Construction and Demolition Waste Concentration in Water Jig, Air Jig and Sensor-Based Sorting

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Objectives

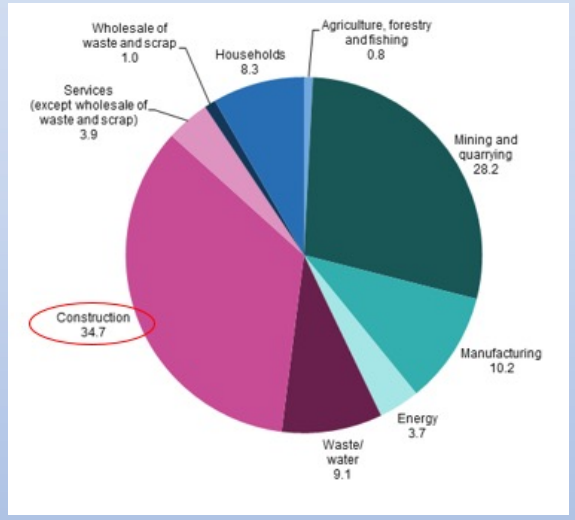
Technical comparison between the three most promising methods of CDW treatment:

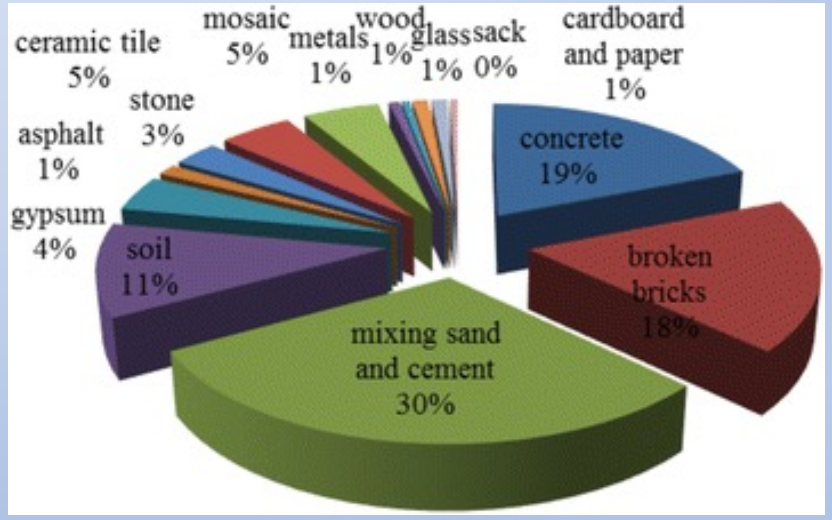
Water jig

Air jig

Sensor-based sorting

Construction and Demolition Waste





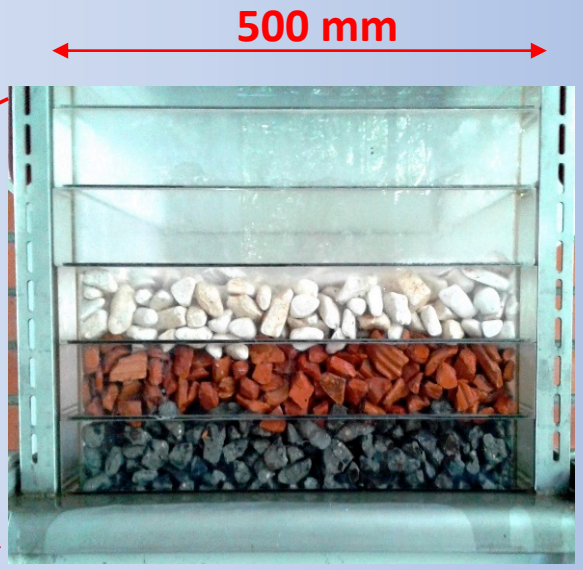
Samples

Tests carried out with the following materials (20x4 mm):

- **Concrete particles (type 30 MPa at 28 days)**
- **Brick particles (red ceramic, 8-hole bricks)**
- **Gypsum particles**

Equipment

Water Jig Allmineral - AllJig S 400/600X400®

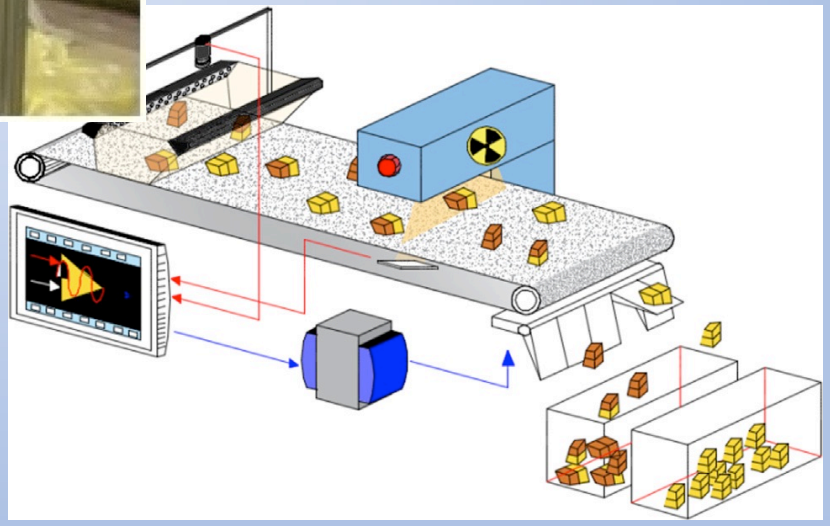


Equipment

Air Jig Allmineral - AllAir® S-500

Equipment

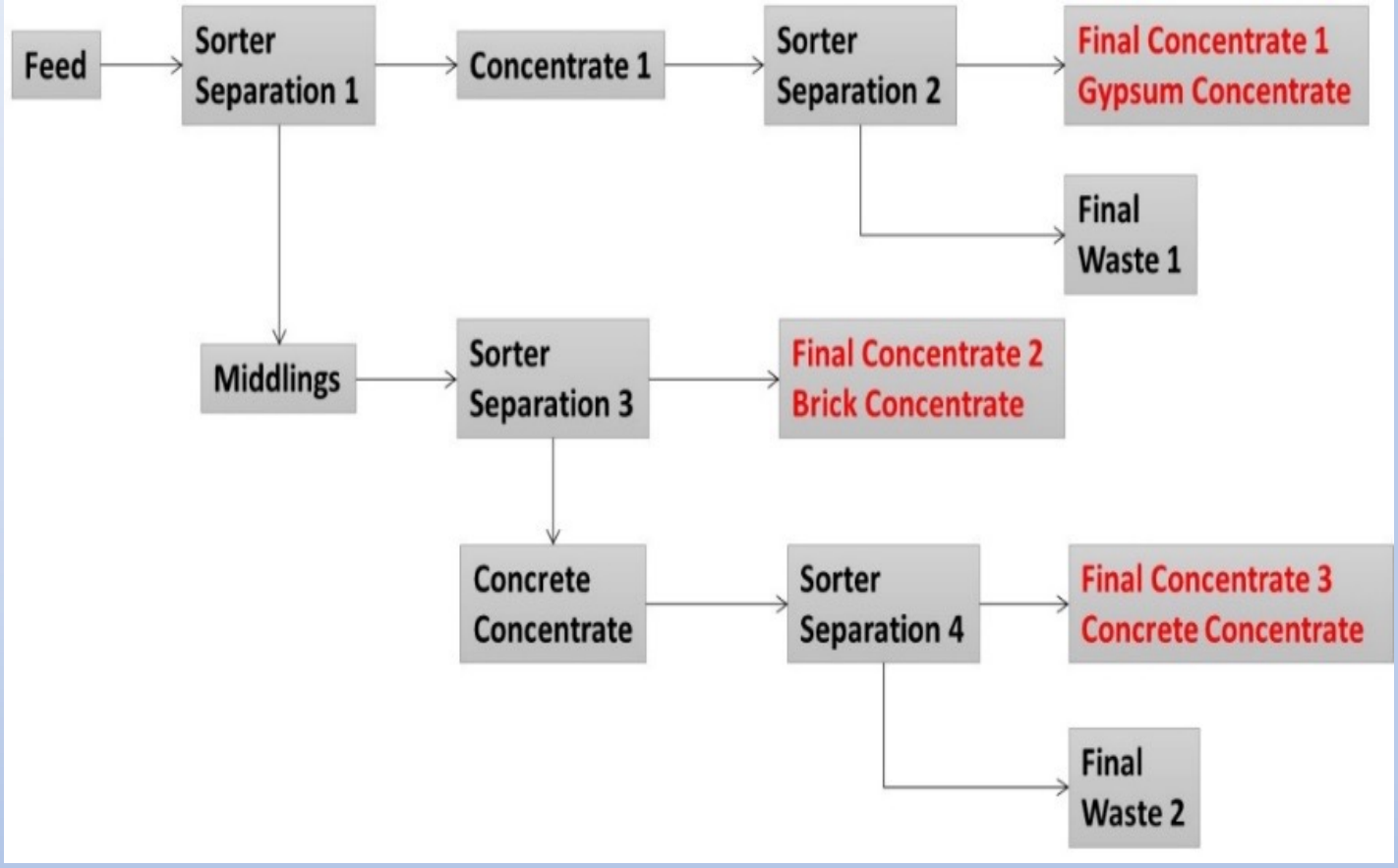
Lab-Sorter COMEX - MSX-400-VL-XR-3D



Two different sensor used:
DE-XRT - densities
CCD Color Camera

Equipment

Lab-Sorter COMEX - MSX-400-VL-XR-3D



Results

Water Jig

	Chamber		
Particles	1	2	3
Concrete (%)	91.9	12.8	0.4
Bricks (%)	8.0	82.1	10.0
Gypsum (%)	0.1	5.1	89.6
Total	100	100	100

Particle concentration of products

	Chamber			
Particles	1	2	3	Total
Concrete (%)	90.1	9.7	0.2	100
Bricks (%)	10.3	82.3	7.4	100
Gypsum (%)	0.1	7.2	92.7	100

Mass recovery in relation to the feed

Results

Air Jig

	Chamber		
Particle	1	2	3
Concrete (%)	80.2	26.7	0.7
Bricks (%)	19.2	63.8	9.1
Gypsum (%)	0.6	9.5	90.2
Total	100	100	100

Particle concentration of products

	Chamber			
Particle	1	2	3	Total
Concrete (%)	79.7	20.0	0.3	100
Bricks (%)	27.0	67.9	5.1	100
Gypsum (%)	1.5	16.5	82.0	100

Mass recovery in relation to the feed

Results

Sensor-based Sorting

	Final Concentrate Products		
Size Range (mm)	Gypsum (%)	Brick (%)	Concrete (%)
-19,1 +12,5	98.7	99.2	97.6
-12,5 +9,1	91.1	100.0	86.4
-9,1 +4,76	34.4	100.0	48.2
Total	93.3	99.4	95.5

Particle concentration of products

Results

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Particle concentration of products

Results

Comparison of the Results

	Water Jig		Air jig		SBS	
	Concentration	Mass Recovery	Concentration	Mass Recovery	Concentration	Mass Recovery
Concrete (%)						
Brick (%)						
Gypsum (%)						

Conclusions

- The tested equipment showed good results for concentrating CDW.
- The water jig was the equipment that presented the best performance.
- Despite the low separation efficiency, good particle concentration and mass recovery results were obtained in air jigs.
- The sensor sorting showed an excellent concentration of particles, but a separation circuit was used.

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References

A. Müller, S. N. Sokolova and V. I. Vereshagin, "Characteristics of lightweight aggregates from primary and recycled raw materials," Construction and Building Materials, 22, 703–712, 2008.

A. Müller and S. C. Angulo, "Determination of construction and demolition recycled aggregates composition, in considering their heterogeneity," Materials and Structures, 42:739–748, 2009.

M. Landmann, A. Müller, U. Palzer and B. Leydolph, "Limitations of Liberation Techniques for Mineral Construction and Demolition Wastes," in EURASIA 2014, Waste Management Symposium, Istambul, 2014.

B. Cazacliu, C. H. Sampaio, G. L. Miltzarek, C. O. P. L. Guen, R. Paranhos, F. Huchet and A. P. Kirchheim, "The potential of using air jigging to sort recycled aggregates," Journal of Cleaner Production, 66, 46-53, 2014.

A. Coelho and J. Brito, "Economic viability analysis of a construction and demolition waste recycling plant in Portugal – part I: location, materials, technology and economic analysis," Journal of Cleaner Production, 39, 338-352., 2013.

C. Medina, P. F. G. Banfill, M. I. Sánches de Rojas and M. Frías, "Rheological and calorimetric behavior of cements blended with containing ceramic sanitary ware and construction/demolition waste," Construction and Building Materials, 40, 822-831, 2013.

F. Rodrigues, M. T. Carvalho, L. Evangelista and J. Brito, "Physicalechemical and mineralogical characterization of fine aggregates from construction and demolition waste recycling plants," Journal of Cleaner Production, 52, 438-445, 2013.

D. Mendis, K. N. Hewage and J. Wrzesniewski, "Reduction of construction wastes by improving construction contract management: a multinational evaluation," Waste Management & Research, 31(10), 1062–1069, 2013.

References

M. M. Sabai, M. G. D. M. Cox, R. R. Mato, E. L. C. Egmond and J. J. N. Lichtenberg, "Concrete block production from construction and demolition waste in Tanzania," Resources, Conservation and Recycling, 72, 9–19, 2013.

H. Yuan, "A SWOT analysis of successful construction waste management," Journal of Cleaner Production, 39, 1-8, 2013.

C. Medina, W. Zhu, T. Howind, M. I. S. Rojas and M. Frías, "Influence of mixed recycled aggregate on the physical e mechanical properties of recycled concrete," Journal of Cleaner Production, 68, 216-225., 2014.

S. B. Ferreira, P. C. Domingues, S. M. Soares and G. Camarini, "Recycled Plaster and Red Ceramic Waste Based Mortars," IACSIT International Journal of Engineering and Technology, 7, nr.3, 2015.

M. Nasrullah, P. Vainikka, J. Hannula, M. Hurme and J. Kärki, "Mass, energy and material balances of SRF production process. Part 2: SRF produced from construction and demolition waste," Waste Management, 34, 2163–2170, 2014.

R. Silva, J. Brito and R. Dhir, "Properties and composition of recycled aggregates from construction and demolition waste suitable for concrete production".Construction and Building Materials 65 (2014) 201–217.

H. Yuan, W. Lu and J. Hao, "The evolution of construction waste sorting on-site," Renewable and Sustainable Energy Reviews 20, 483–490, 2013.

A. Tischer, M. Besiou and C. A. Graubner, "Efficient waste management in construction logistics: a refurbishment case study," Logist. Res. Vol.6, 159–171, 2013.

Thanks a lot!