



Geo-polymeric mortars for masonry remediation.

IS IT:

Product

Technology

Equipment

APPLICABLE FOR:

Restoration

Rehabilitation

New Construction

APPLICABLE ON:

1. Foundations and underground structures

2. Vertical structures

3. Horizontal structures and vertical connections

4. Roof and terraces

5. Façade and building envelope

6. Finishes and completion elements

7. Integrated services

8. General strategies for building recovery

Related companies: No companies; university research; structural study.

DESCRIPTION

The product is under development. Scientific research.

The product is a sustainable innovative material made from an inorganic polymer (geo-polymer) binder – which is mainly a hydraulic compost – that reuses wastes from the paper and the pulp industry (i.e. biomass fly ash), commercial sand (i.e. natural siliceous sand), and various wastes from the same paper/pulp industry. Waste sources are different (biomass fly ash, grits, dregs, calcareous sludge, alkaline effluent) and are suitable for application in construction.

The material might be used for structural purposes showing a class of resistance > M10 (resistance at failure > 10 MPa) according to EN 998-2:2016, Specification for mortar for masonry - Part 2: Masonry mortar, European Committee for Standardization, 2016.

The material can also be used for sustainable, resistant plastering applications.

WHY TO USE

The material is highly sustainable, high performing, reuses a quantity of wastes in perspective of the Circular Economy, its manufacture procedure is easy, economical, and performed at environmental conditions. Furthermore, it is highly durable and resistant to external loads (strong chemical attack, high temperatures, etc.).

HOW TO USE AND APPLY

The application is similar to that of cementitious compounds.

The material, in the fresh state can be poured into moulds (structural application) or applied using spatula (plastering application).

The manufacture process can be conducted at environmental temperature (25°C) and relative humidity (65 %) – environmental conditions – following the steps:

- precursors preparation.
- mix of the solid alumina-silicate source and the liquid alkaline activator. To produce the binder
- Addition of aggregates to obtain the mortar.

TECHNICAL CHARACTERISTICS

The appearance is a dense uniform material.

Technical characteristics of the basic developed materials:

Property	Measured value	
	GP-binder	GP-mortar
consistency (spread by flow table) [cm]	>30	21
bulk density [Kg/m ³]	1307	1832
sorptivity by immersion [%]	38	13
coefficient of capillarity [kg/(m ² ·min ^{0.5})]	0.87	0.35
compressive resistance [MPa]	22.15±1.2 2	21.66±0.0 3
bending resistance [MPa]	3.05±0.37	4.08±0.58

RECOMMENDATIONS AND OTHER INFORMATION

The material is highly alkaline so it must be avoided a direct contact with skin, eyes, etc.

For 1 ton of material, the following raw materials are needed:

Material	kg
MK	60
BFA	14
Sodium hydroxide	6
Sodium silicate	17
Sand	58

EXAMPLES

No example of application, the product is under development.

Scientific research.



REFERENCES / SOURCES AND LITERATURE

Portugal 2020 through European Regional Development Fund (ERDF) in the frame of Operational Competitiveness and Internationalization Programme (POCI) in the scope of the project PROTEUS-POCI-01-0247-FEDER-017729 and in the scope of the project CICECO– Aveiro Institute of Materials POCI-01-0145-FEDER-007679 (FCTRef. UID/CTM/50011/2013), co-financed by national funds through the FCT/MEC.

Saeli, M.; Novais, R.M.; Seabra, M.P.; Labrincha, J.A. Mix design and mechanical performance of geopolymer binder for sustainable construction and building material. IOP Conf. Series: Mater. Sci. Eng. 2017, 264, 12002–12011.

Saeli M., Tobaldi D.M., Seabra M.P., Labrincha J.A., Mix design and mechanical performance of geopolymeric binders and mortars using biomass fly ash and alkaline effluent from paper-pulp industry, Journal of Cleaner Production 208 (2019), 1188-1197.

Saeli M., Senff L., Tobaldi DM., La Scalia G., Seabra MP. and Labrincha JA, Innovative Recycling of Lime Slaker Grits from Paper-Pulp Industry Reused as Aggregate in Ambient Cured Biomass Fly Ash-Based Geopolymers for Sustainable Construction Material, Sustainability 2019, 11, 3481.

Saeli Manfredi, Seabra Maria Paula, Labrincha João A., Alkali-activated mortars for sustainable construction materials: effects of binder-to-aggregate ratio and curing conditions, International Journal of Mechanical and Production Engineering 7(12):2019, 4-11.

Saeli Manfredi, Senff Luciano, Tobaldi David M., Carvalheiras João, Seabra Maria Paula, Labrincha João A., Unexplored alternative disposal of calcareous sludge from the paper-pulp industry in green fly ash-based geopolymeric construction materials, Construction and Building Materials 246 (2020), 118457.

Saeli M., Micale R., Saebra M.P., Labrincha J.A., La Scalia G., Selection of novel geopolymeric mortars for sustainable construction applications using fuzzy topsis approach, Sustainability, Volume 12, Issue 15, August 2020.

WEBSITE OF THE COMPANY

N/A



IMAGES AND CAPTIONS



Fig.1: Possible wastes from the paper-pulp industry: (from left) Biomass Fly Ash, Calcareous Sludge, Grits, and Dregs.

© Manfredi Saeli

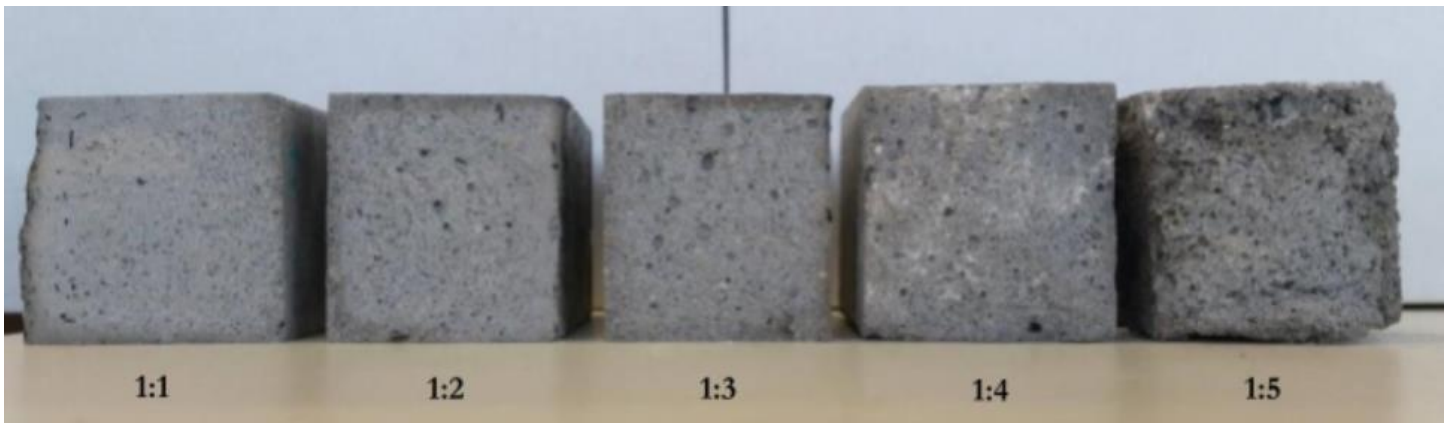


Fig.2: Mortars specimens with various ratios binder/aggregate. © Manfredi Saeli