm
Diameter of the spigot	12,5 mm
Length of the vortex finder	50 mm
Length of the cylindrical section	75 mm
Include con angle	20 °

Needed very fine mesh





Hydrocyclone - model set – check on turbulence approach/options reliability

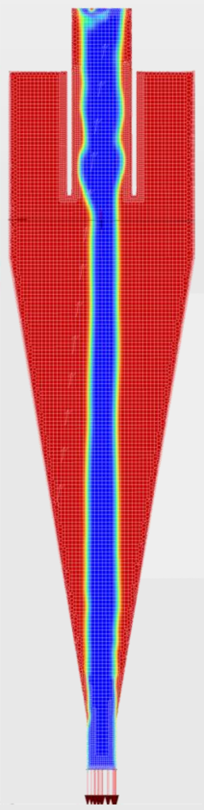
The inputs to build the model are:

1) Mesh
2) Turbulence
3) Particles and how they are present in the fluid (dispersed)

Different kinds of models presented in literature were tested in Ansys-Fluent code to identify the best and reliable design.

<u>Turbulence Models tested to identify the most reliable in validation</u>:

- K-eps: RNG & wall Functions (2 eq.)
- Reynolds Stress Model (7 eq.)



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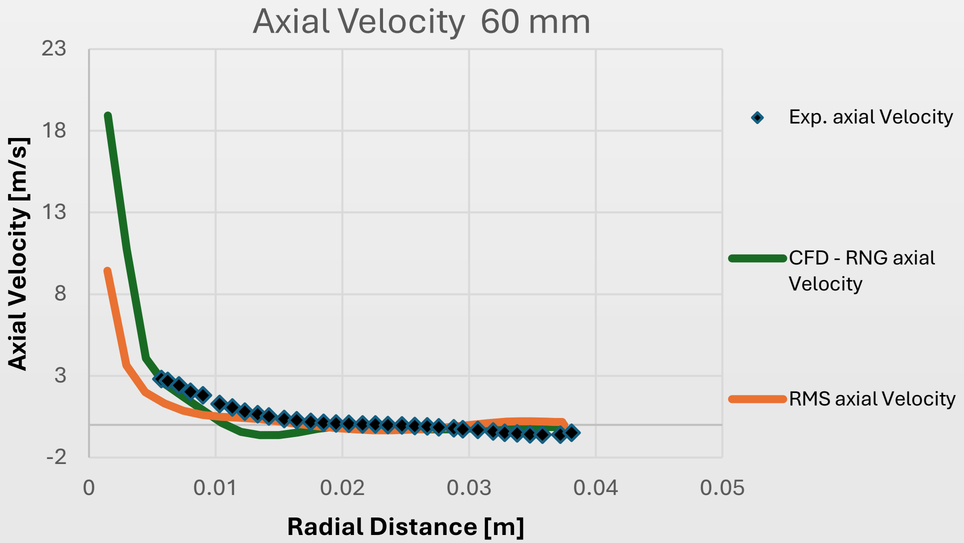
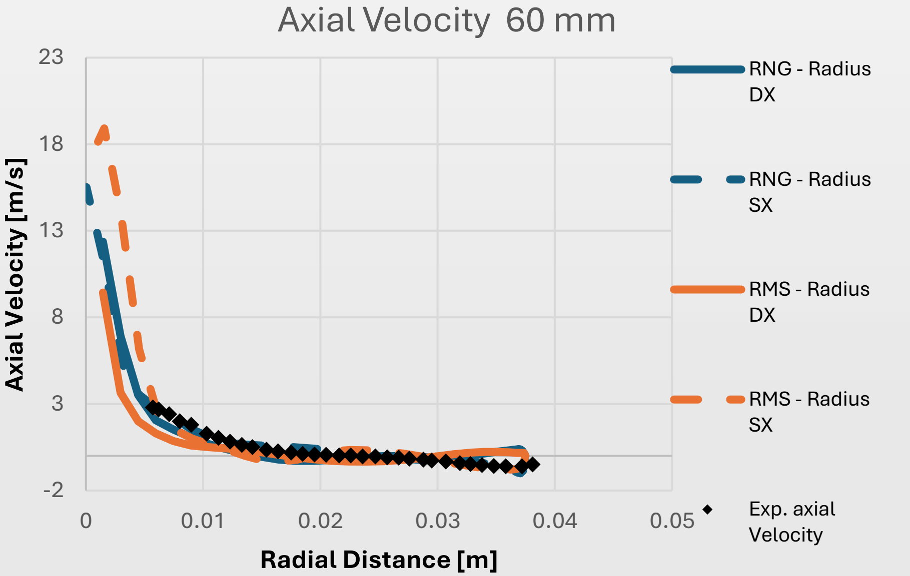
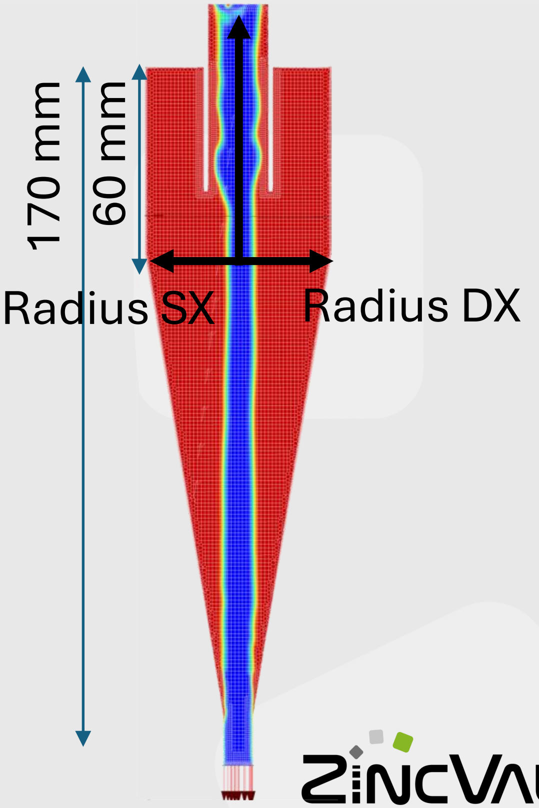
Hydrocyclone - model set – check on turbulence approach/options reliability

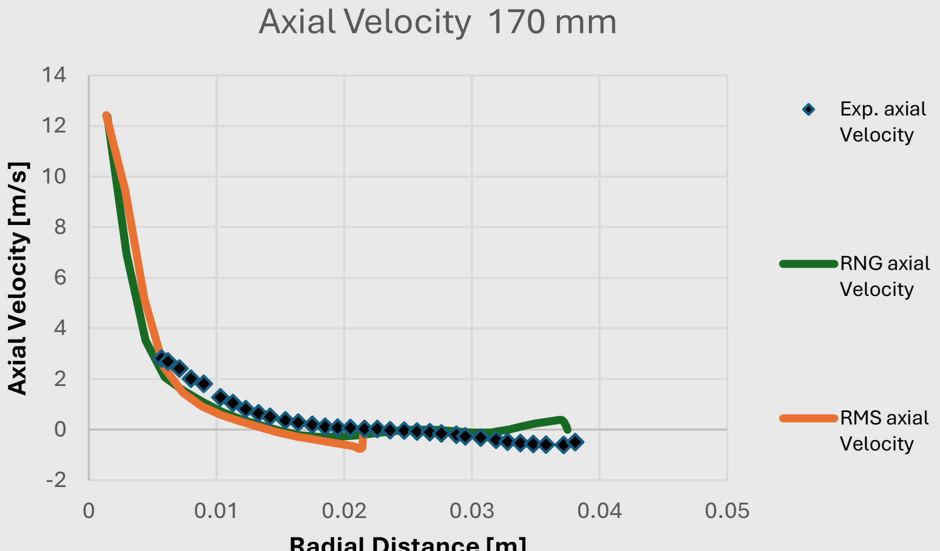


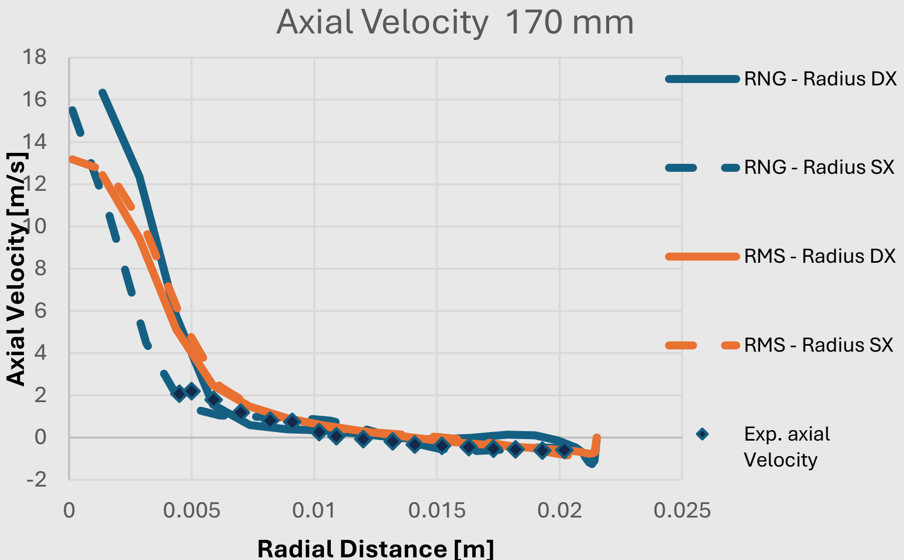


Dots = experimental literature points for validation

RMS preferred also for time calculations issues







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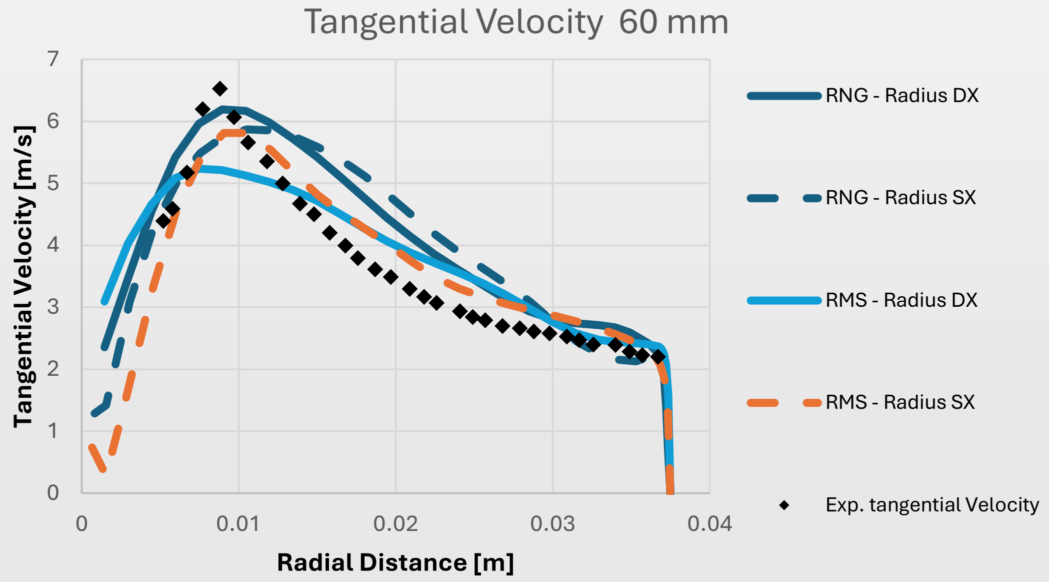

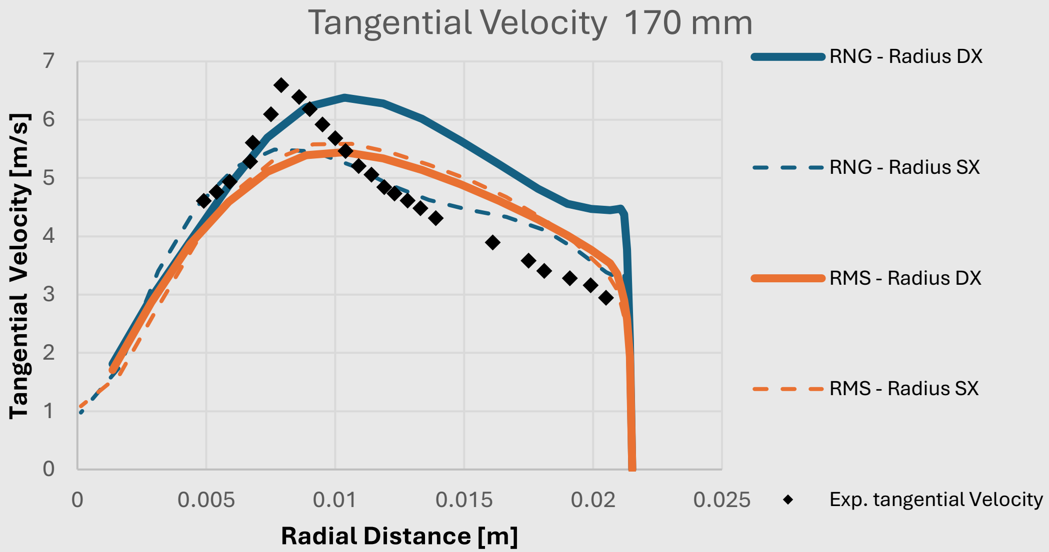

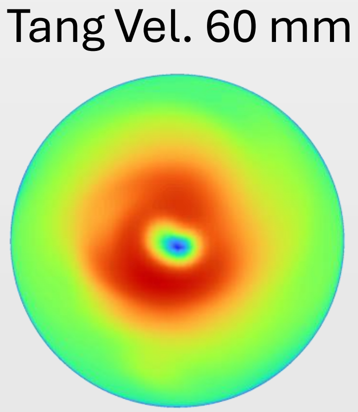

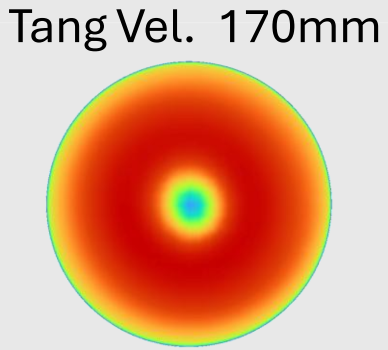

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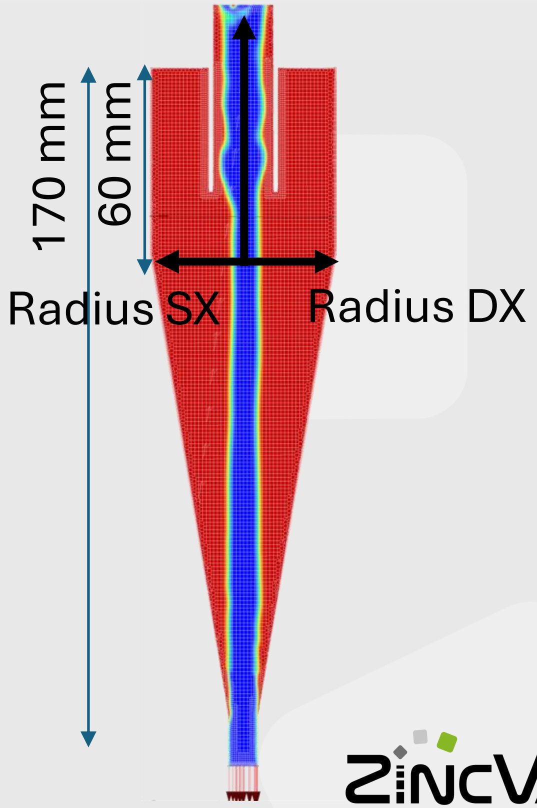

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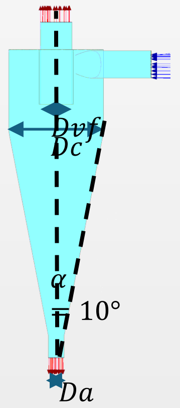
Hydrocyclone – design matrix



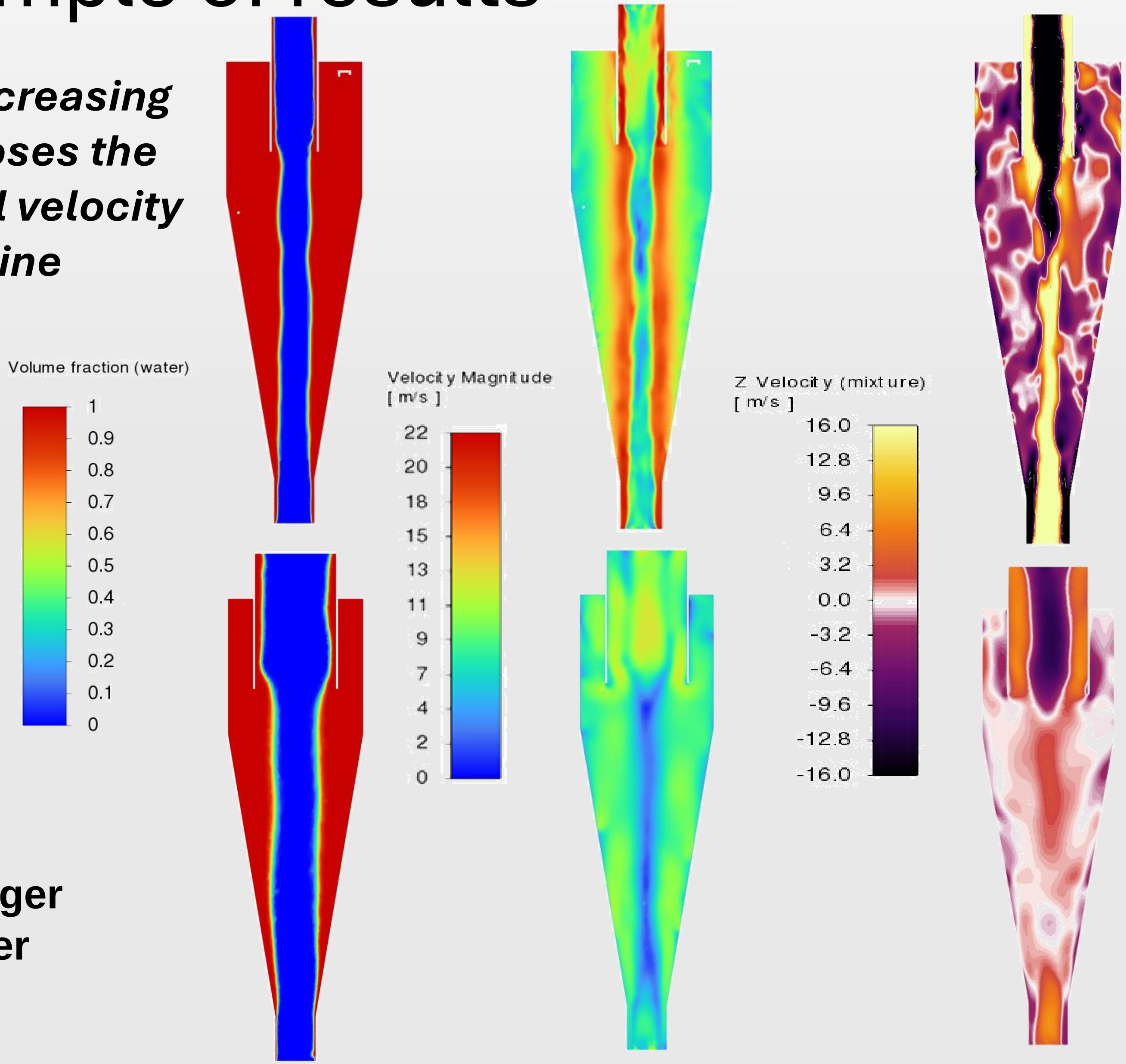
<table>
<tr><th>Case</th><th>Scope of the check</th><th>Feed Velocity V_f [m/s]</th><th>Liquid ρ_l [g/cm3]</th><th>Liquid μ_l [cP]</th><th>Solid ρ_l [g/cm3]</th><th>Solid μ_l [cP]</th><th>Slurry ρ_l [g/cm3]</th><th>Slurry μ_l [cP]</th><th>10 μm $R._{U/F}$ [%]</th><th>20 μm $R._{U/F}$ [%]</th><th>50 μm $R._{U/F}$ [%]</th></tr>
<tr><td>Hesieh</td><td>Reference</td><td rowspan="6">2,28</td><td>1</td><td>1</td><td rowspan="2">2,7</td><td rowspan="4">10,47</td><td>1,07</td><td>1,103</td><td>18</td><td>55</td><td>100</td></tr>
<tr><td>1</td><td>Viscosity variation</td><td>1,11</td><td>10</td><td rowspan="3">1,18</td><td rowspan="3">10,96</td><td>9</td><td>13</td><td>30</td></tr>
<tr><td>1b</td><td>Solid density variation</td><td>1</td><td>1</td><td rowspan="7">4,8</td><td>15</td><td>-</td><td>48</td></tr>
<tr><td>2</td><td>Density +viscosity variation</td><td>1,11</td><td>10</td><td>8</td><td>14</td><td>72</td></tr>
<tr><td>3</td><td>Hsieh scaled = (lengths x15)</td><td rowspan="5">1</td><td rowspan="5">1</td><td rowspan="5">40</td><td rowspan="5">1,46</td><td rowspan="5">1,4</td><td>18</td><td>35</td><td>43</td></tr>
<tr><td>4a</td><td>Higher solid concentration</td><td>62</td><td>90</td><td>100</td></tr>
<tr><td>4b</td><td>As 4a, higher velocity</td><td rowspan="2">6</td><td>77</td><td>92</td><td>100</td></tr>
<tr><td>5a</td><td>As 4, greater lengths</td><td>50</td><td>65</td><td>80</td></tr>
<tr><td>5b</td><td>As 5, higher velocity</td><td>10</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>6</td><td>As 1 with larger vortex finder and apex</td><td>2,28</td><td>1</td><td>1</td><td>4,8</td><td>10,47</td><td>1,07</td><td>1,103</td><td>10</td><td>35</td><td>65</td></tr>
</table>

Hsieh density conditions are different from the industrial ones in our case

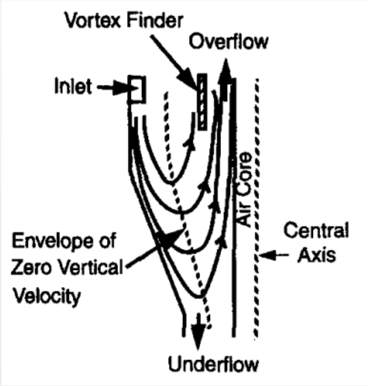
- D *Hydrocyclone diameter*
- μ_l *Fluid viscosity*
- D *Underflow/Apex*
- ρ_s *Solid particles density*
- D *Overflow/VortexFinder diameters*
- ρ_m *Slurry density (water+ particles)*
- V_j *Inlet velocity*
- μ_m *Slurry viscosity (water + particles)*
- ρ_l *Fluid density*
- $R._{U/}$ *Recovery Underflow*

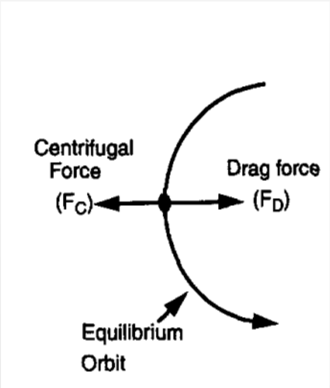
Example of results

Case 5b : ***Increasing the speed loses the zero vertical velocity separation line***



Case 6 : Larger vortex finder and apex

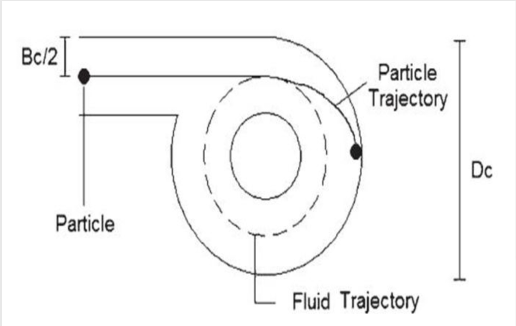




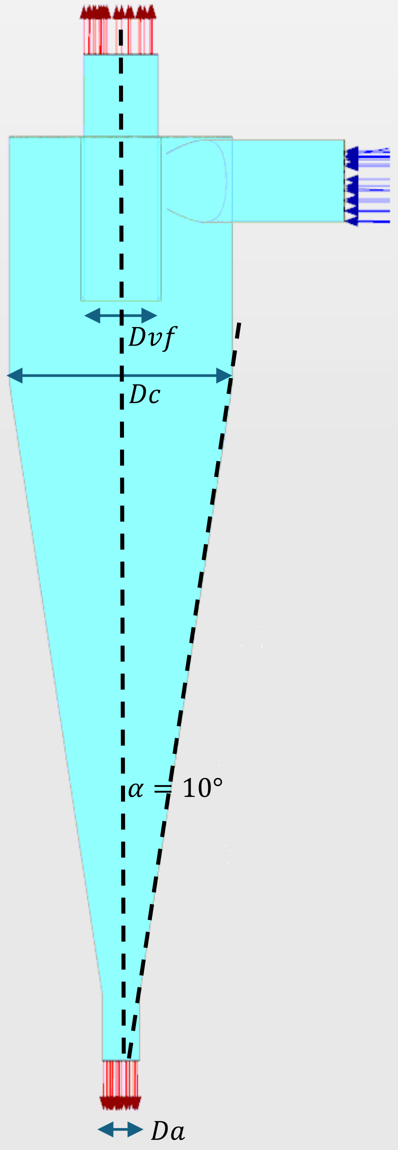
Particle velocity — **Drag Force** — **Inertial Effects** — **Magnus Effects**

$$\frac{du_p}{dt} = \left(1 - \frac{\rho}{\rho_p}\right)g + F_D+F_P+F_A+F_S+F_M+F_B$$

Gravity Force — **Pressure Gradient** — **Staffman Lift Force** — **Basset Force**



Example of results - Case 6



Case 6 proved to be the most efficient in favoring recovery of particles under the Hsieh geometry approach and expected industrial conditions (particle density higher with respect to that in Hsieh)

Therefore, as next steps:

- **<u>Case 'extra 1'</u>** was set up starting from 6 and scaling up to typical hydrociclone lab sizes
- **<u>Case 'extra 2'</u>** was set up with higher velocity (3 times), to provide for the same kinetic energy per unit volume in the scaled up model as in the reference one

‘Tuning cases’ - Overview

<table>
<tr><th>Case</th><th>Liquid
ρ_l
[g/cm3]</th><th>Liquid
μ_l
[cP]</th><th>Solid
ρ_s
[g/cm3]</th><th>Solid
Concentration
[w/w%]</th><th>Slurry
ρ_m
[g/cm3]</th><th>Slurry
μ_m
[cP]</th><th>10 μm
$R._{U/F}$
[%]</th><th>20 μm
$R._{U/F}$
[%]</th><th>50μm
$R._{U/F}$
[%]</th></tr>
<tr><td>Hsieh</td><td rowspan="3">1</td><td rowspan="3">1</td><td>2,7</td><td rowspan="3">10,47</td><td>1,07</td><td>1,103</td><td>18</td><td>55</td><td>100</td></tr>
<tr><td>6Ex 1</td><td rowspan="2">4,8</td><td rowspan="2">1,11</td><td rowspan="2">10</td><td>88</td><td>100</td><td>100</td></tr>
<tr><td>6Ex 2</td><td>55</td><td>86</td><td>100</td></tr>
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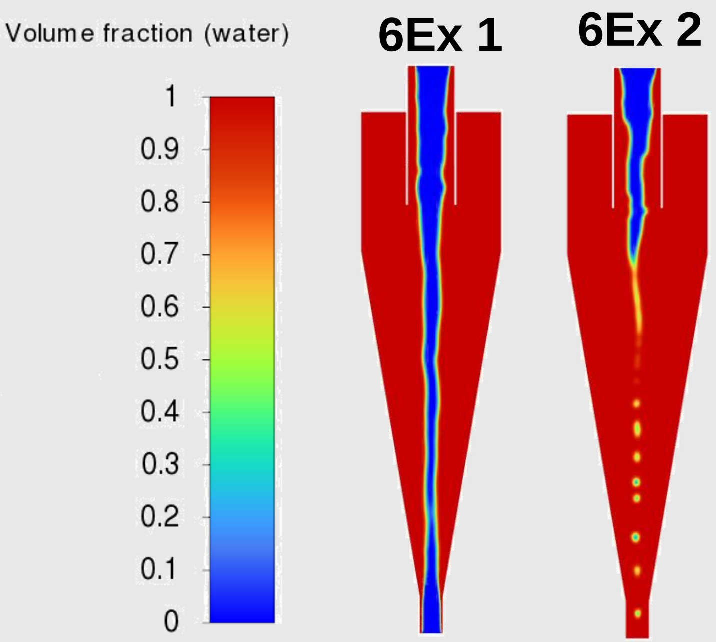

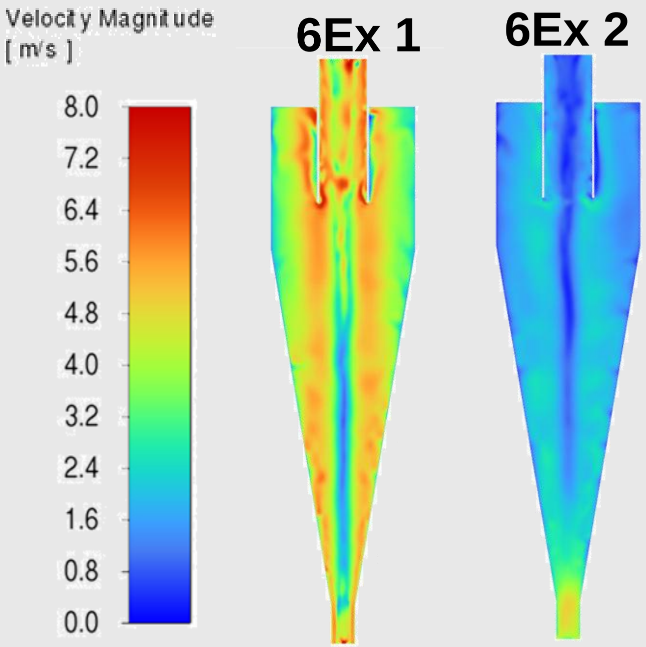

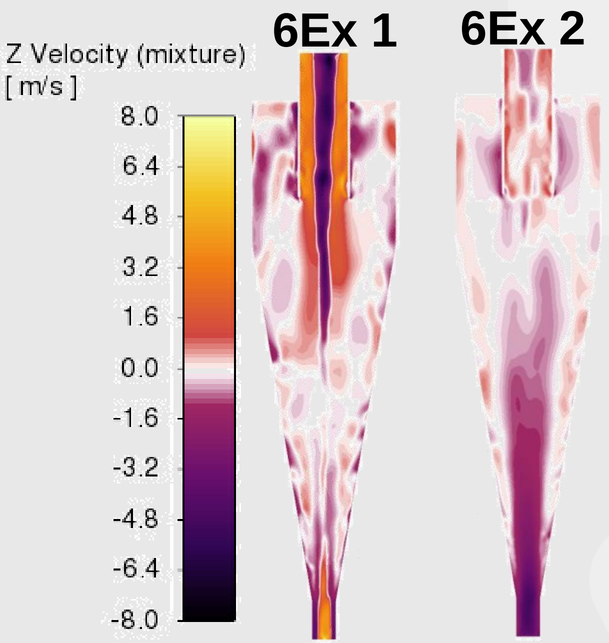

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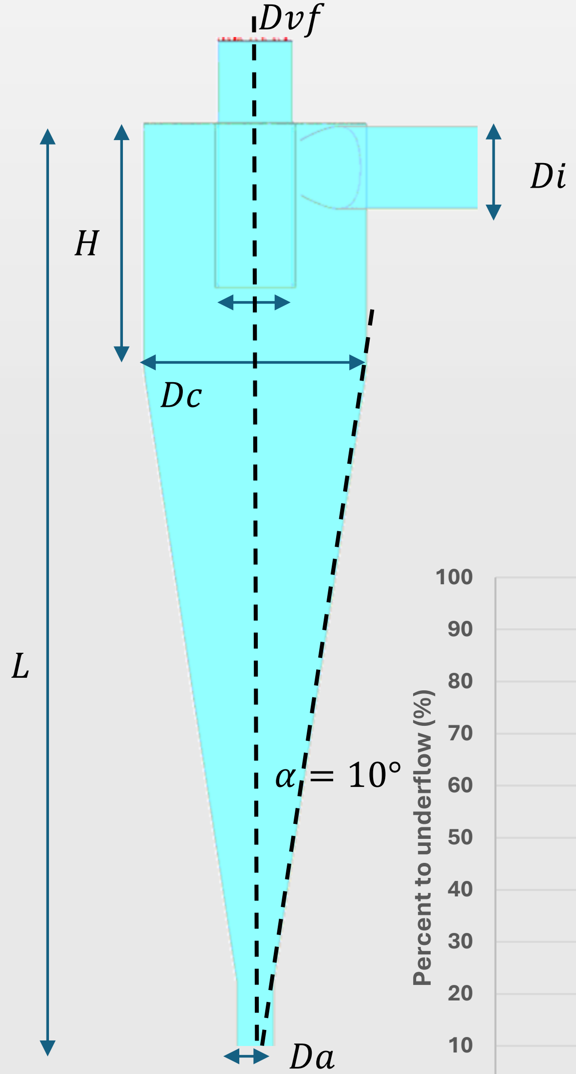
‘Best’ design for lab testing



The geometrical features were identified

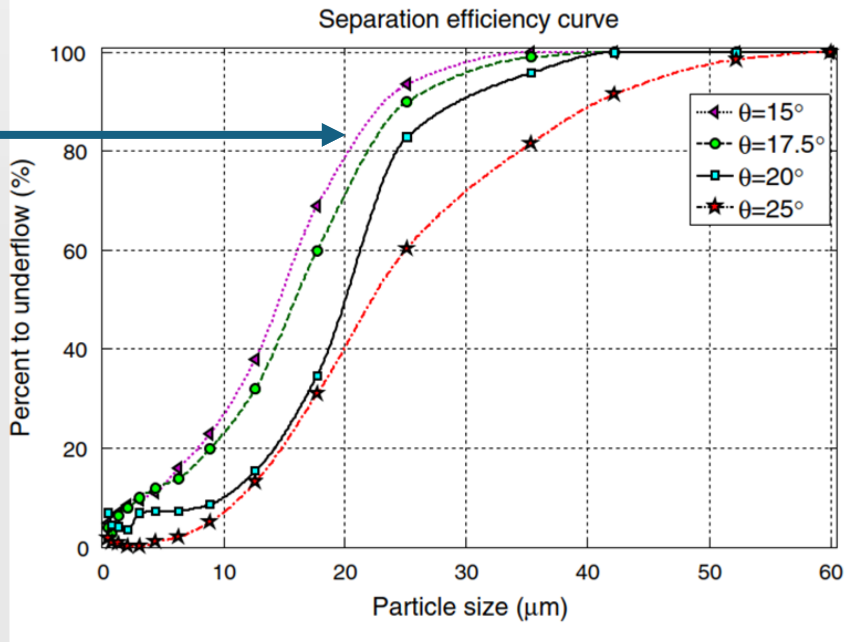
They are in line with more recent literature indication*

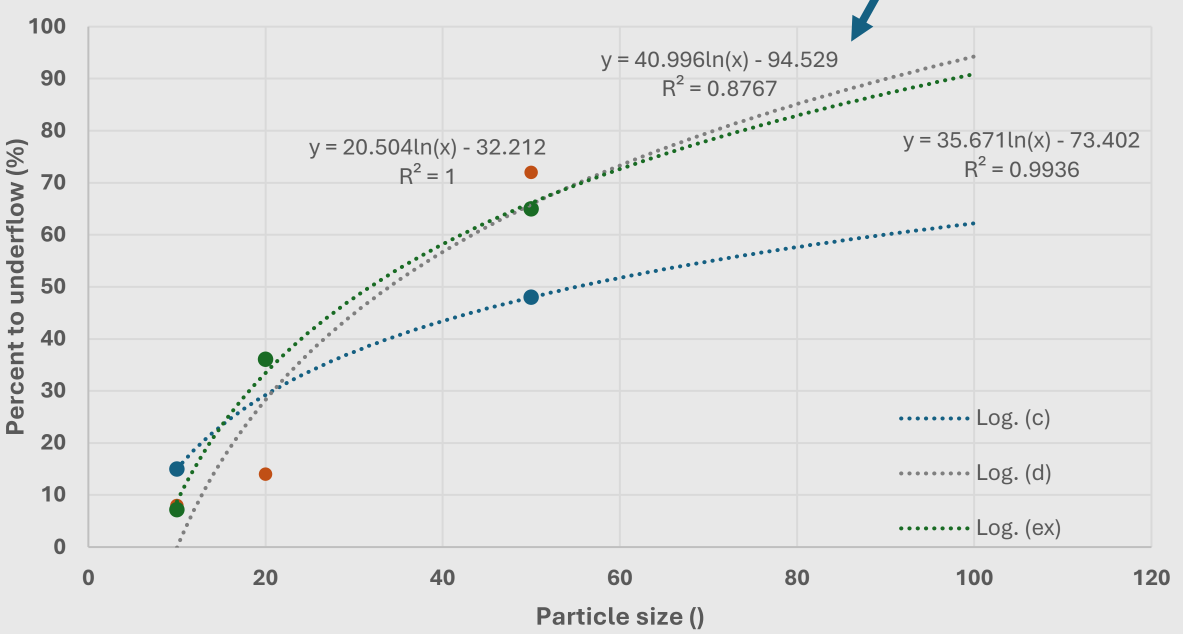
The apex angle chosen is greater based also on more recent literature results

The particle removal efficiency can be extrapolated

Table 1. Optimized scale for different ratios of the best thickener

S.No	Ratio	Notation	Scale for Min Eu Number	Scale for Max overall efficiency
1	Inlet feed diameter to that of Cylindrical section diameter	$\frac{Di}{Dc}$	0.21	0.26
2	Overflow diameter to that of Cylindrical section diameter	$\frac{Do}{Dc}$	0.35	0.19
3	Length of the hydrocyclone to that of cylindrical section diameter	$\frac{L}{Dc}$	7.6	5.63
4	Cone Angle	Θ	12.5°	9°





Lab model will made flexible to let two discharge angles to be possible

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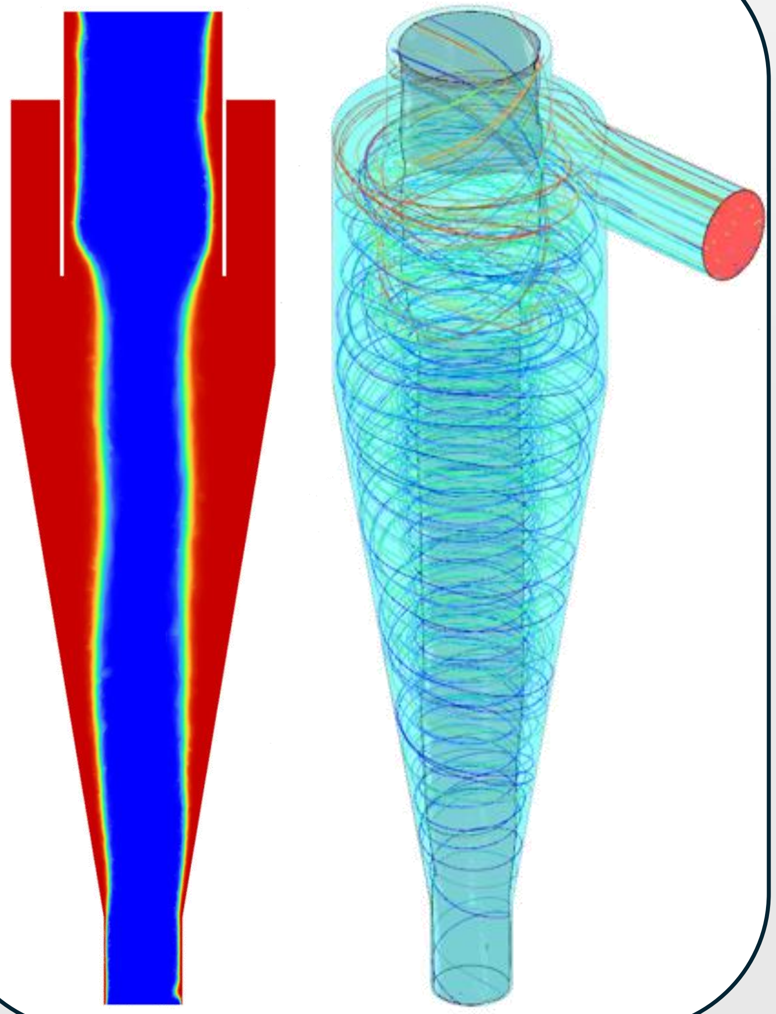
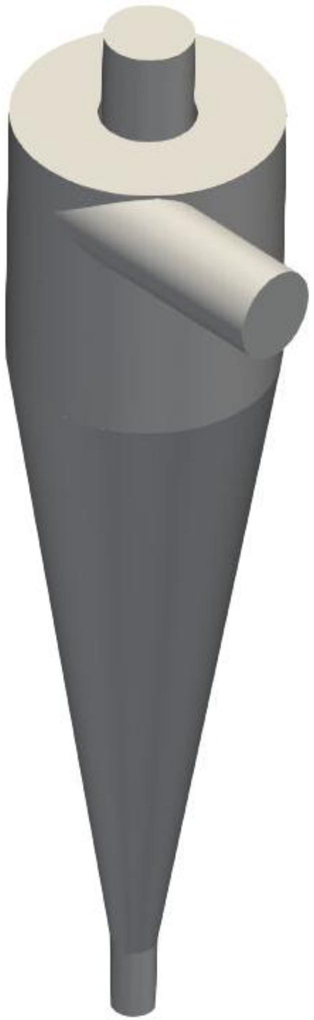
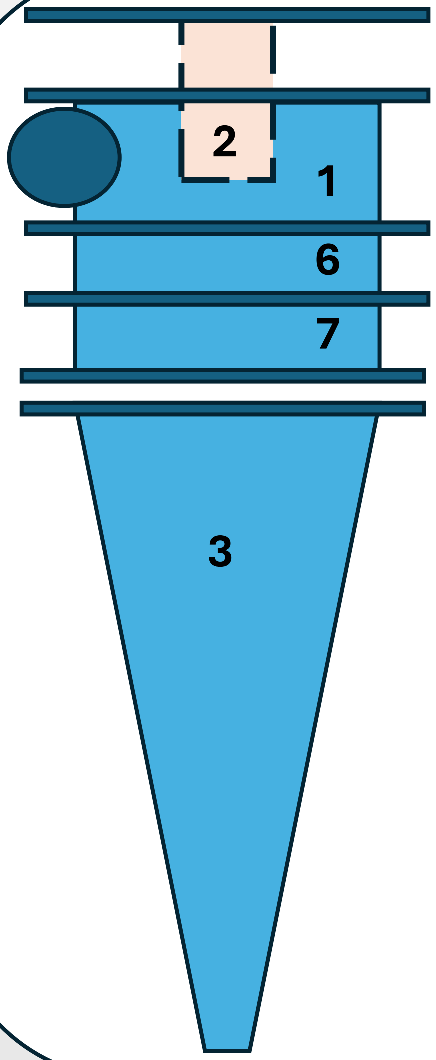
From CFD to prototype

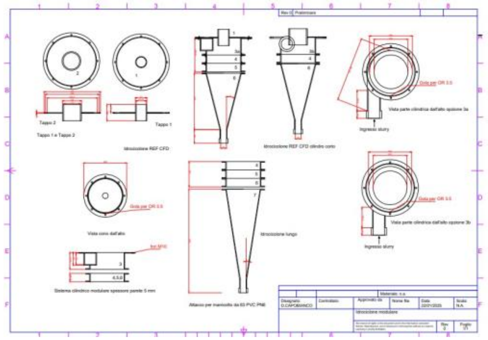


Rough geometry defined **CFD Simulation**



3D design





Scaling-up conditions and management of process parameters aspects (flow rate) evaluate with

Modular Physical

Process parameters aspects **Modular prototype**

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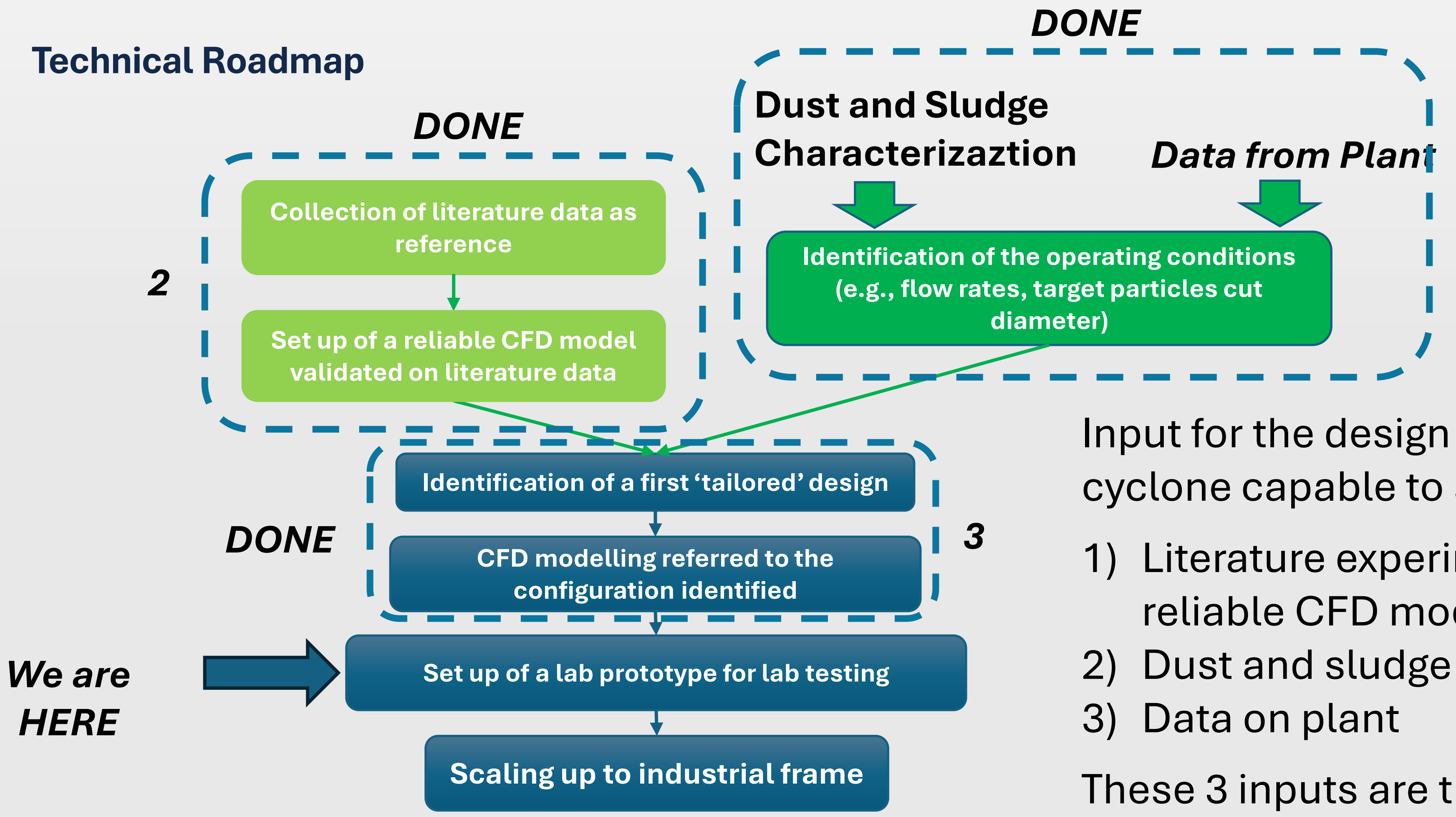
Hydrocyclone - Technical Roadmap



NEXT/FINAL Drawing done, being commissioned

Input for the design of CFD model of a hydro-cyclone capable to separate zinc fraction are:

1) Literature experimental data useful to validate a reliable CFD model.
2) Dust and sludge characterizaztion
3) Data on plant

These 3 inputs are the input for the design of the first tailored CFD design.

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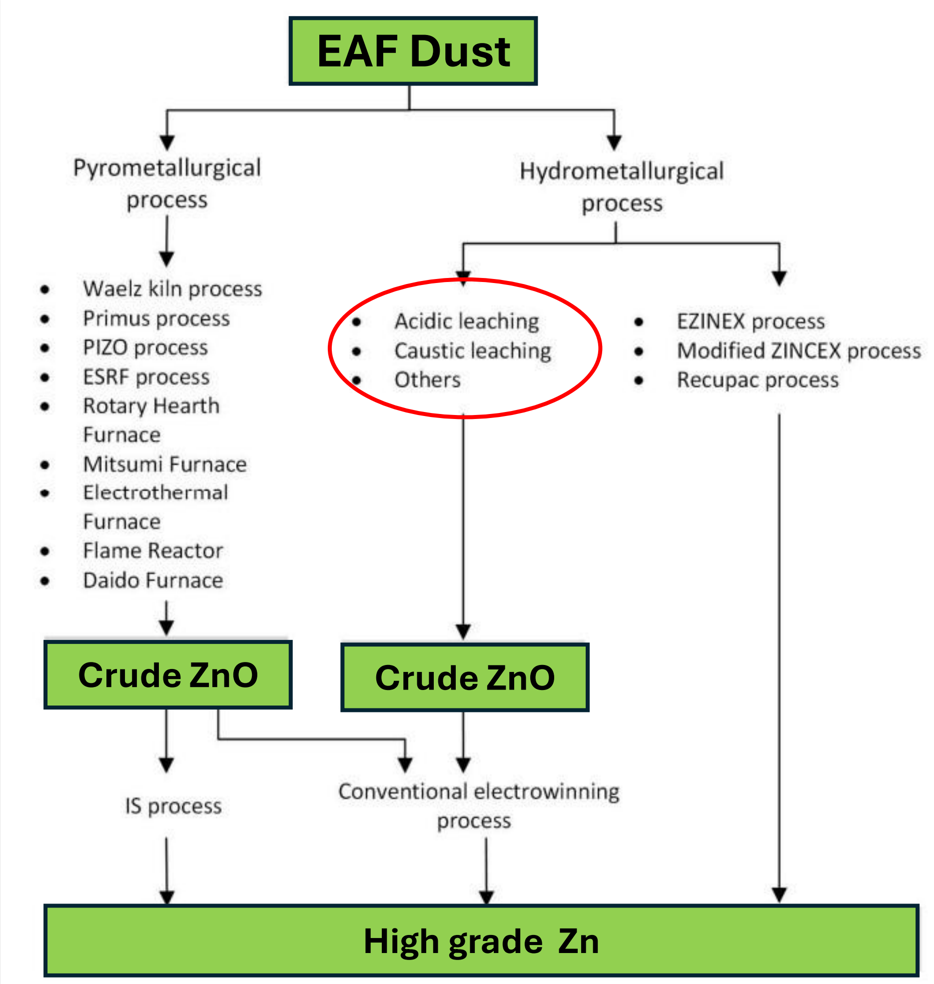
RINA CSM contribution to ZincVal Project

To collect knowledge on the selected treatment methods:

Leaching test

To collect knowledge on the selected treatment methods



Current technologies for steel dust processing are focused on pyrometallurgical methods and consist mainly of high-temperature reduction of ZnO contained in dust and secondary oxidation of Zn in the gas phase.

The Waelz kiln process remains the predominant method for processing dust, with over 85% of the market.

Hydrometallurgical processes are not as popular as pyrometallurgical methods.

Ref. Zinc Recovery from Steelmaking Dust by Hydrometallurgical Methods; Piotr Palimaka et al; Metals 2018, 8, 547; doi:10.3390/met8070547

To collect knowledge on the selected treatment methods

- Leaching process is the first step of hydrometallurgical methods which are used for extraction of metals.
- Inorganic acids have been commonly used as leach reagent in these studies
- Organic acids have also been applied as leach reagents in recent years
- ***Alkaline leaching acts generally more selective. In addition, it is considered to be cost-effective, simple and easy to be operated and managed to extract zinc***

Sample Type	Optimal Condition	Zn Removal, %	Fe Loss, %	Reference
EAF dust (17.05% Zn)	1 M H_2SO_4 , 80 ◦C, 1 h.	87	up to 40%	**Kukurugya, Hydrometallurgy 2015, 154, 20–32**
EAF dust (26.95% Zn)	2.35 M H_2SO_4 , 25 ◦C, 1 h.	79	4	**Kul, MMet. Soc. China 2015, 25, 2753–2762.**
BOF sludge (2.74% Zn)	1 M H_2SO_4 , 80 ◦C, 15 min.	70	up to 60%	**Trung, Z.H.; Hazard. Mater. 2011, 192, 1100–1107.**
BOF sludge (0.77% Zn)	1 M H_2SO_4 , 80 ◦C, 15 min (microwave assisted).	86	4	**Veres, J.; Hydrometallurgy 2012, 129–130, 67–73.**
EAF dust (20.32% Zn)	3 M H_2SO_4 , 60 ◦C, 1.5 h.	80	45	**Oustadakis, P.; Hazard. Mater. 2010, 179, 1–7.**
EAF dust (29.1% Zn)	1 M H_2SO_4 , 50 ◦C, 1 h.	72		**Shawabkeh, R.A; Hydrometallurgy 2010, 104, 61–65.**
EAF dust (20.9% Zn)	1.2 M H_2SO_4 , 80 ◦C, 1 h.	80	20	**Havlik, T.; Hydrometallurgy 2005, 77, 41–50.**

Zn removal is >70% but the iron loss has a great variability (4% to 60%), which could be due to the different composition between each material

Ref. Zinc Recovery from Steelmaking Dust by Hydrometallurgical Methods; Piotr Palimaka et al; Metals 2018, 8, 547; doi:10.3390/met8070547

Ref. Oxidative Leaching of Zinc and Alkalis from Iron Blast Furnace Sludge; Ma. de Jesus Soria-Aguilar; Metals 2019, 9, 1015; doi:10.3390/met9091015

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To collect knowledge on the selected treatment methods

Sample Type	Optimal Condition	Zn Removal, %	Fe Loss, %	Reference
BOS filter cake (6.52% Zn)	1.5 M butyric acid	66	<1	Wang, J.; J. Cleaner Prod. 2019, 209, 1–9.
EAF dust (33.2% Zn)	0.8 M citric acid, 40 ◦C, 1 h	100	8	Halli, P.; Miner. Eng. 2018, 124, 1–9.
EAF dust (33.2% Zn)	**1.2 M HCl or 90% aqua regia; room temperature, 168 h**	**>90**	**<5**	Halli, P; J. Cleaner Prod. 2017, 164, 265–276.
BOF dust (5.1% Zn)	0.2 M iminodiacetic acid, 20 ◦C, 2 h	63	6	Zhang, D.; Hydrometallurgy 2017, 169, 219–228.
EAF dust (24.24% Zn)	CaO pre-treatment: 1100 ◦C, 5 h, air atm. Leaching: 2M NaOH; 70 ◦C, 2 h	>95	-	Chaijraksa-Fujimoto, R.; Hydrometallurgy 2016, 159, 120–125.
EAF dust (29% Zn)	1 M (NH4)2CO3 , 20 ◦C, 2 h	49	-	Ruiz, O.; J. Hazard. Mater. 2007, 141, 33–36.
EAF dust (12.2% Zn)	6 M NaOH; 90 ◦C, 4 h	74	-	Dutra, A.J.B.; Miner. Eng. 2006, 19, 478–485.

Zn removal are obtained (up to 100%) with low Fe loss. The table also shows the alkaline leaching (hydroxide and carbonate solutions) that has been studied due to the insolubility of the ferric in these medium.

Ref. Oxidative Leaching of Zinc and Alkalis from Iron Blast Furnace Sludge; Ma. de Jesus Soria-Aguilar; Metals 2019, 9, 1015; doi:10.3390/met9091015

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To collect knowledge on the selected treatment methods

Experiment Methods stages– EAF dust ; Piotr Palimaka 2018

The leaching process in 3 stages:

1) **Leaching in water to remove chlorine from the material.**
2) **After water leaching, the material was vacuum filtered.**
3) **Residue was subjected to alkaline leaching.**

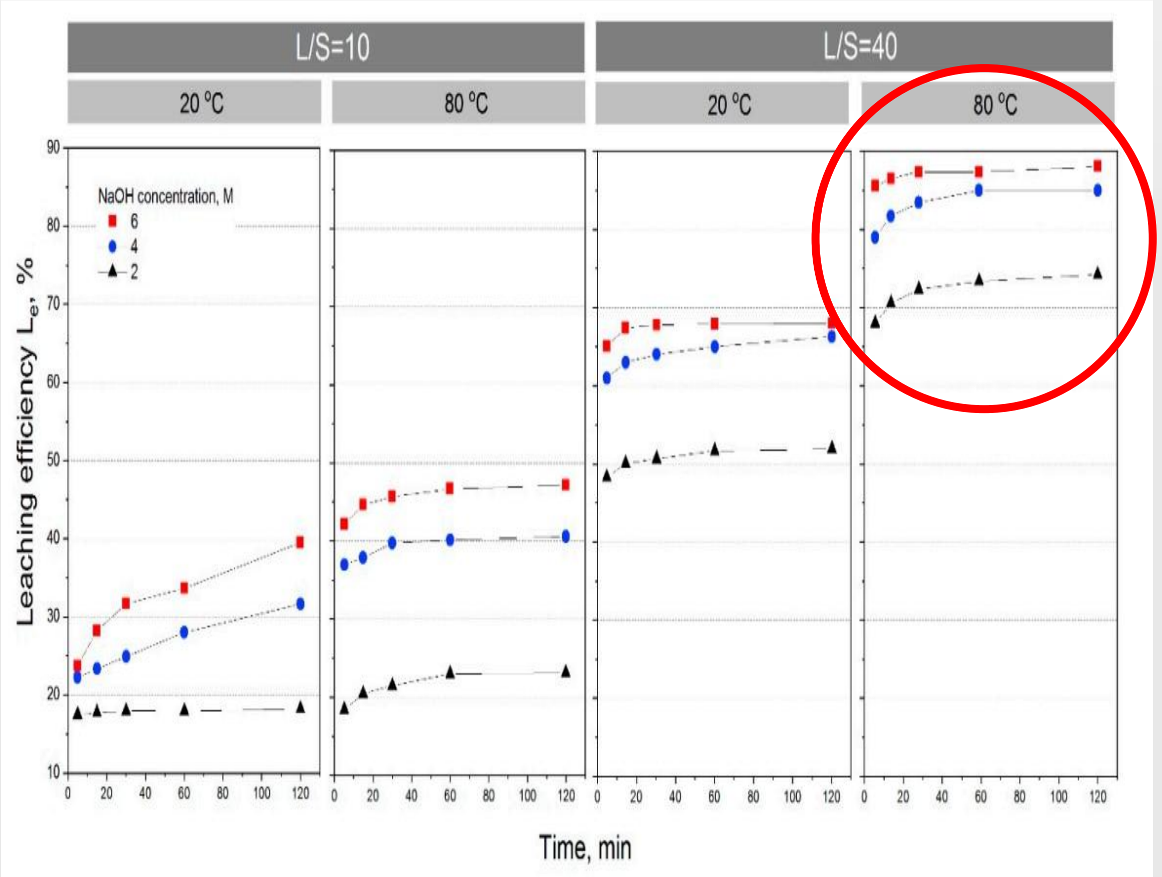
The variable parameters investigated for the leaching process included **NaOH concentration**, **Temperature** and the **liquid/solid ratio (L/S).**

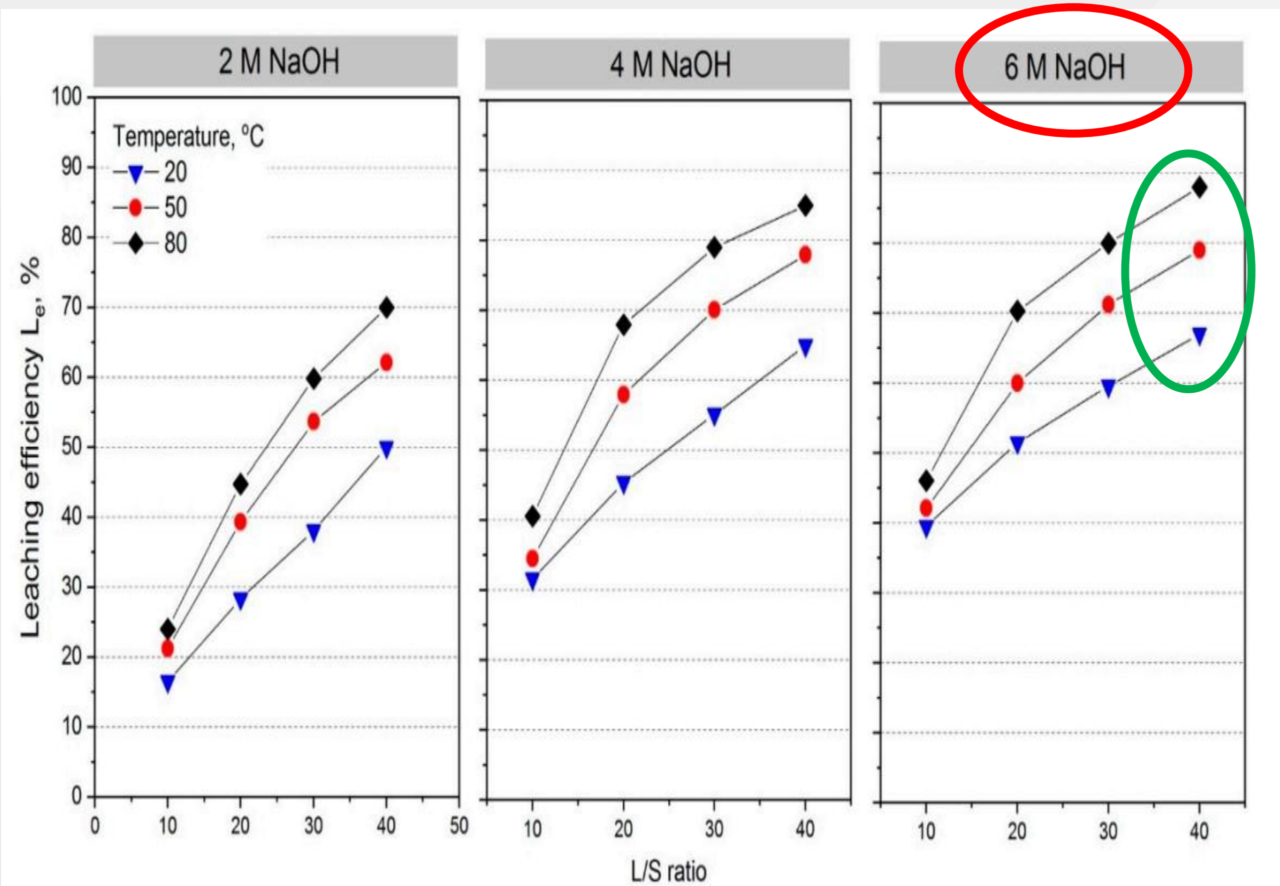
Parameter	Value
NaOH Concentration, M	2, 4, 6
Temperature, ◦C	20, 50, 80
Liquid–solid ratio, cm3/g	10, 20, 30, 40
Stirring speed, rpm	400
Time, min	120

Ref. Zinc Recovery from Steelmaking Dust by Hydrometallurgical Methods; Piotr Palimaka et al; Metals 2018, 8, 547; doi:10.3390/met8070547

To collect knowledge on the selected treatment methods

<u>Results – EAF dust leaching ; Piotr Palimaka 2018</u>





Ref. Zinc Recovery from Steelmaking Dust by Hydrometallurgical Methods; Piotr Palimaka et al; Metals 2018, 8, 547; doi:10.3390/met8070547

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Extrac zinc by Leaching BF, and EAF dust and BF and BOF Sludge with NaOH at RINA CSM laboratory

BF Dust
BF Sludge

→

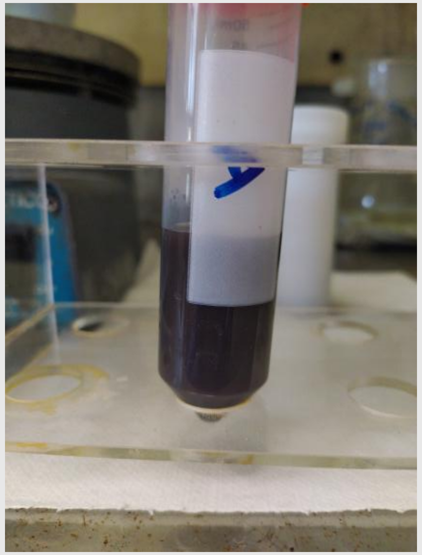
Phase 1 leaching in water to remove chlorine from the material.
Liquid/solid ratio = 20
Temperature = 60 ◦C.
Time = 120 min

→

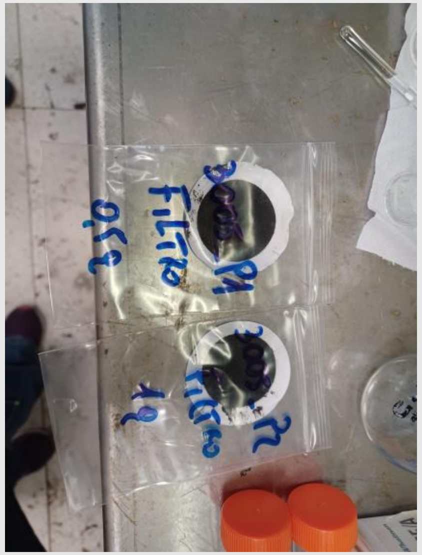
Phase 2 leaching in NaOH to extract Zinc
Sodium Hydroxide concentration = 6 M
Liquid/solid ratio (L/S) = 40
T= 80 °C
Time= 120 min

Sample A in Teflon Becher

Teflon becher A and B glass beaker placed on heating plate



Leaching solution Sample A after leaching test



Filter A and B after vacuum filtration of leaching solution

Filtered solutions of washes and leaching tests A and B

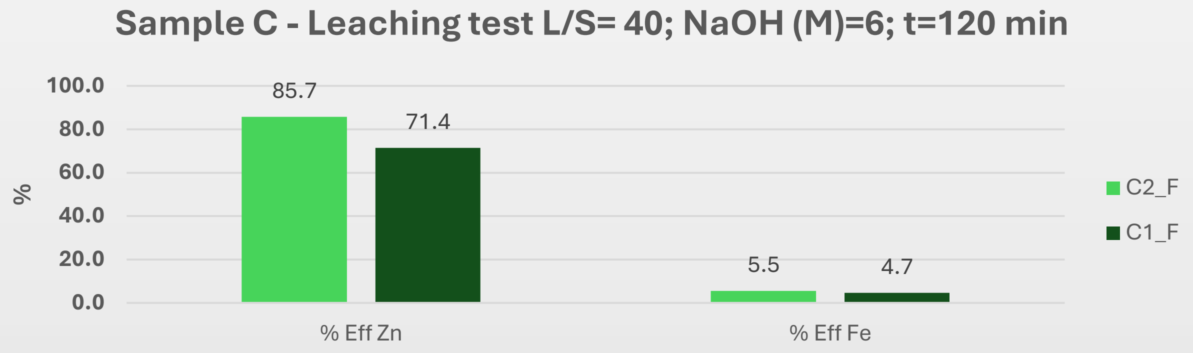
ZINCVAL

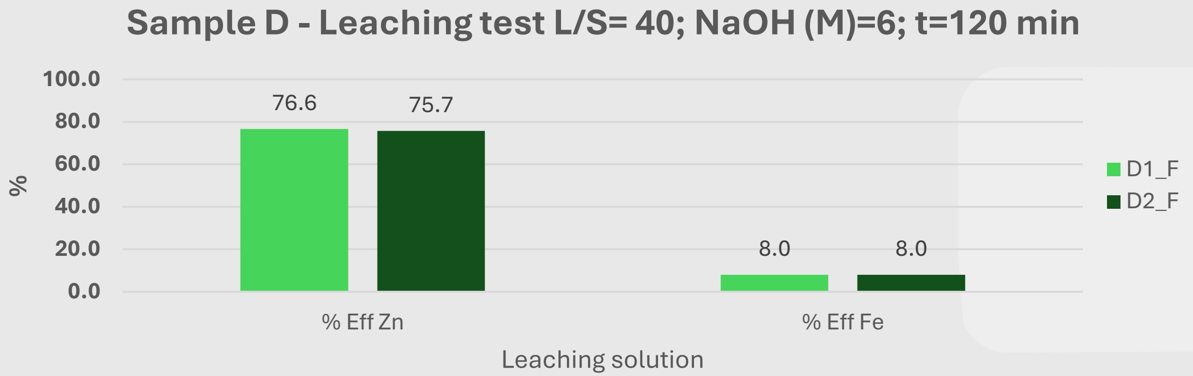
Extrac zinc by Leaching BF, and EAF dust and BF and BOF Sludge with NaOH at RINA CSM laboratory

Sample for leaching test	
Name	**Mass (g)**
Sample 1	**1**
Sample 2	**1**

Sample C – BF Dust %	
Zn	**Fe**
0,7	***39,3***

Sample D – BF Sludge %	
Zn	**Fe**
1,7	**22.56**





Further investigation:

- **Leaching sample G – EAF Dust with sodium hydroxide solution in same condition**
- **Evaluate process efficiency by reducing time, decreasing temperature, or sodium hydroxide concentration**

The efficiency of zinc extraction into the solution was calculated from ***Le = (mZn,t/mZn,0) × 100%***

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RINA CSM contribution to ZincVal Project

Design recipes and methods for producing Agglomerates of EAF dust for recycling back into process

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Design recipes and methods for producing Agglomerates of EAF dust for recycling back into process

Objective: **CSM** and **Ori Martin** will design recipes and methods for producing agglomerates of EAF dust for recycling back into the EAF to reach zinc contents above the threshold set by zinc smelters.

Methodology:

- **Use of about 20% biochar as a renewable reducing agent**
- **Binder selection**
- **Agglomeration method to meet the process and slag formation needs under present production conditions**

Initial tests will be conducted on laboratory scale.
The **produced agglomerates will be characterized in term of cold mechanical resistance and melting behavior in CSM laboratories.**

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Funded by
the European Union

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Research Fund for Coal & Steel