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Characterization of road sweeping waste in view of developing specific strategies to enhance its valorisation

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- European Commission's commitment towards a circular economy will greatly affect waste management policies and strategies

- Targets for 2030 reported in current revised legislative proposals:
  - MSW landfilling <10% of residual MSW
  - MSW landfilling banned for separately collected fractions
  - material recycling >65% of MSW

- Achievement of these targets very challenging, especially for Southern and Eastern European countries, which still depend greatly on landfilling.

- In Italy, waste management strategies applied and recycling rates achieved vary greatly on a Regional basis.
- 2012 target of 65% of separate collection set in order to promote material recycling and landfill avoidance.
- Actual 2016 separate collection rates: national level 52.5%, but:

  - Northern Italy: 64.2%
  - Central Italy: 48.6%
  - Southern Italy: 37.6%

Road sweeping waste make up **3-5%** of MSW
For Italy around 900.000-1.500.000 t/year

- **EU waste code: 200303**
- **Heterogenous waste**
- **Composition** affected by different factors (i.e..: season, location,road type)

Untill recently, in Italy road sweeping waste disposed of in non-hazardous landiflls

Recently: **New treatment plants aimed mainly at inert materials recovery**

Recovery rates (2016): 86% (North) – 10% (Central) – 4% (South)

	Recovery rates of inert materials from road sweeping waste (ton)			
	North	Center	South	Italy
Road sweeping waste to recovery	184.600	22.420	8.440	215.460

Contribution to separate collection: 2% increase in 2016

2016 Data– Report Rifiuti ISPRA

- Providing more information on road sweeping waste collected from a small-medium sized municipality of Central Italy, by

- analyzing their material and chemical composition,
- assessing their leaching behavior as a function of particle size,

- On the basis of the results of the characterization analyses, testing a treatment for washing and separating the organic rich fraction from the inert one for several particle size classes.

- Identifying a simplified treatment layout feasible also for small size towns in Central/Southern Italy, minimizing transport (e.g. 10 ton/d capacity).

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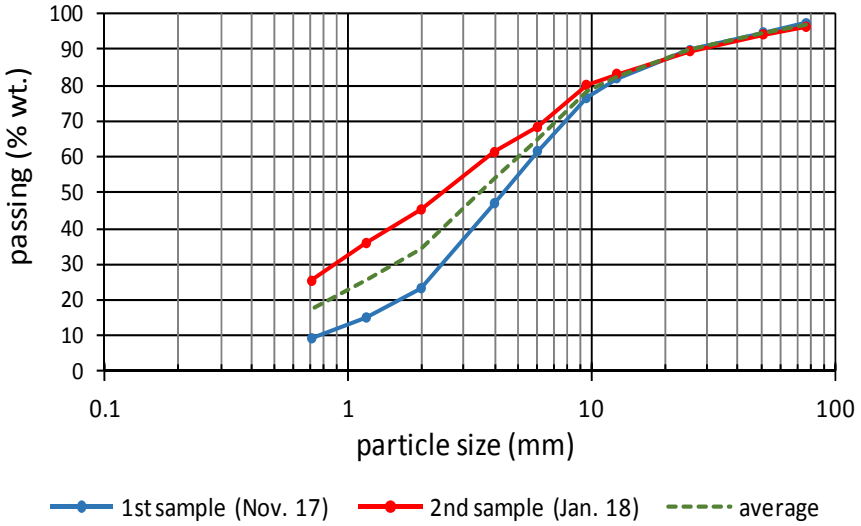
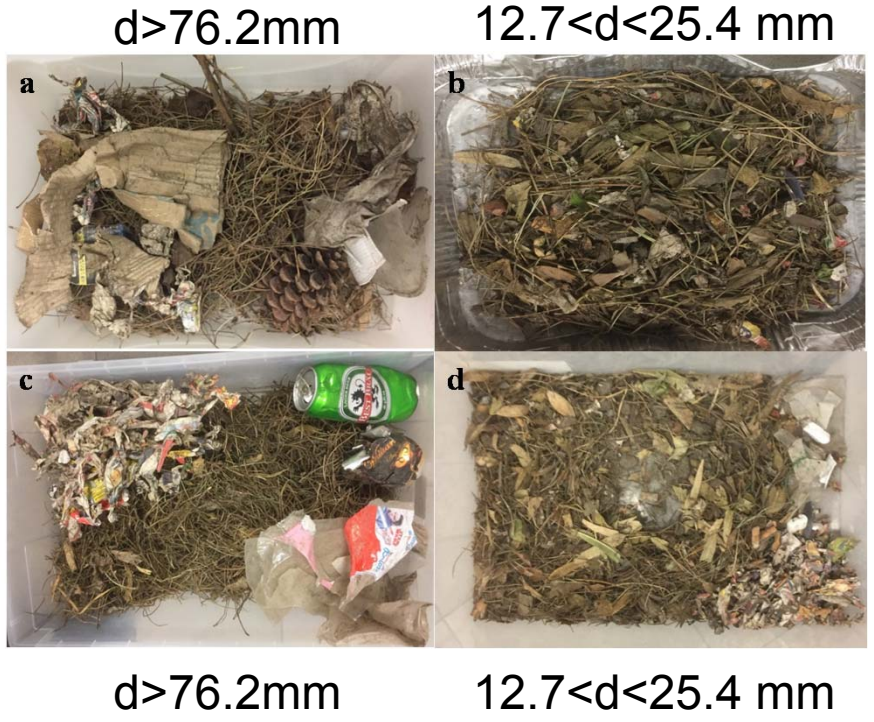
Sampling and particle size distribution

	Sample 1: Nov 17	Sample 2: Jan 18
Sample weight	22,4 kg	17,9 kg
Rain	5 on 7 days	2 on 7 days
Moisture	17,13 %	15,23 %

Particle size distribution:





Characterization

		Analyzed fractions		Legislation and limit values considered as reference
		1st sample (Nov. 2017)	2nd sample (Jan. 2018)	
Sample analysis		***Total content analysis***		
	Main and trace element contents (EPA method 3050B) (mg/kg)	d < 0.7 mm 0.7 ≤ d < 1.19 mm 1.19 ≤d < 2 mm	d < 0.7 mm 0.7 ≤ d < 2 mm	It. Lgs. Decree 152/06 [8] Soil contamination threshold concentrations for residential areas
	TOC (% wt.)	d < 0.7 mm 0.7 ≤ d < 1.19 mm 1.19 ≤ d < 2 mm 2 ≤ d < 4 mm 4 ≤ d <6 mm 6 ≤ d < 9.52 mm	d < 0.7 mm 0.7 ≤ d < 2 mm 2 ≤ d < 4 mm 4 ≤ d <6 mm 6 ≤ d < 9.52 mm	It. Min. Decree 27/9/2010 [9] Waste acceptance criteria for inert waste landfills
Leaching		***Leaching behavior***		
	Eluate contents of main and trace elements and of chlorides and sulfates (EN 12457_2) [10] (mg/l)	d < 0.7 mm 0.7 ≤ d < 1.19 mm 1.19 ≤ d < 2 mm 2 ≤ d < 4 mm 4 ≤ d <6 mm 6 ≤ d < 9.52 mm	d < 0.7 mm 0.7 ≤ d < 2 mm 2 ≤ d < 4 mm 4 ≤ d <6 mm 6 ≤ d < 9.52 mm	It. Min. Decree 186/2006 [11] Limit values for reuse of non hazardous waste under specific conditions
	DOC (mg/l)	d < 0.7 mm 0.7 ≤ d < 1.19 mm 1.19 ≤ d < 2 mm 2 ≤ d < 4 mm 4 ≤ d <6 mm 6 ≤ d < 9.52 mm	d < 0.7 mm 0.7 ≤ d < 2 mm 2 ≤ d < 4 mm 4 ≤ d <6 mm 6 ≤ d < 9.52 mm	It. Min. Decree 27/9/2010 [9] Waste acceptance criteria for inert waste landfills

Material composition

	d> 76.2 mm		12.7<d<25.4 mm	
	1st sample (%)	2nd sample (%)	1st sample (%)	2nd sample (%)
organic fraction	73.4	78.2	24.9	90.5
plastics	1.7	1.6	0.5	0.2
paper and cardboard	17.5	14.0	1.4	3.5
metals	0.0	6.2	0.2	0.0
textiles	3.9	0.0	0.0	0.0
wood	3.5	0.0	0.0	0.0
glass	0.0	0.0	3.1	2.4
inert material	0.0	0.0	69.9	2.6
others (cigarette butts)	0.0	0.0	0.0	0.7

- d>76.2 mm: predominance of organic materials (i.e. pine needles, leaves and cones);
- 25.4<d<49mm: 80% organic materials
- 12.7<d<25.4mm: variable composition between samples 1 and 2.

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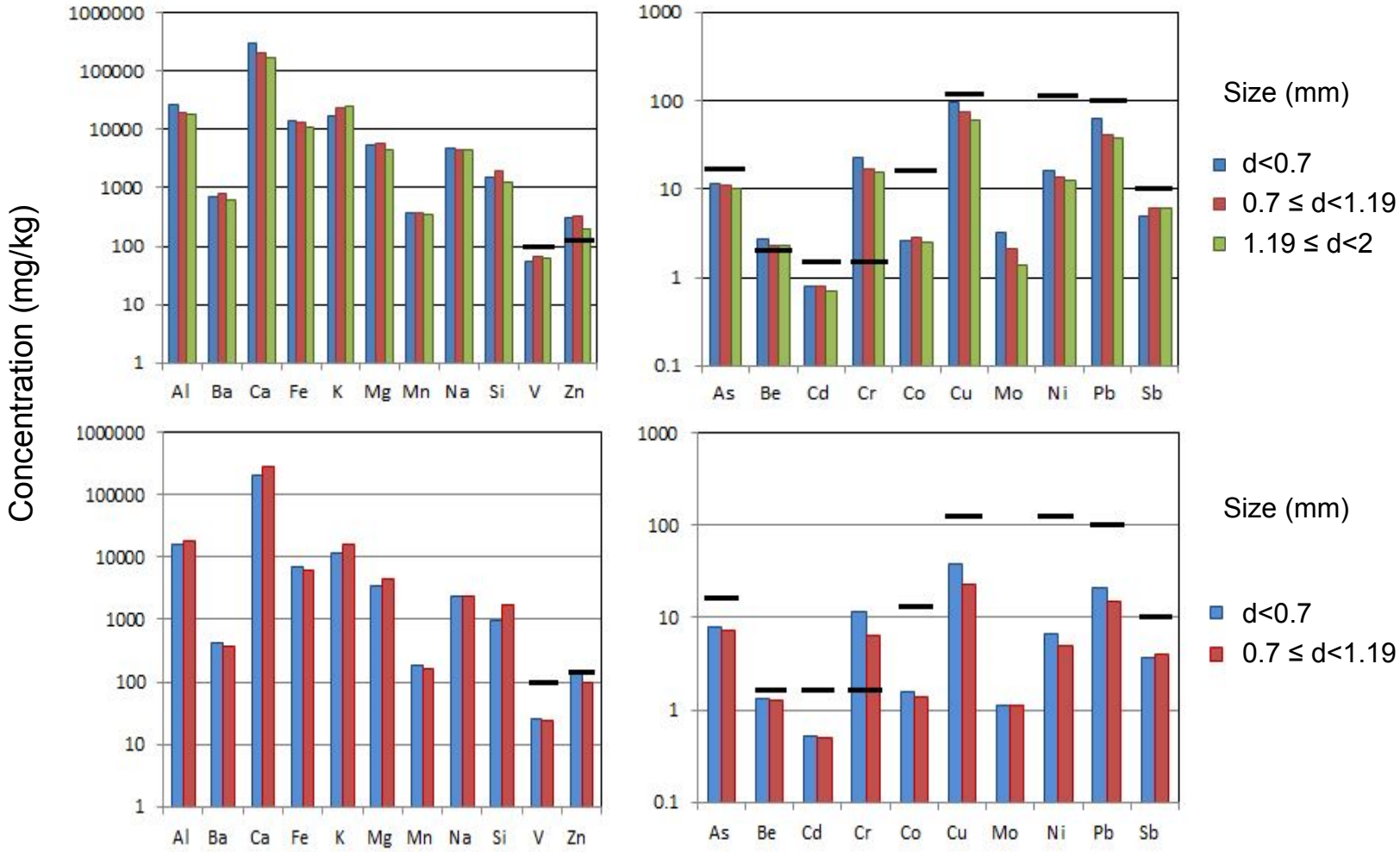
Concentration of heavy metals

SAMPLE 1

SAMPLE 2



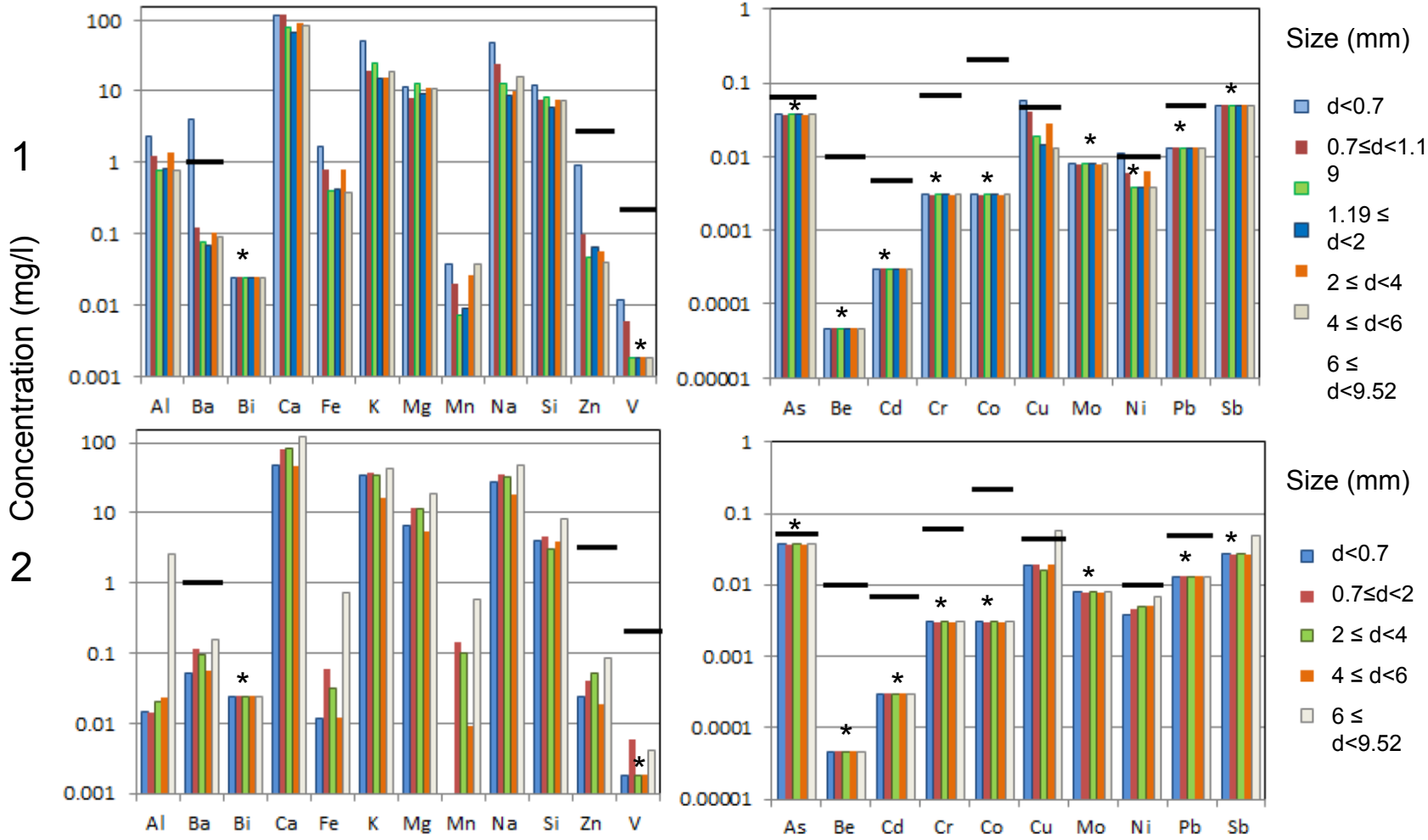
- Similar results for samples 1 and 2

- Values above soil screening values for Cr, Be and Zn.

Concentration of heavy metals (eluate)

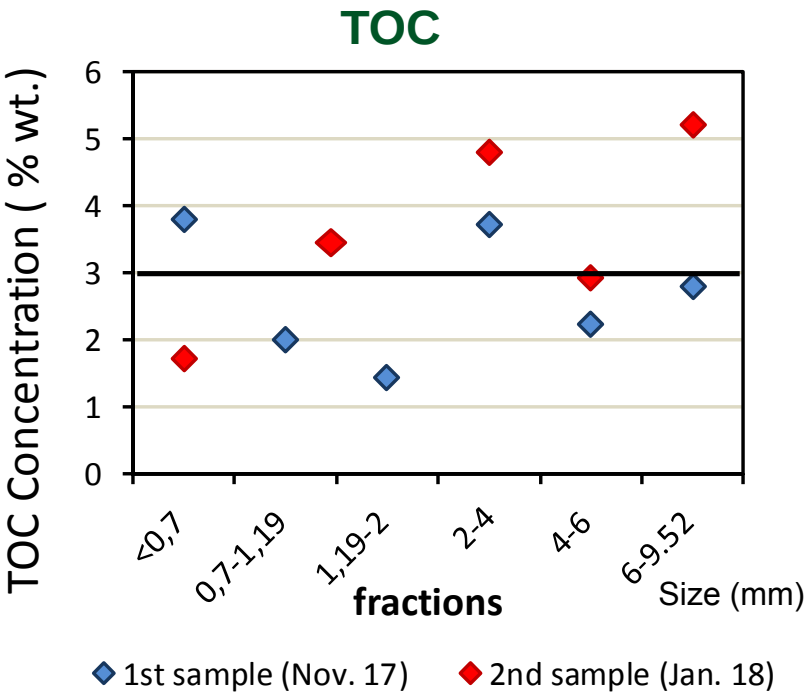
SAMPLE 1

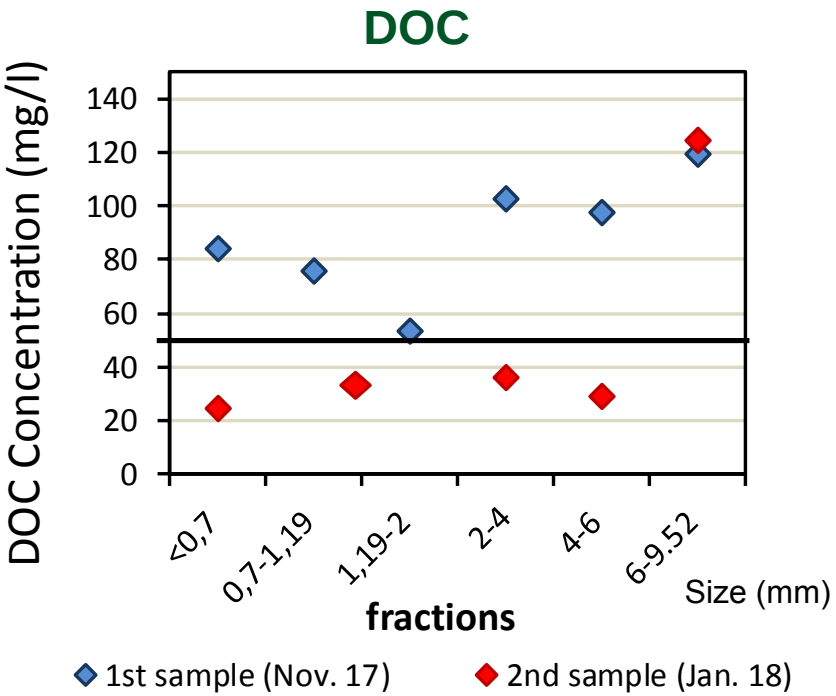
SAMPLE 2



- Sample 1: Ba, Cu, Ni above limit values for reuse (finest fraction).
- Sample 2: Cu above limit values for reuse (coarsest fraction)

TOC and DOC (eluate)





- TOC overall increasing with particle size for sample 2, no trend for sample 1
- TOC values crossing the limit values for waste reuse

- DOC around 1-2% of the measured TOC
- DOC above the limit for inert landfill (sample 1) and largest size of sample 2.

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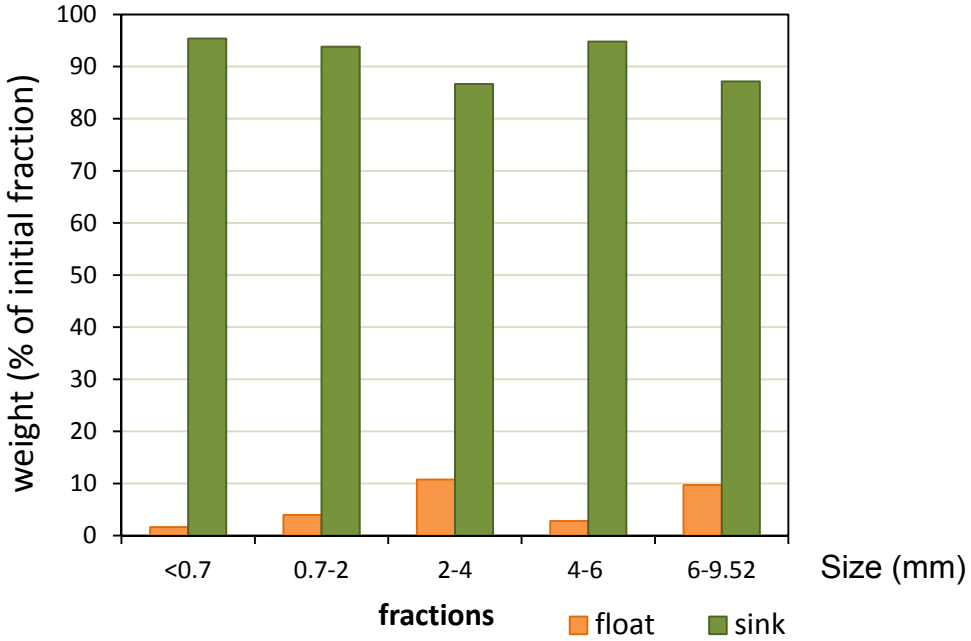
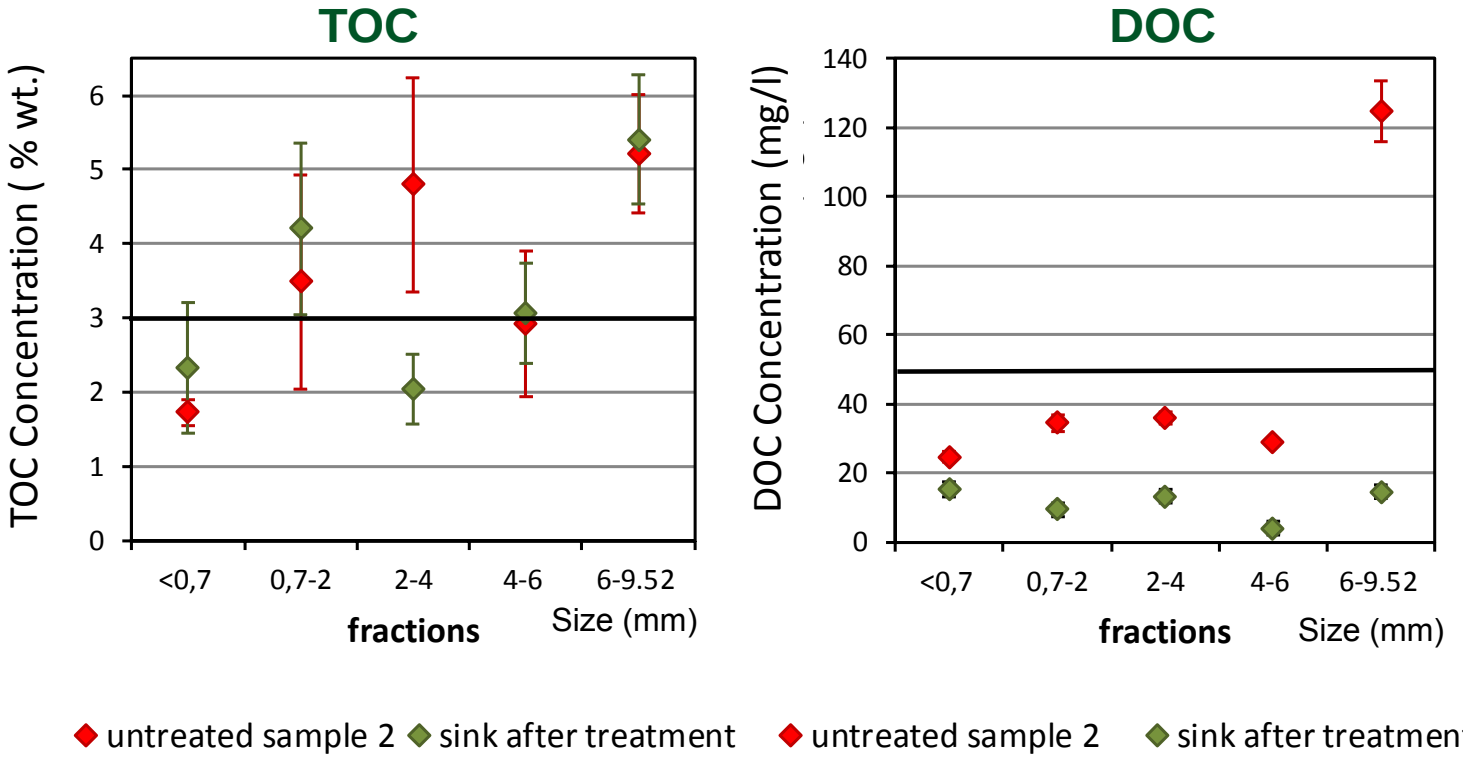
Lab scale washing/separation treatment



- Treatment aimed at obtaining a fraction with lower TOC/DOC
- 100 g samples of different PSDs of sample 2 in 1 l demi water
- 5 minutes stirring and 90 minutes settling (washing + gravity separation)
- Sink fraction prevailing in weight (87-95%)
- Both fractions recovered, dried and sent to analysis

DOC/TOC after washing/separation treatment



- TOC basically not affected by the treatment except for a reduction in sample 2-4mm.

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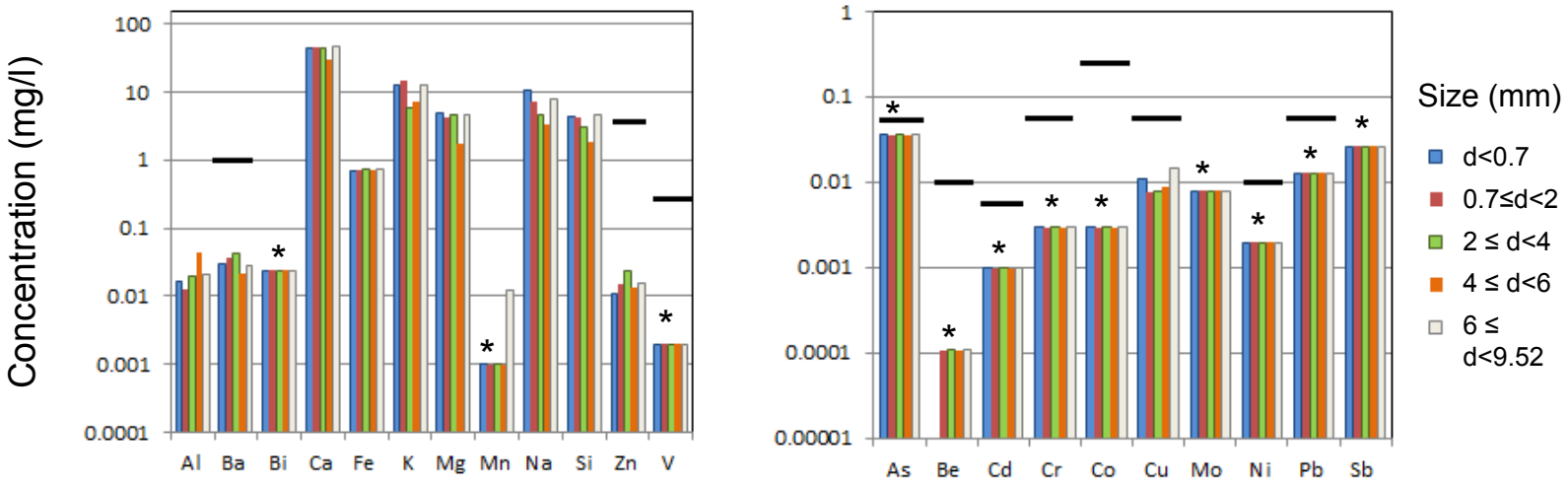
- DOC in the sink fraction always well below the limit values for inert waste landfills

- DOC in the float fraction (not shown) between 103 and 518 mg/l, i.e. one order of magnitude higher than for the sink fraction

Concentration of heavy metals (eluate) after washing/separation treatment



- Sample 2:

  before treatment: Cu above limit values for reuse (coarse fraction)

  after treatment: all parameters below limit values

  reduction of chlorides (from 25-70 of the sample to 10 mg/l of the sink)

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Conclusions

- Size separation not sufficient to obtain fractions suitable for reuse in construction applications
- The critical parameters for the recovery of specific fractions from both of the analyzed samples: TOC and DOC, Cr and Zn content, Ba and Cu release..
- The tested lab-scale washing/separation treatment proved effective in getting a sink fraction with acceptable DOC and leaching behaviour of heavy metals (TOC issue to be better understood)
- Proposed treatment layout (see next slide)

Conclusions: Proposed treatment layout