UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

AGGREGATES FROM ELECTRIC ARC FURNACE SLAG AS MATERIAL FOR SUB-BALLAST LAYER, ENVIRONMENTAL CONSIDERATIONS

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ÁRIDO SIDERÚRGICO EN CAPAS DE SUB-BASE Y DE FORMA EN PLATAFORMAS FERROVIARIAS (ASICAP)

Steel slag aggregates in sub-ballast layers for railway platforms

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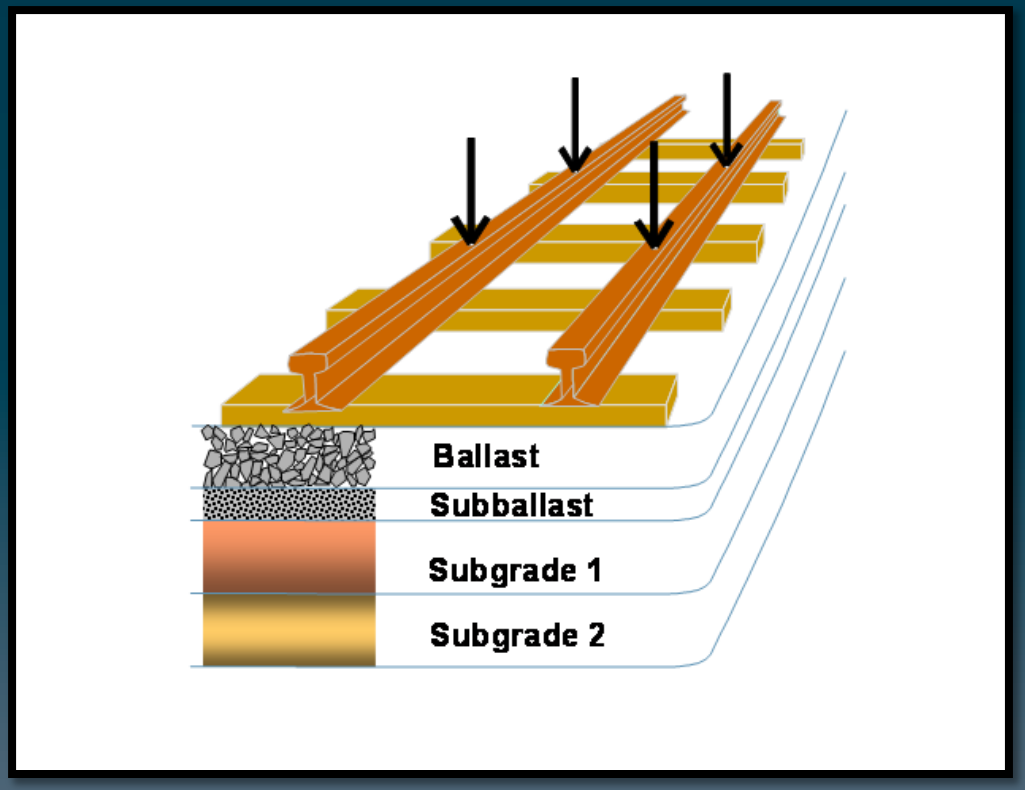
OBJECTIVE

The aim of this investigation is to assess the environmental impact of the use of blend material (electric arc furnace slag + fine calcareous aggregates) in subbalast layers (railway)

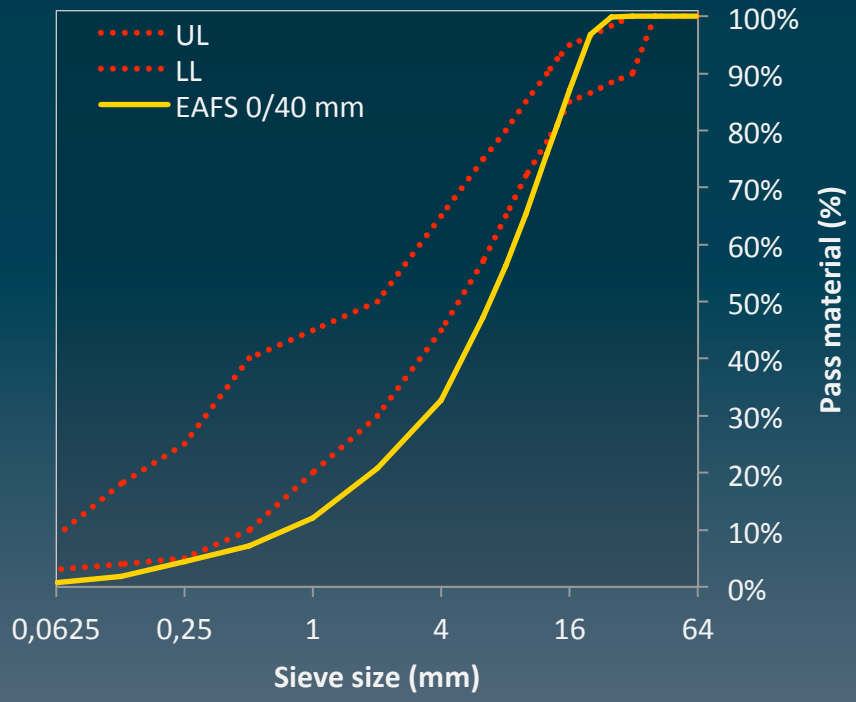
Railway Structure



(railwaysubstructure.org)

Sub-ballast Requirements

Size distribution



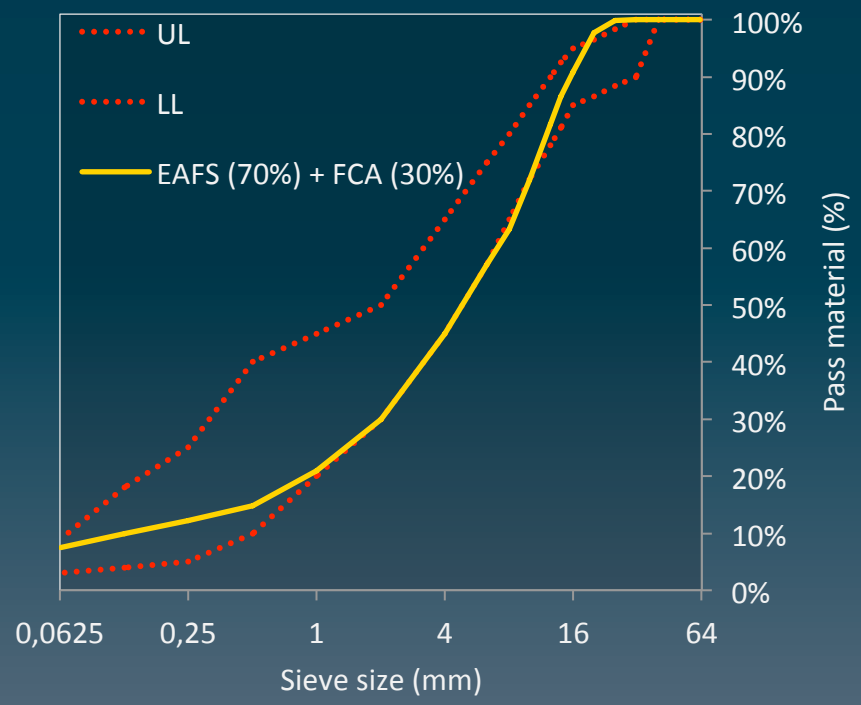
Water permeability

Limit WP <= 10^{-6} m/s

EAFS 0/40 mm WP > 10^{-6} m/s

Sub-ballast Requirements

Size distribution



Water permeability

Limit WP <= 10^{-6} m/s

EAFS 0/40 mm (70%)

+

Fine calcareous aggregate 0/16 mm (30%)

WP = $4{,}0 \times 10^{-6}$ m/s

EAFS (70%) + FCA (30%) = AM

Materials Characterization

Chemical composition (%)

	EAFS 0/40 mm	FCA 0/16 mm
LOI	---	45,17
Fe_2O_3	38,98	0,76
CaO	21,68	31,00
SiO_2	11,65	2,59
Al_2O_3	8,27	0,79
ZnO	4,86	---
MnO	4,59	0,07
SO_3	3,76	0,13
MgO	2,75	19,35
Cr_2O_3	1,88	---

Mineralogical composition

EAFS 0/40 mm

Wuestite

Gehlenite

Magnetite

CalciumSilicate

Lime

Portlandite

Brucite

Fine calcareous aggregate 0/16 mm

Calcite

Dolomite

Quartz

Environmental Impact Study

Leaching test

The maximum availability test (NEN 7371)

Compliance test (EN 12457-2)

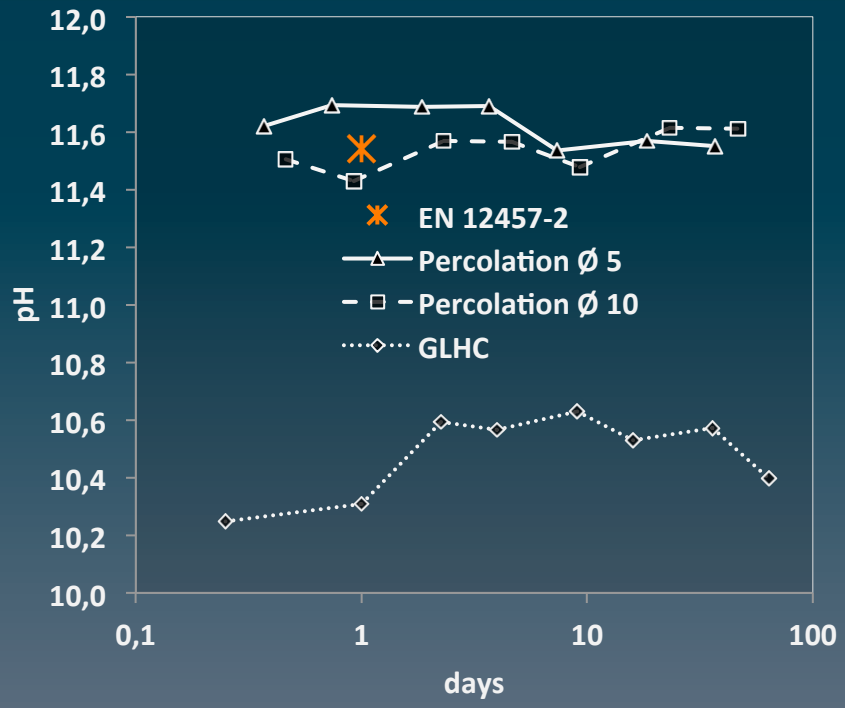
Characterization test

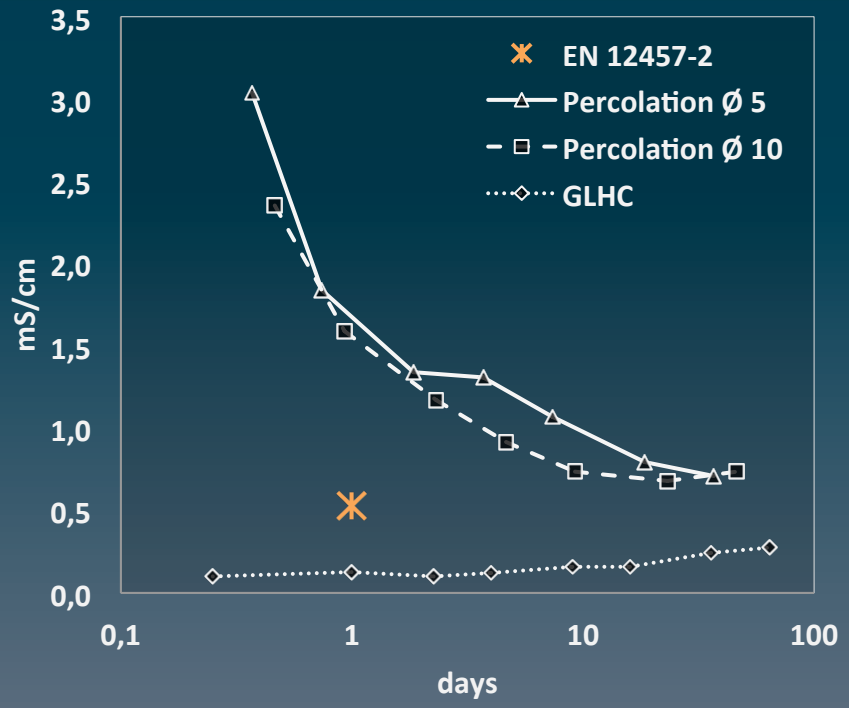
- Percolation with and without size reduction (CEN/TS 14405)
- Granular low hydraulic conductivity (GLHC) (CEN/TS 16637-2)

Environmental Impact Study

Results

pH and electrical conductivity

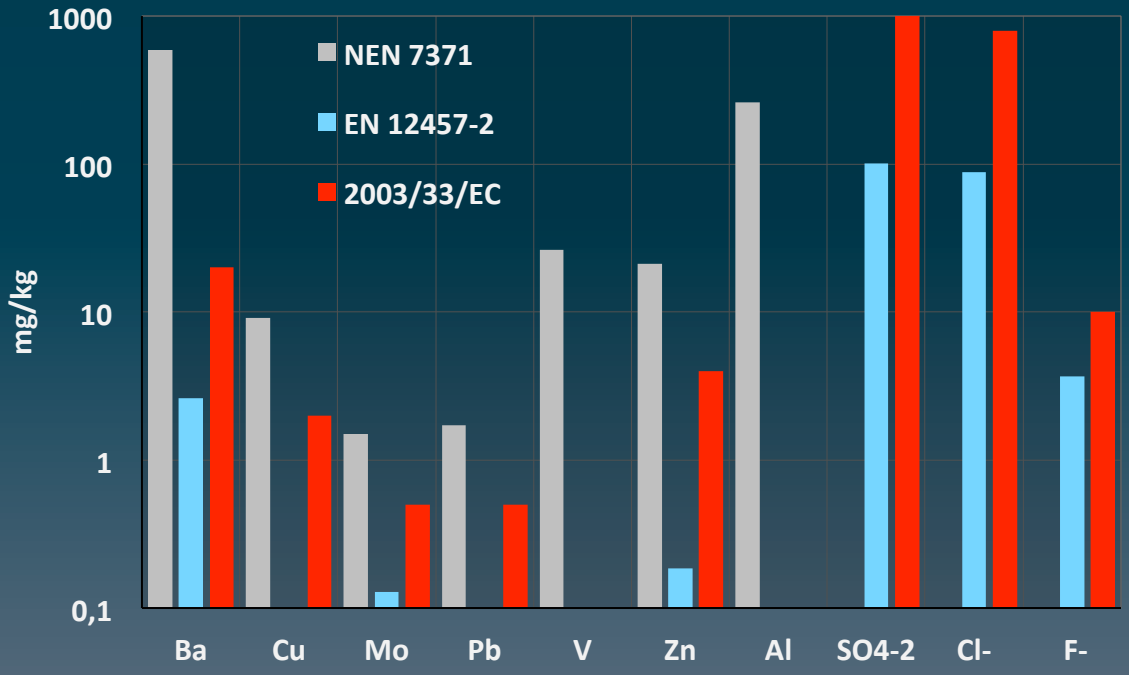




Environmental Impact Study

Results

Release of constituents in Compliance and Maximum Availability test

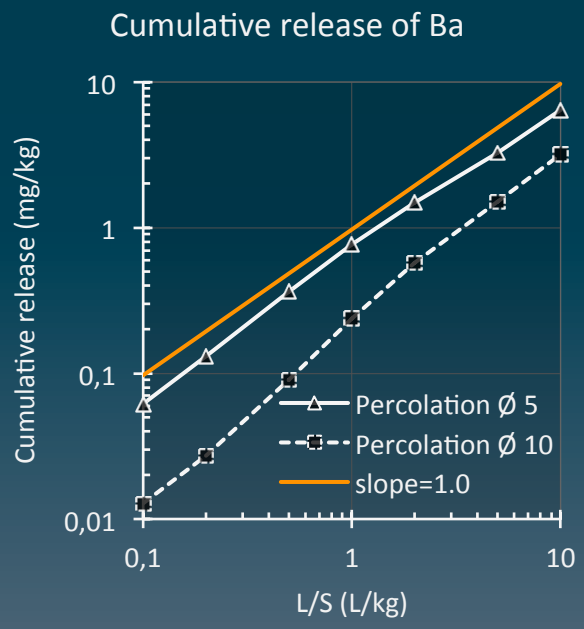


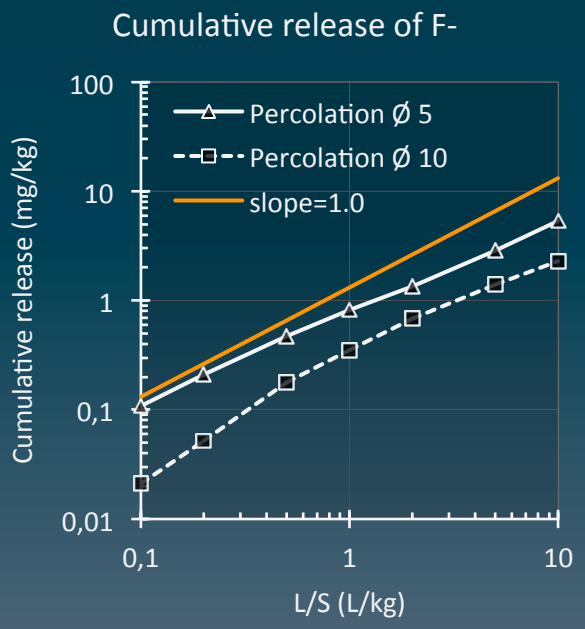
Legal limit defined in the Directive 2003/33/EC for inert material

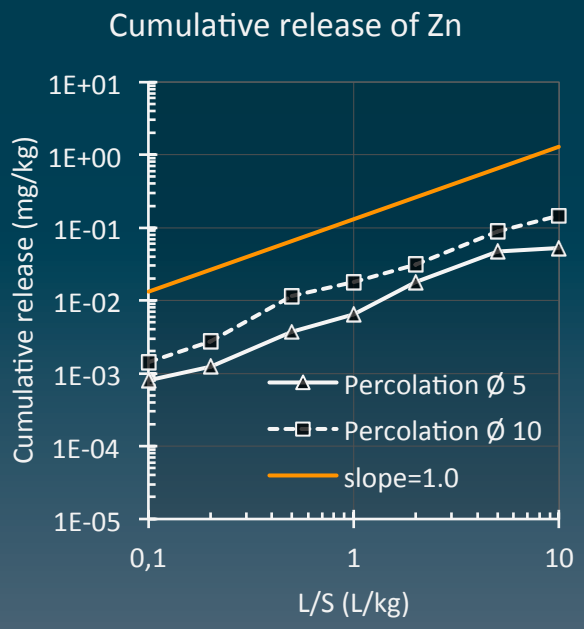
Environmental Impact Study

Results

Percolation (< 4 mm and < 25 mm)





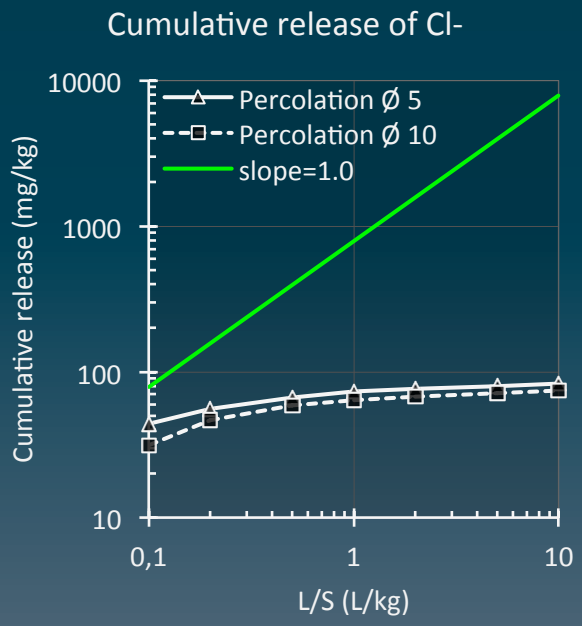


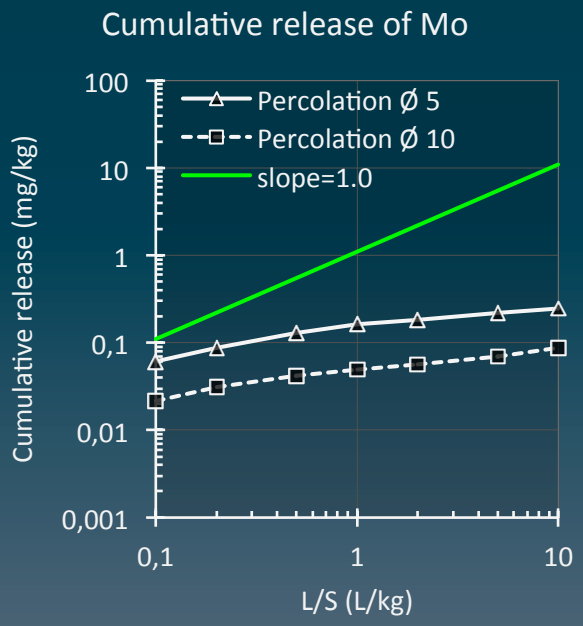
Main mechanism for the release is dissolution

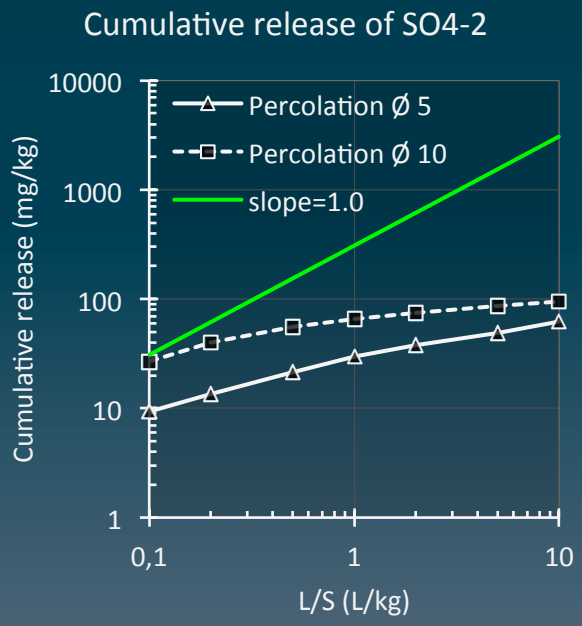
Environmental Impact Study

Results

Percolation (< 4 mm and < 25 mm)



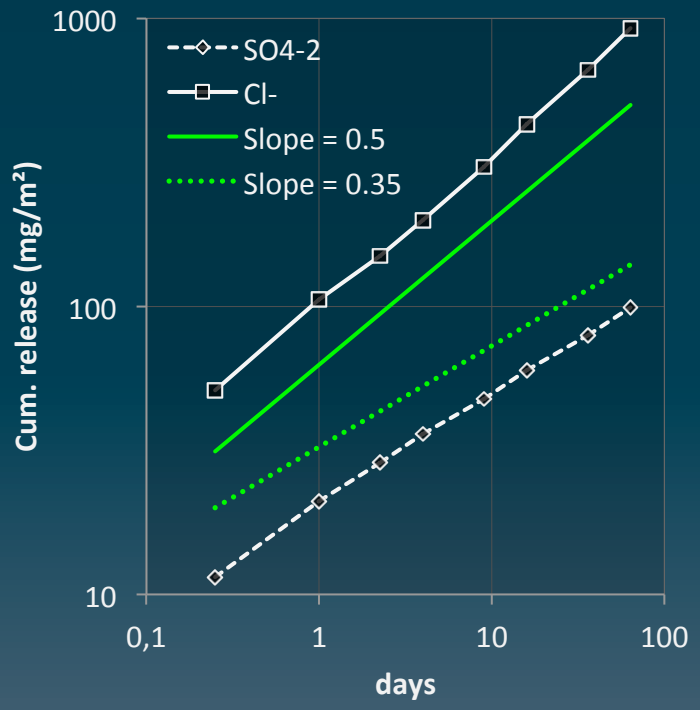


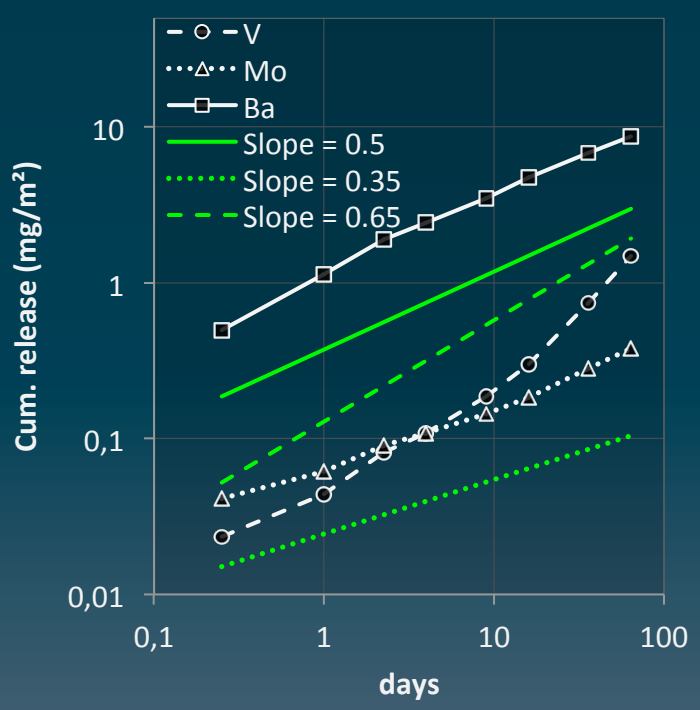


Main mechanism for the release is wash out

Environmental Impact Study

Results
GLHC





Slope Up 0,65 = dissolution

Slope between 0,35 and 0,65 = diffusion

Slope lower 0,35 = washing or depletion

Analysis following the procedure of Annex B, from CEN/TS 166637:2014

Conclusions

In accordance with Decision 2003/33/CE the aggregates mixture (AM) could be considered as a waste at inert landfill

Percolation and GLHC tests can be applied to the mixture. The pH value has been mainly constant along the test

Conclusions

The release mechanism is specific to each species and differs between the executed tests

It has been confirmed that the maximum particle size has an influence on the release quantity for percolation tests

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Thank You For Your Attention

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