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Looking for valorisation alternatives for the biomass bottom ash in road construction. Examples and lessons learnt from a field trial in the A68 highway construction project in Logroño, Spain

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9 October 2024 | Marseilles

Introduction

The biomass ash generation problem and the opportunity behind

Acciona Energy owns and operates 3 biomass power plants, producing 61MW and generating 32.000 tons of waste yearly. 2.000 tons are biomass fly ash, currently valorised in the fertiliser industry and 30.000 tons are slags partially valorised for clinker production, technosols production for mine rehabilitation projects and as general fill in landfills.

Nowadays, ACCIONA Energía is building a new power plant that will generate as much ash as the other three together, so finding more applications and markets for the ash is a must.



VALORIZATION MIX

87%

Of the generated waste

Bottom and fly ash account for most of the waste generated by ACCIONA Energía each year.

100%

Recovered

The recovery strategy deployed by the company makes it possible to reuse bottom ash in different sectors.

Introduction

PIONEERS IN BIOMASS SINCE 2002



■ **4 assets 111MW**

- | 61 MW in operation
- | 50 MW under construction



■ **100 persons**

- | ACCIONA workforce



■ **+ 1 Tm/minute**

- | 640,000 Tm/year



■ **850 GWh/year**

- | 8,000 hours of operation



■ **300 suppliers**

- | Supply of biomass



■ **500 direct jobs**

- | In the supply chain



Introduction

THERE IS NO SINGLE SOLUTION



HEIDELBERG
CEMENT

➤ **Cement industry**
Supply of silicon and calcium;
reduction of quarry material.



enusa

➤ **Degraded areas recovery**
Neutralization of acid soils and
potassium supply.



ROCKWOOL

➤ **Manufacture of insulating material**
Has fire-retardant and insulating
properties



reciclaes
la grulla

➤ **Fertilizer sector**
Supply of potassium to the field.
Production of mineral fertilizers.

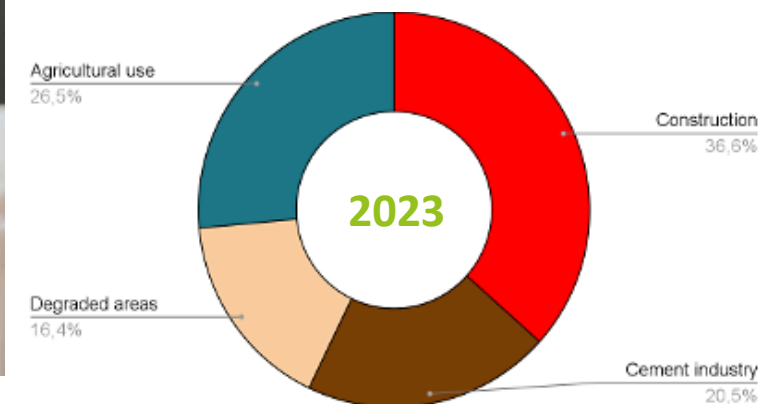
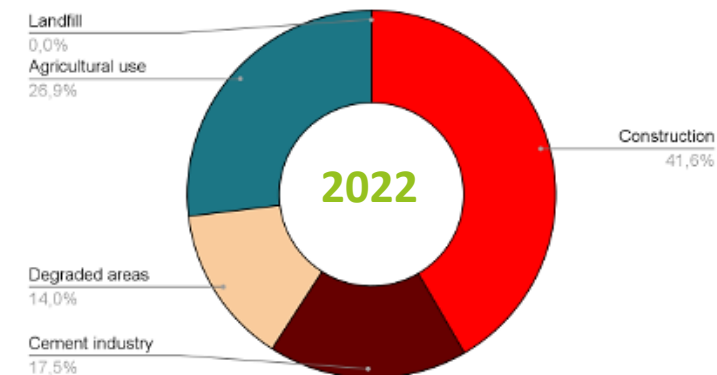


➤ **Construction Sector**
Replacement of quarry material on
roads and highways.



➤ **OTHERS: IN DEVELOPMENT PHASE**

BOTTOM ASH VALORIZATION MIX



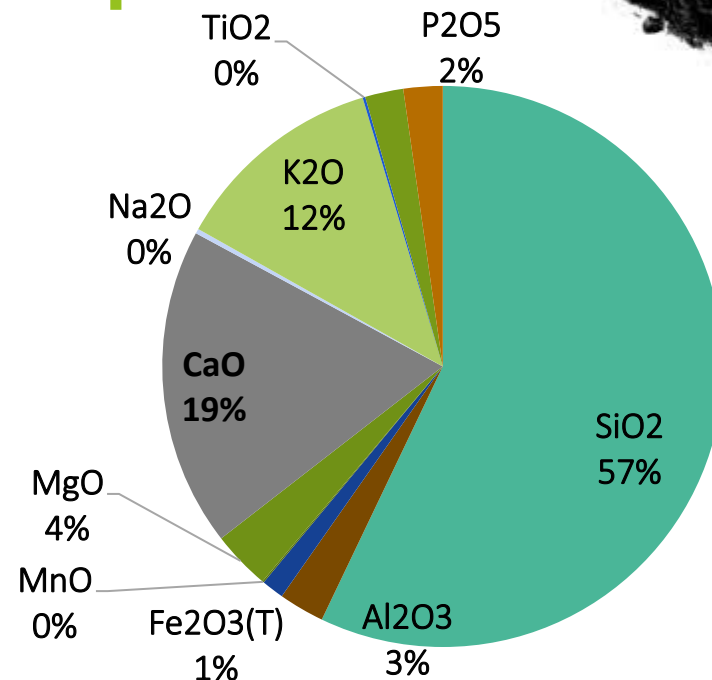
Biomass bottom ash. Nature and composition

What the biomass bottom ash are?

Inorganic residue after biomass combustion, consisting of non-combustible elements of the biomass + soil residues from baling



Composition



What are the positive properties of ash?

Paradigm shift: from risk/hazard of waste to positive material properties

CHEMICAL COMPOSITION

- Silicon, Calcium (cement, glass)
- Potassium (fertilizer)

CHEMICAL PROPERTIES

- High pH, alkaline (neutralization of acidic soils)
- Insulating properties

MECHANICAL PROPERTIES

- Good mechanic resistance (civil works - borrow material)

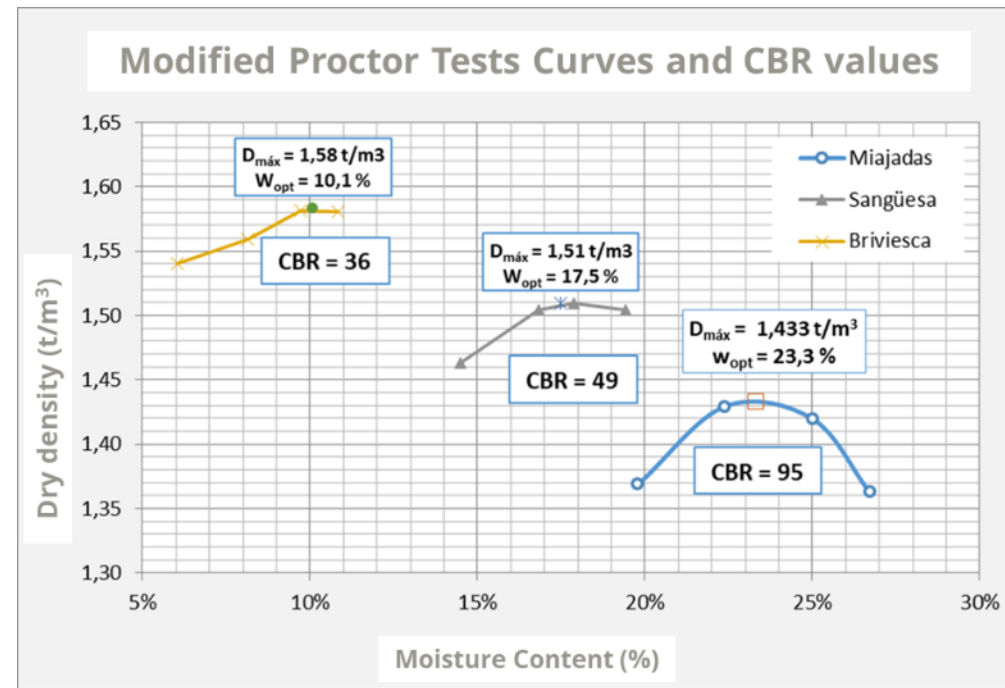
GRADING

- Good grading as soil structuring agent (agriculture)

Biomass bottom ash. Physical and mechanic properties

USE OF SLAGS IN CONSTRUCTION – “ECOARID”

There has been a long tradition of using ashes from coal-fired power plants on roads, but biomass slag has not. We have developed a project to assess biomass ash performance in 2 phases. The first one (lab scale), allow to assess the potential:

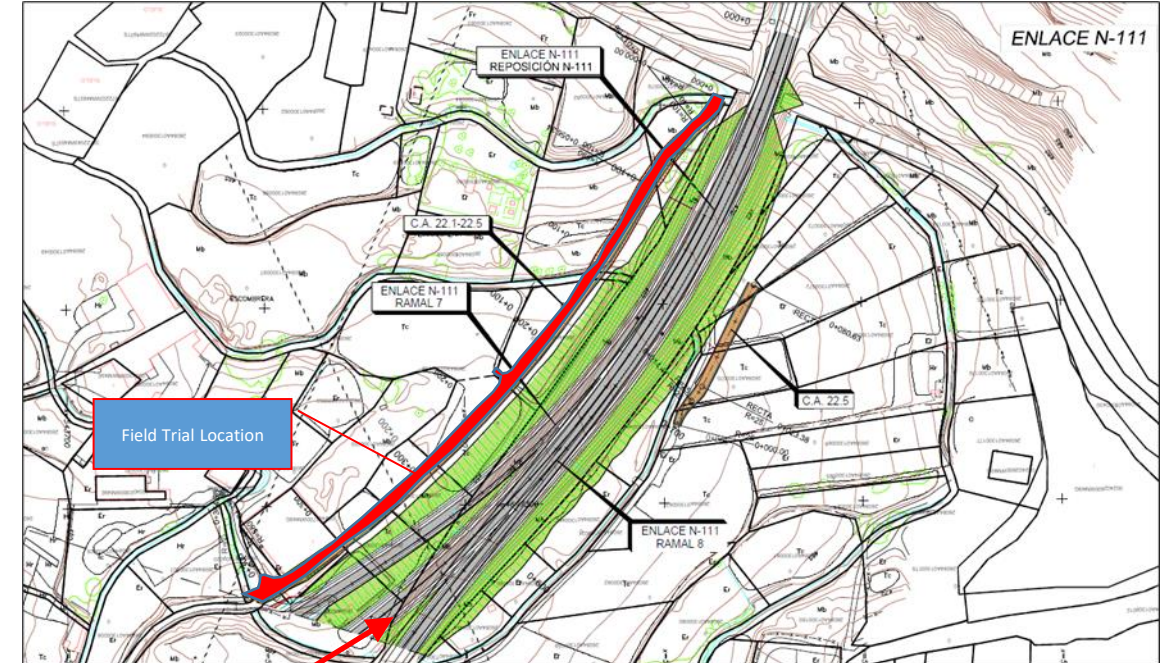
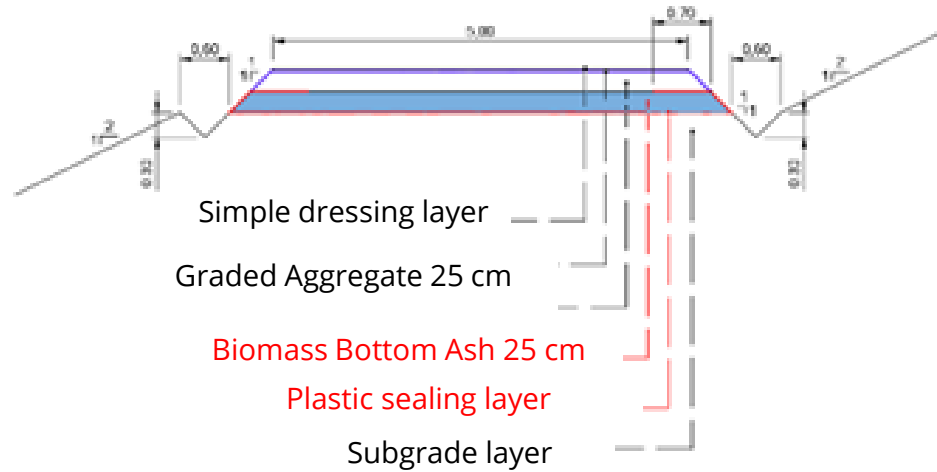


MAIN CONCLUSIONS:

- Good mechanical performance
- Fragile: not suitable for road surface course
- Chemical properties compatible with road regulations
- Stabilized with lime/cement, high quality performances

A68 Highway. Auxiliary road pilot section

Road section with Biomass bottom Ash in road subbase



Some figures:

- 365 m long and 5 m wide
- 1145 t of bottom ash used
- 1400 t of “selected soil” saved

A68 Highway. Auxiliary road pilot section



A68 Highway. Auxiliary road pilot section

Main conclusions and lessons learnt:

- Biomass ash were classified as a marginal material due to its soluble salt content, although for the rest of the parameters, it would have the characteristics of a selected soil.
- Biomass ash must be stockpiled in advance as it is impossible to source the construction project with the daily ash generation.
- Natural Moisture content was around 10 points wet of optimum however, it could be a workable material, could be placed and compacted.
- Despite the fact the material could be compacted 10 % wet of optimum, compaction achieved resulted in a 90 %, below the required 98 %. In any case, CBR reached more than 20, which complies with the technical requirements for selected soils.
- A part of the road stretch was compacted with the optimum moisture content. This areas achieved compaction of 100 %, correlated with CBR index above 50. Much above the requirement.
- Load plate tests showed all moduli above 100, which is feasible for any low-medium heavy traffic intensity roads and for any roadside.
- The low density of this material (1.30 t/m³) makes it interesting for building embankments over low bearing capacity soils or any other situations where low loads are required.

Other applications



Biomasa Miajadas 2021



Celada Windmill farm 2021



Ash + quick lime



Ash instead of cement



Ash

3 roads of 200 length x 5 m width. 966 Tons of Miajadas ash



1 road of 105 x 8 m. 352 t of Briviesca Ash

Relevance of public policy for the Circular Economy

From the Environmental side:

Facilitation of pilot projects by permitting simplification. New Spanish Royal Decree on Waste and Polluted Soils foresees automatic authorisation of R&D pilot projects through a Statement of Responsibility.

Ease of waste management authorisations. Sometimes they are complicated, time-consuming and expensive.

From the Roads Authority:

- Public Procurement including advantages in tenders fostering recycling materials, usually more expensive than raw material.
- Modification of Technical Specifications including new recycled materials
- Focus on technical performance instead of materials nature

**Time for
questions**



Thank you!

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